16 Critical Care of Postoperative Patient after Major Onco-Surgery: Overview

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16.1 Introduction

Postoperative management of major surgical oncology patients is always challenging in view of patient status and complex surgical interventions. Preoperative clinical status may be affected due to chemotherapy, radiotherapy and impact due to cancer per se. This is compounded by complex, long duration, and extensive surgical interventions. Thus, patients require utmost care for an uneventful outcome after successful surgical interventions. Patients may require intensive monitoring in dedicated unit like intensive care unit (ICU) for optimization of various systems functions affected intraoperatively. Usually in cases of uneventful surgery and airway integrity being maintained, trachea is extubated soon after completion of surgery and requires routine postoperative observation in addition to optimal analgesia. However, a group of patients would require intensive monitoring or postoperative mechanical ventilation support in view of compromised systemic function including airway. Due to limited availability of beds in ICU and limited resources, triage should be done for making decision of shifting the patient to ICU. Although ICU constitutes less than 10% of total hospital beds but more than 20% of hospital expenditure is contributed by ICU. Usually ICU stay is 3–5 times more expensive than general surgical wards.

16.2 Need of Surgical ICU

The various issues that mandate transfer to critical care unit after surgery are varied and would depend on many pre- and intra-operative factors. The usual factors include patient hemodynamic instability or requiring mechanical ventilation either due to airway compromise or till optimization of systemic factors. It has been reported that diabetes and old age are risk factor for ICU admission after elective craniotomy. Mostly, patients posted for thoracic or abdominal surgeries are shifted to ICU due to an increased propensity of developing complications. ICU admission facilitates monitoring of oxygenation, bleeding, acidosis, consciousness, vitals, hemodynamics, respiration, pain, sedation, airway, urine output, and perfusion of vital organs. APACHE and SOFA are commonly used scoring system to assess for risk and mortality in postoperative surgical patients. Age, comorbidities, and emergency surgeries are associated with increased mortality risk (Table 16.1).

It is pertinent that certain details need to be communicated to critical care specialist prior to shifting to the ICU. This would help in proper

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Table 16.1 Factors for ICU admission in postoperative surgical oncology patients

• Elective mechanical ventilation in head and neck surgery due to anticipated airway compromise
• Excessive blood loss and associated hemodynamic instability and requirement of inotropes/ vasopressors
• Sepsis and septic shock
• Acute respiratory failure
• Inadequate neuromuscular blockade reversal
• Elective procedures like tracheostomy
• MODS (Multiorgan Dysfunction Syndrome)
• Patients requiring non-invasive mechanical ventilation support for respiratory insufficiency or increased oxygen demand
• Advanced age with associated comorbidities
• Prolonged duration of surgery
• Associated comorbidities like coronary artery disease (CAD), neurological diseases, etc.

Table 16.2 Consideration of patient at shifting to the ICU

• Detailed medical and surgical history: for planning management strategies in ICU
• Indication for ICU admission:
• Comorbidities
• Age
• Nutritional and functional status
• Elective or emergency surgery
• Hemodynamic
• Medication history
• Ventilator settings and special need for some specific ventilator modes
• Complications of surgery or anesthesia intraoperatively
• Number and type of drains and drain output
• Fluid input and urine output status
• Metabolic and respiratory status—arterial blood gas analysis (ABG)
• Blood loss and requirement of blood products as per coagulation and blood investigation values
• Requirement of sedatives, neuromuscular blocking agents or opioids
• Laboratory investigations as per need of the patient
• Admission chest X-ray for the evaluation of central line, endotracheal, nasogastric, and thoracostomy tube
• ECG in patients with new arrhythmia
• Body temperature
• Glasgow Coma Scale/Score (GCS)
• Pain scores, sedation scores assessment like visual analog scale, Ramsay sedation scale, etc.

planning and arranging the necessary monitoring, equipment, drugs, infusions ready prior to shifting of the patient to maintain continuity of care. The issues that require assessment at shifting of postoperative surgical oncology patients are varied (Table 16.2).

Once the patient is received in the ICU, the continuity of care should be continued as per management in the operating room like continuation of drugs (vasopressors, inotropes, and sedation). Transfer of critically ill patient is very challenging. All preparations should be done before shifting the patient to ICU. The initial management needs to include all critical steps that may affect various systemic functions of the patient. Once critical steps have been managed, then routine assessment and planning strategies for further management may be reviewed again. This is followed by initiation of other monitoring and interventions with regular reassessment (Table 16.3).

16.3 Taking Care of Lines, Tubes, and Catheters

Endotracheal tubes must be properly fixed and its position should be checked. Position of oral or nasal gastric tube should be confirmed on chest X-ray. All the drainage tubes should be properly labelled and the drainage output should be continuously monitored. Hemorrhagic drain may suggest surgical bleeding or coagulopathy. All intravascular catheters should be looked and any unnecessary catheter should be removed. Position of central line should be confirmed on X-ray. Arterial line should be properly labelled and continuously flushed with heparinized saline.

16.4 Clinical and Biochemical Monitoring and Other Specific Monitoring as per Need Based on Assessment like Cardiac Output Monitor

Patient needs to be monitored by electrocardiogram, blood pressure, pulse rate, oxygen saturation, and other specific monitors as per patient need. Perfusion of end organs can be clinically monitored by urine output, mean arterial pressure, lactic acid levels, pulse volume, heart rate,

Table 16.3 Various aspects of ICU Care of postoperative surgical oncology patients

1. Care of lines, tubes, and catheters
2. Clinical and biochemical monitoring
3. Other specific monitoring as per need based on assessment like cardiac output monitor
4. Systemic examination: head to toe and also include other system examination
5. Temperature monitoring
6. Nursing care
7. Glucose control
8. Antibiotics to prevent and treat infection as per institutional protocol
9. Ventilator mode, settings, and parameters
10. Weaning from mechanical ventilation and extubation
11. Preventing ventilator-associated pneumonia (VAP)
12. Sedