National Manual on Basic ICU Skills

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<tr>
<td>ABC</td>
<td>Airway Breathing Circulation</td>
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<tr>
<td>ABCD</td>
<td>Airway, Breathing, Circulation, Disability</td>
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<tr>
<td>ABCDE</td>
<td>Airway Breathing Circulation Disability Exposure</td>
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<tr>
<td>ABG</td>
<td>Arterial Blood Gas</td>
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<td>ADG</td>
<td>Additional Director General</td>
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<tr>
<td>AED</td>
<td>Automated External Defibrillator</td>
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<td>AOP</td>
<td>Airway Opening Pressure</td>
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<tr>
<td>APACHE</td>
<td>Acute Physiology and Chronic Health Evaluation</td>
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<tr>
<td>AVPU</td>
<td>Alert Verbal Painful Unresponsive</td>
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<tr>
<td>BiPAP</td>
<td>Bi level Positive Airway Pressure</td>
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<tr>
<td>BIRDEM</td>
<td>Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders</td>
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<td>BLF</td>
<td>Bangladesh Lung Foundation</td>
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<td>BLS</td>
<td>Basic Life Support</td>
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<td>BSACCP</td>
<td>Bangladesh Society of Anesthesia, Critical Care and Pain Physicians</td>
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<tr>
<td>BSL</td>
<td>Blood Sugar Level</td>
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<td>BSM</td>
<td>Bangladesh Society of Medicine</td>
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<td>BSMMU</td>
<td>Bangabandhu Sheikh Mujib Medical University</td>
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<tr>
<td>BVM</td>
<td>Bag Valve Mask</td>
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<tr>
<td>BURP</td>
<td>Backward, Upward and Rightward Pressure</td>
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<tr>
<td>CABD</td>
<td>Circulation Airway Breathing Defibrillate</td>
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<tr>
<td>CAUTI</td>
<td>Catheter Associated Urinary Tract Infection</td>
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<td>CCU</td>
<td>Coronary Care Unit</td>
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<tr>
<td>CDC</td>
<td>Centers for Disease Control and Prevention</td>
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<td>CMV</td>
<td>Controlled Mandatory Ventilation</td>
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<td>CoP</td>
<td>Chief of Party</td>
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<tr>
<td>COPD</td>
<td>Chronic Obstructive Pulmonary Disease</td>
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<td>COVID</td>
<td>Corona Virus Disease</td>
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<td>CPAP</td>
<td>Continuous Positive Airway Pressure</td>
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<td>CPR</td>
<td>Cardio-Pulmonary Resuscitation</td>
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<tr>
<td>CR-BSI</td>
<td>Catheter Related Blood Stream Infection</td>
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<tr>
<td>CSS</td>
<td>Closed Suctioning System</td>
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<td>CTSS</td>
<td>Closed Tracheal Suctioning System</td>
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<tr>
<td>CVA</td>
<td>Central Venous Access</td>
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<td>DBP</td>
<td>Diastolic Blood Pressure</td>
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<td>DG</td>
<td>Director General</td>
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<td>DGHS</td>
<td>Directorate General of Health Services</td>
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<td>DHT</td>
<td>Dalhoff Tube</td>
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<tr>
<td>DNE</td>
<td>Detailed Neurological Exam</td>
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<td>DPM</td>
<td>Deputy Program Manager</td>
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<td>ECG</td>
<td>Electrocardiogram</td>
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<td>EIPA</td>
<td>Inspiratory Positive Airway Pressure</td>
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<td>EN</td>
<td>Enteral Nutrition</td>
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<td>EPAP</td>
<td>Expiratory Positive Airway Pressure</td>
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<tr>
<td>ET</td>
<td>Endotracheal</td>
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<td>ETT</td>
<td>Endotracheal Tube</td>
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<tr>
<td>EUC</td>
<td>Electrolyte, Urea, Creatinine</td>
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<tr>
<td>FBC</td>
<td>Full Blood Count</td>
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<tr>
<td>FiO1</td>
<td>Fraction of Oxygen</td>
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<td>FiO2</td>
<td>Fraction of Inspired Oxygen</td>
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<tr>
<td>GCS</td>
<td>Glasgow Comma Scale</td>
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<td>GEB</td>
<td>Gum Elasti Bougie</td>
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<td>GI</td>
<td>Gastro Intestinal</td>
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<td>GRV</td>
<td>Gastric Residual Volume</td>
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<td>HCP</td>
<td>Health Care Providers</td>
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<td>HCW</td>
<td>Health Care Worker</td>
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<tr>
<td>HFJV</td>
<td>High Frequency Jet Ventilation</td>
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<tr>
<td>HFNC</td>
<td>High-Flow Nasal Cannula</td>
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<tr>
<td>HFNP</td>
<td>High Flow Nasal Prong</td>
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<tr>
<td>HFOV</td>
<td>High Frequency Oscillatory Ventilation</td>
</tr>
<tr>
<td>HoD</td>
<td>Head of Department</td>
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<td>HSM</td>
<td>Hospital Services Management</td>
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<td>ICU</td>
<td>Intensive Care Unit</td>
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<tr>
<td>IMCA</td>
<td>Independent Mental Capacity Assessor</td>
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<tr>
<td>IPAP</td>
<td>Inspiratory Positive Airway Pressure</td>
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<tr>
<td>IPC</td>
<td>Infection Prevention and Control</td>
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<tr>
<td>Jhpiego</td>
<td>Johns Hopkins Program for International Education in Gynecology and Obstetrics</td>
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<tr>
<td>LFTS</td>
<td>Liver Function Tests</td>
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<tr>
<td>LMA</td>
<td>Laryngeal Mask Airway</td>
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<tr>
<td>HCP</td>
<td>Health Care Providers</td>
</tr>
<tr>
<td>LOC</td>
<td>Loss of Consciousness</td>
</tr>
<tr>
<td>LPM</td>
<td>Liter Per Minute</td>
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<tr>
<td>LSCS</td>
<td>Lower Uterine Caesarean Section</td>
</tr>
<tr>
<td>LTA</td>
<td>Laryngeal Tube Airway</td>
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<tr>
<td>MAP</td>
<td>Mean Arterial Pressure</td>
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<tr>
<td>MBP</td>
<td>Mean Blood Pressure</td>
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<tr>
<td>MDT</td>
<td>Multi-Disciplinary Team</td>
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<tr>
<td>MNCSP</td>
<td>Maternal and Newborn Care Strengthening Project</td>
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<tr>
<td>MoH&amp;FW</td>
<td>Ministry of Health &amp; Family Welfare</td>
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<tr>
<td>MSU</td>
<td>Mid-Stream Urine</td>
</tr>
<tr>
<td>MV</td>
<td>Mechanical Ventilation</td>
</tr>
<tr>
<td>NB-BAL</td>
<td>Non Bronchoscopic Bronchoalveolar Lavage</td>
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<tr>
<td>NICE</td>
<td>The national Institute for Health and Care Excellence</td>
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<tr>
<td>NICVD</td>
<td>National Institute of Cardiovascular Disease</td>
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<tr>
<td>NIV</td>
<td>Noninvasive Ventilation</td>
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<tr>
<td>NOK</td>
<td>Next of Kin</td>
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<tr>
<td>NPA</td>
<td>Nasopharyngeal Airway</td>
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<tr>
<td>NGT</td>
<td>Nasogastric Tube</td>
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<tr>
<td>NIBP</td>
<td>Non-Invasive Blood Pressure</td>
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<tr>
<td>OGSB</td>
<td>Obstetrical &amp; Gynecological Society of Bangladesh</td>
</tr>
<tr>
<td>OGT</td>
<td>Orogastric Tube</td>
</tr>
<tr>
<td>OPA</td>
<td>Oropharyngeal Airway</td>
</tr>
<tr>
<td>PaCO2</td>
<td>Partial Pressure of Carbon Di oxide in Arterial Blood</td>
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<tr>
<td>PaO2</td>
<td>Arteria Partial Pressure of Oxygen</td>
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<tr>
<td>PC</td>
<td>Pressure Control Ventilation</td>
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<tr>
<td>PEEP</td>
<td>Positive End-Expiratory Pressure</td>
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<tr>
<td>PEG</td>
<td>Percutaneous Endoscopic Gastrostomy Tube</td>
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<tr>
<td>PIP</td>
<td>Peak Inspiratory Pressure</td>
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<tr>
<td>PN</td>
<td>Parenteral Nutrition</td>
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<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
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<tr>
<td>PSV</td>
<td>Pressure Support Ventilation</td>
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<td>RAP</td>
<td>Right Atrial Pressure</td>
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<tr>
<td>RISE</td>
<td>Reaching Impact, Saturation and Epidemic Control</td>
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<tr>
<td>RR</td>
<td>Respiratory Rate</td>
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<tr>
<td>SaO2</td>
<td>Oxygen Saturation</td>
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<tr>
<td>SBAR</td>
<td>Situation, Background, Assessment, Recommendation</td>
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<tr>
<td>SBP</td>
<td>Systolic Blood Pressure</td>
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<tr>
<td>SHNIBPS</td>
<td>Sheikh Hasina National Institute of Burn and Plastic Surgery</td>
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<tr>
<td>ShSMCH</td>
<td>Shaheed Suhrawardy Medical College and Hospital</td>
</tr>
<tr>
<td>SIMV</td>
<td>Synchronized Intermittent Mandatory Ventilation</td>
</tr>
<tr>
<td>SPIKE</td>
<td>Setup Perception Invitation Knowledge and Empathize</td>
</tr>
<tr>
<td>SpO2</td>
<td>Oxygen Saturation</td>
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<tr>
<td>TAT</td>
<td>Trans Anastomotic tube</td>
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<tr>
<td>TV</td>
<td>Tidal Volume</td>
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<td>UNICEF</td>
<td>United Nations International Children’s Emergency Fund</td>
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<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
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<tr>
<td>VAP</td>
<td>Ventilator Associated Pneumonia</td>
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<td>WHO</td>
<td>World Health Organization</td>
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Preface

This ‘National Manual on Basic ICU Skills’ is to serve as a guide and reference for the doctors and nurses who are working in ICU. Critically ill patients require the precision and diligence in their care. The care should be prompt and efficient. Any lapse may cost the patient their life.

COVID-19 has made us aware of the importance of ICU level of treatment. Severely ill COVID-19 patients have a chance of survival only if they are managed EFFICIENTLY in an Intensive Care Unit with appropriately trained staff.

In our hospitals there are very few ICU experts. Only Anesthesiologists have some exposure to critical care during their training. Now they are being needed to manage an ICU and also work with doctors and nurses who are not trained in critical care.

This manual devised thoughtfully and meticulously by Prof. Dr. Mohammad Abdur Rahman FCPS, Retired Professor, Ex Head of Department of Anesthesia, Intensive Care and Pain, Dhaka Medical College. It discusses details of basic ICU skills and various life saving measures and how to acquire needed skills.

Our wish and hope this manual will be useful and be used.

Professor Dr. M. Khalil ur Rahman
Senior Consultant (Honorary), Department of Anaesthesiology,
Surgical ICU and Pain Medicine,
BIRDEM General Hospital, Dhaka &
Member, National Technical Advisory Committee for COVID-19
On 30 January 2020, the World Health Organization (WHO) declared Coronavirus outbreak as a Public Health Emergency of International Concern (PHEIC) and a Pandemic on 11 March 2020. The first three known cases were reported in Bangladesh by Institute of Epidemiology, Disease Control and Research (IEDCR) on 8 March 2020. The first mortality was reported on 18 March in ICU. According to Worldometer data of 09 April, 2020 total death was 88,543 out of 1,519,442 positive cases, with a mortality rate of 5.83% globally. Whereas, in Bangladesh the total death was 20 out of 218 positive cases, with a mortality rate of 9.17%.

The high mortality rate in Bangladesh was very alarming for us. It indicates that there was a lack of intensive care service in our country. Adequate ICU service to the severe cases can reduce the upcoming mortality significantly. This is very high and crucial time to increase number of ICU bed, logistic support and trained manpower within very short time with maximum effort.

Structured training to increase the new manpower is very essential to encounter the severe ill condition by this new disease. A standard manual is mandatory to provide the service in ICU in this special situation. This manual will help to improve the confidence of service provider to manage critically ill patients with COVID-19 infection in ICU.

At the same time, it will help the faculty to train up new doctors, nurses and other helping staffs to join the pool and provide service to ICU in this very alarming and crucial time.

I must thank to Bangladesh Society of Anesthesiologists Critical Care & Pain Physicians (BSACCPP), especially Professor Dr. Mohammad Abdur Rahman and all other contributors to develop this manual on Basic ICU skills to manage critically ill patients of COVID-19.

I would like to thank to USAID’s RISE project for their generous support in developing this manual.

I think this initiative will contribute to save the life of people in Bangladesh.

**Prof. Dr. Md. Mazharul Hoque**
Line Director, Hospital Services Management (HSM)
Directorate General of Health Services (DGHS)
On January 30, 2020, the World Health Organization (WHO) declared the COVID-19 outbreak as a Public Health Emergency of International Concern. On March 8, the first three COVID-19 cases were reported in Bangladesh by the country’s Institute of Epidemiology, Disease Control and Research (IEDCR). As of 30 December 2020, there have been 511,261 confirmed cases in the country, the second most affected country in South Asia, after India. The first mortality for Bangladesh was reported on 18 March 2020 in an ICU. According to World meter data on 09 April 2020, the total death toll was 88,543 out of 1,519,442 positive cases in the whole world, with a mortality rate 5.83%. Whereas, in Bangladesh, the total death was 20 out of 218 positive cases, with a morality rate of 9.17%. The mortality rate was almost double in Bangladesh in comparison to the mortality rate in the world at that time. The causes of high fatality rate in Bangladesh on that initial time was less preparedness for the management of critically ill patients in existing ICUs, inadequate Pre-ICU management, inadequate logistic support in ICUs, less manpower in ICUs, lack of trained manpower and lack of treatment guideline for this new disease was identified.

To combat this situation Bangladesh Society of Anesthesiologists’ Critical Care and Pain Physicians came forward and direct cooperation with Ministry of health and Family welfare, DGHS, USAID, Jhpiego and provided offline and online training to Doctor, Anesthesiologists, Nurses and ICU technicians for management of COVID-19 patients with self-safety. BSACCPP also developed National ICU and Anesthesia guidelines for COVID-19 Patients and Non COVID-19 patients in this pandemic situation. This action reduces mortality and morbidity on an international level. Approximately 1800 doctors and nurses have been oriented through this manual and participants expressed their satisfaction after receiving the orientation.

With this experience, we attempt to build the “National Manual on Basic ICU skills” for doctors and nurses that will bring significant changes in the existing management plan for the critically ill patients and enough confidence in ICU doctors and nurses to manage their patients.

I would like to take the opportunity to thank Director General, DGHS, ADG (Admin), DGHS, Line Director HSM, DGHS for their directives and other related staff of DGHS, MOH&FW; BSACCPP members, BSM, OGSB, BMDC, BLF and other contributors for developing this manual.

My heartfelt thanks to the editor of this manual Prof. Dr. Mohammad Abdur Rahman, retired Professor & Ex Head Department of Anesthesia, Pain & Critical Care Medicine, Dhaka Medical College. I would also like to thank the USAID’s RISE project managed by Jhpiego Bangladesh for their support to develop the National manual for basic ICU skills.

Prof. Dr. Debabrata Banik
Professor
Dept. of Anesthesia Analgesia & Intensive Care Medicine,
BSMMU, Dhaka and President, BSACCPP
Dean, Medical Technology, BSMMU
USAID MESSAGE

To combat the effects of COVID-19, the Government of Bangladesh (GOB) swiftly implemented a series of prevention and mitigation efforts since the first case was detected on March 08, 2020. From the deployment of prevention risk communication messaging, to increasing the nation’s testing capacity that promptly detected COVID-19 cases, the GOB worked tirelessly to ensure the safety and wellbeing of its population.

In solidarity with the GOB, the U.S Government (USG), through the U.S Agency for International Development (USAID), has provided over $121 million in assistance to support the GOB’s response against COVID-19. With this investment, the laboratory testing capacity increased, surveillance was expanded, and effective infection prevention and control and case management procedures were improved in various healthcare settings. Today, we see this support also assisted the roll out and administration of COVID-19 vaccines across the nation.

During the critical phases of the COVID-19 pandemic, I applaud the GOB’s initiative to decentralize critical services in healthcare facilities and rapidly improve the capacity of the country's Intensive Care Units (ICU). The USG donated 100 high quality ventilators to equip the ICUs that were treating critically ill COVID-19 patients. This success highlights the potential in improving ICU care all around Bangladesh.

On behalf of USAID/Bangladesh, I would like to express my gratitude towards the Ministry of Health and Family Welfare, the Directorate General of Health Services, Hospital Services Management, Bangladesh Society of Anaesthesiologists, Critical Care & Pain Physician (BSACCPP) and other professional bodies for working hand in hand to train healthcare service providers during the COVID-19 pandemic. Your efforts have saved countless lives since the onset of this pandemic. I would also like to specifically acknowledge BSACCPP for taking the initiative in developing the “National Manual on Basic ICU Skills”. With this manual, I hope that any healthcare provider can use it to reinforce their foundational ICU skills for generations to come.

With much appreciation,

Carrie Rasmussen
Ms. Carrie Rasmussen
Director
Office of Population, Health, and Nutrition
USAID/Bangladesh
Executive Summary

An outbreak of COVID-19 pandemic disease, caused by a novel coronavirus SARS-CoV-2, has posed a serious threat to global human health. Bangladesh has also come under the attack of this viral disease. The first case of a COVID-19 patient was detected in Bangladesh on March 8, 2020. Since then, a total of 15,82,985 peoples are officially reported as COVID-19 infected with 28,056 deaths until 25 December, 2021. To combat the COVID-19, the government has taken various steps like, diagnosis of the suspected cases, quarantine of doubted people and isolation of infected patients, local or regional lockdown, closure of all government and private offices, increase public awareness and enforce social distancing, etc. Moreover, to address the socio-economic situations, the government announced several financial stimulus packages of about USD 11.90 billion. During this pandemic situation, USAID donated 100 PB560 ventilators to the Bangladesh Government. The Bangladesh Government distributed the ventilators to 45 public health facilities of different tier. Proper utilization of the ventilators was a big challenge at the health facilities.

USAID’s RISE project implemented by Jhpiego in collaboration with Bangladesh Society of Anaesthesiologists, Critical Care and Pain Physicians (BSACCPP) provided clinical technical assistance to functionalize and strengthen ICU service.

In the first phase, BSACCPP did a facility assessment of 45 health facilities where ventilators were allocated. Through the facility assessment along with other challenges it became evident that proper knowledge and attitude are major barriers to start and run the ICUs in those 45 facilities. BSACCPP, in discussion with DGHS planned to run a short course on ICU to strengthen critical care services in Bangladesh.

To make the ICU course effective, uniform and acceptable, necessity of a course module and a manual was felt. Prof. Mohammad Abdur Rahman, retired professor of anesthesia formulated a course module and a manual. The course module and manual got approval from BSACCPP and the Director General of Health Services, Bangladesh.

With funding from USAID and directives from Directorate General of Health Services, over 1800 doctors and nurses from 45 public health facilities received this course in different platform (i.e. In person, virtual, residential regional, on job) through this manual.

Pre and post course assessment showed significant improvement among the participants. Interest and feedback from the participants were very positive.

This manual can be a useful tool for refreshing the skills of the Health Care Providers. The manual will continue to be refined and updated as consultations and trainings occurs time to time.
Overview of the Manual

The manual is intended to teach the basic skills which are needed and performed regularly in ICU in a safer way with knowledge. Fourteen important topics are incorporated in this manual. In the first part, the basics of skills like usefulness, advantages, disadvantages, adverse effects are discussed. In the second part, the skill steps are listed in order. The complications and the ways to avoid complications are also covered. The safe intrahospital & interhospital transfer of patient, communication with patient/relatives and infection prevention tools are also incorporated in this manual.

This manual will be helping the HCW in performing the skills in a safer way with knowledge and as such will be lessening the complications. Obviously, patient satisfaction and outcome will be improved. This manual can be used as a regular guide. Needless to say that this manual can be updated when needed.

Overview of the course

The course utilizes the hands-on small group discussion. The course comprises lectures, small group discussion, and demonstration of skills. Fourteen skills which are regularly performed in ICU were taught in the course.

Course to be preceded by an Inauguration session.
Course started at 8.00 am and finished at 2.30 pm. Lunch and refreshment were provided.
A total of 32 participants received the course in each session. For each course, there will be a course director.

Participants

Doctors and nurses working in ICU/ HDU/ Post-operative ward/ Operation theatre.

Faculty

Faculties from BSACCPP.

Detail of the course

The course covers the skills discussed in the “National Manual on Basic ICU Skills”. The course comprises lectures & small group learning.
Introduction

An intensive care unit (ICU), also known as a critical care unit is a special department of a hospital or health care facility that provides intensive care to critically ill patients. Intensive care units cater to patients with severe life threatening illnesses and injuries, which require constant care and close supervision, while on life support equipment and medication, in order to ensure basic bodily function. These units are staffed by specially trained doctors, nurses and other supporting staffs who are capable of managing critically ill patients as well as are capable of handling the complex equipments used there for supporting the critically ill patients.

A critically ill patient is a person who’s life is threatened by the failure or the imminent failure of one or more vital functions and whose survival depends on advanced means of surveillance, monitoring and treatment.

History

In 1854, Florence Nightingale used to separate seriously wounded soldiers from those with non-life-threatening conditions. Her experiences during the war formed the foundation for her later discovery of the importance of sanitary conditions in hospitals, a critical component of intensive care.

In 1950, anesthesiologist Peter Safar established the concept of advanced life support, keeping patients sedated and ventilated in an intensive care environment. Safar is considered to be the first practitioner of intensive care medicine as a speciality.

In response to a polio epidemic (where many patients required constant ventilation and surveillance), Bjorn Aage Ibsen established the first intensive care unit in Copenhagen in 1953. The first application of this idea in the United States was in 1955 by William Mosenthal, a surgeon at the Dartmouth-Hitchcock Medical Centre in the 1960s.

In Bangladesh, the first Intensive Care Unit was established in the National institute of Cardiovascular disease (NICVD) in the year 1985. Dr. M Khalilur Rahman, Professor of Anesthesiology was the founder of the intensive care unit in NICVD.

Subsequently intensive care unit was established under department of Anesthesiology of Dhaka Medical College Hospital in the year 1988. Prof. SN Samad Chowdhry, Professor and the then Head of the department of Anesthesiology of Dhaka Medical College be credited for the establishment.
Definition of critically ill patient:
Critical illness is a life-threatening multisystem process that can result in significant morbidity or mortality. In most patients, critical illness is preceded by a period of physiological deterioration; but evidence suggests that the early signs of this are frequently missed.

What is the difference between ICU and critical care?
Critical care is also called intensive care. Critical care treatment takes place in an intensive care unit (ICU) in a hospital. Patients may have a serious illness or injury. In the ICU, patients get round the clock care by a specially trained team.

What is considered as critical care?
Critical care nursing is the field of nursing with a focus on the utmost care of the critically ill or unstable patients following extensive injury, surgery or life threatening diseases.

How do you handle critically ill patients?
Supportive care: The clinician must continue to aggressively sustain the patient's airway, oxygenation, ventilation, and hemodynamics to allow the patient time to recover from the initial issues.

Critical care: The specialized care of patients whose conditions are life-threatening and who require comprehensive care and constant monitoring usually in intensive care units.
CHAPTER ONE:  
INITIAL ASSESSMENT AND MANAGEMENT OF CRITICALLY ILL PATIENT

Learning Objectives: After going through this session the participants will be able to know
- The correct sequence and preparation for management of critically ill patients
- ABCDEs sequences and identification of life-threatening conditions

When treating a critically ill patient the intensive care physician assesses the most life-threatening illness quickly and applies life preserving therapy immediately.

Since time is very crucial, a rapid and accurate systemic approach is essential.

In this section, you will learn the correct sequence of priorities for management of critically ill patients.

The correct sequences are:
- Preparation
- Primary survey using the ABCD approach including immediate management of life-threatening illness
- Secondary survey: Once life-threatening conditions and resuscitation of the patient is completed, or life sustaining management is instituted
- Continued post resuscitation monitoring
- Definitive treatment.

Preparation:
- Planning for arrival of the critically ill patient in ICU.
- Information from referring unit/Hospital/Physician/HCP and the receiving ICU should be smooth and complete
- Properly functioning airway equipment is organized, checked and made easily accessible.
- Prepared airway management trolley is helpful. Use a checklist.
- Ensure that different sizes of intravenous cannula are easily and immediately available.
- Resuscitation instruments like ventilator, defibrillator, Infusion/Transfusion set are immediately available.
- Properly functioning suction machine, suction tubes/catheter immediately available.
- Warm crystalloid fluids are available.
- Emergency medicines like adrenaline, noradrenaline, dopamine, dobutamine, glucose solution, sodium bicarb, and calcium are immediately available.
- Communication (close loop) with all the staff.
- Supporting departments are informed.

Primary Survey:
The primary survey encompasses the ABCDEs sequences and identification of life-threatening conditions.
- On arrival or on sudden collapse of an admitted patient.
- Start oxygen via face mask @ 15 L /min.
- If the patient is already intubated via endotracheal tube, attach the pulse oximeter for continuous monitoring of oxygen saturation status of the patient.
- Then follow the ABCDEs sequences.
The ABCDEs sequences:

- A = Airway patency maintenance.
- B = Breathing & ventilation.
- C = Circulation.
- D = Disability (Assessment of neurological status).
- E = Exposure/Environmental control.

Obstetric Critically Ill patient:
The purpose of this review is to present the recent concepts in critical care management of obstetric patients with special focus mainly on ventilatory strategies, treatment of shock and nutrition. The details regarding management of individual diseases would not be discussed as these would be beyond the review of this manual.

- Obstetric patients admitted to an Intensive Care Unit (ICU) present a challenge to an intensivist because of normal physiological changes associated with pregnancy and puerperium.

- The specific medical diseases peculiar to pregnancy and the need to take care of both the mother and the foetus.

Table 1.1: Reasons for ICU admission of obstetric patients can be categorized into one of the following groups

<table>
<thead>
<tr>
<th>Conditions related to pregnancy</th>
<th>Medical diseases that may be aggravated during pregnancy</th>
<th>Conditions that are not related to pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eclampsia</td>
<td>Congenital heart diseases</td>
<td>Trauma</td>
</tr>
<tr>
<td>Severe pre-eclampsia</td>
<td>Rheumatic and non-rheumatic valvular diseases</td>
<td>Asthma</td>
</tr>
<tr>
<td>Haemorrhage</td>
<td>Pulmonary hypertension</td>
<td>Diabetes</td>
</tr>
<tr>
<td>Amniotic fluid embolus</td>
<td>Anemia</td>
<td>Autoimmune diseases etc</td>
</tr>
<tr>
<td>Acute fatty liver</td>
<td>Renal failure etc.</td>
<td></td>
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<tr>
<td>Peripartum cardiomyopathy</td>
<td></td>
<td></td>
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<tr>
<td>Amniotic fluid embolism</td>
<td></td>
<td></td>
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<tr>
<td>Aspiration syndromes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infections etc.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Initial Assessment:

- As for all critically ill patients initial management of such patients consists of a
  - quick history
  - systemic assessment with an individual organ-based approach
  - special consideration of the gestational age of the foetus.
- The viability of the foetus, advantages and disadvantages in continuation of the pregnancy and the mode of delivery, if required are some of the important issues that need to be discussed at the outset.
- All medications used in an ICU are categorized from A to D (in order of increasing foetal risk) and X (contraindicated); such a list should be readily available for the ICU team.
- It is advisable not to use propofol for sedation in these patients as its risks would outweigh the benefits.
• The mortality predicting scores like APACHE II/III are not as reliable as in non-obstetric patients.
• SAPS II score does seem to have some degree of validity in obstetric ICU.

Special Consideration for Obstetric Patients:
• Like all other critically Ill patient obstetric patient must be approached in the ABCDE approach
• Obstetric patient at or near term have to be nursed in lateral position to avoid deleterious effects of aortocaval compression.
• High flow Oxygen Supplementation on arrival to be started.
• Intrauterine resuscitation of fetus should have to be kept in mind.

Operating team to be informed and prepared earliest in case emergency/urgent surgery become necessary (Mainly Lower Uterine Caesarean Section).
• Blood transfusion department should be alerted early if the patient is bleeding or severely anemic. Labour analgesia team have to be involved in the management of obstetric patient

• Multi departmental approach sometimes become necessary
  o Pregnancy with Heart disease
  o Sepsis
  o Pre existing neurological/Psychological disorder etc.
CHAPTER TWO:
AIRWAY & OXYGENATION

Learning Objectives: After going through this session the participants will be able to

- Know the sequence of management of critically ill patients
- Manage airway
- Identify and use the airway adjuncts
- Know how to insert the airway adjuncts

Airway management:

In managing all critically ill patients regardless of any pathology, first assess the airway and oxygen status of the patient.

Establishment or ensuring a patient’s airway:

- If the patient is able to communicate verbally in a clear voice and can complete a sentence without any difficulty, the airway is not likely to be in immediate jeopardy. Continue repeated assessments.
- In case the patient is not communicable, his/her airway may need to be supported.
- Open the airway by the head tilt and chin lift or the jaw thrush maneuver.
- Clear the airway.
- Maintenance of airway may require airway adjuncts.
- An unconscious patient who has a Glasgow Coma Score (GCS) of 8 or lower usually requires the placement of a definite airway i.e., cuffed, secured tube in the trachea.
- If the patient already has an ETT in situ:
  - Ensure the correct position of the tube.
  - Ensure the patency of the tube.
  - Ensure the cuff is inflated.

Airway adjuncts:

1. Oropharyngeal airway.
2. Nasopharyngeal airway.
3. Supraglottic airway.
   a. Laryngeal mask airway.
   b. LTA.
   c. I-gel.
4. Endotracheal tube.
5. Front of the neck airway.
   a. Needle cricothyrotomy.
   b. Tracheostomy.

The following airway management skills are frequently needed in managing a critically ill patients in the ICU:

A. Basic Airway Skills
   - Insertion of nasopharyngeal airway.
   - Safe use of suction.
   - Insertion of oropharyngeal airway.
B. Advanced Airway Management

- Insertion of Laryngeal Mask Airway (LMA).
- Insertion of Laryngeal Tube Airway (LTA).
- Oral endotracheal intubation.

**Oropharyngeal airway:**

An oropharyngeal airway (also known as an oral airway, OPA or Guedel pattern airway) is a medical device called an airway adjunct used to maintain or open a patient's airway. It does this by preventing the tongue from covering the epiglottis, which could prevent the person from breathing.

![Fig 2.1: Oropharyngeal of different sizes](image1)

![Fig 2.2: Correct size of Oropharyngeal airway](image2)

**Insertion of Oropharyngeal airway:**

- **STEP 1.** Select the proper size of airway. A correctly sized OPA device extends from the corner of the patient’s mouth to the earlobe.
- **STEP 2.** Open the patient’s mouth with the crossed finger (scissors) technique.
- **STEP 3.** Insert a tongue blade on top of the patient’s tongue and far enough back to depress the tongue adequately. Be careful not to cause the patient to gag.
- **STEP 4.** Insert the airway posteriorly, gently sliding the airway over the curvature of the tongue until the device’s flange rests on top of the patient’s lips. The device must not push the tongue backward and block the airway. An alternate technique for insertion, termed the rotation method, involves inserting the OPA upside down so its tip is facing the roof of the patient’s mouth. As the airway is inserted, it is rotated 180 degrees until the flange comes to rest on the patient’s lips and/or teeth. This maneuver should not be used in children.
- **STEP 5.** Remove the tongue blade.
- **STEP 6.** Reassess the patient to ensure that the airway is now patent.

**Nasopharyngeal airway:**

A nasopharyngeal airway, also known as an NPA, nasal trumpet (because of its flared end), or nose hose, is a type of airway adjunct, a tube that is designed to be inserted into the nasal passageway to secure an open airway. It was introduced by Hans Karl Wendl in 1958.
Nasopharyngeal airway insertion:
This procedure is used when the patient would gag on an oropharyngeal airway.

Steps of nasopharyngeal airway insertion:
Step 1. Assess the nasal passage for any apparent obstruction.
Step 2. Select the proper size airway which will easily pass the selected nostril. Usually this is one size smaller than the diameter of the nare. Measure the length from the patient’s nare to the patient’s earlobe.
Step 3. Lubricate the nasopharyngeal airway soluble lubricant or lidocaine gelly or with clean tap water.
Step 4. Insert the tip of the airway into the nostril and direct it posteriorly and toward the ear of that side.
Step 5. Gently insert the nasopharyngeal airway through the nostril into the hypopharynx with a slight rotating motion until the flange rests against the nostril.

Laryngeal mask airway (LMA):
The laryngeal mask airway (LMA) is a supraglottic airway device developed by British Anesthesiologist Dr. Archie Brain. It has been in use since 1988. The LMA is shaped like a large endotracheal tube on the proximal end that connects to an elliptical mask on the distal end.

It is designed to sit in the patient’s hypopharynx and cover the supraglottic structures, thereby allowing relative isolation of the trachea. The patient should be obtunded and unresponsive before one of these devices is placed.

- The LMA is a good airway device in many settings, including the operating room, the emergency department, and out-of-hospital care,
- It is easy to use and quick to place, even for the inexperienced provider.
- A success rate for placement of a LMA of nearly 100% occurs in the operating room.
- A lower rate of achievement for LMA placement may be expected in the emergency setting.
Steps of Laryngeal mask airway insertion:

Step 1. Ensure proper sterilization.
Step 2. Inspect all components for damage.
Step 3. Examine the interior of the tube to ensure that it is free from blockage and loose particles.
Step 4. Ensure that ventilation and oxygenation equipments and the suctioning apparatus are readily available.
Step 5. Inflate the cuff of the LMA to ascertain that the balloon does not leak.
Step 6. Choose the correct size LMA:
   3 for a small female
   4 for a large female or small male
   5 for a large male.
Step 7. Before attempting insertion, completely deflate the LMA cuff by pressing it firmly onto a flat surface and the lubricate it.
Step 8. Hold the LMA with the dominant hand as you would a pen, with the index finger placed at the junction of the cuff and the shaft and the opening of the LMA oriented over the tongue.
Step 9. Pass the LMA behind the upper incisors, with the shaft parallel to the patient’s chest and the index finger pointed toward the intubator.
Step 10. Push the lubricated LMA into position along the palatopharyngeal curve, with the index finger maintaining pressure on the tube and guiding the LMA into the final position.
Step 11. Inflate the cuff with correct volume of air (indicated on the shaft of the LMA).
Step 12. Check the placement of LMA by applying bag mask ventilation.
Step 13. Visually observe chest expansion.

Laryngeal tube:

The laryngeal tube (also known as the King LT) is an airway management device designed as an alternative to other airway management techniques such as mask ventilation, LMA and tracheal intubation. This device can be inserted blindly through the oropharynx into the hypopharynx to create an airway to enable mechanical ventilation of the lungs.
**Insertion of Laryngeal Tube Airway (LTA):**

**STEP 1.** Ensure that adequate ventilation and oxygenation are in progress and that suctioning equipment immediately available in case the patient vomits.

**STEP 2.** Choose the correct size of LTA.

**STEP 3.** Inspect the LTA device to ensure it is sterile and the lumen is clear and has no visible damage.

**STEP 4.** Inflate the cuff of the LTA to check that it does not leak. Then fully deflate the cuff.

**STEP 5.** Apply a water-soluble lubricant to the beveled distal tip and posterior aspect of the tube, taking care to avoid introducing lubricant into or near the ventilatory openings.

**STEP 6.** Have an assistant restrict motion of the patient’s cervical spine.

**STEP 7.** Hold the LTA at the connector with the dominant hand. With the nondominant hand, open the mouth.

**STEP 8.** With the LTA rotated laterally 45 to 90 degrees, introduce the tip into the mouth and advance it behind the base of the tongue.

**STEP 9.** Rotate the tube back to the midline as the tip reaches the posterior wall of the pharynx.

**STEP 10.** Without excessive force, advance the LTA until the base of the connector is aligned with the patient’s teeth or gums.

**STEP 11.** Inflate the LTA cuffs to the minimum volume necessary to seal the airway at the peak ventilatory pressure used (just seal volume).

**STEP 12.** While gently bagging the patient to assess ventilation, simultaneously withdraw the airway until ventilation is easy and free flowing (large tidal volume with minimal airway pressure).

**STEP 13.** Reference marks are provided at the proximal end of the LTA; when aligned with the upper teeth, these marks indicate the depth of insertion.

**STEP 14.** Confirm proper position by auscultation, chest movement, and ideally verification of CO2 by capnography.

**STEP 15.** Readjust cuff inflation to seal volume.

**STEP 16.** Secure LTA to patient using tape or other accepted means. A bite block can also be used, if desired.

**Oral endo-tracheal intubation:**

**STEP 1.** Ensure that adequate ventilation and oxygenation are in progress and that suctioning equipment is immediately available in case the patient vomits.

**STEP 2.** Choose the correctly sized endotracheal tube (ETT).

**STEP 3.** Inspect the ETT to ensure it is sterile and has no visible damage. Check that the lumen is clear.
STEP 4. Inflate the cuff of the ETT to check that it does not leak.
STEP 5. Connect the laryngoscope blade to the handle, and check the light bulb for brightness.
STEP 6. Assess the patient’s airway for ease of intubation, using the LEMON mnemonic.
STEP 7. Direct an assistant to restrict cervical motion. The patient’s neck must not be hyperextended or hyperflexed during the procedure.
STEP 8. Hold the laryngoscope in the left hand. (regardless of the operator’s dominant hand).
STEP 9. Insert the laryngoscope into the right side of the patient’s mouth, displacing the tongue to the left.
STEP 10. Visually identify the epiglottis and then the vocal cords. External laryngeal manipulation with backward, upward, and rightward pressure (BURP) may help to improve visualization. An assistant might help produce this laryngeal pressure while the intubator is visualizing the larynx.
STEP 11. Gently insert the ETT through the vocal cords into the trachea to the correct depth without applying pressure on the teeth, oral tissues or lips.
STEP 12. If endotracheal intubation is not accomplished before the SpO2 drops below 90%, ventilate with a bag-mask device and change the approach [equipment, i.e., gum elastic bougie (GEB) or personnel].
STEP 13. Once successful intubation has occurred, apply bag ventilation. Inflate the cuff with enough air to provide an adequate seal. Do not overinflate the cuff.
STEP 14. Visually observe chest excursions with ventilation.
STEP 15. Auscultate the chest and abdomen with a stethoscope to ascertain tube position.
STEP 16. Confirm correct placement of the tube by the presence of CO2. A chest x-ray exam is helpful to assess the depth of insertion of the tube (i.e., mainstem intubation), but it does not exclude esophageal intubation.
STEP 17. Secure the tube. Each time a patient is moved, reassess the tube placement.
STEP 18. If not already done, attach a pulse oximeter to one of the patient’s fingers (intact peripheral perfusion must exist) to measure and monitor the patient’s oxygen saturation levels and provide immediate assessment of therapeutic interventions.

**Needle Cricothyrotomy:**

STEP 1. Assemble and prepare oxygen tubing by cutting a hole toward one end of the tubing. Connect the other end of the oxygen tubing to an oxygen source capable of delivering 50 psi or greater at the nipple, and ensure the free flow of oxygen through the tubing. Alternatively, connect a bag mask by introducing a 7.5 mm endotracheal tube connector to a 3 cc syringe with the plunger removed.
STEP 2. Place the patient in a supine position. Have an assistant restrict the patient’s cervical motion.
STEP 3. Attach a 12- or 14-gauge over-the-needle cannula to a 5-ml syringe (16-18 gauge for infants and young children).
STEP 4. Surgically prepare the neck, using antiseptic swabs.
STEP 5. Palpate the cricothyroid membrane anteriorly between the thyroid cartilage and the cricoid cartilage. Stabilize the trachea with the thumb and forefinger of the nondominant hand to prevent lateral movement of the trachea during the procedure.
STEP 6. Puncture the skin in the midline with the cannula attached to a syringe, directly over the cricothyroid membrane.
STEP 7. Direct the cannula at a 45-degree angle caudally, while applying negative pressure to the syringe.
STEP 8. Carefully insert the cannula through the lower half of the cricothyroid membrane, aspirating as the needle is advanced. The addition of 2-3 cc of saline to the syringe will aid in detecting air.
STEP 9. Note the aspiration of air, which signifies entry into the tracheal lumen.
STEP 10. Remove the syringe and withdraw the needle while gently advancing the cannula downward into position, taking care not to perforate the posterior wall of the trachea.
STEP 11. Attach the jet insufflation equipment to the cannula, or attach the oxygen tubing or 3 mL syringe (7.5) endotracheal tube connector combination over the catheter needle hub, and secure the catheter to the patient’s neck.
STEP 12. Apply intermittent ventilation either by using the jet insufflation equipment, or using your thumb to cover the open hole cut into the oxygen tubing or inflating with an ambu bag. Deliver oxygen for 1 second and allow passive expiration for 4 seconds. Note: Adequate PaO2 can be maintained for only around 30 to 45 minutes, and CO2 accumulation can occur more rapidly.
STEP 13. Continue to observe lung inflation, and auscultate the chest for adequate ventilation. To avoid barotrauma, which can lead to pneumothorax, pay special attention to lung deflation. If lung deflation is not observed, in the absence of serious chest injury it may be possible to support expiration by using gentle pressure on the chest.

**Surgical Cricothyrotomy:**
STEP 1. Place the patient in a supine position with the neck in a neutral position. Have an assistant restrict the patient’s cervical motion.
STEP 2. Palpate the thyroid notch, cricothyroid cartilage, and sternal notch for orientation.
STEP 3. Assemble the necessary equipment.
STEP 4. Surgically prepare and anesthetize the area locally, if the patient is conscious.
STEP 5. Stabilize the thyroid cartilage with the nondominant hand, and maintain stabilization until the trachea is intubated.
STEP 6. Make a 2- to 3-cm vertical skin incision over the cricothyroid membrane and, using the nondominant hand from a cranial direction, spread the skin edges to reduce bleeding. Reidentify the cricothyroid membrane and then incise through the base of the membrane transversely. Caution: To avoid unnecessary injury, do not cut or remove the cricoid and/or thyroid cartilages.
STEP 7. Insert hemostat or tracheal spreader or back handle of scalpel into the incision, and rotate it 90 degrees to open the airway.
STEP 8. Insert a properly sized, cuffed endotracheal tube or tracheostomy tube (usually a size 5–6) through the cricothyroid membrane incision, directing the tube distally into the trachea. If an endotracheal tube is used, advance only until the cuff is no longer visible to avoid mainstem intubation.
STEP 9. Inflate the cuff and ventilate.
STEP 10. Observe lung inflation and auscultate the chest for adequate ventilation.
CHAPTER THREE:  
OXYGEN THERAPY

Learning Objectives: After going through this session the participants will be able to know

- The physical and chemical characteristics of Oxygen
- The sources of Oxygen in clinical practice
- The uses, indications, advantages, and disadvantages of different oxygen therapy devices
- The steps of oxygen therapy device uses.
- Flowchart and details Management of Hypoxia

Overview:

- Oxygen is a colorless, odorless, tasteless gas that is essential for the body to function properly and to survive.
- Oxygen is required for normal cell metabolism.
- Excessively high concentrations can cause oxygen toxicity such as lung damage or result in respiratory failure in those who are predisposed.
- Higher oxygen concentrations without humidification can dry out the nose.
- The target oxygen saturation recommended depends on the condition being treated. In most conditions a saturation of 94–96% is recommended, while in patient of COPD saturations of 88–92% are preferred.

Air is typically 21% oxygen by volume while oxygen therapy increases this by some amount up to 100%.

Oxygen therapy:

- Oxygen therapy also known as oxygen supplementation is the administration of oxygen at a concentration of greater than that found in the environmental atmosphere.
- The air that we breathe contains approximately 21% oxygen.
- The heart relies on oxygen to pump blood.
- The use of oxygen in medicine became common around 1917.
- It is on the World Health Organization’s Essential Medicines list.
- Oxygen as it is a drug:
  - It must be prescribed by a licensed/registered doctor.
  - Prescription must be dated by the doctor.
  - Doctor must indicate concentration, flow rate and duration of therapy.

Purpose of oxygen therapy:

The purpose is to increase oxygen saturation in tissues where the saturation levels are too low due to illness or injury.

Indications of oxygen therapy:

Oxygen is used as a medical treatment in both chronic and acute cases, and can be used in hospital, pre-hospital or entirely out of hospital.

- Documented hypoxemia as evidenced by
  - $\text{PaO}_2 < 60 \text{ mmHg or SaO}_2 < 90\%$ on room air.
  - $\text{PaO}_2$ or $\text{SaO}_2$ below desirable range for a specific clinical situation.
• Acute care situations in which hypoxemia is suspected
  o Severe trauma.
  o Acute myocardial infarction.
  o Short term therapy (Post anaesthesia recovery).
  o Resuscitation.
  o Cardiac arrest.
  o Anaphylaxis.
  o Major trauma.
  o Bleeding.
  o Shock.
  o Convulsion.
  o Hypothermia.
• Severe respiratory distress
  o Acute asthma.
  o Pneumonia.
• Chronic Conditions
  • Chronic obstructive pulmonary disease (COPD).
  • Breathlessness.

Oxygen toxicity:
• Oxygen toxicity, caused by excessive or inappropriate supplemental oxygen.
• Can cause severe damage to the lungs and other organ systems.
• High concentrations of oxygen, over a long period of time, can increase free radical formation, leading to damaged membranes, proteins, and cell structures in the lungs.

Storage and sources:
The main types of sources for oxygen therapy are:
• Cylinders.
• Wall Outlet
  o Manifold
  o Liquid oxygen tanks.
• Oxygen Concentrator.

Cylinders:
• Oxygen Cylinder
  o The oxygen gas is compressed in a gas cylinder, which provides a convenient storage option, without the requirement for refrigeration found with liquid storage.
  o Large oxygen cylinders hold 6,500 litres (230 cu ft) and can last about two days at a flow rate of 2 litres per minute.
  o A small portable M6 (B) cylinder holds 164 or 170 litres (5.8 or 6.0 cu ft) and weighs about 1.3 to 1.6 kilograms (2.9 to 3.5 lb).
• Liquid Oxygen
  o Liquid oxygen is stored in chilled tanks until required, and then allowed to boil (at a temperature of 90.188 K (−182.96 °C)) to release oxygen as a gas.
  o This is widely used at hospitals due to their high usage requirements, but can also be used in other settings.
• Oxygen Concentrator
  o The use of an electrically powered oxygen concentrator or a chemical reaction based unit.
  o Can create sufficient oxygen for a person to use immediately.
  o Advantage of being a continuous supply without the need for additional deliveries of bulky cylinders.

Assessment:
The need for oxygen therapy should be assessed by Clinical Assessment & Monitoring:
  • ABG - PaO2
  • SpO2

Oxygen using from a cylinder:
  • The oxygen cylinder is delivered with a protective cap to prevent accidental force against the cylinder outlet.
  • To release oxygen safely and at a desirable rate a regulator is used.
  • The amount of oxygen in the cylinder is marked by a reduction gauge.
  • Flow of oxygen in liter/min is regulated by flow meter.
  • Oxygen is passed through a humidifier to prevent dry air from passing into the patient.
Oxygen using from wall outlet:

- Oxygen in the wall outlet is supplied from a central source through a pipeline system.
- The central source of oxygen supply either bulk cylinder from manifold system or from liquid oxygen tank.
- Source may also be from oxygen plant.

Table 3.1: Methods of oxygen administration/Oxygen delivery system:

| 1) Nasal cannula.                      | 5) Venturi mask.                |
| 3) Partial non-breather mask.         | 7) Oxygen tent.                 |
| 4) Non-rebreather mask.               | 8) High flow nasal cannula.     |

1. Nasal cannula (nasal prongs):

- It is a disposable plastic device.
- It has two protruding prongs for insertion into two nostrils.
- A tube for connecting with an oxygen source.
- It is used for low medium concentration of oxygen (24–44%).
- The cannula is generally attached to the patient by way of the tube hooking around the patient's ears or by an elastic headband.
- The earliest, and most widely used form of adult nasal cannula carries 1–3 litres of oxygen per minute.
- Nasal cannula is generally used wherever small amounts of supplemental oxygen are required, without rigid control of respiration.
- Most cannulae can only provide oxygen at low flow rates—up to 5 litres per minute (L/min)—delivering an oxygen concentration of 28–44%.
- Rates above 5 L/min can result in discomfort to the patient, drying of the nasal passages, and possibly nose bleeds (epistaxis).
Also with flow rates above 6 L/min, the laminar flow becomes turbulent and the oxygen therapy being delivered is only as effective as delivering 5–6 L/min.

Patient can eat and talk without interrupting oxygen supply.

Table 3.2: Amount of oxygen delivered with different flow rate by nasal cannula

<table>
<thead>
<tr>
<th>Flow rate</th>
<th>Oxygen supplementation (FiO2)</th>
</tr>
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<tbody>
<tr>
<td>1 L/min</td>
<td>24%</td>
</tr>
<tr>
<td>2 L/min</td>
<td>28%</td>
</tr>
<tr>
<td>3 L/min</td>
<td>32%</td>
</tr>
<tr>
<td>4 L/min</td>
<td>36%</td>
</tr>
<tr>
<td>5 L/min</td>
<td>40%</td>
</tr>
<tr>
<td>6 L/min</td>
<td>44%</td>
</tr>
</tbody>
</table>

Advantages of nasal cannula:

- Patient can talk and eat without interrupting oxygen supply.
- Safe and simple.
- Easily tolerated.
- Can be used in home setting.
- Delivers low concentration.

Disadvantages of nasal cannula:

- Cannot be used in patients who have nasal obstruction.
- Not useful in patients who are mouth breather.
- Drying of mucus membrane.
- Can be dislodged from nares easily.
- Causes skin irritation or breakdown over ears or at nares.
- Patient’s breathing pattern affects FiO2.

2. Face masks:

Types of oxygen face masks-

- Simple face mask (also called Hudson’s mask).
- Partial rebreather mask.
- Non-rebreather mask.
- Venturi mask.
Simple oxygen face mask:
- A simple face mask is usually used to deliver a low to moderate amount of oxygen.
- A simple mask contains holes on the sides to let exhaled air through and to prevent suffocation in case of a blockage.
- It can deliver around 40% to 60% oxygen at 6 to 10 L/min.
- It delivers 35%-60% oxygen at a flow rate of 6-10L/min.
- It has vents on its sides which allow room air to leak at many places, thereby diluting the oxygen supplied from source.
- Often it is used when increased delivery of oxygen is needed for a short period of time.

Advantages of simple face mask:
- Can provide increased amount of oxygen for a short period of time.

Disadvantages of simple face mask:
- Tight seal required to deliver higher concentration.
- Difficult to keep mask in position over nose and mouth.
- Potential for skin breakdown.
- Uncomfortable for patient.
- Need to remove mask with oxygen supply during eating and talking.

3. Partial rebreather mask:
- This has a rebreather bag which must be kept full during inspiration and expiration.
- Reservoir bag collects part of patient’s expired air; remaining exhaled air exits through the vents.
- It can deliver oxygen up to 80%.
- The oxygen flow rate must be maintained at a minimum of 6L/min otherwise the patient may rebreathe large amount of exhaled air containing carbon dioxide.

Advantages of partial rebreather mask:
- Patient can inhale room air in case of failure of oxygen supply.

Disadvantages of partial rebreather mask:
- Require tight seal, uncomfortable for the patient.
- Eating and talking disrupts oxygen supply.
4. **The Non-Rebreather mask:**

A non-rebreather mask is a device used in medicine to assist in the delivery of oxygen therapy.

An NRB requires that the patient can breathe unassisted, but unlike low-flow nasal cannulae, the NRB allows for the delivery of higher concentrations of oxygen.

This mask is called “Non-Rebreather” because, it allows to breathe only pure oxygen. A non-rebreather mask typically delivers 70 to 100 percent oxygen.

- This mask provides the highest concentration of oxygen (95%-100%) at a flow rate 6-15 L/min.
- It is similar to the partial rebreather mask except that it has two one-way valves to prevent conservation of exhaled air.
- The non-rebreather mask covers both the nose and mouth of the patient and attaches with the use of an elastic cord around the patient's head.
- The NRB has an attached reservoir bag, typically one liter, that connects to an oxygen supply system.
- Before an NRB is placed on the patient, the reservoir bag is inflated to greater than two-thirds full of oxygen, at a rate of 15 liters per minute (lpm).
- Approximately ⅓ of the air from the reservoir is depleted as the patient inhales, and it is then replaced by the flow from the O2 supply.
- If the bag becomes completely deflated, the patient will no longer have a source of air to breathe.
- Exhaled air is directed through a one way valve in the mask, which prevents the inhalation of room air and the re-inhalation of exhaled air.
- The valve, along with a sufficient seal around the patient's nose and mouth, allows for the administration of high concentrations of oxygen.

![Fig 3.10: Non-Rebreather mask](image1)

![Fig 3.11: Patient with partial Non-Rebreather mask](image2)

![Fig 3.12: Patient with Non-Rebreather](image3)
5. **Venturi mask:**
   - Venturi mask is a high flow oxygen delivery device.
   - 40%-50% oxygen can be delivered with this mask at a flow rate of 4-15 L/min.
   - The valve is constructed in such a way that a constant flow of room air is blended with fixed concentration of oxygen.
   - Must set O2 flow and air entrapement ratio correctly to achieve desired FiO2

**Advantages of venturi mask:**
   - Delivers most precise oxygen concentration.
   - Does not make dryness of mucus membrane.

**Disadvantages of venturi mask:**
   - Uncomfortable for the patient.
   - Skin irritation may occur.
   - Produce respiratory depression in COPD patient with high concentration of oxygen.
   - Oxygen supply need to be disrupted during eating and talking.

6. **High flow nasal cannula:**

Heat and humidified high flow nasal cannula or High-Flow Nasal Cannula (HFNC), is not simply a standard nasal cannula increased to very high flow rates. It heats gas to 370°C with a 100% relative humidity and can deliver 0.21 – 1.00% FiO2 at flow rates of up to 60 liters/min.

   - High-flow nasal cannula (HFNC) oxygen therapy comprises
     - An air/oxygen blender.
     - An active humidifier.
     - A single heated circuit.
     - A nasal cannula.
• Delivers adequately heated and humidified medical gas at up to 60 L/min of flow.
• Considered to have a number of physiological effects
  o Reduction of anatomical dead space.
  o PEEP effect.
  o Constant fraction of inspired oxygen.
  o Humidification.

Advantages of HFNC:
• Precise oxygen delivery.
• Functional residual capacity enhancement.
• Dead space washout.

Physiological effects:
• High flow of adequately heated and humidified gas is considered to have a number of physiological effects.
• High flow washes out carbon dioxide in anatomical dead space.
• Although delivered through an open system, high flow overcomes resistance against expiratory flow and creates positive nasopharyngeal pressure. While the pressure is relatively low compared with closed systems, it is considered adequate to increase lung volume or recruit collapsed alveoli.
• The difference between the inspiratory flow of patients and delivered flow is small and FIO2 remains relatively constant.
• Because gas is generally warmed to 37°C and completely humidified, mucociliary functions remain good and little discomfort is reported.

Skill Learning:
Oxygen therapy:

Summary:

Oxygen
• Oxygen is a colorless, odorless, tasteless gas that is essential for the body to survive.

Oxygen therapy:
Administration of oxygen at a concentration greater than that found in the environmental atmosphere.
• The air that we breathe contain approximately 21% oxygen.
• The heart relies on oxygen to pump blood.
• The purpose of oxygen therapy is to increase oxygen saturation in tissues where the saturation levels are too low due to illness or injury.
Learning objectives: After this skill station participants will be able

- To identify different oxygen therapy devices.
- To know the usage of different oxygen therapy devices.
- Use the different oxygen therapy devices.

Instruction to the facilitator:
Lead the station in two part:

Part I: Discussion:
Ensure that all participant’s participation
Leading question may be a useful way.

Part II : Skill practice
a. The facilitator will demonstrate the skill without verbalization.
b. The facilitator will demonstrate the skill with simultaneous verbalization.
c. The facilitator will demonstrate one of the participants will verbalize.
d. Participant will perform the skill and will verbalize simultaneously.
e. Ensure that all the participants perform every skill.

Indications of O₂ Therapy:

- Documented hypoxemia as evidenced by
  - PaO₂ < 60 mmHg or SaO₂ < 90% on room air.
  - PaO₂ or SaO₂ below desirable range for a specific clinical situation.
- Acute care situations in which hypoxemia is likely.
- Severe trauma.
- Acute myocardial infarction.
- Short term therapy (Post anaesthesia recovery).
- Severe respiratory distress (acute asthma or pneumonia).
- Chronic obstructive pulmonary disease (COPD, including chronic bronchitis, emphysema, and chronic asthma).

Assessment:
- The need for oxygen therapy should be assessed by
  1. Clinical assessment:
  2. Monitoring:
     o ABG - PaO₂
     o SpO₂
### Table 3.3: Clinical Assessment of Hypoxia

<table>
<thead>
<tr>
<th>Systems affected</th>
<th>Mild to moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNS</td>
<td>• Restlessness</td>
<td>• Disorientation</td>
</tr>
<tr>
<td></td>
<td>• Somnolence</td>
<td>• Impaired judgment</td>
</tr>
<tr>
<td></td>
<td>• Confusion</td>
<td>• Lassitude</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Loss of co-ordination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Headache</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Obtunded mental status</td>
</tr>
<tr>
<td>Cardiac</td>
<td>• Tachycardia</td>
<td>• Bradycardia,</td>
</tr>
<tr>
<td></td>
<td>• Mild hypertension</td>
<td>• Arrhythmia</td>
</tr>
<tr>
<td></td>
<td>• Peripheral vasoconstriction</td>
<td>• Hypotension</td>
</tr>
<tr>
<td>Respiratory</td>
<td>• Dyspnea</td>
<td>• Increasing dyspnoea</td>
</tr>
<tr>
<td></td>
<td>• Tachypnea</td>
<td>• Tachypnoea</td>
</tr>
<tr>
<td></td>
<td>• Shallow &amp; Laboured breathing</td>
<td>• Bradypnoea</td>
</tr>
<tr>
<td>Skin</td>
<td>• Paleness</td>
<td>• Cyanosis</td>
</tr>
<tr>
<td></td>
<td>• Cold</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Clammy</td>
<td></td>
</tr>
</tbody>
</table>
Flow chart for oxygenation of COVID-19 patient (Adult):

Suspected or confirmed COVID-19 patient

Initial quick assessment
- Repidly Increasing Oxygen demand
- Unconsciousness: Hypotension/Tachycardia/Bradycardia
- Increased alarm marker: CRP, D-dimer, Serum ferritin, N-L Ratio

Respiratory Distress (Moderate)
- RR <=30/min
- SpO2 94%

Yes

Venturi mask FiO2 50%; 2-151/min
Non Rebreather mask 151/min

Yes

Critical Case

Respiratory Distress (Severe)
- RR <=30/min
- SpO2 90%
- PaO2/FiO2 3DD

Yes

Venturi mask FiO2 50%; 2-151/min
Non Rebreather mask 151/min

Yes

Reassessment at least every 30 mins in first one hour and then hourly for the next few hours.
- Is the patient deteriorated; no improvement and increasing work of breathing?

No

Yes

Reassessment at least every 30 mins in two hours.
- Is the patient deteriorated; no improvement and increasing work of breathing?

No

Yes

Intubation

RR: Respiratory Rate; SpO2: Oxygen Saturation; PaO2: Partial Pressure of Oxygen; FiO2: Fraction of inspired oxygen; I: Liter; HFNC: High flow nasal canula; NIV: Non-invasive ventilation.
Details of Oxygenation of COVID-19 adult patients with examples

**Step 1: Quick clinical assessment**

+ Disorientation
+ Hemodynamic stability
+ Any sign of airway obstruction
+ And Check SpO2
+ Optional ABG and CXR

**Step 2: Resuscitation based on A B C**

+ ‘A’ stands for airway – look for airway patency
+ ‘B’ stands for breathing – look for breathing pattern
+ ‘C’ stands for circulation – look for pulse and blood pressure

**Step 3: Start Oxygen**

It is assumed that patient with mild disease (SPO2 ≥ 94) may be treated at home; moderate disease (SPO2 90 to 92) may require non-ICU oxygen supported bed; and severe disease (SPO2 < 90) may need ICU for noninvasive/invasive ventilation.

<table>
<thead>
<tr>
<th>Condition of Patient</th>
<th>Oxygenation procedure</th>
<th>Target</th>
<th>Preferred source</th>
<th>Preferred device</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpO2 is persistently lower than 94%</td>
<td>Start supplemental oxygen up to 1-6 LPM and provide up to 40% FiO2. <strong>Consider awake proning</strong> Monitor SpO2, Consciousness, Respiratory rate, Pulse and Blood pressure</td>
<td>SpO2 ≥ 92% to 96% with the minimum FiO2.</td>
<td>Oxygen cylinder or oxygen concentrator</td>
<td>Nasal cannula or face mask</td>
</tr>
</tbody>
</table>

**Step 4: If no improvement in oxygenation**

<table>
<thead>
<tr>
<th>Condition of Patient</th>
<th>Oxygenation procedure</th>
<th>Target</th>
<th>Preferred source</th>
<th>Preferred device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild to moderate SPO2 ≤90% to 92% room air.</td>
<td>Give higher oxygen 5-10 LPM which provide up to 60% FiO2. <strong>Consider awake proning</strong> Monitor SpO2, Consciousness, Respiratory rate, Pulse and Blood pressure</td>
<td>SpO2 ≥ 92% to 96% with the minimum FiO2.</td>
<td>Oxygen cylinder or oxygen concentrator</td>
<td>Nasal cannula or face mask</td>
</tr>
</tbody>
</table>

**Step 5: If no improvement in oxygenation, plan to transfer to any appropriate health facility where higher oxygen storage system is available**

1. Calculate oxygen requirement during transfer and keep extra cylinder and pulse oximeter in the ambulance.
2. It is recommended that the following delivery devices should be available in ambulance settings where oxygen is administered.
   - High concentration reservoir mask (non-rebreath mask) for high-dose oxygen therapy.
   - Nasal cannulae (preferably) or simple face mask for medium dose oxygen therapy.
3. This guideline suggests aiming to achieve a normal or near-normal oxygen saturation for all acutely ill patients apart from those at risk of hypercapnic respiratory failure. The suggested target saturation range for most patients is 94-98%. Patients at risk of hypercapnic respiratory failure have a lower target saturation range, usually 88-92%.
4. In ambulance, if SpO₂ is 85 – 91%, Titrate O₂ flow to SpO₂ of 92 – 96%
   - Initial dose of 2 – 6 L/min via nasal cannulae
   - Consider simple face mask 5 – 10 L/m
5. In ambulance, if SpO₂ < 85%
   - Initial dose nonrebreather mask 10-15 L/min
   - If inadequate VT, consider BVM ventilation with 100% Oxygen
6. Once Patient haemodynamically stable and has reliable oximetry reading
   - Titrate O₂ flow to SpO₂ of 92 – 96%

<table>
<thead>
<tr>
<th>Calculation of oxygen requirement with transport time (considering Type D Oxygen Cylinder-1500 Liter)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of device</strong></td>
</tr>
<tr>
<td>Nasal cannula</td>
</tr>
<tr>
<td>Face mask</td>
</tr>
<tr>
<td>NRB mask</td>
</tr>
</tbody>
</table>

**Step 6: Referred to in any appropriate health facility where higher oxygen storage system is available**

<table>
<thead>
<tr>
<th>Condition of Patient</th>
<th>Oxygenation procedure</th>
<th>Target</th>
<th>Preferred source</th>
<th>Preferred device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referred to District Hospital/ MCH/ in any appropriate health facility if condition is deteriorating</td>
<td>Venturi Mask: up to 15 LPM and provide up to 60% FiO₂ Or Partial rebreather mask: up to 15 LPM and provide up to 70% FiO₂ Or Nonrebreather mask: up to 15 LPM and provide up to 95% FiO₂ Monitor SpO₂, Consciousness, Respiratory rate, Pulse and Blood pressure</td>
<td>SpO₂ 92% to 96% with the minimum FiO₂.</td>
<td>Central gas line or Large cylinder at District Hospital/ MCH/ in any appropriate health facility</td>
<td>Venturi Mask or Partial rebreather mask or Nonrebreather mask</td>
</tr>
</tbody>
</table>
Step 7: If no improvement in oxygenation

<table>
<thead>
<tr>
<th>Condition of patient</th>
<th>Oxygenation procedure</th>
<th>Target</th>
<th>Preferred source</th>
<th>Preferred device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe disease SPO₂ &lt; 90</td>
<td>1. HFNC should be preferable in ICU settings and should only be used in the presence of trained person. HFNC can provide up to 100% FiO₂ with 60L/min flow. Increased risk of aerosolization. Need frequent adjustment. Can not be used for prolonged time and improve filtration must be followed. Indicated for hypoxic respiratory failure, COPD exacerbation and acute cardiogenic pulmonary edema. Or CPAP/BiPAP via oronasal mask. CPAP can reduce work of breathing and improve oxygenation, while bilevel positive airway pressure (BiPAP) generally improves ventilation and can improve tidal volumes. CPAP/BiPAP should be considered in patients who have failed by high-flow nasal cannula or if high-flow nasal cannula is not available and those who don’t prefer to intubate. 2. Patients who remain hypoxemic despite use of oxygen, HFNO, or NIV, and who do not exhibit clear signs of respiratory distress; this however requires close monitoring and clear failure and escalation criteria. Prone positioning</td>
<td>SpO₂ 92% to 96% with the minimum FiO₂.</td>
<td>1. For HFNC need central oxygen line with 4 bar pressures 2. PSA or VSA Oxygen Plant 3. Noninvasive ventilation (BiPAP and CPAP) can be used with any oxygen source with backup battery</td>
<td>High flow nasal cannula/non invasive ventilation</td>
</tr>
</tbody>
</table>

| | | | 3. Monitor SpO₂, Con sciousness, Respiratory rate, Pulse and Blood |

for 12–16 hours in case of refractory hypoxemia (PaO₂/FiO₂ < 150 mmHg, FiO₂ ≥ 0.6, PEEP ≥ 10 cmH₂O).
Step 8: If no improvement in oxygenation

<table>
<thead>
<tr>
<th>Condition of patient</th>
<th>Oxygenation procedure</th>
<th>Target</th>
<th>Preferred source</th>
<th>Preferred device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indications of tracheal intubation and mechanical ventilation</td>
<td>Ventilator setup for COVID 19 patients with ARDS Low tidal volume ventilation strategy:</td>
<td>SpO₂ 92% to 96% with the minimum FiO₂.</td>
<td>For HFNC need central oxygen line with 4 bar pressures</td>
<td>High flow nasal cannula/no invasive ventilation</td>
</tr>
<tr>
<td>➢ Signs of impending respiratory failure</td>
<td>➢ AC with TV target 6 ml/kg BW (range 4 to 8 ml/kg BW)</td>
<td></td>
<td>PSA or VSA Oxygen Plant</td>
<td></td>
</tr>
<tr>
<td>➢ Rapid progression of disease over hours</td>
<td>➢ RR 12 to 25 breaths/min</td>
<td></td>
<td>Non invasive ventilation (BiPAP and CPAP) can be used with any oxygen source with backup battery</td>
<td></td>
</tr>
<tr>
<td>➢ Lack of improvement on &gt;40L/min of high flow oxygen and FiO₂ &gt; .6</td>
<td>➢ PEEP: PEEP 5 to 20 cm H₂O.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>➢ Increasing work of breathing</td>
<td>➢ FiO₂: titrate oxygen to target PaO₂ 55 to 80 mmHg, SpO₂ 90 to 96 for most patients</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>➢ Worsening mental status</td>
<td>➢ Plateau pressure &lt; 30 cm H₂O Monitor SpO₂, Consciousness, Respiratory rate, Pulse and Blood pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>➢ Arterial pH &lt; 7.3 with PaCO₂ &gt; 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>➢ Hemodynamic instability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>➢ Multiorgan organ failure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q. Name the oxygen therapy devices (Make sure that “All the participants should be able to identify the devices”).
   - Nasal cannula
   - Simple oxygen mask
   - Non-rebreathing mask
   - Used for low-medium concentrations of Oxygen (24-44%)

Q. How much oxygen can be delivered with different devices?
   - Nasal cannula: 24-44%
   - Simple oxygen mask: 35-60%
   - Partial non-breathing mask: 60%
   - Non-rebreathing mask: 95-100%
   - Venturi mask: 24-60%
   - One litre of oxygen will enrich by 4%

Part II: Skills Practice:
Exhibit the different oxygen therapy devices. Ask the participant to identify the devices.
The following devices the participants should identify:
1. Nasal Cannula
2. Face masks
3. Venturi masks
4. Partial rebreathing mask
5. Non-rebreathing mask
6. High flow nasal cannula

Demonstrate the usage of different oxygen therapy devices. Make sure that all the participants now know how to use the devices.

Nasal Cannula/Face mask. (One participant can be used as simulator)
   Step 1. Identify the patient to whom you want to supplement oxygen by nasal cannula.
   Step 2. Tell the patient what you are going to do.
   Step 3. Explain the advantages and disadvantages to the patient.
   Step 4. Take consent from the patient (Verbal).
   Step 5. Check the oxygen source that sufficient oxygen is present.
   Step 6. Fit the Adaptor to oxygen source.
   Step 7. Adjust oxygen supply to 2-3 LPM (Should not more than 5LPM).
   Step 8. Anchor the device.
   Step 9. Ask if the patient is comfortable.
   Step 10. Connect the patient to Pulse oximeter.
   Step 11. Monitor SpO2 for improvement.

Equipment List:
1. Nasal Cannula 2
2. Oxygen face mask (Hudson mask) 2
3. Partial Non-Breathing mask 2
4. Non-rebreathing mask 2
5. Venturi mask 1 set
6. High flow nasal cannula 1
Fig 3.14: Devices that are commonly used to deliver oxygen.
A: Non-rebreathing reservoir mask; B: simple face mask;
C: Venturi mask; D: low-flow nasal cannula;
E: low-flow humidified system (unheated);
Oxygen Therapy for Children:
Fewer children than adults have been affected by the COVID-19 pandemic, and the clinical manifestations are distinct from those of adults. Some children particularly those with acute or chronic co-morbidities are likely to develop critical illness.

Indications:
Any child with a SPO2 < 90% should receive oxygen (15)
Oxygen delivery methods in children and infants

Table 3.4: Oxygen Delivery Methods in Children and Infants:

<table>
<thead>
<tr>
<th>Method</th>
<th>Maximum O₂ flow (LPM)</th>
<th>Actual inspired fraction (%) from 1LPM by a 5 kg infant</th>
<th>PEEP</th>
<th>Humidification</th>
<th>Risk for hypercapnoea</th>
<th>Risk for airway obstruction</th>
<th>Equipment required</th>
<th>Nursing demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasal prongs</td>
<td>Neonates: 0.5 - 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Infants: 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preschool: 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>School: 6</td>
<td>45</td>
<td>Minimal</td>
<td>Not required</td>
<td>No</td>
<td>Minimal</td>
<td>Nasal prongs</td>
<td>+</td>
</tr>
<tr>
<td>Nasal catheter</td>
<td>Neonates: 0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Infants: 1</td>
<td>50</td>
<td>+</td>
<td>Not required</td>
<td>No</td>
<td>+</td>
<td>8-F catheter</td>
<td>++</td>
</tr>
<tr>
<td>Nasopharyngeal catheter</td>
<td>Neonates: 0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>++</td>
</tr>
<tr>
<td></td>
<td>Infants: 1</td>
<td>55</td>
<td>++</td>
<td>Required</td>
<td>No</td>
<td></td>
<td>8-F catheter, humidifier</td>
<td>+++</td>
</tr>
<tr>
<td>Head box, facemask, incubator, tent Not recommended, as oxygen is used inefficiently</td>
<td>Head box: 2–3 LPM</td>
<td>Nil</td>
<td>Not required</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>Head box, facemask</td>
<td>+++</td>
</tr>
</tbody>
</table>

F, French; PEEP, positive end expiratory pressure
Higher flow rates without effective humidification may cause drying of nasal mucosa, with associated bleeding and airway obstruction (16).
CHAPTER FOUR:
VENTILATION

Learning Objectives: After this session participants will be able to

- Understand the situations of ventilation compromise.
- Know the indications of Mechanical ventilation.
- Know the ways of ventilatory support.
- Operate the non-invasive and invasive ventilators.

Introduction:
Ensuring a patent airway is an important step in providing oxygen to patients, but it is only the first step. Airway patency does not guarantee adequate ventilation. Adequate gas exchange is required to maximize oxygenation and carbon dioxide elimination.

Causes of Ventilation Compromise:

- Airway obstruction.
- Altered ventilatory mechanics.
- Central nervous system depression.

Signs of Inadequate Ventilation:

- Look for chest movement.
- Listen for air movement on both side of chest.
- Pulse oximeter is useful.

Mechanical Ventilation:
Most patients admitted to intensive care require some form of respiratory support. This is usually because of hypoxaemia or ventilatory failure, or both.

The support offered ranges from -

- Oxygen therapy by face mask.
- Through non-invasive techniques such as continuous positive airways pressure.
- To full mechanical ventilatory support with endotracheal intubation.
- Mechanical ventilation is the process of using positive pressure devices to provide oxygen and carbon dioxide transport between the environment and the pulmonary capillary bed.
- The desired effect of mechanical ventilation is
  - To maintain adequate levels of PO2 and PCO2 in arterial blood.
  - Unloading the inspiratory muscles.

The Basic Components of A Mechanical Ventilatory Support System:

- An artificial airway (or sometimes a mask) that provides the interface between the mechanical ventilator and the patients airways.
- A source of oxygen enriched positive pressure breaths delivered either in accordance with a set timer or in response to a patient effort.
- The capability to maintain an end expiratory positive pressure.
Clinical Problems That Constitute The ‘Indications’ for Providing Mechanical Ventilatory Support:

- Provide a reliable number of breaths in patients without an appropriate spontaneous ventilatory controller.
- Unload fatigued or impaired ventilatory muscles that are incapable of providing adequate tidal breaths.
- Maintain alveolar patency in patients with inflamed or flooded lung units.
- Support an artificial airway in a patient who cannot maintain and/or protect the natural airway.

Indications for Intubation and Ventilation:

- Protect the airway; eg. facial trauma or burns, unconscious patient (GCS <8).
- Treat profound hypoxaemia; eg. pneumonia, cardiogenic pulmonary oedema, acute respiratory distress syndrome.
- Postoperative care; eg. after cardiothoracic surgery and other major, complicated, or prolonged surgery.
- Allow removal of secretions; eg. myasthenia gravis, Guillain-Barré syndrome.
- Rest exhausted patients; eg. severe asthma.
- Avoid or control hypercapnia; eg. acute brain injury, hepatic coma, chronic obstructive airways disease.

Indication of Ventilatory Support:

- Bradypnea or Apnea with respiratory arrest.
- Acute lung injury and the acute respiratory distress syndrome.
- Tachypnea (respiratory rate >30 breaths per minute in adults).
- Vital capacity less than 15 mL/kg.
- Minute ventilation greater than 10 L/min.
- Arterial partial pressure of oxygen (PaO2) with a supplemental fraction of inspired oxygen (FIO2) of less than 55 mm Hg.
- Alveolar-arterial gradient of oxygen tension (A-a DO2) with 100% oxygenation of greater than 450 mm Hg.
- Clinical deterioration.
- Respiratory muscle fatigue.
- Obtundation or coma.
- Hypotension.
- Acute partial pressure of carbon dioxide (PaCO2) greater than 50 mm Hg with an arterial pH less than 7.25.
- Neuromuscular disease.

Potential Problems During Intubation:

- Hypotension.
- Reduced intrinsic sympathetic drive.
- Reduced cardiac output.
- Severe hypoxaemia.
- Regurgitation and aspiration of gastric contents.
- Arrhythmias.
- Electrolyte disturbances, especially hyperkalaemia after suxamethonium.
Ventilatory Support Methods:

- Bag mask ventilation.
- Mechanical ventilation.
  - Non-invasive ventilation.
  - Invasive ventilation.

Bag Mask Ventilation:

Ventilatory assistance may be needed prior to intubation. Effective ventilation can be achieved by bag-mask techniques. However, one-person ventilation techniques using a bag mask may be less effective than two-person techniques, in which both sets of hands can be used to ensure a good seal. For this reason, bag-mask ventilation should be performed by two people whenever possible.

Intubation of patients with hypoventilation and/or apnea may not be successful initially and may require multiple attempts. The patient must be ventilated periodically during prolonged efforts to intubate. Every effort should be made to optimize intubation conditions to ensure success on the first attempt.

One-person Bag mask Ventilation:

- **STEP 1.** Select the proper size of mask to fit the patient’s face. The mask should extend from the proximal half of the nose to the chin.
- **STEP 2.** Connect the oxygen tubing to the bag-mask device and adjust the flow of oxygen to 15 L/min.
- **STEP 3.** Ensure that the patient’s airway is patent (an oropharyngeal airway will prevent obstruction from the tongue).
- **STEP 4.** Apply the mask over the patient’s nose and mouth with the dominant hand, ensuring a good seal. This is done by creating a ‘C’ with the thumb and index finger while lifting the mandible into the mask with other three fingers of the dominant hand.
- **STEP 5.** Initiate ventilation by squeezing the bag with the non-dominant hand.
- **STEP 6.** Assess the adequacy of ventilation by observing the patient’s chest movement.
- **STEP 7.** Ventilate the patient in this manner every 5 seconds.

Two Person Bag Mask Ventilation:

- **STEP 1.** Select the proper size of mask to fit the patient’s face.
- **STEP 2.** Connect the oxygen tubing to the bag-mask device and adjust the flow of oxygen to 15 L/min.
- **STEP 3.** Ensure that the patient’s airway is patent (an oropharyngeal airway will prevent obstruction from the tongue).
- **STEP 4.** The first person applies the mask to the patient’s face, performing a jaw-thrust maneuver. Using the thenar minence (or thumbs-down) technique may be easier for novice providers. Ensure a tight seal with both hands.
- **STEP 5.** The second person initiates ventilation by squeezing the bag with both hands.
- **STEP 6.** Assess the adequacy of ventilation by observing the patient’s chest movement.
- **STEP 7.** Ventilate the patient in this manner every 5 seconds.
Non-invasive Ventilation:

![Non-invasive Ventilation](image)

**Fig 4.1: Non-invasive Ventilation**

**Background:**
- Initially used in the treatment of hypoventilation with neuromuscular disease
- Now accepted modality in the treatment of acute respiratory failure

**Respiratory Mechanics:**
- Respiratory efforts required for inspiration to overcome
  - Elastic work
  - Flow resistance work (airway obstruction)
- Respiratory failure - forces opposing inspiration exceeds respiratory muscle effort.

**Respiratory Failure:**
- Failure to maintain adequate gas exchange.
- Two types of respiratory failure are
  - Hypoxic (Type 1) respiratory Failure
  - Hypercapnic/Hypoxic (Type 2) respiratory failure
- Respiratory failure may be
  - Acute
  - Chronic
  - Acute on chronic

**Effects of Non-invasive Ventilation:**
- Improves alveolar ventilation to reverse respiratory acidosis and hypercarbia.
- Recruit alveoli and increase FRC to reverse hypoxia.
- Reduces work of breathing.
Advantages of Non-invasive Ventilation:

- Non-invasiveness.
- Application: Easy to implement and easy to remove.
- Reduces sedation need.
- Oral patency: Preserves speech, swallowing & cough.
- Avoids resistive work of endotracheal tube (ETT).
- Avoids complications of ETT
  - **Early**
    - Trauma.
    - Aspiration.
    - Hypoxia.
    - Failed intubation.
  - **Late**
    - Injury to the hypopharynx, larynx & trachea.
    - Hoarseness of voice.
    - Injury to laryngeal nerves.
    - Nosocomial infection.
- Reduces cost and hospital stay.
- Reduces cost and hospital stay.

Disadvantages:

- System
  - Slower correction of gas exchange abnormalities.
  - Gastric distension.
- Masks
  - Air leakage.
  - Facial skin necrosis (most common complication).
- Lack of airway access and protection
  - Suctioning.
  - Aspiration.
- Compliance/claudrophobia.
- Cannot be provided in unconscious patient.
- CPAP (Continuous Airway Pressure) mode.
- Bilevel / Bi PAP mode.

Which Mode When?

In general, in hypoxaemia CPAP is suitable. In hypercapnia and hypoxaemia, combined Bi-level is suitable.

CPAP:

- Stands for continuous positive airway pressure.
- There is constant airway pressure throughout the cycle.
- Recruit alveoli
  - Improves oxygenation.
  - Decrease work of breathing.
  - Unloads inspiratory muscle.
  - Improves oxygenation/correct hypoxia.
- Reduces intra-pulmonary shunt.
Indications of CPAP:

- Acute Pulmonary oedema.
- Pneumonia.

Bi-Level Pressure Support:

- Combination of IPAP & EPAP.
  - IPAP
    - Stands for Inspiratory positive airway pressure.
    - Is the pressure support.
  - EPAP
    - Stands for Expiratory positive airway pressure.
    - Is the CPAP.

Respiratory Effects of Bi-PAP:

- EPAP
  - Provide PEEP.
  - Increases Functional Residual Capacity.
  - Reduces FiO2 required to optimize SaO2.
- IPAP
  - Decreases work of breathing.
  - Increases spontaneous tidal volume.
  - Decreases spontaneous respiratory rate.

Indications for Bi-Level:

- Acute Respiratory Failure.
- Chronic airway limitation /COPD.
- Asthma.

Indications CPAP/BiPAP:

- AOP, COPD.
- Contraindication excluded.
  - Assessment
    - Sick but not moribund.
    - Able to protect airway.
    - Conscious, co-operative.
    - Haemodynamic stability.
  - Premorbid, ceiling of therapy.

Contraindications:

- Impaired consciousness, confusion, agitation.
- Inability to protect airway.
- Excessive secretion or vomiting.
- Haemodynamic instability.
- Untreated pneumothorax.
- Bowel obstruction.
- Facial trauma/ facial Burn/ recent facial surgery.
- Fixed upper airway obstruction.
Complications of CPAP/BiPAP

- Hypoxia
- Pulmonary barotrauma.
- Reduced cardiac output.
- Vomiting & aspiration.
- Gastric distension.

Non-invasive Ventilator Settings:

- **LVP**
  - CPAP at 5-8 cm H2O, increase to max 10-15 cm H2O.
  - Increase pressure until adequate tidal volume (7 ml/Kg), RR <25 & patient’s comfort is achieved.
  - Titrate FiO2 to achieve SpO2 >90%.
  - Keep Peak pressure < 25-30 cm H2O.

- **COPD**
  - Mode: Spontaneous/Timed.
  - EPAP: 4-5 cm H2O, IPAP :12-15 cm H2O.
  - Trigger: Maximum sensitivity.
  - Back up RR: 15 /min.
  - Back up I:E: 1:3.

Monitoring During Non- invasive Ventilator:

- **Physiological**
  - Continuous oximetry, BP every 4 hours.
  - Exhaled tidal volume.
  - ABG initial, then after 1 hour, then every 2-6 hours.

- **Objective**
  - Respiratory rate.
  - Chest movement.
  - Co-ordination of respiratory effort with NIV.
  - Accessory muscle use.
  - Heart rate & blood pressure.
  - Mental state.

- **Subjective**
  - Dyspnoea.
  - Comfort.

Invasive ventilation:

![Fig 4.2: Invasive Ventilation](image-url)
• The inability to breathe spontaneously inevitably leads to the need for mechanical ventilation (MV).
• MV is an essential supportive treatment for critically ill patients and is a frequent occurrence in the ICU.
• It is connected to the patient through the use of an endotracheal tube or a tracheostomy tube via a closed circuit.
• Ventilators are classified based on the methods utilized to cycle between the inspiratory and the expiratory phases. These include the:
  o Pressure control mode - the inspiratory pressure is set, the rate is set and the volume is dependent on the patient’s lung compliance.
  o Volume control mode - the tidal volume is pre-set, the rate is set but the peak inspiratory pressure varies depending on the patient’s degree of lung compliance.

Table 4.1: Different Ventilatory Modes:

<table>
<thead>
<tr>
<th>Ventilator mode</th>
<th>Description</th>
</tr>
</thead>
</table>
| • SIMV (Synchronised intermittent mandatory ventilation) | o Delivers pre-set volume or pressure at a pre-set rate and it is synchronised with the patient’s own respiratory effort  
  o Volume or pressure cycled  
  o Most commonly used ventilator mode  
  o Can be used as a weaning mode  |
| • CMV (Controlled mandatory ventilation) | o Delivers gas at a pre-set volume and rate is not synchronised with spontaneous breaths                                                                                                                   |
| • PSV (Pressure support ventilation)    | o A pre-set inspiratory pressure enhances the spontaneous breaths of the patient  
  o The rate and volume of the ventilation is controlled by the patient                                                                                                                                 |
| • PC (Pressure control ventilation)      | o Gas is delivered at a pre-set rate and inspiratory pressure, and volume is dependent on the patient’s lung compliance                                                                                     |
| • BIPAP (Bilevel positive airway pressure) | o Pressure-controlled ventilation that allows spontaneous breaths from the patient anywhere in the cycle  
  o Provides high and low positive end-expiratory pressure                                                                                         |
| • CPAP (Continuous positive airway pressure) | o Provides constant positive airway pressure in spontaneous mode (often seen with PSV)  
  o Promotes the exchange of gasses through the opening of alveoli and by increasing the functional residual capacity                                                                                   |
| • PEEP (Positive end-expiratory pressure) | o Same principle as CPAP but in a non-spontaneous mode                                                                                                                                                    |
Skill Learning:

One-person Bag Mask Ventilation:

- **STEP 1.** Select the proper size of mask to fit the patient’s face. The mask should extend from the proximal half of the nose to the chin.
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- **STEP 5.** Initiate ventilation by squeezing the bag with the non-dominant hand.
- **STEP 6.** Assess the adequacy of ventilation by observing the patient’s chest movement.
- **STEP 7.** Ventilate the patient in this manner every 5 second.

Equipment list:

- Intubating mannequin 01
- AMBU bag 02
- CPAP machine 01
- Mechanical ventilator 01
CHAPTER FIVE:
INFECTION PREVENTION CONTROL AND STERILITY MAINTENANCE IN ICU

Learning Objectives: After this session participants will be able to

- Identify the sources of preventable infection in ICU
- Understand and apply the importance of hand washing
- Know the most important moments for hand washing
- Understand other measures of infection prevention in ICU

Healthcare-associated infections are those that occur 48 h after hospital admission and can lead to significant morbidity and mortality, with blood stream and pulmonary infections carrying the highest mortality rate.

Critically ill patients have more risk for infection due to

- Low resistance of patients to infection.
- Invasive procedures/interventions are undertaken frequently.
- Inappropriate antimicrobial usage.
- Drug resistance to microbes.
- Contaminated environments.

What Is Infection Control Protocol In Intensive Care Unit?

- Routine hand washing before and after patient contact remains the most important infection control measure.
- Transmission of exogenous Staphylococcus or other potential pathogens, especially in the ICUs where patient care necessitates frequent contact, by the hands of HCWs is well-documented.

Application of Standard Precautions:

Standard Precautions are the infection prevention practices that to applied for patient care and personal safety. There are 7 Elements for Standard Precaution-

- Hand hygiene (soap-water/ alcohol based (70% alcohol) handrub).
- Respiratory hygiene and cough etiquette (cover cough-sneeze).
- Personal protective equipment (PPE) use (gloves, mask, gown, eye protection as needed).
- Safe injection practices, sharps management and injury prevention.
- Safe handling, cleaning and disinfection of patient care equipment (including sample, patient care area).
- Decontamination of environmental surfaces (patient care area, work surfaces, table, room etc.) and safe handling and cleaning of soiled linen.
- Waste management.

How Is Infection Controlled In ICU?

Four distinct areas stand out as particular areas of concentration

- Preventing contact transfer
- Improving surface cleaning
- Preventing device-related infections
- Altering hand hygiene compliance.
How Can We Prevent ICU Infection?

Measures of infection control include-
- Identifying patients at risk of nosocomial infections.
- Observing hand hygiene.
- Following standard precautions to reduce transmission.
- Implementing strategies to reduce Ventilator Associated Pneumonia (VAP), Catheter Related Blood Stream Infection (CR-BSI), Catheter Associated Urinary Tract Infection (CAUTI)
- Emphasizing environmental factors and architectural layout.

What Are The 5 Standard Precautions for Infection Control?

Standard Precautions:
- Hand hygiene.
- Use of personal protective equipment (e.g., gloves, masks, eyewear).
- Respiratory hygiene/cough etiquette.
- Sharps safety (engineering and work practice controls).
- Safe injection practices (i.e., aseptic technique for parenteral medications).
- Sterile instruments and devices.

What Is The Most Effective Way to Prevent Infection?
- Proper hand washing is the most effective way to prevent the spread of infections in hospitals.
- If you are a patient, don't be afraid to remind friends, family and health care providers to wash their hands before getting close to you.

Standard precaution steps:
- Hand washing.
- PPE.
- Decontamination.
- Waste disposal.

WHO Infection Control Standard Precautions:

Standard Precautions Consist of
- Hand hygiene.
- Safe cleaning and decontamination.
- Safe handling and disposal of waste and linen.
- Sharps safety.
- Correct use of personal protective clothing.
- Safe handling of blood and body fluids and respiratory hygiene.
- Clean and disinfected environmental surfaces.
HAND HYGIENE:
- Hand washing is the most effective measure in infection control.
- 80% of disease are spread by hands.

What Are The 5 Moments of Hand Hygiene?
- Before touching a patient.
- Before clean/aseptic procedures.
- After body fluid exposure/risk.
- After touching a patient.
- After touching patient surroundings.

Fig 5.1: Five moments of hand hygiene
How to Handwash?

Hand Hygiene Technique with Soap and Water

Duration of the entire procedure: 40-60 seconds

0. Wet hands with water;
1. Apply enough soap to cover all hand surfaces;
2. Rub hands palm to palm;
3. Right palm over left dorsum with interlaced fingers and vice versa;
4. Palm to palm with fingers interlaced;
5. Backs of fingers to opposing palms with fingers interlocked;
6. Rotational rubbing of left thumb clasped in right palm and vice versa;
7. Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;
8. Rinse hands with water;
9. Dry hands thoroughly with a single use towel;
10. Use towel to turn off faucet;
11. Your hands are now safe.

Fig 5.2: Hand wash steps
SAVE LIVES: Clean Your Hands Campaign

“Clean care for all – it’s in your hands”

Each year the “SAVE LIVES: Clean Your Hands” campaign aims to progress the goal of maintaining a global profile on the importance of hand hygiene in health care and to ‘Bring People Together’ in support of hand hygiene improvement globally.

Critical Care Bundle Therapy:

A “Bundle” is a structured way to improve patient care and outcomes by following straightforward, well defined, checklist based set of evidence based practices and it is an essential part of surveillance for infection in ICUs.

The bundles which are prepared as an objective, bedside practice based approach with 3–5 elements in each have shown significant reduction in HAIs and improvement in patient outcomes.

It is all or none, for example, “Yes, I completed the ENTIRE bundle” or “No, I did not complete the ENTIRE bundle.”

Fig 5.3: Hand rub steps
Central Line Maintenance Bundle:
- Daily review of line necessity.
- Hand hygiene before manipulation of the intravenous (IV) system.
- Daily inspection of the insertion site.
- Catheter site care.
- Alcohol scrub of insertion hubs for 15 sec before each use.

Ventilator Bundle:
- Elevation of the head end of the bed between 30° and 40°.
- Mouth care with 1%–2% Chlorhexidine (6 h).
- Subglottic suctioning 1–2 h.
- Daily sedation vacation.
- Daily assessment of readiness to wean.
- Daily spontaneous breathing trial.
- Peptic ulcer disease prophylaxis.
- Deep venous thrombosis prophylaxis.

Points to Be Remembered:
- Cuts and wounds to be covered.
- Gloves is not substitute of hand washing.
- When bar soap is used it should be kept dry in a soap case.
- When liquid soap is used avoid topping off of the solution. Keep the dispenser dry.

Fig 5.4: When to Wash Hands
**Respiratory Hygiene and Cough Etiquette:**

These are infection prevention measures designed to limit the transmission of respiratory pathogens spread by droplet or airborne routes. A person with respiratory signs and symptoms is recommended to apply measures given below:

- Wear surgical mask in public place specially when coughing/sneezing.
- Dispose used tissues and masks in yellow waste bin.
- Perform hand hygiene after contact with respiratory secretions.
- In case of sudden episode, use upper arm during coughing and sneezing.
- Turn your head away from people/patients or food while sneezing or coughing In healthcare facilities following precautions to be maintained.
- Place acute febrile respiratory symptomatic patients 1-2 meter away from others in common waiting areas.
- Post visual alerts at the entrance to health-care facilities instructing persons with respiratory symptoms to practice hygiene/cough etiquette.
- Make hand hygiene materials, disposable towels and masks available in common areas and areas used for the evaluation of patients with respiratory illnesses.

**Remember:** In resource limited settings, during sudden episode of coughing and sneezing—using your upper arm could be more convenient—avoid using bare hand palms—if use upper arm, do not touch your upper arm later.

**Personal Protective Equipment (PPE):**

Personal protective equipment (PPE) refers to wearable equipment that is designed to protect healthcare personnel from exposure to or contact with infectious agents. Types of PPE used in healthcare settings include:

- Gloves to protect hands.
- Gowns/aprons to protect skin and/or clothing.
- Masks to protect mouth/nose.
- Respirators to protect the respiratory tract.
- Goggles to-protect eyes.
- Face shield to protect face, mouth, nose and eyes.

**Gloves:**

Gloves impede the contact of the skin of the hand with contaminated surfaces. Things to consider when using gloves include:

- Work from “clean to dirty.”
- Protect yourself, patients and the environment.
- When to change gloves?
  - Change gloves between patient care and procedure of another patient.
  - Change between procedure in the same patients if infectious materials in different areas.
  - Change gloves whenever you are on a break.
- Remove gloves after use, before touching non-contaminated items and surfaces, and before going to another patient.
- Dispose gloves in the designated place.

There is no clear evidence available to support the use of double gloves vs. single gloves.
Skill Learning:

Hand Washing

WHO hand hygiene 7 Steps:

- **Step 1.** Wet hands. Wet your hands and apply enough liquid soap to create a good lather.
- **Step 2.** Rub palms together.
- **Step 3.** Rub the back of hands.
- **Step 4.** Interlink your fingers.
- **Step 5.** Cup your fingers.
- **Step 6.** Clean the thumbs.
- **Step 7.** Rub palms with your fingers.

Equipment List:

Laminate

- Moments of Hand washing
- Steps of Hand washing
Learning objectives: After finishing this session participants will be to

- Know the vital signs of a critically ill patient
- Know the clinical monitoring
- Be able to do electronic monitoring in the ICU
- Conduct laboratory monitoring in ICU
- Be able to collect sample for arterial blood gas analysis
- Interpret and monitor findings

Introduction:

Intensive care units (ICUs) are vital for enhancing the survival of critically ill patients through the continuous monitoring and maintenance of their vital functions.

Continuous monitoring of patients’ vital signs or physiological functions aids in ensuring patient safety through awareness of critical changes in the patient’s health status, and it guides daily therapeutic interventions.

Early recognition of patient deterioration and timely intervention are critical in saving patients’ lives.
Subtle changes in vital signs such as respiratory rate, blood pressure, heart rate temperature and oxygen saturation are early signs of clinical deterioration that will eventually lead to adverse events. Through continuous monitoring of vital signs, clinical deterioration can be identified well in advance of any adverse events occurring. In order to recognise an acute change in a patient’s physiology, their vital signs must first be accurately assessed.

Vital Signs:

The NICE guidelines recommends that a minimum monitoring in ICU should include-
- Pulse/heart rate (HR).
- Respiratory rate (RR).
- Blood pressure (BP).
- Oxygen saturation (SpO2).
- Level of consciousness.
- Temperature.

The additional monitoring of
- Pain.
- Urine output.
- Biochemical analysis.

Pulse:
- Pulse is defined as “the palpable rhythmic expansion of an artery produced by the increased volume of blood pushed into the vessel by the contraction and relaxation of the heart”.
- It reflects both the circulating volume and the strength of contractility.
- There are many factors that can impact the pulse of a patient including:
  - Age.
  - Medication (e.g. beta-blockers).
  - Existing medical conditions (e.g. fever).
  - Fluid status (hyper/hypovolaemia).
- When palpating pulse
  - the strength/amplitude of the pulse.
  - regularity of the pulse.
  - the peripheral equality of pulses between right and left side.

Electrocardiography (ECG):
- Is essential in diagnosing cardiac rhythm disorders.
- The incidence of cardiac arrhythmias is as high as 40% in patients in the ICU.
- Arrhythmia can be attributed to
  - Electrolyte imbalances.
  - Metabolic disturbances.
  - Invasive lines.
  - Multiple drug therapy
  - Quick changes in their intravascular volumes
- The bedside cardiac monitor (oscilloscope) in the ICU
  - Provides a continuous display the patient’s ECG, which includes-
    - Heart rate (measured as the number of QRS complexes)
    - Rhythm
    - Oxygen saturation (SpO2)
Continuous ECG monitoring facilitates quick identification of arrhythmias and therefore staff can promptly respond to such events.

The 3- or 5-lead ECG provides easy attachment and immediate information about the electrical activity of the heart, but the 12-lead ECG provides a more accurate assessment.

In order to detect any abnormalities in rhythm, it is recommended that the HR be assessed for a full 60 seconds.

Definite arrhythmias are diagnosed based on an ECG.

Arrhythmias can be broadly classified into two groups based on heart rate

- Tachycardias (HR > 100 bpm).
- Bradycardias (HR < 60 bpm).

Respiratory Rate:

- Respiratory rate refers to the number of breaths as calculated over one minute.
- Normal RR being 12-20 breaths per minute.
- A rise in RR is the most sensitive indicator of clinical deterioration and impending adverse events such as cardiac arrest or death.
- Tachypnoea refers to a rate of more than 20 breaths per minute and is a sign of respiratory distress.
- Bradypnoea, refers to a RR less than 10 breaths per minute and is often caused by
  - Drugs (e.g. opioids)
  - Hypothermia
  - Fatigue or central nervous system depression.
- A RR of more than 24 breaths per minute is considered a medical emergency as it indicates the possibility of respiratory failure.
- While the measurement of RR is vital, it is also important to assess:
  - Respiratory effort - including depth of inspiration, use of accessory muscles and the sound of breathing (noisy breathing is indicative of an increased workload in breathing)
  - Chest movement - is it equal, bilateral, and symmetrical
  - Pattern/rhythm of breathing.

Table 6.1: Few terminology and definitions

<table>
<thead>
<tr>
<th>Terminology</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tachypnoea</td>
<td>Abnormally quick RR (&gt;20 breaths/minute)</td>
</tr>
<tr>
<td>Bradypnoea</td>
<td>Abnormally slow RR (&lt;12 breaths/minute)</td>
</tr>
<tr>
<td>Dyspnoea</td>
<td>Difficulty with breathing</td>
</tr>
<tr>
<td>Orthopnoea</td>
<td>Difficulty breathing necessitating an upright sitting position to alleviate</td>
</tr>
<tr>
<td>Hypoxia</td>
<td>Insufficient oxygen at a cellular level</td>
</tr>
<tr>
<td>Hypoxaemia</td>
<td>Low levels of oxygen in the blood</td>
</tr>
<tr>
<td>Anoxia</td>
<td>Lack of oxygen</td>
</tr>
</tbody>
</table>
Blood Pressure (BP):

- Blood pressure can be defined as the pressure exerted by the circulatory blood on the arterial walls.
  - It provides an important reflection of the blood flow when the heart is contracting (systole) and relaxing (diastole).
  - Three values are considered when measuring BP:
    - Systolic (SBP)
    - Diastolic (DBP)
    - Mean (MBP) pressure
- SBP indicates the peak pressure attained during the cardiac cycle whereas DBP is the trough.
- Mean arterial pressure (MAP) is defined as the mean pressure during the cardiac cycle and is an important parameter during resuscitation procedures.
- The difference between SBP and DBP is known as the pulse pressure (PP) and determines the peripheral palpability of the arterial pressure.

### Table 6.2: Normal BP values

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Normal values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic Blood Pressure (SBP)</td>
<td>90-140 mm.Hg</td>
</tr>
<tr>
<td>Diastolic Blood pressure (DBP)</td>
<td>60-90 mm.Hg</td>
</tr>
<tr>
<td>Mean Arterial Pressure (MAP)</td>
<td></td>
</tr>
<tr>
<td>[SBP + (2XDBP)]/3</td>
<td>70-105 mm.Hg</td>
</tr>
<tr>
<td>Right Atrial pressure</td>
<td>2-6 mm.Hg</td>
</tr>
</tbody>
</table>

Oxygen Saturation/Pulse Oximetry:

- Pulse oximetry is the technique used to measure arterial oxygen saturation in the peripheral blood vessels.
- It can be defined as “The ratio between oxygenated haemoglobin and the total amount of haemoglobin” in the blood.
  - It is expressed as $\text{SpO}_2$.
  - An $\text{SpO}_2$ of 95-100% is considered within normative ranges.
  - An $\text{SpO}_2$ of less than 90% is of grave concern.
  - It is an easy, painless, non-invasive method whereby a probe is placed on the fingertip or earlobe to measure the oxygen saturation indirectly.
  - A fall in $\text{SpO}_2$ indicates the development of hypoxaemia long before any visual evidence of cyanosis becomes evident.
- Various factors influence the accuracy of pulse oximetry and these include:
  - Movement of the patient.
  - Incorrect positioning of the probe.
  - Hypothermia.
  - Hypovolaemia.
  - Vasocostriction.
  - Nail polish - as it absorbs the light waves used to measure $\text{SpO}_2$.  
Temperature:

- Body temperature is represented by “The balance between heat produced and heat lost (Thermoregulation).”
- Clinically, three types of body temperature have been described:
  - Patient’s core body temperature.
  - Patient’s report on how they feel.
  - Surface body temperature/how the patient feels to touch.
- Temperature can be affected by many factors, including the
  - Underlying pathophysiology (e.g. infection or sepsis).
  - Skin exposure (e.g. in the operating theatre).
  - Small changes at extreme ages.
  - The site where the temperature is measured.
  - Environmental factors such as the oral temperature immediately after consumption of hot/cold beverages.
- Core thermometers (located on catheters and probes inserted into the pulmonary artery, oesophagus, bladder or rectum) are considered to be more accurate than peripheral thermometers (oral, axillary, temporal artery, tympanic membrane) and preferred in critically ill patients.
- Normal body temperature in healthy individuals is considered to be 36.8°C ± 0.4°C [98.2°F ± 0.7 °F] (measured in the oral cavity) with normal circadian variations of 0.5°C (0.9°F)
- Clinically, temperatures of-
  - 33-36°C (91-96.8°F) are considered as mild hypothermia,
  - 28-32°C (82.4-89.6°F) as moderate hypothermia, and
  - below 28°C (82.4°F) as deep hypothermia, whereas any temperature above 38.3°C (~101°F) is considered a fever/hyperthermia.
- A cool skin temperature can also be indicative of poor peripheral perfusion (a circulatory problem) and the capillary refill time (CRT) (normal <2 secs) should therefore also be assessed.

Level of Consciousness:

- Level of consciousness (LOC) is the single most important indicator of cerebral functioning.
- It can be defined as the “degree of arousal and awareness” of a patient.
- In the critically ill patient, the LOC is most commonly assessed using the Glasgow Coma Scale (GCS)
- The simpler AVPU rapid neural assessment method can also be used:

**AVPU:**

A= Alert.
V= Responsive to Verbal stimulation.
P= Responsive to Painful stimulation.
U= Unresponsive.
Glasgow Coma Scale (GCS):

- The GCS assesses two aspects of consciousness, namely, arousal/wakefulness.
- A GCS score of less than 12 is considered concerning and a patient with a score of less than 8 will probably require airway intervention and intubation.
- A reduction of 2 points on the GCS is considered significant in indicating clinical deterioration of the patient.
- A patient’s LOC or mental status can be affected by several factors including side effects in some cases of:
  - Medications (sedatives or analgesics, e.g. benzodiazepines, anxiolytics, opioids)
  - Hypoxia.
  - Hypercapnia.
  - Hypoglycaemia.
  - Hypotension.
  - Alcohol.
  - Cerebral pathology etc.

Urine Output:

- Even though urine output is an indicator of renal perfusion, it is frequently used as an indicator of cardiac output (25% of cardiac output perfuses the kidneys).
- Normal urine output in adults is at least 0.5 ml/kg/h, which also signals adequate renal perfusion.
- With urine output of less than 500 ml in 24 hours, the kidneys are unable to excrete the waste products of metabolism which can result in uremia, metabolic acidosis and hyperkalaemia.
- A drop in urine output may be the first clinical indicator of fluid and electrolyte imbalance and is considered an early sign of hypovolaemia.
- When cardiac output falls so does renal perfusion, ultimately leading to renal failure.

Table 6.3: The parameters for urinary output disorders

<table>
<thead>
<tr>
<th>Urinary Output condition</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anuria</td>
<td>&lt;50ml urine in 24 hours</td>
</tr>
<tr>
<td>Oliguria</td>
<td>&lt;400 ml urine in 24 hours [&lt;0.5ml/kg/h]</td>
</tr>
<tr>
<td>Polyuria</td>
<td>&gt;3000 ml urine in 24 hours</td>
</tr>
<tr>
<td>Dysuria</td>
<td>Painful micturition</td>
</tr>
</tbody>
</table>

People who are seriously ill and admitted into the intensive care unit (ICU) will have a wide variety of tests done on different body fluids, such as blood and urine. This is to help diagnose potential medical problems or to see how well their treatment is working.
Common Blood Tests in ICU:

**Why Do People In Intensive Care Have Lots of Blood Tests?**

People in intensive care are usually seriously ill and their condition changes often. For this reason, they will have a wide variety of tests done on different body fluids, such as blood and urine. This is to help diagnose potential medical problems or to see how well their treatment is working.

**Why So Many Different Tests and So Often?**

The types of tests and how often they are done depend on why the person is in ICU and how stable they are. Most often, testing happens when the person is first admitted to ICU, and then every day. However, in a number of different situations, some tests will be repeated quite often.

**How Are The Tests Done?**

Most tests are done in the same way as an outpatient pathology service – that is, blood is withdrawn from a vein in the arm. However, because blood tests need to be done more often in ICU, a thin catheter is inserted into an artery. This catheter is called an ‘arterial line’ and it stays there to help minimise their discomfort from repeated needles. But, unfortunately, some tests cannot be done using an arterial line. All staff who withdraw blood for these tests are trained to minimise the person’s discomfort.

**Who Will Explain The Results?**

Usually the tests are explained generally, such as whether the results were normal or abnormal. It is probably not helpful for the person in ICU and their loved ones to become anxious about the day to day results of most blood tests. This is because a proper understanding of the results is difficult without a background in medicine or the health sciences.

However, if the results are of serious concern, such as anaemia or worsening kidney function, they will usually be explained.

**Blood Tests:**

- Electrolytes (Sodium, Potassium, Chloride)
- Urea and Creatinine

**ELECTROLYTE, UREA, CREATININE (EUC):**

- Involves taking between 1-4 ml of blood from either a vein or an artery.
- This test looks at the basic chemical balance of the blood, as well as kidney function.
- An imbalance in the chemical makeup of the blood can happen in a number of medical conditions.
- This test will also show whether a body salt needs to be replaced. And urea and creatinine levels show how well the kidneys are working.
- EUC is usually done when a person is admitted to ICU, and then regularly, which could be daily.
- If there is a concern about kidney function or chemical balance, then EUC will be repeated more often
  - For example, if a person is on dialysis, this test is usually done four times a day.
  - If potassium (an essential body salt) is being replaced, the test may be repeated to see if enough has been given.
- The results are usually available within 1-2 hours.
ARTERIAL BLOOD GAS (ABG):

- This test involves taking a small amount of blood, around 1-2 ml from an artery. ABG is extremely important for several reasons
  - It tells the intensive care staff how well the lungs are functioning (showing the oxygen and carbon dioxide levels)
  - It will show whether or not the respiratory (breathing) support the person is receiving is enough
  - It gives an idea of the metabolic balance in the body.
- Examples of conditions where ABG is important could include
  - Pneumonia
  - Poorly controlled diabetes
  - Cardiac failure
  - Kidney failure
- ABG is done using a smaller needle than other blood tests, but blood must be taken from an artery
- The most common arteries used are those in the patient’s wrists because these arteries are easy to get to
- Some bruising may result after this test is done.

LIVER FUNCTION TESTS (LFTs):

- The same blood sample taken for a EUC test can be used for LFTs.
- As the name suggests, LFTs check how well the liver is working.
- The liver cleanses the blood of waste products, but can function poorly if the person is sick.
- LFTs are usually done daily, with results available in 1-2 hours.

FULL BLOOD COUNT (FBC):

- This blood test involves taking approximately 4 mL of blood from a vein or artery.
- As the name suggests, an FBC ‘counts’ the number of each of the different blood cells in the blood.
- Haemoglobin or ‘Hb’ shows those parts of the blood cells that carry oxygen around the body.
- A low Hb is called anaemia. A blood transfusion may be required if the Hb is too low.
- The white cell count (WCC) shows there is an infection or inflammation in the body.
- And platelets form an essential part of the blood clotting process.

COAGULATION STUDIES (COAGS):

- This test checks whether the blood is clotting as it should. If it is not, then the person can bleed too easily.
- Blood clotting is a complex process that can be affected by a number of serious illnesses.
- Around 4 mL of blood from a vein or artery is needed to run this test.
- Coags are done upon admission, and are repeated regularly if the coagulation status is abnormal or the person is receiving medicines that affect it.
- Regular coagulation studies are needed when a person is receiving anti-clotting medicines such as heparin or warfarin.

BLOOD SUGAR LEVEL (BSL):

- A BSL can be done in different ways. The blood may be taken from a sample used for a EUC or an ABG, or by a finger prick.
- If a blood sample is taken through a finger prick, it is generally done at the person’s bedside using a small glucometer (a device that measures blood sugar levels).
BSL is an important blood test. Unless there is a concern over the level of sugar in the blood, BSL is usually done 1-2 times a day. But it will be done more often if the person is diabetic.
BSL is unstable person is receiving a medicine that could affect their BSL.
BSL needs to be kept within a tight range.

Other Tests:
- **URINALYSIS**
  - A urinalysis is a routine test that is done by the nursing staff in intensive care.
  - It involves inserting a test strip into a urine sample.
  - This strip can show a number of problems, including
    - Infection (leukesterase)
    - Dehydration (ketones)
    - Abnormal kidney or liver function (blood, protein, urobilinogen)
    - Hyperglycemia (glucose)

Pathological Tests to Identify Possible Infection:
- Pathology tests are usually done if an infection is suspected. It normally involves testing the blood, mucus, and urine, as well as testing the samples from any other sites, such as wounds.
- Doing pathology tests to check for infection is called a ‘septic workup’, and is usually done on people with a high or increasing temperature, or those who have been in ICU for a long time.

**BLOOD CULTURE:**
- Blood cultures are done if a person shows symptoms of an infection, such as a raised temperature, a low blood pressure or a wound that appears infected, and to check how well antibiotic treatment is working.
- Usually two sets of tests will be done, followed by further tests if needed.
- Some ICUs do routine blood cultures on people who’ve been in ICU for a long time to pick up possible infections early.
- Blood cultures involve taking 10-20 ml of blood from a vein under sterile conditions.
- This blood is placed into specific sample bottles and sent to the lab.
- At the lab, small amounts of blood from the sample are placed onto special plates to see what bugs may be growing in the blood.

**MID STREAM URINE (MSU):**
- MSU involves taking a small urine sample under as clean conditions as possible. Since most seriously ill people have a urinary catheter in place, obtaining a clean sample is quite easy.
- The urine sample is taken to the microbiology lab and tested to check for infection. The results are usually available within 1-2 days.
- If it is suspected that the renal (kidney) system is the cause of a possible infection, then antibiotics that can kill a wide range of bacteria will be started.
- Once the bug is identified, a more specific antibiotic can be given.

**SPUTUM (OR MUCUS) TESTING:**
- The lungs are quite often the source of an infection in a person admitted to ICU.
- It is normal to have a number of bacteria in the throat and upper airways, so their presence in the mucus of the lungs does not necessarily mean that the person has pneumonia.
• A sputum sample (mucus specimen) can be obtained in a number of ways. Ideally, the sputum should be taken from deep inside the lungs, so simply coughing the sputum into a sample container is not always ideal.
• Usually, if the person is ventilated, the mucus will simply be sucked out with a clean suction catheter.
• To get the best sample, a bronchoscopy (where a thin tube is inserted into the lungs) may need to be done. Or a simpler procedure called a ‘non-bronchoscopic bronchi alveolar lavage’ (NB-BAL) may be used.
• In both bronchoscopy and NB-BAL, 20-40 mL of saline is injected into the lower airways and immediately suctioned out. This ‘washes’ out the lower airways and returns a cleaner sample for examining.

**WOUND SWABS:**

• If a wound, such as a graze or surgical cut, appears infected, a wound swab is usually done.
• This involves cleaning the wound with normal saline and ‘wiping’ a sterile swab across the wound.
• This swab looks much like a cotton wool bud, but with a longer handle.
• The swab is taken to the microbiology lab for testing.
• Occasionally a wound may be opened because there may be a large amount of swelling and/or discharge.
• Surface wounds generally don’t need antibiotic treatment. If the wound is considered to be causing a widespread infection, antibiotic treatment may be started.

**CEREBROSPINAL FLUID (CSF):**

• CSF is the fluid that bathes the brain and spinal cord.
• A sample of this fluid can be taken in different ways.
• A lumbar puncture may be performed. This procedure involves inserting a needle between two vertebrae (bones in the spine) in the lower back under sterile conditions.
• The needle goes into the subarachnoid space in the brain, and a small amount of CSF is drained and sent to the lab to check for infection and other abnormalities.
• A lumbar puncture may be performed in intensive care if infection is suspected.
• Another way to get a CSF sample is if the patient already has in place an intraventricular drain (a plastic tube placed by neurosurgeons to drain extra CSF to relieve pressure on the brain).
• A sample can be taken from this drain and sent to the lab to check for possible infection as a routine procedure.

**Other Body Fluids:**

• Samples of fluids from other parts of the body may be sent for testing if they could be the source of infection.
• If the person has a drain tube (e.g. intercostal catheter) in place, a sample from this site can easily be taken for testing.

**GCS Calculation:**

• **Arterial Blood Gas Sample Collection: Procedure for Arterial Blood Sampling Using Radial Artery:**

For sampling from the radial artery using a needle and syringe, follow the steps outlined below.

• Approach the patient, introduce yourself and ask the patient to state their full name.
• Place the patient on their back, lying flat. Ask the nurse for assistance if the patient's position needs to be altered to make them more comfortable. If the patient is clenching their fist, holding their breath or crying, this can change breathing and thus alter the test result.

• Locate the radial artery by performing an Allen test for collateral circulation. If the initial test fails to locate the radial artery, repeat the test on the other hand. Once a site is identified, note anatomic landmarks to be able to find the site again. If it will be necessary to palpate the site again, put on sterile gloves.

• Perform hand hygiene clear off a bedside work area and prepare supplies. Put on an impervious gown or apron, and face protection, if exposure to blood is anticipated.

• Disinfect the sampling site on the patient with 70% alcohol and allow it to dry.

• If the needle and syringe are not preassembled, assemble the needle and heparinized syringe and pull the syringe plunger to the required fill level recommended by the local laboratory.

• Holding the syringe and needle like a dart, use the index finger to locate the pulse again, inform the patient that the skin is about to be pierced then insert the needle at a 45 degree angle, approximately 1 cm distal to (i.e. away from) the index finger, to avoid contaminating the area where the needle enters the skin.

• Advance the needle into the radial artery until a blood flashback appears, then allow the syringe to fill to the appropriate level. DO NOT pull back the syringe plunger.

• Withdraw the needle and syringe; place a clean, dry piece of gauze or cotton wool over the site and have the patient or an assistant apply firm pressure for sufficient time to stop the bleeding. Check whether bleeding has stopped after 2–3 minutes. Five minutes or more may be needed for patients who have high blood pressure or a bleeding disorder, or are taking anticoagulants.

• Activate the mechanisms of a safety needle to cover the needle before placing it in the ice cup. In the absence of a safety-engineered device, use a one-hand scoop technique removal.

• Expel air bubbles, cap the syringe and roll the specimen between the hands to gently mix it. Cap the syringe to prevent contact between the arterial blood sample and the air, and to prevent leaking during transport to the laboratory.

• Label the sample syringe.

• Dispose appropriately of all used material

• Remove gloves and wash hands thoroughly with soap and water, then dry using single-use towels; alternatively, use alcohol rub solution.

• Check the patient site for bleeding (if necessary, apply additional pressure) and thank the patient.

• Transport the sample immediately to the laboratory, following laboratory handling procedures.

**Equipment list:**

• Pulse oximeter.

• Multiparameter monitor.

• Insulin syringe.

• Ice bag.

• Laminated GCS chart.
CHAPTER SEVEN: SHOCK

Learning Objectives: After this session participants will be able to

- Understand the pathophysiology of shock.
- Understand the clinical signs and symptoms of shock.
- Understand types of shock.
- Manage shock.
- Use vasopressor and inotropes.
- Prepare solutions for vasopressor and infusion.

Definition of Shock:

Shock is a physiological state characterized by systemic reduction in tissue perfusion, resulting in decreased oxygen delivery to tissue. Shock is a clinical condition where circulation fails to meet metabolic need of tissue at the same time fails to remove the metabolic waste from tissue.

- Inadequate tissue perfusion to meet tissue demand.
- Usually is a result of inadequate blood flow and/or inadequate oxygen delivery.
- Inadequate tissue perfusion leads to failure of oxygenation.
- Lead to anaerobic metabolism.
- Lactic acid production.
- Cell function ceases and swells.
- Membrane become more permeable.
- Electrolytes and fluid sweeps in and out of the cell.
- Sodium-Potassium pump impaired.
- Mitochondria damaged.
- Cell death.
Effects of Shock On Organs:
- Heart: ↓ CO/hypotension/myocardial depression
- Lungs: ↓ gas exchange / tachypnoea/ pulmonary oedema
- Endocrine: ADH → ↑ reabsorption of water
- CNS: ↓ perfusion → Drowsy
- Blood: Coagulation abnormalities → DIC
- Renal: ↓ GFR: ↓ Urine output
- GIT: Mucosal oedema – Bleeding
- Hepatic enzymes ↑

Clinical Features of Shock:

Features of shock depends on
- Degree of volume loss and
- Duration.

Types:
- Mild
- Moderate
- Severe.
Mild Shock:
- Collapse of subcutaneous veins of extremities especially of feet which become pale and cool.
- Sweat on forehead, hand and feet.
- Urine output normal.
- Pulse rate normal.
- Blood pressure normal.
- Patient feels thirsty and cold.

Moderate Shock:
- Mild shock features, feeling drowsy and confused.
- Oliguria.
- Pulse rate increased but usually less than 100 /min.
- Blood pressure initially normal then falls in latter stage.

Severe Shock:
- Unconscious.
- Gasping respiration.
- Anuria.
- Rapid pulse.
- Profound hypotension.

Stages of Shock:
- Initial The cells become leaky and switch to anaerobic metabolism
- Non-progressive (Compensated Stage) Attempt to correct metabolic upsets of shock
- Progressive (Decompensated Stage) Eventually the compensation will begin to fail
- Refractory Organs fail, and the shock can no longer be reversed.
Monitoring:
- Blood pressure.
- Heart Rate.
- Respiratory rate.
- Urine output.
- Blood CBC.
- Pulse oximetry.
- ECG.
- U/s CT, X ray.

Special Monitoring:

Cardiovascular-
- Central venous pressure
  o Normal: 5-10 cm H2O
  o If CVP < 5 cm H2O: Inadequate blood volume / Hypovolemia.
  o CVP > 10 cm H2O: Cardiac dysfunction.

Systemic and Organ perfusion-
- Clinical: Urine output
- Serum lactate estimation.
- Blood gas analysis, Mixed venous oxygen saturation

Management Guidelines:
- Treat causes.
- Improve cardiac function.
- Improve tissue perfusion.

Principles of Resuscitation: ABC
- Breathing: adequate ventilation and oxygenation.
- Circulation:
  o Placement of adequate and secured IV access
  o Cardiac function
  o Oxygenation.

Fluid Therapy in Shock:
- Crystalloid solution
  o Normal saline
  o Hartman’s solution
  o Ringer lactate solution.
- Colloid Solution.
- Blood transfusion.

Dynamic fluid response:
- Infusing 250 -500 ml of fluid in 5-10 min
  o Responders: Improving.
  o Transient responders: revert back.
  o Non-responders: No improvement.
Vasopressors/Inotropic Drugs:
- Vasopressors- Noradrenaline/ Vasopressin / Phenylephrine.
- Inotropes- Dobutamine / Dopamine.

Skill Learning:

Vasopressor/Inotrope Doses and preparation

Dobutamine:
- 5 ml ampoule contain 250 mg. (50 mg /ml).
- Dose: 5-20 microgram /Kg / min – To be adjusted according to response and targeted BP.
- Preparing (Dilution)- If syringe pump is used (50 ml Syringe).
  - Step 1. Identify the patient prescribed for dobutamine.
  - Step 2. Ensure that the prescription is duly signed with date by physician.
  - Step 3. Take a 50 ml sterile syringe.
  - Step 4. Know the body weight of the patient in kg.
  - Step 6. Take equivalent mg of dobutamine of the multiplied figure in step 5 in the 50 ml syringe.
  - Step 7. Add normal saline to the dobutamine taken into the 50 ml syringe to make the solution 50 ml.

Example:
- Take 3 X Body wt. in kg = mg of dobutamine
- Make 50 ml by adding normal saline.
- Infuse@ ml/hour equal to Desired microgram /kg/min.
- Suppose the patient’s weight is 50 kg
- Amount of dobutamine to be taken = 50 X 3 = 150 mg 1, e 3 ml of dobutamine from a 50 ml ampoule.
- Dilution : Make this 3 ml to 50 ml by adding normal saline. (3 ml Dobutamine + 47 ml normal saline).
- Infusion Rate : If you want to give 5 microgram /kg /min the infuse @ 5 ml/ hour. If you want to give 6 microgram /kg/min the infuse @ 6 ml/ hour. If you want to give 8 microgram/kg /min then infuse @ 8 ml / hour and so on.
In case a syringe pump is not available, use micro burette for infusion:

- In that case Multiply body weight with 6 instead of 3 and dilute with normal saline to make it 100 ml. (6 ml Dobutamine + 94 ml normal saline).
- Infuse @ micro drop/min as desired microgram/kg/min.

Example:

- Suppose the Patient’s weight is 50 kg.
- Amount of dobutamine to be taken = 50 X 6 = 300 mg i.e. 6 ml of dobutamine from a 50 ml ampoule.
- Dilution: Make this 6 ml to 100 ml by adding normal saline.
- Infusion Rate: If you want to give 5 microgram/kg/min the infuse @ 5 micro drop/min. If you want to give 6 microgram/kg/min the infuse @ 6 micro drop/min. If you want to give 8 microgram/kg/min then infuse @ 8 micro drop/min. and so on.

Dopamine:

Same as Dobutamine, with the only difference that Dopamine ampoule contains 200 mg in 5 ml.

Noradrenaline/Adrenaline:

- 1 ml = 2 mg = 2000 microgram.
- Dose: 0.05 - 0.2 microgram/Kg/Min.
- 0.06 X BW mg in 50 ml
- 10 ml/hour infusion equivalent to 0.1 microgram/Kg/Min.
- Start with 10 ml and escalate according to response and target.

Equipment List:

1. 50 ml syringe
2. Dopamine, Dobutamine, Noradrenaline and Adrenaline ample
3. Syringe pump
CHAPTER EIGHT:
VENOUS ACCESS

Learning Objectives: After this session participants will be able to
- Understand the need for venous access
- Understand routes of venous access
- Know advantages, disadvantages and complications of different routes of venous access
- Understand the Seldinger technique
- Be able to perform venous access.

Venous Access:
Venous access is important the management of critically ill patients in ICU. All the patients need venous channel. Both peripheral and central routes are used according to the indications.

A strict aseptic technique has to be used during cannulation in these sepsis vulnerable patients.
- Peripheral venous access
- Central venous access

Routes of Central Venous Access:
- Central venous access: most common sites are-
  - Femoral vein,
  - Internal jugular vein and
  - Subclavian vein

Indications of Central Venous Line Placement:
- Failed or inadequate peripheral cannulation.
- Requirement for long term cannulation with lower the risks of infection (CVC only).
- Requirement for central vasopressors or inotropes (CVC only).
- Administration of multiple infusions at a time (dual or quad lumen CVCs).

Advantages and Disadvantages of Central Venous Line Placement:
Advantages:
- Secure access in a large vein: less likely to extravasate.
- Ability to give fluids and blood faster if a wide-bore cannula is used
- Ability to give multiple drugs and infusions at once (CVC).
- Lower incidence of infection
  - If good asepsis is adhered to, CVCs should last for longer than the recommended 3 days of a peripheral cannula.
  - External jugular cannulae should be changed after 3-5 days.
  - Note: all cannulae should be checked daily and be replaced if signs of infection at the site.

Disadvantages:
- Requires appropriate equipment.
- Requires training and regular use to maintain competence.
• **Increased risk of complications:**
  o Failure (especially in very hypovolaemic patients): IO access is often the method of choice initially in such patients.
  o Bleeding: especially if coagulopathic (correct coagulopathy if time allows).
  o Accidental arterial cannulation.
  o Nerve damage.
  o Infection.
  o Venous thrombosis.
  o Pneumothorax (internal jugular and subclavian CVC or external jugular cannulation)
  o Perforation of the posterior wall of the vein (venous cut down)
  o Risk of air embolus: ALWAYS ensure the cannula is either capped off or attached to fluid. Never leave open to air.

**Who Should Perform The Procedure?**
The individual most trained in the technique should either undertake the procedure or be directly supervising it.

**Central Venous Cannulation – General Principles:**

**Landmark Technique:**

• **Preparation:**
  o Clean the insertion area thoroughly with chlorhexidine and alcohol or iodine solution
  o Pay strict attention to sterility throughout the procedure and use an aseptic no touch technique with sterile drapes surrounding the insertion site.
  o Ideally use a sterile gown, hat, mask, sterile gloves

• **Line selection:**
  o Dedicated central lines should be used
  o Vascath may be used for rapid infusion of fluids and blood.
  o Single, dual or quad lumen lines exist
  o Femoral lines should be 15–20 cm for adults
  o Right internal jugular lines should be 15 cm
  o Left internal jugular lines should be 15–20 cm
  o Flush all lumens of the CVC with 0.9% saline before insertion

• **Seldinger Technique:**
  o Attach the needle to an empty 5 or 10 ml syringe.
  o With the insertion site identified, advance the needle with continuous aspiration.
  o Once aspirating blood, detach the syringe from the needle.
  o Advance the guidewire through the needle.
  o Remove the needle over the guidewire.
  o Make a 4–5 mm incision at the wire entry point using a scalpel.
  o Railroad the dilator over the guidewire and dilate up the vein.
  o Remove the dilator.
  o Railroad the CVC over the guidewire. Ensure you always have a hold of the guidewire (proximally or distally to catheter).
  o Apply caps/bungs to each lumen and ensure each lumen aspirates and flushes freely
  o Suture in place.
  o Apply a translucent dressing over.
Ultrasound Technique:
Ultrasound-guided CVC insertion has been shown to reduce complications and should be used if equipment and skill set allows.

External Jugular Vein Cannulation:

Anatomy of external jugular vein:
The external jugular vein is a superficial and easily accessible vein. It takes an oblique course crossing over the sternocleidomastoid muscle and is often > 10 mm in diameter. It joins the subclavian vein anterior or just lateral to the anterior scalene muscle.

Technique:
- Place the patient in a 15–30° head-down position.
- Turn the head away from the intended side of puncture.
- Clean the skin with alcohol based skin prep.
- Identify the external jugular vein, which should be visible overlying the middle third of the sternocleidomastoid muscle.
- Have an assistant occlude the lower end of the visible part of the vein just above the clavicle.
- Puncture the skin and enter the vein as you would perform peripheral venous cannulation elsewhere, sliding the cannula over the needle.
- When a free flow of blood is obtained on aspiration, tape the cannula securely in this position.
- Flush the cannula and connect your fluid.
- Once patient is resuscitated and haemodynamically stable, establish venous access at other peripheral sites due to risk of air embolism at external jugular site.

Fig 8.1: External jugular vein anatomy


Femoral Vein Cannulation:

![Fig 8.2: Femoral vein anatomy](image)

**Anatomy of Femoral Vein:**

- The femoral vein is found in the femoral triangle, which is bordered by the inguinal ligament superiorly, sartorius muscle laterally and adductor longus muscle medially.
- Within the femoral triangle, the common femoral vein is enclosed within the femoral sheath where it lies medial to the femoral artery.
- Medial to Lateral: Vein, Artery Nerve (mnemonic VAN).
- The femoral artery is located at the mid-inguinal point, halfway along a line joining the anterior superior iliac spine and the pubic symphysis.
- The vein is located approximately 0.5 cm medial to the arterial pulsation.

**Femoral venous catheter Insertion technique:**

- Stand at the foot of the bed.
- Place 2 or 3 fingers of one hand over the femoral artery pulsation.
- Proceed with insertion of the cannula using the Seldinger technique.
- Femoral Venipuncture: Seldinger Technique.
- Note: Sterile technique should be used when performing this procedure.

**Steps of Femoral Vein Catheter Placement:**

- **STEP 1.** Place the patient in the supine position.
- **STEP 2.** Cleanse the skin around the venipuncture site well and drape the area. The femoral areas normally has a high skin flora count and can cause bacteremia if not cleansed well.
- **STEP 3.** Locate the femoral vein by palpating the femoral artery. The vein lies directly medial to the femoral artery (remember the mnemonic NAVEL, from lateral to medial: nerve, artery, vein, empty space, lymphatic).
  
  Keep a finger on the artery to facilitate anatomical location and avoid insertion of the catheter into the artery. Use ultrasound to identify the femoral artery and visualize placement of needle into the vein.
- **STEP 4.** If the patient is awake, use a local anesthetic at the venipuncture site.
• **STEP 5.** Introduce a large-caliber needle attached to a 10-mL syringe with 0.5 to 1 mL of saline. Direct the needle toward the patient’s head, entering the skin directly over the femoral vein. Hold the needle and syringe parallel to the frontal plane.

• **STEP 6.** Directing the needle cephalad and posteriorly, slowly advance it while gently withdrawing the plunger of the syringe.

• **STEP 7.** When a free flow of blood appears in the syringe, remove the syringe and occlude the needle with a finger to prevent air embolism. If the vein is not entered, withdraw the needle and redirect it. If two attempts are unsuccessful, a more experienced clinician should attempt the procedure, if available.

• **STEP 8.** Insert the guidewire and remove the needle.

• **STEP 9.** Make a small skin incision at the entry point of wire, pass the dilator (or dilator introducer combination) over the wire and remove the dilator holding pressure at the exit site of the wire (or remove dilator if introducer combination is used).

• **STEP 10.** Insert the catheter over the guidewire aspirate to assure free blood flow. If using an introducer, spirate it.

• **STEP 11.** Flush the catheter or introducer with saline and cap or begin fluid infusion.

• **STEP 12.** Affix the catheter in place (with a suture), dress the area according to local protocol.

• **STEP 13.** Tape the intravenous tubing in place.

• **STEP 14.** Change the catheter location as soon as it is practical.

**Internal Jugular Central Venous Catheter Placement:**

The internal jugular approach is better than the femoral approach. It may also be associated with less long-term infection. However, it has a higher complication rate and should ONLY be performed by those skilled in its technique.

**Anatomy of Internal Jugular Vein:**

- The vein originates at the jugular foramen and runs down the neck, to terminate behind the sternoclavicular joint, where it joins the subclavian vein.
- It lies alongside the carotid artery and vagus nerve within the carotid sheath.
- The vein is initially posterior to, then lateral and then anterolateral to the carotid artery during its descent in the neck.
- The vein lies most superficially in the upper part of the neck.

![Fig 8.3: Anatomy of Subclavian and Internal Jugular Veins](image-url)
**Insertion Technique:**

- Lie the patient in the Trendelenburg position with left tilt.
- Turn the patient’s head to the opposite side.
- Identify the two heads of the sternocleidomastoid.
- At a level just caudad of the bifurcation of the two heads of sternocleidomastoid, palpate the carotid artery. The vein is situated just lateral to the carotid artery in the carotid sheath. Keep fingers on carotid pulse.
- Infiltrate with LA after cleaning the area.
- Direct the needle caudally, parallel to the sagittal plane, at a 30° angle, aiming towards the ipsilateral nipple. Never aim medially.
- For catheter placement use the Seldinger insertion technique.

**Subclavian Venipuncture: Infra Clavicular Approach**

(Note: Sterile technique should be used when performing this procedure)

- **STEP 1.** Place the patient in the supine position, with the head at least 15 degrees down to distend the neck veins and prevent air embolism. Only if a cervical spine injury has been excluded can the patient’s head be turned away from the venipuncture site.
- **STEP 2.** Cleanse the skin around the venipuncture site well, and drape the area.
- **STEP 3.** If the patient is awake, use a local anesthetic at the venipuncture site.
- **STEP 4.** Introduce a large-caliber needle, attached to a 10-mL syringe with 0.5 to 1 mL of saline, 1 cm below the junction of the middle and medial one-third of the clavicle.
- **STEP 5.** After the skin has been punctured, with the bevel of the needle upward, expel the skin plug that can occlude the needle.
- **STEP 6.** Hold the needle and syringe parallel to the frontal plane.
- **STEP 7.** Direct the needle medially, slightly cephalad, and posteriorly behind the clavicle toward the posterior, superior angle of the sternal end of the clavicle (toward the finger placed in the suprasternal notch).
- **STEP 8.** Slowly advance the needle while gently withdrawing the plunger of the syringe.
- **STEP 9.** When a free flow of blood appears in the syringe, rotate the bevel of the needle, caudally remove the syringe, and occlude the needle with a finger to prevent air embolism.
- If the vein is not entered, withdraw the needle and redirect it. If two attempts are unsuccessful, a more experienced clinician (if available) should attempt the procedure.
- **STEP 10.** For catheter placement use the Seldinger technique.
- **STEP 11.** Obtain a chest x-ray film to confirm the position of the intravenous line and identify a possible pneumothorax.

**Equipment List:**

- Task trainer for venous access
- Peripheral venous cannula different size
- Central venous catheter set
- Local anesthetic solution.
CHAPTER NINE:
COMMUNICATION AND COUNSELLING IN ICU

Learning Objectives: After the session the participants will be able to learn

- Five Fundamental Principles for Better Communication
- Strategies for breaking bad news
- SPIKES and ABCDE PROTOCOL
- Critical Care Communication
- Giving bad news
- Breaking bad news on the telephone

OVERVIEW:
Communication between physicians and patients and their families is “consistently identified as the most important and least accomplished factor in quality of care” in the intensive care unit (ICU).

Bad news has been defined as “Any information which adversely and seriously affects an individual’s view of his or her future.” (Baille et al, 2000)

Effective communication doesn't happen by chance, it requires a systematic, considered approach. Breaking bad news to relatives effectively can help minimise the distress of relatives and maintain therapeutic relationships.

Five Fundamental Principles for Better Communication

- Principle 1: A central skill “Ask-Tell-Ask.”
- Principle 2: When you are stuck “Ask for more information”, “Tell me more.”
- Principle 3: Use reflection rather than questions to learn more.
- Principle 4: Skills for responding to emotions.
- Principle 5: Assess the Other Person's Informational, Decision-making and Coping Style.

Principle 1: A Central Skill "Ask-Tell-Ask."
Ask the family to describe their current understanding of the issue-

- This will help you craft your message to take into account the patient and family's level of knowledge, emotional state, and degree of education.
- It allows you to determine if the family has misperceptions.
- It gives you information about their medical knowledge and language style.
- “Ask-Tell-Ask” also gives you the opportunity to determine the family’s concerns and then negotiate the agenda for the conversation.

Some sample questions to open your conversation:

- “What is the most important issue for us to talk about today?”
- “To make sure we are on the same page, can you tell me how you see the situation?”
- “What have the other doctors been telling you about your loved one’s illness since the last time we spoke?”

Asking permission prior to giving information-

- Ways to do this include:
  - “Is this a good time for me to talk about what has happened since your dad was admitted?”
  - “Would you like to hear our recommendation about what should be done?”
After you have done this, the next step is to-

- Tell the family in straightforward language what you need to communicate, such as the bad news, treatment options, and other information.
- Too much information can be confusing.
- Information should be provided in short, digestible chunks.
- A rule of thumb is not to give more than three pieces of information at a time.
- Then check in to make sure they understand what you have said.
- Before you go on, you should…
  - Ask the family whether they understand what you just said.
  - Did they get the facts straight?
  - Is their understanding appropriate?
  - Did they hear what was said?


- If you find that the conversation is going off track say, “I think we're not on the same page.”
- The first level of conversation could be called the “What is happening?” conversation, in which the family is trying to apprehend and understand information.
- The second level of conversation has to do with emotions—at this deeper level, patients or family members are asking themselves “How do I feel about this?”
- “Could you tell me more about what information you need at this point?”
- “Could you say something about how you are feeling about what we’ve discussed?”
- “Could you tell me what this means for you and your life?”

**Principle 3: Use reflections rather than questions to learn more**

- Reflections are restatements of the family’s words or guesses at what the family means. Reflections can be simple or complex.

**Simple reflection:**

Example:

- SON: I know he is really sick but I cannot give up hope.
- MD: You cannot give up hope.
- SON: I have to be hopeful. I am not sure what I will do if he gets sicker or does not make it.

**Complex reflections,** on the other hand, go beyond what person says and includes the clinicians’ thoughts about speaker’s underlying emotions, values, or beliefs.

- These reflections are riskier because clinicians can be incorrect in their interpretation; however, they also are more powerful as they may help the speaker see things differently.

Example:

- Daughter: I just don’t know how I’m going to tell my kids about this. They will be devastated.
- MD: I can see that you care deeply for your kids and do want them prepared for what is happening to their grandmother.

**Principle 4: Skills for Responding to Emotion.**

- Being in the ICU, typically involves bad news.
- There is often the potential for death.
- In addition, there may be a loss of physical function (for example, a stroke, surgery or just being in the hospital) social function (being able to be a breadwinner) or quality of life (the physical or psychological pain associated with being or watching a loved one suffer).
When faced with loss, people react by emoting. It is important to attend to these emotional reactions. When people are experiencing strong emotions, they are less able to hear cognitive information. The concept of an "accepting response" is helpful here.

- Accepts what the family says non-judgmentally,
- Acknowledges that family members ought to hold their own views and feelings, and
- Validates the importance of the family’s contributions in a therapeutic relationship.

**Principle 5: Assess the Other Person's Informational, Decision-making and Coping Style.**

**Strategies for breaking bad news:**

Different protocols have been applied for breaking bad news and these includes:

- SPIKES
- BREAKS
- CONES
- ABCDE

SPIKES & ABCDE are commonly used.

**SPIKES PROTOCOL**

- SPIKES Protocol was developed by the late Robert F. Buckman, Walter F. Baile and their colleagues in 1992.
- It centres on defining central element of the bad news, that is what makes it bad news to the patient and addressing it as well as acknowledging patient’s concerns and emotions.
- It is a six step protocol.

**Objectives of spikes protocol**

The ‘SPIKES’ protocol for breaking bad news has four objectives:

- Gathering information from the patient
- Transmitting the medical information
- Providing support to the patient
- Eliciting patient’s collaboration in developing a strategy or treatment for the future.

The four objectives of SPIKES can be met by six steps of SPIKES

**Six Steps of SPIKES:**

**S – Setting**

- Arrange for some privacy
- Involve significant others
- Sit down
- Make connection and establish rapport with the patient
- Manage time constraints and interruptions.

**P – Perception of condition/seriousness**

- Determine what the patient knows about the medical condition or what he suspects.
- Listen to the patient’s level of comprehension
- Accept denial but do not confront at this stage.

**I – Invitation from the patient to give information**

- Ask patient if s/he wishes to know the details of the medical condition and/or treatment
- Accept patient’s right not to know
- Offer to answer questions later if s/he wishes.
K – Knowledge: giving medical facts

- Use language intelligible to patient
- Consider educational level, socio-cultural background, current emotional state
- Give information in small chunks
- Check whether the patient understood what you said
- Respond to the patient’s reactions as they occur
- Give any positive aspects first
- Give facts accurately about treatment options, prognosis, costs etc.

E - Explore emotions and sympathize

- Prepare to give an empathetic response:
- Identify emotion expressed by the patient (sadness, silence, shock etc.)
- Identify cause/source of emotion
- Give the patient time to express his or her feelings

S – Strategy and summary

- Close the interview
- Ask whether they want to clarify something else
- Offer agenda for the next meeting

ABCDE Protocol:

ABCDE stands for
- A= Advanced preparation.
- B= Build a therapeutic environment / relationship.
- C = Communicate well
- D= Deal with patient / family reactions
- E= Encourage and validate emotions

A- Advanced Preparation:

- Familiarize yourself with the relevant clinical information.
- Be prepared to allocate enough and adequate time.
- Arrange an environment which is comfortable and maintain privacy.
- Instruct stuffs not to interrupt during conversation.
- Be prepared to provide at least basic information about progress and treatment options.
- Rehearse how you will deliver the news.
- Know your patient / family members of the patient to whom you will be talking well.

B- Build a therapeutic Environment/ Relationship:

- Introduce yourself to everybody present
- Determine patient / family members preferences for what and how much they want to know.
- Summarize what happened to patient to date.
- Give a warning shot: “I am afraid it looks more serious than we had hoped”
- Pay attention to verbal and non-verbal cues.
- Avoid inappropriate humor.
- Assure that you will be available when necessary.

C- Communicate Well:

- Speak frankly but with passion.
- Determine family members (to whom you are talking) knowledge and understanding of the situation.
• Avoid medical jargons.
• Allow for silence and tears.
• Encourage and answer questions.
• Provide written / drawn information to encourage understanding and remembrance.

D- Deal with patient / Family Reactions:
• Assess and respond to emotional reactions.
• Be empathetic.
• Be aware of cognitive coping strategies
  o Denial
  o Blame
  o Disbelief
  o Guilt
  o Acceptance
• Don’t argue or criticize colleagues. Avoid defensiveness regarding your or a colleagues medical care.

E- Encourage and Validate Emotions:
• Offer realistic hopes and encouragement about what options are available.
• Explore what the news means to the patient.
• Discuss treatment options.
• Use multidisciplinary services.

Another approach described here uses the PLIIE

PLIIE APPROACH:
• Prepare
  o Who needs to be there? (family and support for them, other disciplines)
  o Plan the meeting: people and correct names, content of message, know details well, what do I want to get across and how
  o Talk to other staff members prior
  o Seek advice if required
  o Trainees: need to be taught
• Location
  o Private
  o Comfortable
  o Appropriate layout
  o No disturbances (phones, pagers)
  o Set aside sufficient time
  o Support people (if required)
• Introduction
  o My name and role
  o Other staff members
  o Ask family to introduce self (so names can be used)
  o Use appropriate language and body language
  o Start out by finding out what the family already knows
  o Warn about bad news before the bad news is broken
• **Information**  
  o Use understandable language (clear and simple)  
  o Deliver information in small bites  
  o No jargon  
  o Tailor information  
  o Give as much information as required by family  
  o Monitor pace of information  
  o Allow time for reflection  

• **Listen**  
  o Silence is good  
  o Allow time for discussion  
  o Convey respect and empathy  
  o Check understanding  
  o Elicit concerns  
  o Open disclosure  

• **End:**  
  o Answer all questions  
  o Offer support  
  o Arrange a follow up meeting  
  o Document meeting in clinical notes  

**BREAKING BAD NEWS ON THE TELEPHONE:**  
The first rule of breaking bad news is: do not do it over the phone. However, in some situations – such as family being overseas – it is unavoidable.  

Here is an approach:  
• Rehearse before making the call (e.g. with a social worker, or someone else skilled in difficult conversations)  
• Although this needs to be done in a timely fashion, delay the phone call until you are psychologically prepared if at all possible  
• Check the identity of the patient and the identity of the NOK, including contacts details  
• Introduce yourself clearly (Name, Role, Hospital)  
• Check that you are speaking to the right person and they are an adult  
• Be direct and compassionate, use the “D-word” – for example, say “I’m sorry that I have to tell you the worst possible news. Your son, Mike, died in a car crash tonight.”  
• Check if they have support… if they don’t, offer to call someone for them)  
• Provide follow up (e.g. social worker contact number)  

**TIPS AND TRICKS:**  
Hot tip (courtesy of Vera Sistenich):  
• The person involved in an emotionally draining resuscitation doesn’t have to be the person who breaks bad news to the family.  
• A senior colleague who was not emotionally involved in the case may be better placed to have the discussion.  
• Debrief after a family meeting with the other staff present (e.g. nurse, social worker) and seek feedback on ways to improve.
CHAPTER TEN:
CARE OF PATIENTS ON VENTILATOR

Learning Objectives: At the end of the session participants will be able to learn

- The essential cares need to be provided to a patient on ventilator
- The essential monitoring of ventilator setting to be done frequently
- To read the order of ventilator setting
- To make plan for maintaining the patient on ventilator
- The measures of infection prevention & control of ventilated patient

Top 10 care essentials for ventilator patients:

Essential Care 1: Review communications

- Communication among care providers promotes optimal outcomes.
- For mechanically ventilated patients, care providers may include
  - primary care physicians,
  - pulmonary specialists,
  - hospitalists,
  - respiratory therapists, and
  - nurses.
- Communicating with the patient is essential too.
- Provide writing tools or a communication board so that the patient can express his/her needs.
- Ask simple yes/no questions to which he/she can nod or shake his/her head.

Essential Care 2: Check ventilator settings and modes

- When you enter the patient’s room
  - take vital signs
  - check oxygen saturation
  - listen to breath sounds and
  - note changes from previous findings
  - Also assess the patient’s pain and anxiety levels.
- Read the patient’s order and obtain information about the ventilator.
- Compare current ventilator settings with the settings prescribed in the order.
- Familiarize yourself with ventilator alarms and the actions to take when an alarm sounds.
- Locate suction equipment and review its use.
- Look for a bag-valve mask, which should be available for every patient with an artificial airway; be sure you know how to hyperventilate and hyper oxygenate the patient.

Ventilator settings and modes:

Generally, ventilators display ordered settings and patient parameters. Check the following settings:

- Respiratory rate, the number of breaths provided by the ventilator in each minute.
- Manually count the patient’s respiratory rate, because he/she may be taking her own breaths at a rate above the ventilator setting.
- Fraction of inspired oxygen (FiO2), expressed as a percentage (room air is 21%).
- Tidal volume (TV or VT), the volume of air inhaled with each breath, expressed in milliliters
- Peak inspiratory pressure (PIP), the pressure needed to provide each breath.
• Target PIP is below 30 cm H2O.
• High PIP may indicate
  o A kinked tube,
  o A need for suctioning,
  o Bronchospasm, or
  o A lung problem, such as
    ■ Pulmonary enema or
    ■ Pneumothorax.

**Essential Care 3: Suction appropriately**

• Patients receiving positive-pressure mechanical ventilation have a tracheostomy, endotracheal, or nasotracheal tube.
• Most initially have an endotracheal tube; if they stay on the ventilator for many days or weeks, a tracheotomy may be done.
• Tracheotomy decisions depend on patient specifics. Controversy exists as to when a tracheotomy should be considered.
• Although specific airway management guidelines exist, always check your facility’s policy and procedure manual. General suctioning recommendations include the following:
  o Suction only as needed—not according to a schedule.
  o Hyper oxygenate the patient before and after suctioning to help prevent oxygen desaturation.
  o Don’t instil normal saline solution into the endotracheal tube in an attempt to promote secretion removal.
  o Limit suctioning pressure to the lowest level needed to remove secretions.
  o Suction for the shortest duration possible.
  o If your patient has an endotracheal tube,
    o Check for tube slippage into the right mainstem bronchus, as well as inadvertent extubation.
  o Other complications of tracheostomy tubes include
    o Tube dislodgment,
    o Bleeding, and infection.
  o To identify these complications,
    ■ Assess the tube insertion site,
    ■ Breath sounds,
    ■ Vital signs, and
    ■ PIP trends.
• If your patient has a tracheostomy, perform routine cleaning and care according to facility policies and procedures.

**Essential Care 4: Assess pain and sedation need**

• Even though your patient can’t verbally express her needs, you’ll need to assess her pain level using a reliable scale.
• Keep in mind that a patient’s acknowledgment of pain means pain is present and must be treated.
• Two scales that help you evaluate your patient’s sedation level are the Richmond Agitation Sedation Scale and the Ramsay Sedation Scale.
Essential Care 5: Prevent infection

- Ventilator-associated pneumonia (VAP) is a major complication of mechanical ventilation.
- The Institute for Healthcare Improvement includes the following components in its best-practices of VAP prevention “bundle”:
  - Keep the head of the bed elevated 30 to 45 degrees at all times, if patient condition allows. Healthcare providers tend to overestimate bed elevation, so gauge it by looking at the bed frame rather than by simply estimating.
  - Every day, provide sedation “vacations” and assess readiness to extubate, indicated by vital signs and arterial blood gas values within normal ranges as well as the patient taking breaths on her own.
  - Provide peptic ulcer disease prophylaxis, as with a histamine-2 blocker such as famotidine.
  - Provide deep vein thrombosis prophylaxis, as with an intermittent compression device.
  - Perform oral care with chlorhexidine daily.
  - Provide measures that decrease VAP risk include extubating the patient as quickly as possible,
  - Performing range-of-motion exercises and patient turning and positioning to prevent the effects of muscle disuse,
  - Having the patient sit up when possible to improve gas exchange,
  - Providing appropriate nutrition to prevent a catabolic state.
  - Assess the patient’s tolerance when he/she performs an activity by checking vital signs, oxygenation status, and pain and agitation levels.
  - Keeping bacteria out of oral secretions also reduces VAP risk.
  - Use an endotracheal tube with a suction lumen above the endotracheal cuff to allow continuous suctioning of tracheal secretions that accumulate in the subglottic area.
  - Don’t routinely change the ventilator circuit or tubing.
  - Brush the patient’s teeth at least twice a day and provide oral moisturizers every 2 to 4 hours.

Fig. 10.1: Pain assessment scale
Essential Care 6: Prevent hemodynamic instability

- Monitor the patient’s blood pressure every 2 to 4 hours, especially after ventilator settings are changed or adjusted.
- Mechanical ventilation causes thoracic-cavity pressure to rise on inspiration, which puts pressure on blood vessels and may reduce blood flow to the heart; as a result, blood pressure may drop.
- To maintain hemodynamic stability, you may need to increase I.V. fluids or administer a drug such as dopamine or norepinephrine, if ordered.
- High levels of inspiratory pressure with PSV and PEEP increase the risk of barotrauma and pneumothorax. To detect these complications:
  - Assess breath sounds and oxygenation status often.
  - To help prevent these conditions, use the lowest pressure level for ventilator-delivered breaths and adjust the level as tolerated.

Essential Care 7: Manage the airway

- The cuff on the endotracheal or tracheostomy tube provides airway occlusion.
- Proper cuff inflation ensures the patient receives the proper ventilator parameters, such as TV and oxygenation.
- Inflate the cuff and measure for proper inflation pressure using the minimal leak technique or minimal occlusive volume.
- When performing mouth care, suction oral secretions and brush the patient’s teeth, gums, and tongue at least twice a day using a soft paediatric or adult toothbrush.
- With assistance from an experienced colleague, change the tracheostomy tube or tracheostomy ties and endotracheal tube-securing devices if they become soiled or loose.
- Incorrect technique could cause accidental extubation.

Essential Care 8: Meet the patient’s nutritional needs

- For optimal outcomes, ventilator patients must be well nourished and should begin taking nutrition early.
- But like any patient who can’t swallow normally, they need an alternative nutrition route.
- Preferably, they should have feeding tubes with liquid nutrition provided through the gut.
- If this isn’t possible, the healthcare team will consider parenteral nutrition.
- Patients with tracheostomy tubes may be able to swallow food.

Essential Care 9: Wean the patient from the ventilator appropriately

- As your patient’s indications for mechanical ventilation resolve and he/she’s able to take more breaths on her own, consider removing him/her from the ventilator.
- Weaning methods may vary by facility and provider preference.
- Although protocols may be used to guide ventilator withdrawal, the best methods involve teamwork, consistent evaluation of patient parameters, and adjustment based on these changes.

Essential Care 10: Educate the patient and family

- Seeing a loved one attached to a mechanical ventilator is frightening.
- To ease distress in the patient and family, teach them why mechanical ventilation is needed and emphasize the positive outcomes it can provide.
Each time you enter the patient’s room, explain what you’re doing.
Reinforce the need and reason for multiple assessments and procedures, such as laboratory tests and X-rays.
Communicate desired outcomes and progression toward outcomes so the patient and family can actively participate in the plan of care.
Caring of a patient on mechanical ventilation requires
  o Teamwork,
  o Knowledge of care goals, and
  o Interventions based on
    ■ Best practices,
    ■ Patient needs, and
    ■ Response to therapy.

Mechanical ventilation has become a common treatment, and nurses must be knowledgeable and confident when caring for ventilator patients.
CHAPTER ELEVEN:
ENDOTRACHEAL TUBE AND TRACHEOSTOMY TUBE SUCTIONING

Learning Objectives: At the end of the session participants will be able to learn

- Care of Endotracheal Tube
- Indications of Endotracheal tube suctioning
- Preparation for Endotracheal tube suctioning
- Equipments needed for suctioning
- Dangers of ETT suctioning
- How to perform ETT suctioning in a safer way

Introduction:
Endotracheal or tracheostomy tube (ET) suctioning is performed to maintain the patency of the artificial airway and prevent complications. The presence of artificial airways impairs effective coughing and secretion removal, which may result in the need for periodic removal of pulmonary secretions with suctioning.

- Suctioning of a tracheal tube is a frequent and integral activity of airway management in an intensive care unit.
- Airway suctioning can have deleterious effects on the patient’s physiological variables.
- The variability in pathophysiology between patients requiring mechanical ventilation and the potential adverse effects of the procedure require that suctioning be customised to individual patients.
- Assessment of the patient to identify the need of suction of a tracheal tube should be continuous with chest auscultation performed every two hours or more frequently as indicated by clinical signs.
- The decision of suction of a tracheal tube must be made on the basis of the clinical need to maintain the patency of the tracheobronchial tree.
A tracheal tube should only be suctioned when clinically indicated by signs which could include:

i. Visible, palpable or audible secretions (such as sputum, gastric or upper airway contents or blood)

ii. Respiratory:
   o Desaturation,
   o Rising peak inspiratory pressure (during volume controlled mechanical ventilation/modes),
   o Decreasing tidal volume (during pressure-controlled ventilation/modes),
   o Increased respiratory rate,
   o Increased work of breathing or
   o Coarse breath sounds on auscultation.

iii. Cardiovascular: increased heart rate and blood pressure.
iv. Other: restless/agitated or diaphoretic patient.

v. A saw - tooth pattern on a flow-volume loop or expiratory flow-time waveform as illustrated on the ventilator graphics.

Prior to suctioning, consideration should be given to the potential complications and contraindications in individual patients.

Clinical Practice:

- The size of the suction catheter should be less than half the internal diameter of the tracheal tube.
- The total suction procedure (from insertion to removal of catheter) should take a maximum of 15 seconds with negative pressure applied continuously as the catheter is being withdrawn from the tracheal tube.
- In patients considered at high risk of adverse events, trauma and stimulation of the carina should be minimised to prevent complications. Therefore, the suction catheter should only be inserted down to a tracheal tube until it just emerges out of the lumen of the tube.
- The maximum occluded suction pressure should be limited to 80 to 150 mmHg (20kPa)
- The wall outlet should have a high pressure gauge attached.
- If a patient has high oxygen and PEEP requirements and/or is known to desaturate to clinically significant levels, pre-oxygenation should be considered.
- If pre-oxygenating, use the ventilator capability to deliver 100% oxygen.
- To prevent the occurrence of adverse events, bolus instillation of normal saline should not be routinely used prior to suctioning.
- Closed suction catheter systems should be used as the system of choice for patients with an ETT or tracheostomy who require suction.
- Closed suction catheter systems should be changed as per manufacturer’s instructions.
- Closed suction systems should be cleaned as per the manufacturers’ instructions to maintain patency and minimise colonisation.
- Hyperinflation should not be performed on a routine basis prior to suctioning.
- Tracheal tubes with subglottic suction capability should be used for mechanically ventilated patients who are expected to be ventilated > 72hours.
- If a tracheal tube does not have subglottic suction capability, a Y-catheter should be used to remove “above the cuff” secretion
- Standard precautions require the use of PPE to prevent contamination and mucosal or conjunctival splash injuries and is mandatory while suctioning a patient.
Measurement of Length to give Suction

Suction should only be to the tip of the ETT and should never exceed more than 0.5 cm beyond the tip of the ETT to prevent mucosal irritation and injury. Measurement of length to give suction is to be predetermined at shift commencement. Length is determined by using the centimetre markings on the ETT; and by adding the length of additional space of the ETT adapter (usually 1-1.5 cm). If patient on HFOV or HFJV, allow for different lengths of suction adaptors.

Equipment

- Functioning wall suction unit with suction tubing connected
- This should be checked at shift commencement of each nursing shift and prior to each procedure
- Suction pressure at 80-100 cmH2O. Suction pressure may be lower for a small or unstable infant, or higher to remove thick or tenacious secretions. Maximum pressure should not be higher than 200 cmH2O. The likelihood of needing a higher pressure increases with smaller sized closed suction catheters
- Neopuff set to appropriate settings (checked at shift commencement)
- Suction catheter for open suction (see table below for appropriate sizes)

7 TIPS FOR SUCCESSFUL ENDOTRACHEAL (ET) SUCTIONING

Endotracheal suctioning is often necessary for ventilated patients, but it comes with significant risks ranging from respiratory distress to cardiac arrhythmias to hypertension.

1. **Suction only as needed:** It should be performed only if necessary due to its risks and adverse effects including that patients often describe it as “painful and uncomfortable and may result in a choking sensation.” Despite the discomfort, it is often a necessary procedure that can improve breathing.

2. **Increase oxygen in different amounts for adults and children:** While pre-oxygenation at 100% is the typical practice with adults before, during and after intubation, that same level of oxygen can cause hyperoxia—over oxygenation

3. **Use low vacuum pressure unless otherwise necessary:**
   - A number of studies recommend using the lowest vacuum pressure to reduce risks of hypoxia—a lack of oxygen—atelectasis, and tracheal mucosa injury.
   - However, the pressure has to be strong enough to remove the secretion.
   - Ultimate recommendation is to use the lowest possible suction pressure—usually between 80 and 120 mmHg, unless the secretion is not responding.

4. **Choose the right suction catheter size:**
   - If a suction catheter is too large for the ET or there is too much vacuum pressure, atelectasis can occur
   - Ideally, the general recommendation is to use a suction catheter “that has an external diameter less than 50% of the size of the [endotracheal tube (ETT)] inner diameter
   - Or, put another way, a suction catheter that “occludes less than one-half the internal diameter of the ETT lumen,” and to always use the smallest suction catheter possible that will still allow for effective aspiration.
5. **Weigh the pros and cons of open or closed suctioning systems:**
   - While the literature is inconclusive as to whether open trachea or closed tracheal suctioning systems cause greater infections or trauma to tissues,
   - many health care professionals have come to prefer Closed Suctioning Systems (CSS or CTSS) for their convenience and speed “improved oxygenation; decreased clinical signs of hypoxemia; maintenance of positive end-expiratory pressure; limited environmental, personnel and patient contamination; and smaller loss of lung volume.”

6. **Use continuous suction:**
   Both continuous and intermittent suctioning can cause some damage to the trachea however, when using the CTSS system, researchers recommend using continuous suctioning, otherwise there is a risk of alveolar collapse.

7. **Use shallow suction depth when possible:**
   - Deeper suctioning can cause mucosal injury, bleeding, and even vagal stimulation and bradycardia.
   - However, sometimes deep suctioning is needed, particularly when there are larger amounts of mucus in the lower airways.
   - In lieu of more conclusive studies, the general recommendation is to “minimize the use of deep suctioning.”
CHAPTER TWELVE:  
INSERTION AND CARE OF NASO GASTRIC TUBE (NGT)

Learning Objectives: At the end of the session participants will be able to learn

- Indications of NG tube insertion
- Preparation for NG tube insertion
- Care of NG tube
- Precautions during insertion of NG tube
- Safer way of NG tube insertion

Introduction:

A Nasogastric Tube (NGT) is inserted through the nose into the stomach via the oesophagus for the purposes of:

a. Enteral feeding
b. Administration of medication
c. Gastric aspiration and decompression

- Many nasogastric feeding tubes are inserted each day without incident.
- However, there is a small risk that a nasogastric tube can be misplaced during insertion or displaced after a successful insertion.
- Should misplacement occur and not be recognised serious harm could be experienced by the patient
- In line with National Patient Safety Agency guidance nasogastric tubes used for feeding should be radio-opaque along their entire length, be CE marked and have external visual length markings
- The size of nasogastric tube used for enteral feeding should be between 6 to 12fg.

Types of Nasogastric Tubes:

There are two common types of nasogastric feeding tubes:

1. A short term nasogastric feeding tube is usually made of PVC or low grade polyurethane and may be recommended for use up to 7-10 days.
2. A long term nasogastric feeding tube is usually made of polyurethane and will often have a guidewire throughout its length, stiffening the tube to aid the insertion process.

- Lifespan of this type of tube is usually 6 to 8 weeks but may vary according to individual manufacturers.
- Nasogastric tubes are commonly inserted by a variety of practitioners including nurses, doctors and allied health professionals
- Before undertaking this procedure the practitioner should have completed training and demonstrated competency in nasogastric tube insertion in accordance with local policy
- Although this procedure can safely be undertaken by one competent practitioner it is advisable to have a second person present to assist with positioning of the patient and to provide reassurance to the patient as and when required
- The insertion of a nasogastric tube must be a clean procedure
- A multi-disciplinary team (MDT) approach to the initiation of nasogastric tube feeding should be utilised.
- The responsibility for the decision to place a nasogastric tube lies with the senior healthcare professional in charge of the patient’s care.
Before undertaking the procedure:
  o Ensure the rationale for the decision to insert a nasogastric feeding tube has been documented in the patient’s notes.
  o Review the patient’s medical notes to assess for previous surgery or contraindications to tube insertion or use.
  o Ensure all relevant investigations are undertaken (where appropriate) e.g. blood clotting tests.
  o Ensure the person undertaking the procedure is competent to do so.
  o To ensure feeding is appropriate and in the best interests of the patient.

Practitioners will have different levels of experience in placing nasogastric feeding tubes. Some contraindications, therefore are relative and may be dictated by level of experience and/or speciality.

Contraindications may include:

- Basal skull fractures
- Maxillo facial disorders
- Unstable cervical spinal injuries
- Nasal/pharyngeal /oesophageal obstruction or ulceration
- Choanal atresia
- Tracheoesophageal fistula
- Oesophageal/pharyngeal pouch
- Oesophageal stricture or other abnormalities of the oesophagus
- Oesophageal tumours or have undergone oesophageal surgery
- Oropharyngeal tumours or have undergone oropharyngeal surgery
- Actively bleeding oesophageal or gastric varices
- The purpose of the procedure and risks associated with it should be discussed with the patient and where the patient has capacity to consent, their agreement should be obtained.
- Following discussion the patient should be allowed time to consider their decision.
- Verbal consent is sufficient for this procedure.
- Discussion and patient decision should be documented in the relevant patient notes.
- Where patients demonstrate a lack of capacity a ‘best interests decision’ should be taken by the MDT responsible for their care.
- This may necessitate further discussion with the wider MDT and may require a best interests meeting involving the patient’s next of kin (NOK), an advocate or an independent mental capacity assessor (IMCA) as per local policy.

Steps of insertion of NG tube:

- Gather all equipment prior to approaching the patient to undertake the procedure including:
  o Non sterile gloves and apron and other PPI if appropriate
  o A clean, clear working surface area
  o Nasogastric tube appropriate for intended purpose
  o Appropriate enteral syringe (usually 60ml)
  o pH indicator strips (CE marked for human aspirate)
  o Receiver or vomit bowl
  o Tissues
  o Hypoallergenic tape and scissors or specific NG retention device or dressing
  o Water for flushing once gastric position has been confirmed.
This could be freshly run tap water from a drinking source, cooled boiled water or sterile water.

Glass of water or squash with drinking straw (if patient has a safe swallow, is permitted to drink, and is not nil by mouth)

Suction and oxygen (if required)

- Wash hands before putting on gloves and apron
- Follow the five moments for hand hygiene.
- Ensure universal precautions are used at all times.
- Prepare equipment on a clean surface area.
- Agree the patient role during the procedure including:
  - A signal to indicate a problem or their wish to stop the procedure (if able to do so) e.g. raising a hand.
  - Performing a swallow as they feel the tube passing through the pharynx (if able to do so).
- To facilitate smooth passage of the tube
  - Reassure and where possible involve patient. Clear the nose by asking the patient to blow their nose, if able to do so. If this is not possible consider cleaning the area.
  - Note there will always be one nostril slightly clearer than the other.
- Use the sniff test
  - As an example, using the index finger to occlude one nostril and then asking the patient to sniff and then do the same to the other side to identify which nostril is clearer at the time the procedure is due to be undertaken.
- Be aware that previous trauma including nasal fracture, polyps or sinusitis may mean only one nostril can be used.
- If no discernible difference you may wish to ask the patient if they have any preference for which nostril to use.
- To ensure nasal passages are clear for smooth passage of the tube.
- To assess for any physiological malformation that may inhibit tube insertion.
- If a guidewire is present gently manipulate it to ensure it moves freely within the tube.
- Prior to inserting the nasogastric tube ensure the guidewire is locked firmly into place.
- Lubricate the outside of the nasogastric tube.
- DO NOT lubricate the inner lumen of the tube with water before insertion and checking gastric positioning.
- Remove the nasogastric tube from its packaging.
- To facilitate easier removal of the guidewire following tube insertion
- To facilitate smooth passage of the tube and increase patient comfort.
- Activation of lubrication within the nasogastric tube has been shown to reduce pH readings and potentially give a false positive.
- Estimate the length of the nasogastric tube (nose, ear, xiphisternum).
- To do this:
  - Place the exit port of the tube at the tip of the nose, extend the tube across to the earlobe. and then down to the xiphisternum.
  - Note the predetermined mark.
  - You may wish to mark the tube with a pen directly for a clear indication of the required measurement during the insertion procedure.

NB: This measurement is only an estimate. The position of the nasogastric tube may need to be adjusted to enable gastric aspirate to be collected (plus or minus 10%).
To ascertain an approximate measurement to ensure the tip of the nasogastric tube reaches the stomach.

After lubricating the outside of the nasogastric tube gently insert the tube into the agreed nostril aiming toward the back of nose and along the nasopharynx.

Ensure the head is not hyperextended.
- Where a patient is safe to swallow fluid and has capacity, offer a glass of water/squash with a straw and ask patient to swallow some water.
- Where patient is not safe to swallow fluid but has capacity, ask them to perform a dry swallow.

In some instances, to assist insertion, a ‘chin tuck’ may be performed (tucking the chin down toward the chest).
- To aid intubation into the oesophagus and reduce risk of tracheal intubation.

Slowly, advance the tube to the predetermined measurement.
- If any significant resistance is felt during insertion halt the procedure, and pull the tube back but do not remove it completely.
- If the patient starts to cough during the procedure, stop, pull the tube back slightly and wait for coughing to settle.
- If the patient becomes distressed it is advisable to stop and seek senior specialist advice.
- Never force the nasogastric tube if resistance is felt.
- A maximum of 3 attempts should be made at one time. If the procedure is unsuccessful after 3 attempts stop and seek senior specialist advice.
- Before continuing, ask the patient to open their mouth to check the nasogastric tube has not coiled up at the back of the oral cavity.

If the nasogastric tube has been inserted to, or slightly beyond, the predetermined mark:
- Leave the guidewire in position (if there is a guidewire).
- Connect a 60 ml enteral syringe onto the end of the nasogastric tube.
- Flush the tube with 10mls air to remove any debris collected during the insertion procedure.
- then exert gentle pressure to withdraw aspirate along the length of the nasogastric tube into the syringe.
- If available - Test the aspirate obtained, with pH indicator paper/strips that are CE marked for human gastric aspirate.
- The pH reading must be 5.5 or below before feed, fluid or medication can be administered via the nasogastric tube.
- Note that if a guidewire is removed and the nasogastric tube requires repositioning,
- UNDER NO Circumstance should the guidewire be re-inserted into the tube whilst the tube remains in the patient
- Secure the nasogastric tube at the nose or cheek once gastric position is confirmed.
- If a guidewire is present and has not been removed, remove it at this point,
- Flush the tube with water.
- Securing the nasogastric tube to the cheek rather than the nose reduces the risk of nasal erosion or ulceration.

### Documentation of the procedure:

- Fully document procedure in the appropriate patient records (written or electronic).
- Documentation should include as a minimum:
  - The date and time tube inserted.
  - The size and type of nasogastric tube used.
External cm markings at the nostril.

The method used to confirm gastric positioning of the tube.

Details of healthcare professional who inserted the tube including name and designation.

Include how consent was obtained/patient agreement indicated. Fully document best interests decisions.

Any problems experienced during the procedure.

- Also consider documenting:
  - Patient tolerability of the procedure.
  - The number of attempts undertaken to insert the nasogastric tube.
  - In which nostril the tube is situated.
  - The date a tube change is due.

**Management of NG Tube:**

- The nasogastric tube should be secured using hypoallergenic tape to the patients’ nose or cheek.
- Dressings with an adhesive channel to secure the nasogastric tube on the cheek are available as an alternative or in addition to the use of hypoallergenic tape.
- The tape/dressing should be checked daily and replaced if soiled or loose.
- The tape/dressing should be changed at least weekly but more frequently if it loosens or becomes soiled.
- Check nasogastric tube or securement device is not causing pressure damage or excoriation externally or internally to the nostrils.
- Ensure checks are undertaken at least daily. Clearly document findings in the patient notes.

**Patient positioning prior to using the nasogastric tube action:**

- Before administering feed or medication ensure the patient is positioned upright or at a minimum of a 30° angle.
  - This helps to prevent reflux and aspiration.
CHAPTER THIRTEEN:
NUTRITION IN CRITICAL CARE

Learning Objectives: After the session participants will be able to learn

• Importance of nutrition of critically ill patients in ICU
• The feeding protocols of ICU Patients
• Route of Feeding
• Advantages and disadvantages of enteral/parenteral feeding

Introduction:
The Intensive Care Unit (ICU) is a specialised area of a hospital which has the facilities, equipment and staff expertise required to manage patients with life-threatening conditions.

Patients in an acute hospital are classified according to their severity of illness rather than their hospital location. Generally, the patients in the ICU will be level 2 (high dependency) or level 3 (intensive)

• Level 0: Patients whose needs can be met through normal ward care in an acute hospital.
• Level 1: Patients at risk of their condition deteriorating, or those recently relocated from higher levels of care, whose needs can be met on an acute ward with additional advice and support from the critical care team.
• Level 2: Patients requiring more detailed observation or intervention, including support for a single failed organ system or postoperative care and those stepping down from higher levels of care.
• Level 3: Patients requiring advanced respiratory support alone or basic respiratory support together with support of at least two organ systems.

Appropriate nutrition provision in the ICU is associated with

o improved patient outcomes,
o reduced length of hospital stay,
o decreased duration of dependence on mechanical ventilation and
o reduced infections

Initiation of nutritional support:

• Enteral Nutrition (EN) supports the functional and structural integrity of the gut, modulates the systemic immune response and attenuates disease severity
• In the critically ill patient who is unable to maintain their own nutritional intake, it is recommended that EN be initiated within 24 to 48 hours

Feeding protocols:

• A feeding protocol should be standard practice in the ICU to facilitate early enteral feeding
• Features of ICU feeding protocols.
  o Specify a starter feed.
  o Define target feeding rate.
  o Provide details of feed advancement strategies which may include a volume-based feeding approach.
  o Give specific instructions on handling gastric residual volumes (GRVs).
  o Detail conditions under which enteral nutrition should be adjusted, stopped or when an alternative route of delivery (such as post-pyloric feeding) should be considered.
Route of feeding:

- It is practical and safe to use enteral nutrition (EN) in most critically ill patients.

Enteral Nutrition (EN) vs. Parenteral Nutrition (PN):

- The advantages of EN over PN include:
  - Reduced cost,
  - Maintenance of gut integrity,
  - Modulation of the immune response and
  - A reduced risk of septic complications

- In critically ill patients where EN is contraindicated or does not meet nutritional targets, full or supplemental PN should be considered to prevent the risks associated with underfeeding.

- The recommended timing of the initiation of PN is unclear but international guidelines suggest that exclusive PN should be withheld for the first 7 days following ICU admission in patients at low nutrition risk and commenced as soon as possible in those at high nutrition risk.

Supplemental PN:

- A combination of PN with EN should be considered when EN fails to meet nutritional targets
- Early supplemental PN is not advised in critically ill patients as it is costly and provides minimal benefits

Summary:

In the absence of more conclusive guidance, the need for PN should be considered on a case-by-case basis.

- Close monitoring of critically ill patients receiving PN is required to prevent overfeeding and associated hyperglycaemia

ICU ENTERAL FEEDING GUIDELINES

a) Initiation of Feeding:

- Ventilated patients should receive an Orogastric Tube (OGT), Nasogastric Tube (NGT) or Dobhoff Tube (DHT).
- The correct position of the tube should be confirmed by auscultation and KUB.
- Patients at high risk for aspiration should receive small bowel feeding access.
- For patients requiring chronic enteral nutrition support, feeding access should be obtained as per the physician’s discretion.
- Enteral feeding should be initiated within 12-24 hours of admission to ICU, unless
  a. the patient is not hemodynamically stable,
  b. adequately resuscitated, or
  c. the gastrointestinal (GI) tract is believed to be non-functioning.
- Patients with recent abdominal surgeries require prior discussion with the surgeon before commencing enteral feeding.
- Patients receiving enteral feedings should be placed in the semi-recumbent position with the Head side of the bed 30-45o up unless otherwise contra-indicated.

b) Feeding calculation:

- Energy requirements may be calculated either through simplistic formulas (25-30 kcal/kg/d)
Following formula are also in use

a. Harris-Benedict Equation
b. Based on disease condition

<table>
<thead>
<tr>
<th>Clinical Condition</th>
<th>Energy (Kcal/Kg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>25</td>
</tr>
<tr>
<td>Stressed/MICU</td>
<td>25-30</td>
</tr>
<tr>
<td>Trauma/General Surgery</td>
<td>30</td>
</tr>
<tr>
<td>Trauma ICU</td>
<td>30-35</td>
</tr>
<tr>
<td>Burn</td>
<td>Curreri Formula: 25 *(weight (kg)) + 40 (%TBSA burned)</td>
</tr>
<tr>
<td>Cancer</td>
<td>Inactive, nonambulatory 25-30 Wt gain, nutritional repletion 30-35 Hypermetabolic, stressed 35 *Use Actual BW unless BMI &gt;29.9, then use Idea</td>
</tr>
<tr>
<td>Obesity, BMI &gt;29.9</td>
<td>Mifflin St. Jeor Equation: Men: (10 x kg) + (6.25 x cm) – (5 x age) + 5  Women: (10 x kg) + (6.25 x cm) – (5 x age) - 161</td>
</tr>
</tbody>
</table>

- Estimated protein needs should be adjusted according to the severity and type of illness. Protein provision will be included in total calorie intake in critically ill patients while they are in ICU.

**Enteral Feeding:**

**Introduction**-

Enteral feeding is a method of supplying nutrients directly into the gastrointestinal tract unable to consume adequate nutrients

- Impaired swallowing/sucking
- Facial or oesophageal structural abnormalities
- Anorexia related to a chronic illness
- Eating disorders
- Increased nutritional requirements,
- Congenital anomalies
- Primary disease management.

Enteral feeding tubes can be used to:

- Administer bolus, intermittent feeds and continuous feeds
- Medication administration
- Facilitate free drainage and aspiration of the stomach contents
- Facilitate venting/decompression of the stomach
- Stent the oesophagus

**Nasogastric Tube/Orogastric Tube- Checking the Position:**

- Prior to accessing a NGT/OGT for any reason nursing staff members must ensure that the tube is located in the stomach.
- Coughing, vomiting and movement can move the tube out of the correct position.
- The position of the tube must be checked:
  - Prior to each feed
  - Before each medication
o Before putting anything down the tube
o If the child has vomited
o 4 hourly if receiving continuous feeds

Nursing staff should perform the following observations and obtain a gastric aspirate to establish tube position.

- Ensure taping is secure
- Observe and document the position marker on NGT/OGT – compare to initial measurements.
- Observe for any signs of respiratory distress

**Obtain gastric aspirate:**

To check the position of the tube need to have prepared the following equipment:

- pH test indicators;
- Enteral/oral syringe – 5ml – 20ml for aspiration;
- Gloves

Procedure:

- Attach a 10-20 ml oral/enteral syringe to the enteral tube
- Attach a 20-50 ml oral/enteral syringe to the enteral tube
- Aspirate minimum 0.5 - 1ml of gastric content (or sufficient amount to enable pH testing if available).
- Utilising pH indicator strips a reading of between 0-5 should be obtained and documented.

If a reading greater than 5 is obtained

- Placement of the tube is questionable and it should not be used until the position of the tube is confirmed.
- Leave for up to 1 hour and try aspirating again. Small-bore tubes can be difficult to aspirate therefore the following are suggested techniques to try enhance the ability to obtain aspirate:
  - Turn the patient onto their side. This will allow the tip of the tube to move to a position where fluid has accumulated
  - Using a 20-50ml oral/enteral syringe insufflate 1-5 ml of air (into the tube. This may move the tube away from the wall of the stomach. It will also clear the tube of any residual fluid.
  - Wait for 15-30 minutes. This will allow fluid to accumulate in the stomach and try aspirating again.
  - If no aspirate obtained, advance the tube by 1-2 cm and try aspirating again
  - If aspirate not obtained discuss with senior nursing staff or medical staff and consider removing the tube or checking position by x-ray.

**Ongoing Assessment**

**During Continuous feeds – Nasogastric/Orogastric Tube:**

1. The position of the tube needs to be checked 4 hourly with change of feeds
   - Should there be any dispute as to the position of the tube, do not recommence feeds. Discuss with senior nursing staff or medical staff.
2. The following needs to be checked every 2 hourly during the feed:
   - Taping
   - Marker on NGT
   - Observe for signs of respiratory distress.
   - Check infusion hourly and document intake.
   - Feeds should hang for no longer than 4 hours to reduce the risk of bacterial growth.
Other assessment considerations for the patients receiving enteral feeds:

- Regular Weights (at least twice weekly or as clinically indicated)
- Blood tests

Management:

**Flushing enteral tubes:**

The purpose of flushing is to check for tube patency and prevent clogging of enteral tubes. Flushing is not routine on the Neonatal unit and flushing with air is the preferred method. Enteral feeding tubes should be flushed regularly with water (or sterile water if appropriate):

- Prior to and after feeding
- Prior to, in-between and after medications
- Regularly in between tube use

Nurses should prepare an enteral/oral syringe, enteral tube connector and water for a flush.

- Tap water is suitable for most patients with OGT or NGT
- Boiled/sterile water may be necessary for children under 6 months of age or as clinically indicated e.g. immunocompromised patients

**Flushing:**

- Enteral tubes should be flushed with between 5 – 20 mls of water depending on the viscosity of the feed/medication,

**Venting:**

- Feeding tubes may be used to facilitate venting or decompression of the stomach from the accumulation of air during such interventions as High Flow Nasal Prongs, Non-Invasive or Invasive Ventilation.
- The tube may be clamped for 30 minutes to an hour post administration to prevent loss of feed or medication

**Feeds:**

Feeds can be administered via syringe, gravity feeding set or feeding pump.

For patients who have a newly established enteral tube feeding regime:

- Feeds should be recommended and ordered by the medical team and/or dietitian, taking in to account the nutritional needs and clinical condition of the patient.
- Formula can be ordered

**Administration of Feeds:**

When preparing to administer feeds the position of the enteral tube must be confirmed Prior to and after feeds should adequately flush the enteral tube.

**Position:**

- Lying prone/supine during feeding increases the risk of aspiration and therefore where clinically possible the patient should be placed in an upright position.
- If unable to sit up for a bolus feed or if receiving continuous feeding, the head of the bed should be elevated 30-45 degrees during feeding and for at least 30 minutes after the feed to reduce the risk of aspiration.
Using a syringe for a bolus feed:

- Remove the plunger from the syringe and place the tip of the syringe into the enteral tube connector at end of the enteral tube.
- Holding the syringe and enteral tube straight, pour the prescribed amount of feed into the syringe. Let it flow slowly through the tube e.g. 250ml over 20 minutes.
- Pour the prescribed amount of water into the syringe and allow to flow through to flush the feeding tube appropriately.

Completion of feed:

The tube must be flushed with water (air in neonates) to prevent tube from blocking (see above).

Giving sets:

- Rinsed out with warm water (tap or sterile).
- Ensure tip of giving set is covered between uses.
- Only prime the giving set with formula immediately prior to feeding time.
- The set should be changed every 24 hours or as per manufactures instructions.

Types of feeds:

The decision for which type of enteral feed a patient should receive should be made in consultation with the dietician, medical team, nursing staff and family, taking into account the nutritional needs, clinical status and tolerance of feeds of the patient.

Medication administration:

Nurses who are preparing and administrating medication via an enteral tube must adhere to the Medication Management Procedure.

- Do not administer drugs through tubes used for aspiration or on free drainage unless specifically directed by medical staff.
- Confirm that the enteral feeding tube is the intended route for a medication before administration.
- Confirm the position of the enteral tube prior to medication administration
- Adequately flush the enteral tube before, in-between and after medication administration (see above).

Choice of drug preparation:

- Liquid formulations are usually preferred for enteral tube administration, unless the formulation contains other ingredients that could cause unwanted side-effects (e.g. sorbitol can cause diarrhoea). Liquid formulations may inappropriate in some patients (e.g. the carbohydrate content may be too high for patients on a ketogenic diet).
- Viscous liquid medications may require dilution to prevent clogging of the enteral tube.
- If a liquid formulation is not available consult a pharmacist to confirm if the tablet form can be crushed to a fine powder and then dispersed in water, or whether a capsules can be opened to disperse the contents in water.
- Do not mix medications with feeds.
- Do not crush enteric coated or sustained/controlled release medications.
Adverse effects:

Unblocking Tubes:

Blocking of tubes can occur due to:

- Interaction between gastric acid, formula and medications
- Interactions between medications if tube is not flushed between medications
- Inappropriately prepared medications e.g. inadequately crushed tablets
- Small internal diameter of the tubes and longer tubes
- Binding of medication to the tube
- Viscosity of some liquid preparation
- Poor flushing technique
- Bacterial colonization of the nasogastric tube

Flushing is the single most effective action that prolongs the life of nasogastric tubes. It is recommended that flushing occur **BEFORE, DURING** and **AFTER** administration of enteral medications and feeds.

To unblock enteral tubes, flush the tube in a pulsating manner (push/pull) with 10-20ml with warm water, if it is safe to do so taking into account the child’s age, size and clinical status. It may be appropriate to allow the warm water to soak, by clamping/capping the tube, in the tube to assist with unblocking.

Please note that there is no evidence to support the practice of using carbonated drinks such as Coca-Cola™ to unblock enteral tubes.

Steps:

- Wash your hands.
- Measure the correct amount of formula and warm it to the desired temperature. ...
- Check tube placement (observing mark on NG tube and pH testing).
- Pinch the tube.
- Attach a syringe to the feeding tube.
- Pour the formula into the syringe.
- Unpinch the tube.
CHAPTER FOURTEEN:
PATIENT TRANSFER

Learning Objective: At the end of the session participants will be able to learn

- Understand why a patient should need a transfer
- Know the types of transfer
- Understand the preconditions for transfer
- Know intra-hospital & inter-hospital transfer protocols
- Know and apply ISOBAR

Transfers are defined as moving a patient from one flat surface to another, such as from a bed to a stretcher. Types of hospital transfers include bed to stretcher, bed to wheelchair, wheelchair to chair, and wheelchair to toilet and vice versa.

Transport of critically ill patient poses added risk of being more unstable. But there are some occasions the critically ill patients from ICU need to be transported from current location to other location.

The following are the situations when the critically ill patient needs to be transported from ICU:

- For specific investigations
- To provide specific treatment not available in the present location
- From ward /one hospital to other hospital in critical care unit
- From one critical unit to another critical unit for specific treatment

Intra-hospital and Inter-hospital Transfer

Transfer of patients traditionally fall in two groups
A) Intra-hospital Transfer
B) Inter-hospital Transfer

A. Intra-hospital transfer:

Transfer of patient from one location to other location within the hospital.

Intra-hospital transfer usually become necessary to

- Facilitate critical investigations not possible bed side like: CT Scan
- Facilitate specific intervention
  o Transfer to operation room for operative procedure
  o Transfer to Cath lab for cardiac interventions
  o Transfer to dialysis unit in case dialysis facility not available in ICU
  o From one critical unit to other critical care unit for specific treatment
    ■ From Coronary Care Unit (CCU) to ICU for ventilatory support
    ■ From general ICU to Neuro ICU

Intra-hospital Transfer protocol

Steps to be followed before, during and after transfer:

- Confirm identity of the patient
- Ensure that correct patient is for transfer
• Moving patient should be associated with no or little compromise in their condition
• Patient with unstable physiology should not be transported till the condition is stabilized except
  Intervention or investigation is required for stabilization of the patient or in case the specific
  treatment cannot be started.
• Example:
  o In case of stroke patient, it become necessary to diagnose the nature of stroke
    Ischemic/Hemorrhagic.
  o Emergency evacuation of blood intra cerebral blood clot
  o Control of bleeding
• Journey should be minimum
• **A structural approach must be followed:**
  o Communication with patient or in case unconscious patient patient’s legal guardian/ relative
    should be counselled
    ■ Assessing a need for transfer
    ■ Who will make critical care decisions
    ■ Advantages and disadvantages of transport
    ■ Risks during transfer
    ■ Risks of the intervention/investigation.
    ■ Preparation for managing any critical events during transport.
    ■ A written consent for transfer should be obtained
• Before transfer
  o Perform ABCD sequence of examination
  o Check airway and secure it
  o If patient is on ETT/Tracheostomy: Suction it
  o Optimize ventilation & oxygenation
  o Check venous access and ensure patency and adequacy
  o Measure empty and document drainage/urine bag
  o Address sedation/analgesic/muscle relaxant schedule of the patient
  o Clearly label the ongoing infusions mentioning infusion rate and dilution.
  o Check the battery powers.
  o Check the Oxygen cylinder content
  o Ensure oxygen supply during transfer and during the procedure
  o Handover of the patient should be among the transport team and ICU nurse (Nurse to Nurse)
  o Determine & ensure who will accompany the patient
  o Continue monitoring during transfer and during intervention/Investigation
    ■ SpO₂
    ■ Blood pressure
    ■ 3/5 lead ECG
    ■ ETCO₂

**B. Inter-hospital Transfer:**

An inter-hospital critical care transfer is defined as the secondary transfer of a critically ill patient from
any hospital facility (Emergency Department, Critical Care Unit, Ward, Operating Department) to another
centre to continue critical care support.

• The decision to transfer any critically ill patient will always be a balance of associated benefits and
  risk.
• The decision must always be made by a consultant in intensive care medicine or anaesthesia at the referring hospital, in discussion with consultant colleagues from the receiving hospital.
• The final decision to accept a patient lies with the critical care consultant in the receiving hospital.
• Assessment of risks associated with any inter-hospital transfer must benefit of transfer and the timing of transfer will reflect factors such as the need for time-critical interventions.
• A detailed risk assessment to determine the level of risk of the patient should be performed by an experienced clinician prior to the transfer.
• The nursing staff will give a verbal summary of the patients’ clinical details to the nursing staff at the receiving hospital.
• As soon as the consultant to consultant referrals have been made the patient needs to be prepared for transfer. The transfer preparation checklist must be completed.

Pre-transfer stabilisation and preparation:
• A proper and meticulous preparation and stabilisation of patient should be done before transfer to prevent any adverse events or deterioration in patient's clinical condition.
• The patient should be adequately resuscitated and stabilised to the maximum extent possible without wasting undue time.
• During the preparation, patient's A, B, C and D, i.e., airway, breathing, circulation and disability, should be checked, and any associated preventable problems should be corrected.

Airway:
• The patients with possibility of airway compromise during transfer should be electively intubated with endotracheal tube (ETT) with a cuff which should be secured properly after confirming its correct position.
• A properly placed nasogastric tube is required in some patients to prevent aspiration of gastric contents during transfer.
• The cervical spine stabilisation may be required in some trauma patients.

Breathing:
• The ventilation should be adequately controlled with optimisation of the arterial blood gas values.
• In the suspected pneumothorax, chest drain should be inserted before transfer, especially before air transport.

Circulation:
• The patient should have at least two wide bore intravenous working cannulas in place before transfer.
• External haemorrhage, if any, should be adequately controlled, and any shock should be treated with intravenous fluids and/or vasopressors.
• The availability of crossed-matched blood may be required during the transport.

Disability or neurological status:
• Patients with head injury should have their Glasgow coma scale (GCS) adequately monitored and documented before and during transfer and before administration of any sedative or paralytic agent.
Apart from the above pre-transfer checklist, the patient should be protected from cold by provision of suitable blankets. All the baseline investigations should be done on the day of transfer to reflect the present condition of the patient.

**Mode of transfer:**

The two most commonly employed modes of transfer of patients are
a) Ground transport, with the inclusion of ambulances
b) Air transport which includes helicopter or aeroplane ambulances.

**Ground transport:**

This is accomplished by the use of different types of ambulances:
Basic life-support ambulance: These ambulances are equipped with appropriate staff and monitoring devices to transport patients with non-life-threatening conditions as these can only provide basic life-support services. Advanced life-support ambulance: These ambulances can provide advanced life-support services such as endotracheal intubation, cardiac monitoring, defibrillation, administration of intravenous fluids or vasopressors. These are adequately staffed and equipped for transporting patients with life-threatening conditions

**Air transport:**

The use of air transport has been on the rise in developed countries because of advantages of rapid transport with inclusion of specialised medical care.

**Accompanying the patient:**

- It is usually recommended to have at least two competent personnel accompanying the patient to be transferred. One doctor/paramedics and one nurse.
- The accompanying person should be suitably trained, competent and experienced and preferably should have done training in patient transfer and should have sufficient training in advanced cardiac life support, airway management and critical care.
- If the physician is not available to transfer unstable patients, then the provision of contacting the concerned physician by the transport team should definitely be available.

**Equipment, drugs, and monitoring:**

- A proper monitoring with the provision of all lifesaving drugs is mandatory for transfer of all patients with level 1, 2 and 3 critical care needs.
- The transfer ambulance must be equipped with all the drugs and instruments required for
  - airway management
  - oxygenation
  - ventilation
  - haemodynamic monitoring and
  - resuscitation
- All the monitoring needs to be established before the commencement of transfer along with the starting of infusion drugs.
- The drugs needed for patient transfer include
  - muscle relaxants,
  - sedatives,
• analgesics
• inotropes and
• resuscitation drugs.

The person in charge of patient transfer should ensure proper supplies of these emergency drugs.

Some of these drugs may be required to be prepared in pre-filled syringes before the transfer.

The minimum standard of monitoring recommended for patient transfer includes
• continuous electrocardiogram monitoring,
• non-invasive blood pressure,
• oxygen saturation,
• end-tidal carbon dioxide (in ventilated patients) and
• temperature.

The non-invasive blood pressure may be significantly affected by the motion artefacts, so it may be prudent to use invasive blood pressure monitoring in selected subset of patients.

All the monitoring equipment should be secured properly and should be placed at or below the level of the patient for uninterrupted monitoring.

The electrical equipment must be functional on battery power with the provision of extra batteries during the transfer.

Patients on ventilator must be transferred on portable transport ventilators with the provision of display of alarms related to tidal volume, airway pressure, inspiratory: expiratory ratio, inspired oxygen fraction and respiratory rate.

**Documentation:**

• The documentation of patient transfer is most important but often missed as part of transfer.
• The documentation should always be clear at all stages of transfer.
• As it was the only legal document that the patient was transferred, so it must include the
  o patient’s condition,
  o reason to transfer,
  o names and designation of referring and receiving clinicians,
  o details and status of vital signs before the transfer,
  o clinical events during the transfer and the treatment given.
• A standardised document should be used and maintained both for intra- and inter-hospital transfer.

**Skill Learning:**

**Transfer Communication**

**STEP 1.** Use the ABC SBAR method of ensuring complete communication.
• A= Airway
• B= Breathing
• C= Circulation
• S=Situation
  o Patient name
  o Age
  o Referring facility
  o Referring physician name
  o Reporting nurse name
  o Indication for transfer
• B= Background
  o Event history
  o AMPLE assessment
  o Blood products
  o Medications given (date and time)
  o Imaging performed
  o Splinting

• A= Assessment
  o Vital signs
  o Pertinent physical exam findings
  o Patient response to treatment

• R= Recommendation
  o Transport mode
  o Level of transport care
  o Meds intervention during transport
  o Needed assessments and interventions

Detailed Neurological Examination:

STEP 1. Examine the pupils for size, shape and light reactivity.
STEP 2. Reassess the new GCS score.
STEP 3. Perform a cranial nerve exam by having patient open and close eyes; move eyes to the right, left, up and down; smile widely; stick out the tongue; and shrug the shoulders.
STEP 4. Examine the dermatomes for sensation to light touch, noting areas where there is sensory loss. Examine those areas for sensation to pinprick, noting the lowest level where there is sensation.
STEP 5. Examine the myotomes for active movement and assess strength (0–5) of movement, noting if limited by pain.
STEP 6. Ideally, test patient’s reflexes at elbows, knees, and ankles (this step is least informative in the emergency setting).
CHAPTER FIFTEEN:
CARDIO PULMONARY RESUSCITATION (CPR)

Learning Objectives: At the end of the session participants will be able to learn

- Identification of collapsed patient
- Correct Sequence of CPR
- How to provide CPR

Be Safe

- Make sure the scene is safe before proceeding.
- Move the person out of traffic.
- Move the person out of water and dry the person. (Drowning persons should be removed from the water and dried off; they should also be removed from standing water, such as puddles, pools, gutters, etc.)
- Be sure you do not become injured yourself.

Assess the Person

- Shake the person, tap their shoulder hard, and talk to them loudly.
- Check to see if the person is breathing. (Agonal breathing, which is occasional gasping and is ineffective, does not count as breathing.)

Call EMS

- Send someone for help or to call your emergency number and to get an AED.
- If alone, call for help while assessing for breathing and pulse. (The ILCOR emphasizes that cell phones are available everywhere now and most have a built-in speakerphone. Call for help without leaving the person.)

CPR

- Begin sets of compressions and rescue breaths.

Defibrillate

- Attach the AED pads when available.

CPR STEPS

1. Check for the carotid pulse on the side of the neck (Figure 15.1). Keep in mind to not waste time trying to feel for a pulse; feel for no more than 10 seconds. If you are not sure you feel a pulse, begin CPR with a cycle of 30 chest compressions and two breaths.

Fig : 15.1 A: Carotid Pulse Check
2. Use the heel of one hand on the lower half of the sternum in the middle of the chest.

3. Put your other hand on top of the first hand. (Figure 15.1.C).

4. Straighten your arms and press straight down (Figure 15.1 C). Compressions should be 2 to 2.4" (5 to 6 cm) into the person’s chest and at a rate of 100 to 120 compressions per minute.

5. Be sure that between each compression you completely stop pressing on the chest and allow the chest wall to return to its natural position. Leaning or resting on the chest between compressions can keep the heart from refilling in between each compression and make CPR less effective.

6. After 30 compressions, stop compressions and open the airway by tilting the head and lifting the chin (Figure 15.1.D &15.1.E).
   - Put your hand on the person’s forehead and tilt the head back.
   - Lift the person’s jaw by placing your index and middle fingers on the lower jaw; lift up.
   - Do not perform the head-tilt/chin-lift if you suspect the person may have a neck injury. In that case, the jaw-thrust is used.
   - For the jaw-thrust manoeuvre, grasp the angles of the lower jaw and lift it with both hands, one on each side, moving the jaw forward. If their lips are closed, open the lower lip using your thumb (Figure 15.1.F).
7. Give a breath while watching the chest rise. Repeat while giving a second breath. Breaths should be delivered over one second.
8. Resume chest compressions. Switch quickly between compressions and rescue breaths to minimize interruptions in chest compressions.

**CPR: For Adults**

**CABD (Circulation, Airway, Breathing, Defibrillate)**

There is a common acronym in BLS used to guide providers in the appropriate steps to assess and treat patients in respiratory and cardiac distress. This is CAB-D (Circulation, Airway, Breathing, Defibrillate). The following scenario will help guide you in performing CAB-D.

You find an adult lying on the ground.

Assess to make sure the scene is safe for you to respond to the down patient.

Assess Responsiveness: Stimulate and speak to the adult asking if they are ok. Look at the chest and torso for movement and normal breathing.

If unresponsive:

- (One provider) first call the emergency response team and bring an AED to the patient.
- (Two providers) Have someone near call the emergency response team and bring the AED.
- Place patient supine on a hard flat surface.

**Circulation**

- Check the patient for a carotid pulse for 5-10 seconds. (Do not check for more than 10 seconds.)

If the patient has a pulse:

Move to the airway and rescue breathing portion of the algorithm:

- Provide 10 rescue breaths per minute (1 breath every 6 seconds).
- Recheck pulse every 2 minutes.
If the patient doesn’t have a pulse:
Begin 5 cycles of CPR (lasts approximately 2 minutes).
Start with chest compressions:

- Provide 100 to 120 compressions per minute. This is 30 compressions every 15 to 18 seconds.
- Place your palms midline, one over the other, on the lower 1/3 of the patient’s sternum between the nipples.
- Lock your arms.
- Using two arms press to a depth of 2 to 2.4 inches (5-6cm) or more on the patient’s chest.
- Press hard and fast.
- Allow for full chest recoil with each compression.

1 cycle of adult CPR is 30 chest compressions to 2 rescue breaths.
If two providers are present: switch rolls between compressor and rescue breather every 5 cycles.

Airway

In the event of an unwitnessed collapse, drowning, or trauma:
Use the Jaw Thrust maneuver. (This maneuver is used when a cervical spine injury cannot be ruled out):
- Place your fingers on the lower rami of the jaw.
- Provide anterior pressure to advance the jaw forward.
In the event of a witnessed collapse with no reason to assume a C-spine injury:
Use the Head Tilt-Chin Lift maneuver:
- Place your palm on the patient’s forehead and apply pressure to tilt the head backward.
- Place the fingers of your other hand under the mental protuberance of the chin and pull the chin forward and cephalic.

Breathing
Scan the patients chest and torso for possible movement during the “assess unresponsiveness” portion of the algorithm. Watch for abnormal breathing or gasping.
If the patient is breathing adequately:
Continue to assess and maintain a patent airway and place the patient in the recovery position. (Only use the recovery position if it’s unlikely to worsen patient injury.)

If the patient is not breathing or is breathing inadequately:
If the patient has a pulse:
  • Commence rescue breaths immediately.

If the patient has no pulse:
  • Begin CPR. (move to the “Circulation” portion of the algorithm.)
  • Use a barrier device if available.
  • Pinch the patient’s nose closed.
  • Make a seal using your mouth over the mouth of the patient or use a pocket mask or bag mask.
  • Each rescue breath should last approximately 1 second.
  • Watch for chest rise.
  • Allow time for the air to expel from the patient.

During normal CPR without an advanced airway:
  • Provide approximately 6-8 rescue breaths per minute

During normal CPR with an advanced airway:
  • Provide 10 rescue breaths per minute (don’t pause chest compressions for breaths).

If patient has a pulse and no CPR is required:
  • Provide 10 rescue breaths per minute (1 breath every 6 seconds).
  • Recheck pulse every 2 minutes.

If there is a foreign body obstruction:
  • Perform abdominal thrusts

Fig. 15.5: Mouth to mouth Breathing
Recovery position
(lateral recumbent or 3/4 prone position):
This position is used to maintain a patent airway in the unconscious person.

- Place the patient close to a true lateral position with the head dependent to allow fluid to drain.
- Assure the position is stable.
- Avoid pressure of the chest that could impairs breathing.
- Position patient in such a way that it allows turning them onto their back easily.
- Take precautions to stabilize the neck in case of cervical spine injury.
- Continue to assess and maintain access of airway.
- Avoid the recovery position if it will sustain injury to the patient.

Defibrillate
Arrival of the AED (Automated External Defibrillator)

Power:
- Turn AED On NOW! (early defibrillation is the single most important therapy for survival of cardiac arrest and should be done as soon as it arrives).
- Follow verbal AED prompts.

Attachment:
- Firmly place appropriate pads (adult/pediatric) to patient’s skin to the indicated locations (pad image).
Analyze:
A short pause in CPR is required to allow the AED to analyze the rhythm. If the rhythm is not shockable:

- Initiate 5 cycles of CPR.
- Recheck the rhythm at the end of the 5 cycles of CPR.

If the shock is indicated:

- Assure no one is touching the patient or is in mutual contact of a good conductor of electricity by yelling “Clear, I’m Clear, you’re Clear!” prior to delivering a shock.
- Press the shock button when the providers are clear of the patient.
- Resume 5 cycles of CPR.

Fig.15.8. AED lead placement
CPR: for infants 0-1 year of age

CABD (Circulation, Airway, Breathing, Defibrillate)

An infant is found lying on the ground.
Assess to make sure the scene is safe for you to respond to the down patient.
Assess Unresponsiveness: Lightly shake or tap the infant’s foot and say their name. Look at the chest and torso for movement and normal breathing.

If the infant is unresponsive:

- (One provider) If alone and collapse is un-witnessed: First perform 2 minutes of CPR then call the emergency response team and bring an AED to the patient.
- (One provider) If alone and collapse is witnessed: First call the emergency response team and bring an AED, then start CPR.
- (Two providers) Have someone near call the emergency response team and bring the AED and you start CPR.
- Place patient supine on a hard flat surface.

Circulation

Feel for either the brachial or femoral pulse (Do not check for more than 10 seconds).

If the infant has a pulse:
Move to the airway and rescue breathing portion of the algorithm.

- Give 12-20 breaths per minute.
- Recheck the pulse every 2 minutes.

If the infant doesn’t have a pulse:
Begin 5 cycles of CPR (lasts approximately 2 minutes).

Start with Chest Compressions:

- Provide 100 to 120 compressions per minute. This is 30 compressions every 15 to 18 seconds.
- (One provider) Place two fingers on the sternum of the lower chest. One between the nipple line and the other 1cm below.
- (Two providers) Encircle the infant’s torso with both hands with both thumbs pointing cephalic positioned 1cm below the nipples over the sternum.
- Chest Compressions should be at least 1.5 inches or 1/3 the depth of infant’s chest.
- Press hard and fast.
- Allow for full chest recoil.
• Only allow minimal interruptions to the chest compressions.
• (One provider: 1 cycle is 30 chest compressions to 2 rescue breaths)
• (Two providers: 1 cycle is 15 chest compressions to 2 rescue breaths)

If you have two providers: switch rolls between compressor and rescue breather every 2 minutes or 5 cycles of CPR.

![Fig15.10. Chest compression with two fingers in infant](image)

**Airway**

In the event of an unwitnessed collapse, drowning, or trauma:

Use the Jaw-Thrust maneuver. (This maneuver is used when cervical spine injury cannot be ruled out.):

- Place your thumbs on the upper cheek bones of the infant.
- Place your fingers on the lower rami of the jaw.
- Provide anterior pressure to advance the jaw forward.

In the event of a witnessed collapse and there’s no reason to assume C-spine injury:

Use the Head Tilt-Chin Lift maneuver:

- place your palm on the patient’s forehead and apply pressure to tilt the head backward.
- place the fingers of your other hand under the mental protuberance of the chin and pull the chin forward and cephalic.

![Fig.15.11. Head tilt Chin lift manoevre](image)

**Breathing**

Scan the patients chest and torso for possible movement during the “assess unresponsiveness” portion of the algorithm. Watch for abnormal breathing or gasping.

If the infant has adequate breathing:

- Continue to assess and maintain a patent airway and place the infant in the infant recovery position. (only use the recovery position if its unlikely to worsen patient injury).
If the infant is not breathing or is inadequately breathing:
If the infant has a pulse:
   - Commence rescue breaths immediately.
If the infant doesn’t have a pulse:
   - Begin CPR (go to Circulation portion of the algorithm).
   - Use a barrier device if available.
   - Make a seal using your mouth over the mouth and nose of the patient.
   - Each rescue breath should be small and last approximately 1 second.
   - Watch for chest rise.
   - Allow time for the air to expel from the patient.

During normal CPR with an advanced airway:
   - Provide 12-20 rescue breaths per minute (do not stop chest compressions for rescue breaths).
If the patient has a pulse and no CPR is required:
   - Provide 12-20 rescue breaths per minute.
   - Recheck pulse every 2 minutes.

![Rescue Breathing (Mouth to Mouth)](image)

Recovery position for infants
   - Cradle the infant with the infant’s head tilted downward and slightly to the side to avoid choking or aspiration.
   - Continually check the infant’s breathing, pulse, and temperature.

**Defibrillate**

**Arrival of AED (Automated External Defibrillator)**

**Power:**
   - Turn AED On NOW! (early defibrillation is the single most important therapy for survival of cardiac arrest. Begin use on patient as soon as it arrives).
   - Follow verbal AED prompts.

**Attachment:**
   - Firmly place appropriate pads (adult/pediatric) to patient’s skin to the indicated locations (pad image).
Analyze:
A short pause in CPR is required to allow the AED to analyze the rhythm. If the rhythm is not shockable:
- Initiate 5 cycles of CPR.
- Recheck the rhythm at the end of the 5 cycles of CPR.

Manual defibrillators are preferred for infant use. If the manual defibrillator is not available the next best option is an AED with a pediatric attenuator. An AED without a pediatric attenuator can also be used.

**CPR: for a child older than 1 year of age to puberty**

**CABD** (Circulation, Airway, Breathing, Defibrillate)

You find a child lying on the ground.

Assess to make sure the scene is safe for you to respond to the down patient.

Assess Unresponsiveness:
- Stimulate and speak to the child.
- Look at the chest and torso for movement and normal breathing.

If unresponsive:
(One provider) If alone and collapse is un-witnessed:
- Perform 2 minutes of CPR first then call the emergency response team and bring an AED to the patient.

If alone and collapse is witnessed:
- (one provider) Call the emergency response team and bring an AED first, then start CPR.
- (two providers) Have someone near call the emergency response team and bring the AED.
- (two providers) You start CPR.

Place patient supine on a hard flat surface.

**Circulation**
- Check the patient for a carotid pulse for 5-10 seconds.

![Carotid pulse check](image)

If pulse is present: Move to the airway and rescue breathing portion of the algorithm:
- Provide 12-20 rescue breaths per minute.
- Recheck pulse every 2 minutes.
If no pulse: Begin 5 cycles of CPR (lasts approximately 2 minutes)
Start with chest compressions:
- Provide 100 to 120 compressions per minute. This is 30 compressions every 15 to 18 seconds.
- Use one or two arms.
- Place one or both of your palms midline, one over the other, on the lower sternum, between the nipples.
- Press at least to 1/3 the depth of patient’s chest or 2 inches.
- Press hard and fast.
- Allow for full chest recoil with each compression.
- Allow for only minimal interruptions to chest compressions.

(One Provider: 1 cycle is 30 chest compressions to 2 rescue breaths) (Two Providers: 1 cycle is 15 chest compressions to 2 rescue breaths)

Airway
In the event of an unwitnessed collapse, drowning, or trauma: Use the Jaw-Thrust maneuver. (this maneuver is used when cervical spine injury cannot be ruled out):
- Place your fingers on the lower rami of the jaw.
- Provide anterior pressure to advance the jaw forward.

In the event of a witnessed collapse and there’s no reason to assume a C-spine injury: Use the Head Tilt-Chin Lift maneuver.
- place your palm on the patient’s forehead and apply pressure to tilt the head backward.
- place the fingers of your other hand under the mental protuberance of the chin and pull the chin forward and cephalic.

Breathing
Scan the patients chest and torso for possible movement during the “assess unresponsiveness” portion of the algorithm. Watch for abnormal breathing or gasping that will require additional ventilatory support.

If adequate breathing:
Continue to assess and maintain a patent airway and place the child in the recovery position. (Only use the recovery position if its unlikely to worsen patient injury)

If not or inadequate breathing:
has a pulse: Commence rescue breaths immediately.
no pulse: Begin CPR (go to Circulation portion of the algorithm).
• Use a barrier device if available.
• Pinch the patient’s nose closed.
• Make a seal using your mouth over the mouth of the patient.
• Each rescue breath should last approximately 1 second.
• Watch for chest rise.
• Allow time for the air to expel from patient.

During normal CPR without an advanced airway:
(One provider) Provide at least 6 rescue breaths per minute.
(Two provider) Provide at least 12 rescue breaths per minute.

During normal CPR with an advanced airway:
• Provide 12-20 rescue breaths per minute (do not stop chest compressions for rescue breaths).

If patient has a pulse and no CPR is required:
• Provide 12 -20 rescue breaths per minute.
• Recheck pulse every 2 minutes.

If foreign body obstruction:
• Perform abdominal thrusts.

Recovery position (lateral recumbent or 3/4 prone position)
This position is used to maintain a patent airway in the unconscious person.
• Place the patient close to a true lateral position with the head dependent to allow fluid to drain.
• Assure the position is stable.
• Avoid pressure of the chest that could impairs breathing.
• Position patient in such a way that it allows turning them onto their back easily.
• Take precautions to stabilize the neck in case of cervical spine injury.
• Continue to assess and maintain access of airway.
• Avoid the recovery position if it will sustain injury to the patient.

Defibrillate
Arrival of AED (Automated External Defibrillator)

Power:
• Turn AED On NOW! (early defibrillation is the single most important therapy for survival of cardiac arrest. Use immediately upon its arrival to the scene).
• Follow verbal AED prompts.

Attachment:
• Firmly place appropriate pads (adult/pediatric) to patient’s skin to the indicated locations (pad image).

Analyze:
A short pause in CPR is required to allow the AED to analyze the rhythm.
If rhythm is not shockable:
• Initiate 5 cycles of CPR.
• Recheck the rhythm at the end of the 5 cycles of CPR.

If shock is indicated:
• Assure no one is touching the patient or in mutual contact of a good conductor of electricity by yelling “Clear, I’m Clear, you’re Clear!” prior to delivering a shock.
• Press the shock button when the providers are clear of the patient.
• Resume 5 cycles of CPR.

An AED with a pediatric attenuator should be used in children under 8 years of age if available. An AED without a pediatric attenuator can also be used.
Signs and symptoms of a child/adult choking:

Universal signal for choking:
Patient has both hands wrapped around the base of their throat. With complete airway obstruction, the child is unable to speak, cry, or provide any sounds of respiration. The patient may be confused, weak, obtunded, or cyanotic.

Partial airway obstruction may result in stridor or a high-pitched audible noise during respiration. Partial airway obstruction may allow for a productive cough or allow the patient to speak. Get the patient’s attention and ask them if they are choking. Assess for signs and symptoms of airway obstruction.

If partial airway obstruction:

- Do not attempt Heimlich maneuver.

If complete airway obstruction:

- (one provider) immediately call the emergency response team.
- (one provider) Attempt Heimlich maneuver
- (two provider) Send someone to call the emergency response team, while you attempt the Heimlich maneuver.

How to perform the Heimlich maneuver:

- Stand directly behind the child/adult.
- Place both of your arms around patient’s waist.
- Make a fist with one hand and grab the fist with opposite hand.
- Position the thumb end of the fisted hand immediately above the patient’s naval (ample distance away from the xiphoid process).
- Perform fast upward and inward diaphragmatic abdominal thrusts.
- Continue abdominal thrusts until the obstruction is removed.
If patient becomes unconscious:
- Initiate CPR.

Before attempting rescue breaths during normal CPR, assess the airway, removing any visually present obstruction. Do not use a blind finger sweep in an attempt to remove an obstruction.

Choking: Infant Under 1 Year Old

Signs and symptoms of an infant choking:
With complete airway obstruction, the infant is unable to speak, cry, or provide any sounds of respiration. The infant may be confused, weak, obtunded, or cyanotic.

Partial airway obstruction may result in stridor or a high-pitched audible noise during respiration. If the child has a partial airway obstruction, powerful cough, or strong audible cry, do not attempt the Heimlich maneuver.

If signs and symptoms of choking are present and infant is conscious:
- (one provider) immediately call the emergency response team.
- (one provider) Assess the airway for any visually present obstruction and manually remove it if possible.
- (two provider) Send someone to call the emergency response team while you assess the airway.
- Never use a blind finger sweep.

Position the patient:
- Lay infant’s face and torso down on forearm (prone) with chest being supported by your palm and their head and neck by your fingers.
- Tilt the infant’s body at a 30 degree angle, head downward (trandelenburg).
- Use your thigh or other object for support.

Interventional Back Blows:
- Provide 5 rapid forceful blows using a flat palm on the infant’s back between the two scapula.
Reposition the patient:
   • Rotate the infant face up (supine), head downward (trandelenburg) by switching the infant to the opposite arm.

Interventional Chest Thrusts:
   • Place your two fingers on the center of the infant’s sternum immediately below the nipple line.
   • Provide 5 rapid compressions, with thrusts equaling 1/3 to 1/2 the total depth of the chest.
   • Continue cycling back and forth between interventional back blows and chest thrusts until the obstruction is removed or until consciousness is lost.

If the patient becomes unconscious:
   • Initiate CPR.
   • Before attempting rescue breaths during normal CPR, assess the airway, removing any visually present obstruction.
   • Do not use a blind finger sweep in an attempt to remove an obstruction.
CHAPTER SIXTEEN:
NATIONAL COURSE ON BASIC ICU SKILL

By conducting a course for learning the basic ICU skills incorporated in the “National Manual for Basic ICU Skills” will prepare the HCW working in ICU to perform the skills with knowledge.

At the end of this chapter, the participants will be able to:
- Understand and improve the skills of the HCW
- Make your skills stronger and safer
- Improve patient service
- Improve health outcomes of the patient

Overview of the Course:
The course utilizes the hands-on small group discussion. The course comprises lectures, small group discussion and demonstration of skills. Fourteen skills which are regularly performed in ICU were taught in the course.

This is a two day course.
Course was preceded by an Inauguration session.
Course started at 8.00 am and finished at 2.30 pm. Lunch and refreshment were provided.
A total of 32 participant received the course in each session. For each course there was a course director.

Participants: Doctors and nurses working in ICU/Post-operative ward/Operation theatre.
Faculty: Faculties from BSA CC PP.

Details of the course are as below: Given in Annexure

Skill Stations:

Skill Station 1

<table>
<thead>
<tr>
<th>Chapter number and name</th>
<th>CHAPTER ONE: Initial Assessment and management of critically ill patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Objective</td>
<td>After the session participants will be able to learn/explain about:</td>
</tr>
<tr>
<td></td>
<td>- The correct sequence of priorities for management of critically ill patients</td>
</tr>
<tr>
<td></td>
<td>- ABCDEs sequences and identification of life-threatening conditions</td>
</tr>
<tr>
<td>Topics covered in the session</td>
<td>- Correct sequence of priorities for management of critically ill patients are</td>
</tr>
<tr>
<td></td>
<td>- The ABCDEs sequences</td>
</tr>
<tr>
<td>Time</td>
<td>40 Minutes</td>
</tr>
<tr>
<td>Modality</td>
<td>Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion, Question &amp; answer</td>
</tr>
<tr>
<td>Equipment required</td>
<td>NIV Mask, Mannequin, Oxygen Cylinder, Nasal Cannula</td>
</tr>
<tr>
<td>Materials required</td>
<td>Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, push pin</td>
</tr>
</tbody>
</table>
### Skill Station 2

<table>
<thead>
<tr>
<th>Chapter number and name</th>
<th>CHAPTER TWO: Airway &amp; Oxygenation</th>
</tr>
</thead>
</table>
| Learning Objective      | After the session participants will be able to learn/explain:  
|                         | - ABCDEs Airway Management  
|                         | - Airway adjuncts  
|                         | - Airway management skills  
|                         | - Insertion of Oropharyngeal, Nasopharyngeal, Laryngeal mask airway (LMA) and Laryngeal Tube Airway (LTA)  
|                         | - Oral endo-tracheal intubation  
|                         | - Needle and surgical Cricothyrotomy |
| Topics covered in the session | Establishment or Ensure a patent airway.  
|                         | - ABCDEs Airway Management  
|                         | - Airway adjuncts  
|                         | - Oropharyngeal airway  
|                         | - Airway management  
|                         | - Insertion of Oropharyngeal  
|                         | - Nasopharyngeal airways  
|                         | - Laryngeal mask airway (LMA)  
|                         | - Insertion of Laryngeal Tube Airway (LTA)  
|                         | - Oral endo-tracheal intubation  
|                         | - Needle Cricothyrotomy |
| Time                    | 40 Minutes |
| Modality                | Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion, Question & answer |
| Equipment required      | NIV Mask, Mannequin, Oxygen Cylinder, Nasal Cannula |
| Materials required      | Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, Push pin |

### Skill Station 3

<table>
<thead>
<tr>
<th>Chapter number and name</th>
<th>CHAPTER THREE: Oxygen Therapy</th>
</tr>
</thead>
</table>
| Learning Objective      | After the session participants will be able to learn/explain;  
|                         | - Purpose and indication of oxygen therapy  
|                         | - Oxygen toxicity  
|                         | - Storage and sources  
|                         | - Clinical Assessment of Hypoxia  
|                         | - Oxygen using from a cylinder and wall outlet  
|                         | - Methods of oxygen administration/Oxygen delivery system  
|                         | - Advantages and disadvantages of nasal canula  
|                         | - Types of oxygen face masks  
|                         | - Advantages & disadvantages simple face mask & partial rebreather mask, Venturi mask  
<p>|                         | - High flow nasal canula, advantages of high flow nasal canula |</p>
<table>
<thead>
<tr>
<th>Topics covered in the session</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Purpose and indication of oxygen therapy</td>
<td></td>
</tr>
<tr>
<td>• Oxygen toxicity</td>
<td></td>
</tr>
<tr>
<td>• Oxygen storage and sources</td>
<td></td>
</tr>
<tr>
<td>• Clinical assessment of hypoxia</td>
<td></td>
</tr>
<tr>
<td>• Oxygen using from a cylinder and wall outlet</td>
<td></td>
</tr>
<tr>
<td>• Methods of oxygen administration/Oxygen delivery system</td>
<td></td>
</tr>
<tr>
<td>• Advantages and disadvantages of nasal canula</td>
<td></td>
</tr>
<tr>
<td>• Types of oxygen face masks</td>
<td></td>
</tr>
<tr>
<td>• Advantages &amp; disadvantages simple face mask &amp; partial rebreather mask, Venturi mask</td>
<td></td>
</tr>
<tr>
<td>• High flow nasal canula, advantages of high flow nasal canula</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>40 Minutes</td>
</tr>
<tr>
<td>Modality</td>
<td>Hands on coaching, Role play, Brain storming, Discussion, Group discussion, Question &amp; Answer</td>
</tr>
<tr>
<td>Equipment required</td>
<td>Oxygen mask, simple face mask &amp; partial rebreather mask, Venturi mask, Oxygen cylinder, Nasal Canula, High flow nasal canula, oxygen reservoir bag</td>
</tr>
<tr>
<td>Materials required</td>
<td>Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, Push pin</td>
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</tbody>
</table>

**Skill Station 4**

<table>
<thead>
<tr>
<th>Chapter number and name</th>
<th>CHAPTER FOUR: Ventilation</th>
</tr>
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<tbody>
<tr>
<td>Learning Objective</td>
<td>After the session participants will be able to learn/explain;</td>
</tr>
<tr>
<td></td>
<td>➢ Mechanical ventilation</td>
</tr>
<tr>
<td></td>
<td>➢ Bag mask ventilation</td>
</tr>
<tr>
<td></td>
<td>➢ Non-invasive ventilation</td>
</tr>
<tr>
<td></td>
<td>➢ Respiratory Failure</td>
</tr>
<tr>
<td></td>
<td>➢ CPAP</td>
</tr>
<tr>
<td></td>
<td>➢ Bi-Level pressure support</td>
</tr>
<tr>
<td></td>
<td>➢ When to use CPAP/BiPAP</td>
</tr>
<tr>
<td></td>
<td>➢ Complications of CPAP/BiPAP</td>
</tr>
<tr>
<td></td>
<td>➢ Invasive ventilation and different ventilatory mode</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topics covered in the session</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Mechanical ventilation</td>
<td></td>
</tr>
<tr>
<td>➢ Bag mask ventilation</td>
<td></td>
</tr>
<tr>
<td>➢ Non-invasive ventilation</td>
<td></td>
</tr>
<tr>
<td>➢ Respiratory Failure</td>
<td></td>
</tr>
<tr>
<td>➢ CPAP</td>
<td></td>
</tr>
<tr>
<td>➢ Bi-Level pressure support</td>
<td></td>
</tr>
<tr>
<td>➢ When to use CPAP/BiPAP</td>
<td></td>
</tr>
<tr>
<td>➢ Complications of CPAP/BiPAP</td>
<td></td>
</tr>
<tr>
<td>➢ Invasive ventilation</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>40 Minutes</td>
</tr>
<tr>
<td>Modality</td>
<td>Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion, Question &amp; answer</td>
</tr>
<tr>
<td>Equipment required</td>
<td>Ventilator, oxygen resurver bag, Blood pressure machine</td>
</tr>
<tr>
<td>Materials required</td>
<td>Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, Push pin</td>
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</table>
### Skill Station 5

<table>
<thead>
<tr>
<th>Chapter number and name</th>
<th>CHAPTER FIVE: Infection, Prevention, Control and Sterility Maintenance in ICU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning Objective</strong></td>
<td>After the session participants will be able to learn/explain;</td>
</tr>
<tr>
<td></td>
<td>- What is infection control protocol in intensive care unit</td>
</tr>
<tr>
<td></td>
<td>- How can we prevent ICU infection</td>
</tr>
<tr>
<td></td>
<td>- What are the 5 standard precautions for infection control</td>
</tr>
<tr>
<td></td>
<td>- What is the most effective way to prevent infection</td>
</tr>
<tr>
<td></td>
<td>- WHO infection controls standard precautions</td>
</tr>
<tr>
<td></td>
<td>- WHO hand hygiene 7 Steps</td>
</tr>
<tr>
<td></td>
<td>- Personal protective equipment</td>
</tr>
<tr>
<td></td>
<td>- How to hand wash and hand rub</td>
</tr>
<tr>
<td><strong>Topics covered in the session</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Infection control protocol</td>
</tr>
<tr>
<td></td>
<td>- Prevent ICU infection</td>
</tr>
<tr>
<td></td>
<td>- 5 standard precautions for infection control</td>
</tr>
<tr>
<td></td>
<td>- Most effective way to prevent infection</td>
</tr>
<tr>
<td></td>
<td>- WHO infection controls standard precautions</td>
</tr>
<tr>
<td></td>
<td>- WHO hand hygiene 7 Steps</td>
</tr>
<tr>
<td></td>
<td>- Personal protective equipment</td>
</tr>
<tr>
<td></td>
<td>- Hand wash &amp; hand rub</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>40 Minutes</td>
</tr>
<tr>
<td><strong>Modality</strong></td>
<td>Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion, Question &amp; Answer</td>
</tr>
<tr>
<td><strong>Equipment required</strong></td>
<td>Hand gloves, PPE, masks, Eye protector, Soap, hand sanitizer, hand rub, bucket, mug, tissue</td>
</tr>
<tr>
<td><strong>Materials required</strong></td>
<td>Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, Push pin</td>
</tr>
</tbody>
</table>

### Skill Station 6

<table>
<thead>
<tr>
<th>Chapter number and name</th>
<th>CHAPTER SIX: Patient Monitoring and Transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning Objective</strong></td>
<td>After the session participants will be able to learn/explain;</td>
</tr>
<tr>
<td></td>
<td>- Patient monitoring</td>
</tr>
<tr>
<td></td>
<td>- ECG, Respiratory Rate</td>
</tr>
<tr>
<td></td>
<td>- Oxygen saturation/pulse oximetry</td>
</tr>
<tr>
<td></td>
<td>- Temperature, Level of consciousness</td>
</tr>
<tr>
<td></td>
<td>- AVPU, GCS, Urine output</td>
</tr>
<tr>
<td></td>
<td>- Electrolyte, urea, creatinine (EUC), LFTS</td>
</tr>
<tr>
<td></td>
<td>- Coagulation studies (COAGS)</td>
</tr>
<tr>
<td></td>
<td>- Blood Pressure, Blood Sugar, Culture, FBC</td>
</tr>
<tr>
<td></td>
<td>- MSU, Sputum Testing, CSF</td>
</tr>
<tr>
<td></td>
<td>- Transfer Communication</td>
</tr>
</tbody>
</table>
### Topics covered in the session
- Patient monitoring
- ECG, Respiratory Rate,
- Oxygen saturation/pulse oximetry
- Temperature, Level of consciousness
- AVPU, GCS, Urine output
- Electrolyte, urea, creatinine (EUC), LFTS
- Coagulation studies (COAGS)
- Blood Pressure, Blood Sugar, Culture, FBC
- MSU, Sputum Testing
- Different Fluid (CSF)
- Transfer Communication

### Time
- 40 Minutes

### Modality
- Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion,
- Pulse oximeter.
- 3. Insulin syringe.
- 4. Ice bag.
- 5. Laminated GCS chart.
- 6. Annexure 1 & 2 Sheets copy Sufficient (one for each participant)

### Equipment required
- Mannequin, Hand gloves, BP machine, pulse oximetry, Thermometer,

### Materials required
- Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, push pin

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### Skill Station 7

<table>
<thead>
<tr>
<th>Chapter number and name</th>
<th>CHAPTER SEVEN: Shock</th>
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</thead>
<tbody>
<tr>
<td><strong>Learning Objective</strong></td>
<td>After the session participants will be able to learn/explain;</td>
</tr>
<tr>
<td></td>
<td>- Definition of Shock</td>
</tr>
<tr>
<td></td>
<td>- Physiologic aspects of shock</td>
</tr>
<tr>
<td></td>
<td>- Types of shock</td>
</tr>
<tr>
<td></td>
<td>- Management of shock</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topics covered in the session</th>
<th>- Definition of Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Basic Physiologic aspects of shock</td>
</tr>
<tr>
<td></td>
<td>- Types of shock</td>
</tr>
<tr>
<td></td>
<td>- Management of shock</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>40 Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Modality</strong></td>
<td>Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion, Question &amp; Answer</td>
</tr>
<tr>
<td><strong>Equipment required</strong></td>
<td>Syringe, Cannula, Micropore, BP machine, Pulse oximeter</td>
</tr>
<tr>
<td><strong>Materials required</strong></td>
<td>Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, push pin</td>
</tr>
</tbody>
</table>
### Skill Station 8

<table>
<thead>
<tr>
<th>Chapter number and name</th>
<th>CHAPTER EIGHT: Venous Access</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning Objective</strong></td>
<td>After the session participants will be able to learn/explain;</td>
</tr>
<tr>
<td></td>
<td> What is shock, Routes of central venous access</td>
</tr>
<tr>
<td></td>
<td> Indications of central venous line placement</td>
</tr>
<tr>
<td></td>
<td> Advantages and disadvantages of central venous line placement</td>
</tr>
<tr>
<td></td>
<td> Who performs the procedure?</td>
</tr>
<tr>
<td></td>
<td> Seldinger technique</td>
</tr>
<tr>
<td></td>
<td> External jugular vein cannulation</td>
</tr>
<tr>
<td></td>
<td> Femoral vein cannulation</td>
</tr>
<tr>
<td></td>
<td> Anatomy of Femoral Vein</td>
</tr>
<tr>
<td></td>
<td> Femoral venous catheter Insertion technique</td>
</tr>
<tr>
<td></td>
<td> Steps of Femoral vein catheter placement</td>
</tr>
<tr>
<td></td>
<td> Anatomy of Internal Jugular Vein</td>
</tr>
<tr>
<td></td>
<td> Infra clavicular Approach</td>
</tr>
<tr>
<td><strong>Topics covered in the session</strong></td>
<td>➢ Definition of Shock</td>
</tr>
<tr>
<td></td>
<td>➢ Routes of Central venous access</td>
</tr>
<tr>
<td></td>
<td>➢ Indications of central venous line placement</td>
</tr>
<tr>
<td></td>
<td>➢ Advantages and disadvantages of central venous line placement</td>
</tr>
<tr>
<td></td>
<td>➢ Who should perform the procedure?</td>
</tr>
<tr>
<td></td>
<td>➢ Seldinger technique</td>
</tr>
<tr>
<td></td>
<td>➢ External jugular vein cannulation</td>
</tr>
<tr>
<td></td>
<td>➢ Femoral vein cannulation</td>
</tr>
<tr>
<td></td>
<td>➢ Anatomy of Femoral Vein</td>
</tr>
<tr>
<td></td>
<td>➢ Femoral venous catheter Insertion technique</td>
</tr>
<tr>
<td></td>
<td>➢ Steps of Femoral vein catheter placement</td>
</tr>
<tr>
<td></td>
<td>➢ Anatomy of Internal Jugular Vein</td>
</tr>
<tr>
<td></td>
<td>➢ Subclavian Venipuncture: Infra clavicular Approach</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>40 Minutes</td>
</tr>
<tr>
<td><strong>Modality</strong></td>
<td>Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion, Question &amp; Answer</td>
</tr>
<tr>
<td><strong>Equipment required</strong></td>
<td>Cannula, Syringe, Micropore, BP machine, Pulse oximeter</td>
</tr>
<tr>
<td><strong>Materials required</strong></td>
<td>Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, push pin</td>
</tr>
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### Skill Station 9

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<thead>
<tr>
<th>Chapter number and name</th>
<th>CHAPTER NINE: Communication and counseling in ICU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning Objective</strong></td>
<td>After the session participants will be able to learn/explain;</td>
</tr>
<tr>
<td></td>
<td>➢ Five Fundamental Principles for Better Communication</td>
</tr>
<tr>
<td></td>
<td>➢ Strategies for breaking bad news</td>
</tr>
<tr>
<td></td>
<td>➢ SPIKE and ABCDE PROTOCOL</td>
</tr>
<tr>
<td></td>
<td>➢ Critical Care Communication</td>
</tr>
<tr>
<td></td>
<td>➢ Giving bad news</td>
</tr>
<tr>
<td></td>
<td>➢ Breaking bad news on the telephone</td>
</tr>
</tbody>
</table>
### Skill Station 10

| Topics covered in the session | ➢ Fundamental Principles for Better Communication  
| | ➢ Strategies for breaking bad news  
| | ➢ SPIKE and ABCDE PROTOCOL  
| | ➢ Critical Care Communication  
| | ➢ Giving bad news  
| | ➢ Breaking bad news on the telephone |
| Time | 40 Minutes |
| Modality | Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion, Question & Answer |
| Equipment required |  |
| Materials required | Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, push pin |

**CHAPTER TEN: Care of Patients on Ventilator**

| Learning Objective | After the session participants will be able to learn/explain;  
| | ➢ Review communications  
| | ➢ Check ventilator settings and modes  
| | ➢ Suction appropriately  
| | ➢ Assess pain and sedation need  
| | ➢ Prevent infection  
| | ➢ Prevent hemodynamic instability  
| | ➢ Manage the airway  
| | ➢ Meet the patient’s nutritional needs |
| Topics covered in the session | ➢ Review communications  
| | ➢ Ventilator settings and modes  
| | ➢ Suction appropriately  
| | ➢ Assess pain and sedation need  
| | ➢ Prevent infection  
| | ➢ Prevent hemodynamic instability  
| | ➢ Manage the airway  
| | ➢ Meet the patient’s nutritional needs |
| Time | 40 Minutes |
| Modality | Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion, Question & Answer |
| Equipment required | Ventilator, nasal cannula, Cannula, Syringe, Microport, BP machine, Pulse oximeter |
| Materials required | Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, push pin |
### Skill Station 11

<table>
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<tr>
<th>Chapter number and name</th>
<th>Learning Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 11</td>
<td>After the session participants will be able to learn/explain;</td>
</tr>
<tr>
<td></td>
<td>- Endotracheal Tube and Tracheostomy Tube Suctioning</td>
</tr>
<tr>
<td></td>
<td>- Clinical practice</td>
</tr>
<tr>
<td></td>
<td>- Measurement of Length to Suction</td>
</tr>
<tr>
<td></td>
<td>- 7 tips for successful Endotracheal (ET) suctioning</td>
</tr>
<tr>
<td></td>
<td>- Use continuous suction</td>
</tr>
<tr>
<td></td>
<td>- Use shallow suction depth when possible</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topics covered in the session</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Endotracheal Tube and Tracheostomy Tube Suctioning</td>
</tr>
<tr>
<td>- Clinical practice</td>
</tr>
<tr>
<td>- Measurement of Length to Suction</td>
</tr>
<tr>
<td>- 7 tips for successful Endotracheal (ET) suctioning</td>
</tr>
<tr>
<td>- Use continuous suction</td>
</tr>
<tr>
<td>- Use shallow suction depth when possible</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 Minutes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Modality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion, Question &amp; Answer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves, Inflated Cuff, Vocal Cord, Suction Catheter, Valve, Syringe, Micropor, BP Machine, Pulse Oximeter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, Push Pin</td>
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</tbody>
</table>

### Skill Station 12

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<th>Chapter number and name</th>
<th>Learning Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 12</td>
<td>After the session participants will be able to learn/explain;</td>
</tr>
<tr>
<td></td>
<td>- Insertion and Care of Naso Gastric Tube (NG TUBE)</td>
</tr>
<tr>
<td></td>
<td>- Types of nasogastric tubes</td>
</tr>
<tr>
<td></td>
<td>- Insertion of a nasogastric tube is a clean procedure</td>
</tr>
<tr>
<td></td>
<td>- Steps of insertion of NG tube</td>
</tr>
<tr>
<td></td>
<td>- Management of NG Tube</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topics covered in the session</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Insertion and Care of Naso Gastric Tube (NG TUBE)</td>
</tr>
<tr>
<td>- Types of nasogastric tubes</td>
</tr>
<tr>
<td>- Insertion of a nasogastric tube is a clean procedure</td>
</tr>
<tr>
<td>- Steps of insertion of NG tube</td>
</tr>
<tr>
<td>- Management of NG Tube</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 Minutes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Modality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion, Question &amp; Answer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves, NG tube, Micropore, BP Machine, Pulse Oximeter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laptop, Multimedia, Flip Paper, Marker, Handrub, VIP card, Push Pin</td>
</tr>
</tbody>
</table>
### Skill Station 13

<table>
<thead>
<tr>
<th>Chapter number and name</th>
<th>CHAPTER THIRTEEN: Nutrition in Critical Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Objective</td>
<td>After the session participants will be able to learn/explain;</td>
</tr>
<tr>
<td></td>
<td>- Initiation of nutritional support</td>
</tr>
<tr>
<td></td>
<td>- Route of feeding, Feeding protocols</td>
</tr>
<tr>
<td></td>
<td>- Enteral Nutrition vs. Parenteral Nutrition</td>
</tr>
<tr>
<td></td>
<td>- Supplemental PN</td>
</tr>
<tr>
<td></td>
<td>- Initiation of Feeding</td>
</tr>
<tr>
<td></td>
<td>- Feeding calculation, Enteral Feeding</td>
</tr>
<tr>
<td></td>
<td>- Using a syringe for a bolus feed</td>
</tr>
<tr>
<td></td>
<td>- Completion of feed</td>
</tr>
<tr>
<td></td>
<td>- Unblocking tubes</td>
</tr>
<tr>
<td>Topics covered in the session</td>
<td>- Initiation of nutritional support</td>
</tr>
<tr>
<td></td>
<td>- Route of feeding, Feeding protocols</td>
</tr>
<tr>
<td></td>
<td>- Enteral Nutrition vs. Parenteral Nutrition</td>
</tr>
<tr>
<td></td>
<td>- Supplemental PN</td>
</tr>
<tr>
<td></td>
<td>- Initiation of Feeding</td>
</tr>
<tr>
<td></td>
<td>- Feeding calculation, Enteral Feeding</td>
</tr>
<tr>
<td></td>
<td>- Using a syringe for a bolus feed</td>
</tr>
<tr>
<td></td>
<td>- Completion of feed</td>
</tr>
<tr>
<td></td>
<td>- Unblocking tubes</td>
</tr>
<tr>
<td>Time</td>
<td>40 Minutes</td>
</tr>
<tr>
<td>Modality</td>
<td>Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion, Question &amp; Answer</td>
</tr>
<tr>
<td>Equipment required</td>
<td>Gloves, Micropore, BP machine, Pulse oximeter</td>
</tr>
<tr>
<td>Materials required</td>
<td>Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, push pin</td>
</tr>
</tbody>
</table>

### Skill Station 14

<table>
<thead>
<tr>
<th>Chapter number and name</th>
<th>CHAPTER FOURTEEN: Patient Transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Objective</td>
<td>After the session participants will be able to learn/explain;</td>
</tr>
<tr>
<td></td>
<td>- The Intra-hospital and inter-hospital transfer of patient</td>
</tr>
<tr>
<td></td>
<td>- Need for transfer</td>
</tr>
<tr>
<td></td>
<td>- Risks of transfer</td>
</tr>
<tr>
<td></td>
<td>- Methods of transfer</td>
</tr>
<tr>
<td></td>
<td>- Communication of transfer</td>
</tr>
<tr>
<td>Topics covered in the session</td>
<td>- What is transfer</td>
</tr>
<tr>
<td></td>
<td>- What are the types of transfer?</td>
</tr>
<tr>
<td></td>
<td>- Inter hospital transfer protocol</td>
</tr>
<tr>
<td></td>
<td>- Intra hospital; transfer protocol</td>
</tr>
<tr>
<td></td>
<td>- Transfer preparation</td>
</tr>
<tr>
<td></td>
<td>- Transfer protocols</td>
</tr>
<tr>
<td></td>
<td>- Transfer communication</td>
</tr>
<tr>
<td></td>
<td>- ABCSBAR</td>
</tr>
<tr>
<td>Time</td>
<td>40 Minutes</td>
</tr>
<tr>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>Modality</td>
<td>Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion, Question &amp; Answer</td>
</tr>
<tr>
<td>Equipment required</td>
<td>Laminate</td>
</tr>
<tr>
<td>Materials required</td>
<td>Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, push pin</td>
</tr>
</tbody>
</table>

**Skill Station 15**

<table>
<thead>
<tr>
<th>Chapter number and name</th>
<th>CHAPTER FIFTEEN: Cardio-Pulmonary Resuscitation (CPR)</th>
</tr>
</thead>
</table>
| Learning Objective      | After the session participants will be able to learn/explain;  
                        | - Be Safe  
                        | - Assess the Person  
                        | - Call EMS  
                        | - CPR  
                        | - Defibrillate  
                        | - CPR STEPS  
                        | - CPR: for adults, Infants |
| Topics covered in the session |  
                        | - Be Safe  
                        | - Assess the Person  
                        | - Call EMS  
                        | - CPR  
                        | - Defibrillate  
                        | - CPR STEPS  
                        | - CPR: for adults, Infants |
| Time                   | 40 Minutes |
| Modality               | Hands-on coaching, Role play, Brainstorming, Discussion, Group discussion, Question & Answer |
| Equipment required     | Mannequin, Gloves, Micropore, BP machine, Pulse oximeter |
| Materials required     | Laptop, Multimedia, Flip paper, Marker, Handrub, VIP card, push pin |
ANNEXURES:

Daily Patient Monitoring Sheet

<table>
<thead>
<tr>
<th>Date</th>
<th>Name of the Patient</th>
<th>Diagnosis</th>
<th>Consultant</th>
<th>Date of Admission</th>
<th>Date of Discharge/Died</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>In</th>
<th>Out</th>
<th>Balance</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>HR</th>
<th>BP</th>
<th>Vascular Access Support</th>
</tr>
</thead>
</table>

**Legend:**
- IV: Intravenous
- Oral
- Nasal
- Venous

**To Be Signed In Big Size Paper:**

---

National Manual on Basic ICU Skills
Daily Individual Patient Record Form (Sample)

<table>
<thead>
<tr>
<th>Name of the Patient</th>
<th>Date</th>
<th>Investigation</th>
<th>Advice</th>
<th>Status</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: This form to be filled up by the ICU Nurses upon doctors guidance for each patient daily to monitor the patient status.
Daily ICU Register (COVID/ Non-COVID)
[Please put tick (√) into appropriate department] [SAMPLE]

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Date of admission</th>
<th>Name</th>
<th>Age</th>
<th>Sex</th>
<th>Address</th>
<th>Registration No.</th>
<th>Primary Diagnosis</th>
<th>Name and department of primary consultant/referred from</th>
<th>Status (Critical/ Stable)</th>
<th>Outcome (Death/ Cured/ referred out)</th>
<th>High flow nasal canula used</th>
<th>BiPAP/ CPAP used</th>
<th>Ventilator used</th>
<th>Date of discharge</th>
<th>Remarks (Cause of death, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hospital</td>
<td>ICU</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: This form to be filled up by the ICU Nurses
### Monthly ICU Report Form [SAMPLE]

<table>
<thead>
<tr>
<th>Total patient</th>
<th>Male</th>
<th>Female</th>
<th>Death</th>
<th>Cured</th>
<th>Referred out</th>
<th>Total HFNC used</th>
<th>Total Bi PAP/CPAP used</th>
<th>Total ventilator used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: This report can be prepared by ICU Nurses from the compilation of “Daily ICU Register” and submit to Statistician or responsible person for reporting to DGHS website.
Two Days Schedule:

<table>
<thead>
<tr>
<th>Time</th>
<th>Modalities</th>
<th>Topic</th>
<th>Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07.30 a.m. - 08.00 a.m.</td>
<td>REGISTRATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>08.00 a.m. - 09.00 a.m.</td>
<td>Inauguration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09.00 a.m. - 09.20 a.m.</td>
<td>Refereshment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09.20 a.m. - 09.35 a.m.</td>
<td>Lecture</td>
<td>Course Overview</td>
<td>Course Director</td>
</tr>
<tr>
<td>09.35 a.m. - 09.45 a.m.</td>
<td>Pre Test MCQ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09.45 a.m. - 10.00 a.m.</td>
<td>Lecture</td>
<td>Airway &amp; Oxygenation</td>
<td>Any</td>
</tr>
<tr>
<td>10.00 a.m. - 10.10 a.m.</td>
<td>Tea Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.10 a.m. - 01.00 p.m.</td>
<td>Small Group Rotation (Skill Station)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01.00 p.m. - 01.15 p.m.</td>
<td>Lecture</td>
<td>Non invasive Ventilation</td>
<td></td>
</tr>
<tr>
<td>01.15 p.m. - 01.30 p.m.</td>
<td>Lecture</td>
<td>Invasive Ventilation</td>
<td></td>
</tr>
<tr>
<td>01.30 p.m. - 02.30 p.m.</td>
<td>Lunch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02.30 p.m. to 03.00 p.m.</td>
<td>End of the Day/Faculty Meeting</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Day 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07.30 a.m. - 08.00 a.m.</td>
<td>Recap Day 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>08.00 a.m. - 09.00 a.m.</td>
<td>Lecture</td>
<td>Infection Control &amp; Prevention</td>
<td></td>
</tr>
<tr>
<td>09.00 a.m. - 09.20 a.m.</td>
<td>Refereshment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09.00 a.m. - 12.00 p.m.</td>
<td>Small Group Rotation</td>
<td></td>
<td>Course Director</td>
</tr>
<tr>
<td>12.00 p.m. -01.00 p.m.</td>
<td>Pos test MCQ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01.00 p.m. - 02.00 p.m.</td>
<td>LUNCH</td>
<td>Invasive Ventilation</td>
<td></td>
</tr>
<tr>
<td>02.00 p.m. - 02.30 p.m.</td>
<td>Closing /Certificate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02.30 p.m. - 03.00 p.m.</td>
<td>End of the Day/Faculty Meeting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Five days Schedule:

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Modality</th>
<th>Topic</th>
<th>Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>07.30 a.m. - 08.00 a.m.</td>
<td>Registration</td>
<td>-</td>
<td>All</td>
</tr>
<tr>
<td>08.00 a.m. - 09.00 a.m.</td>
<td>Inauguration</td>
<td>-</td>
<td>All</td>
</tr>
<tr>
<td>09.00 a.m. - 09.15 a.m.</td>
<td>Refreshment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>09.15 a.m. - 09.45 a.m.</td>
<td>Pre Course MCQ</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>09.45 a.m. - 10.10 a.m.</td>
<td>Lecture 1</td>
<td>Overview of the Course</td>
<td>Course Director</td>
</tr>
<tr>
<td>10.00 a.m. - 10.30 a.m.</td>
<td>Demonstration</td>
<td>Initial Assessment</td>
<td>All</td>
</tr>
<tr>
<td>10.30 a.m. - 10.45 a.m.</td>
<td>Lecture 2</td>
<td>Airway Management</td>
<td>Any Faculty</td>
</tr>
<tr>
<td>11.00 a.m. - 02.00 p.m.</td>
<td>Small Group Rotation (Skill Station)</td>
<td>Airway Management</td>
<td>4 Faculty in 4 room</td>
</tr>
<tr>
<td>02.00 p.m. - 02.30 p.m.</td>
<td>LUNCH &amp; Close</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>02.30 p.m. - 03.00 p.m.</td>
<td>Faculty Meeting</td>
<td>Review of the day &amp; Next Day Schedule</td>
<td>All</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 2</th>
<th>Modality</th>
<th>Topic</th>
<th>Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>08.00 a.m. - 08.30 a.m.</td>
<td>Recap of Day 1</td>
<td>-</td>
<td>All</td>
</tr>
<tr>
<td>08.30 a.m. - 09.30 a.m.</td>
<td>Discussion</td>
<td>Feedback and Recommendation from Participants</td>
<td>All Led by Course Director</td>
</tr>
<tr>
<td>09.00 a.m. - 09.20 a.m.</td>
<td>Lecture -3</td>
<td>Oxygen Therapy</td>
<td>Any Faculty</td>
</tr>
<tr>
<td>09.20 a.m. - 09.50 a.m.</td>
<td>Refreshment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>09.50 a.m. - 12.50 p.m.</td>
<td>Small Group Rotation (Skill Stations)</td>
<td>Oxygen Therapy</td>
<td>All</td>
</tr>
<tr>
<td>12.50 p.m. - 02.00 p.m.</td>
<td>Small Group Rotation</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>02.00 p.m. - 2.50 p.m.</td>
<td>Lunch/Prayer/End of the day</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>02.50 p.m. - 03.10 p.m.</td>
<td>Faculty Meeting</td>
<td>-</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 3</th>
<th>Modality</th>
<th>Topic</th>
<th>Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>08.00 a.m. - 08.30 a.m.</td>
<td>Recap of Day 2</td>
<td>-</td>
<td>All</td>
</tr>
<tr>
<td>08.30 a.m. - 09.30 a.m.</td>
<td>Discussion</td>
<td>Feedback and Recommendation from Participants</td>
<td>All Led by Course Director</td>
</tr>
<tr>
<td>09.00 a.m. - 09.15 a.m.</td>
<td>Lecture -4</td>
<td>Non Invasive ventilation</td>
<td>Any Faculty</td>
</tr>
<tr>
<td>09.15 a.m. - 09.40 a.m.</td>
<td>Lecture 5</td>
<td>Basics of Invasive Ventilation</td>
<td>Any Faculty</td>
</tr>
<tr>
<td>09.40 a.m. - 10.00 a.m.</td>
<td>Refreshment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10.00 a.m. - 01.00 p.m.</td>
<td>Small Group Rotation (Skill Stations)</td>
<td>Non invasive ventilation: Invasive Ventilation</td>
<td>All</td>
</tr>
<tr>
<td>01.00 p.m. - 02.00 p.m.</td>
<td>Lunch &amp; Prayer</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>02.00 p.m. - 03.00 p.m.</td>
<td>Faculty Meeting</td>
<td>Review of the day &amp; Next Day Schedule</td>
<td>All</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 4</th>
<th>Modality</th>
<th>Topic</th>
<th>Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>08.00 a.m. - 08.30 a.m.</td>
<td>Recap of Day 3</td>
<td>-</td>
<td>All</td>
</tr>
<tr>
<td>08.30 a.m. - 09.30 a.m.</td>
<td>Discussion</td>
<td>Feedback and Recommendation from Participants</td>
<td>All Led by Course Director</td>
</tr>
<tr>
<td>09.00 a.m. - 09.15 a.m.</td>
<td>Lecture -5</td>
<td>Monitoring in ICU</td>
<td>Any Faculty (To be assigned earlier by Course Director)</td>
</tr>
<tr>
<td>09.15 a.m. - 09.40 a.m.</td>
<td>Lecture 6</td>
<td>Shock &amp; Its management</td>
<td>Any Faculty (To be assigned earlier by Course Director)</td>
</tr>
<tr>
<td>09.40 a.m. - 10.00 a.m.</td>
<td>Refreshment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10.00 p.m. - 01.00 p.m.</td>
<td>Small Group Rotation (Skill Stations)</td>
<td>Monitoring in ICU Filling up of Forms Shock, Definition, Types, Arterial Blood</td>
<td>All</td>
</tr>
<tr>
<td>01.00 p.m. - 02.00 p.m.</td>
<td>Lunch &amp; Prayer</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>02.00 p.m. - 03.00 p.m.</td>
<td>Faculty Meeting</td>
<td>Review of the day &amp; Next Day Schedule</td>
<td>All</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 5</th>
<th>Modality</th>
<th>Topic</th>
<th>Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>08.00 a.m. - 08.30 a.m.</td>
<td>Recap of Day 4</td>
<td>-</td>
<td>All</td>
</tr>
<tr>
<td>08.30 a.m. - 09.30 a.m.</td>
<td>Lecture -6</td>
<td>Infection Control &amp; prevention in ICU</td>
<td>Any Faculty (To be assigned earlier by Course Director)</td>
</tr>
<tr>
<td>09.15 a.m. - 09.40 a.m.</td>
<td>Lecture 7</td>
<td>CPR</td>
<td>Any Faculty (To be assigned earlier by Course Director)</td>
</tr>
<tr>
<td>09.40 a.m. - 12.40 p.m.</td>
<td>Refreshment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12.40 p.m. - 01.00 p.m.</td>
<td>Post Course MCQ</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>01.00 p.m. - 02.00 p.m.</td>
<td>Lunch &amp; Prayer</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>02.00 p.m. - 03.00 p.m.</td>
<td>Faculty Meeting</td>
<td>Review of the training</td>
<td>All</td>
</tr>
</tbody>
</table>
RESIDENTIAL TRAINING OUTLINE

Duration: 15 days
Time: 8.30 a.m. - 2.30 p.m.
Venue: ICU unit of any Government Medical College Hospital

Modality of the training:
1. The training is mostly practical and skill-based, on regular and routine services which are commonly practiced in ICU.
2. Log book: Every participant must need to maintain the log book and have to complete the tasks written on that log book and trainers have to sign them every day. (Attached in Annex: 09)
3. Theoretical session: Power Point Presentation to be prepared from this manual by faculties
4. Training content and schedule: Attached in Annex: 08
5. After completion they have to participate test exam

Course assessment: (After Course Completion)
Oral test (50 Marks)
Skill Test (50 marks)

General Instruction for the Trainee:
1. Please be in the department at least 15 minute before your duty start.
2. Change in the ICU dress.
3. Wash your hand with soap.
4. Report your arrival to the authority.
5. Know your assignment.
6. Take hand over from your previous one.
7. Completely understand the patient.
8. Give a follow up and document the follow up findings clearly.
9. Fill up the flow sheet properly.
10. Actively participate in the procedures which will be performed during your stay in ICU.
11. Actively participate in resuscitation of patient.
12. At the end of your duty clearly hand over your patient to your reliever

Trainee Daily Monitoring:
1. Arrival: In time / Delayed by _______/ Absent
2. Change in dress: Proper/ Not proper / Not done
3. Personal protection: Proper/ Not proper / Reluctant
4. Take over: Proper/ Not proper / Reluctant
5. Hand over: Proper/ Not proper / Reluctant
6. Take part in daily procedure: Proper/ Not proper / Reluctant
7. Patient daily care: Proper/ Not proper / Reluctant
8. Physiotherapy: Proper/ Not proper / Reluctant
9. Communication with patient attendant: Yes/No
### Residential Training Schedule

<table>
<thead>
<tr>
<th>Day</th>
<th>Session</th>
<th>Schedule</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Initial assessment and management of critically ill patient</td>
<td>08.00 a.m. to 9.00 a.m.</td>
<td>Health Break</td>
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<td></td>
<td></td>
<td>09.00 a.m. to 10.00 a.m.</td>
<td>ICU Duty</td>
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<tr>
<td></td>
<td></td>
<td>10.00 a.m to 10.30 a.m.</td>
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<tr>
<td></td>
<td></td>
<td>10.30 p.m. to 02.30 p.m.</td>
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<tr>
<td>2</td>
<td>Airway &amp; oxygenation</td>
<td>Lecture</td>
<td>Health Break</td>
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<tr>
<td></td>
<td></td>
<td>Hands on</td>
<td>ICU Duty</td>
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<tr>
<td>3</td>
<td>Oxygen therapy</td>
<td>Lecture</td>
<td>Health Break</td>
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<tr>
<td></td>
<td></td>
<td>Hands on</td>
<td>ICU Duty</td>
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<tr>
<td>4</td>
<td>Ventilation</td>
<td>Lecture</td>
<td>Health Break</td>
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<td>Hands on</td>
<td>ICU Duty</td>
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<tr>
<td>5</td>
<td>Infection prevention, control and sterility maintenance</td>
<td>Lecture</td>
<td>Health Break</td>
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<td>Hands on</td>
<td>ICU Duty</td>
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<tr>
<td>6</td>
<td>Patient monitoring</td>
<td>Lecture</td>
<td>Health Break</td>
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<td>Hands on</td>
<td>ICU Duty</td>
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<tr>
<td>7</td>
<td>Shock</td>
<td>Lecture</td>
<td>Health Break</td>
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<tr>
<td></td>
<td></td>
<td>Hands on</td>
<td>ICU Duty</td>
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<tr>
<td>8</td>
<td>Venous access</td>
<td>Lecture</td>
<td>Health Break</td>
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<td></td>
<td>Hands on</td>
<td>ICU Duty</td>
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<tr>
<td>9</td>
<td>Communication and counseling in ICU</td>
<td>Lecture</td>
<td>Health Break</td>
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<td></td>
<td>Hands on</td>
<td>ICU Duty</td>
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<tr>
<td>10</td>
<td>Care of Patient on Ventilator</td>
<td>Lecture</td>
<td>Health Break</td>
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<td>Hands on</td>
<td>ICU Duty</td>
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<tr>
<td>11</td>
<td>Endotracheal tube/Tracheostomy tube suction</td>
<td>Lecture</td>
<td>Health Break</td>
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<td>Hands on</td>
<td>ICU Duty</td>
</tr>
<tr>
<td>12</td>
<td>Insertion and care of nasogastric tube</td>
<td>Lecture</td>
<td>Health Break</td>
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<td></td>
<td>Hands on</td>
<td>ICU Duty</td>
</tr>
<tr>
<td>13</td>
<td>Nutrition in critical care</td>
<td>Lecture</td>
<td>Health Break</td>
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<td>Hands on</td>
<td>ICU Duty</td>
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<tr>
<td>14</td>
<td>Transfer of patient</td>
<td>Lecture</td>
<td>Health Break</td>
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<td></td>
<td>Hands on</td>
<td>ICU Duty</td>
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<tr>
<td>15</td>
<td>National course on Basic ICU skill</td>
<td>Lecture</td>
<td>Health Break</td>
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<tr>
<td></td>
<td></td>
<td>Hands on</td>
<td>ICU Duty</td>
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</tbody>
</table>
Note: Instruction for HCW: Please keep daily record. Sum up monthly/Yearly. Send report to competent authority.
ALGORITHM OF BASIC LIFE SUPPORT

Criteria for high-quality CPR:
- Start chest compressions (hard and fast) within 10 seconds
- Allow for complete chest recoil between compressions
- Minimize interruptions between chest compressions
- Assure that the breaths make chest rise
- Do not over-ventilate
- Assess for shockable rhythm as soon as AED available in witnessed cardiac arrest as it is most likely a shockable rhythm.

UNRESPONSIVE WITHOUT NORMAL RESPIRATIONS

CALL 999/EMS GET AN AED

Assess pulse:
DEFINITE PULSE WITHIN 5 TO 10 SECONDS

Start cycles of 30 compressions and two breaths

AED/DEFIBRILLATOR ARRIVES

ASSESS FOR SHOCKABLE RHYTHM

Administer one shock and resume CPR immediately for two minutes

Yes, Shockable

Administer one shock and resume CPR immediately for two minutes

No, Non-shockable

Resume CPR immediately for two minutes
Assess rhythm every two minutes
Continue Steps until ACLS providers arrive or until the person shows signs of return of circulation

Published by: USAID, RISE, etc.
References:
4. Davidson’s Principles and Practice of Medicine 23rd Edition. 2018
9. Guy Jukes, Trainee ODP Guy’s and St Thomas’ NHS Critical Care. 2015
17. Resuscitation Council (UK) The ABCDE Approach, Resuscitation Council (UK), 2020
18. Smith, G ALERT. Acute Life-Threatening Events Recognition and Treatment, 2nd Edn, University Of Portsmouth, Portsmouth. 2003,
19. Smith, G & Pitcher, D, Prevention of Cardiac Arrest and Decisions About CPR, Resuscitation Council (UK), 2015
22. Martin Urner, MD, Carolyn S. Calfee, Eddy Fan et al. Titrating Oxygen Therapy in Critically Ill Patients
25. B Ronan O'Driscoll and Rachel Smith. Oxygen Use in Critical Illness. Respiratory Care October 2019, 64 (10) 1293-1307; DOI: https://doi.org/10.4187/respcare.0704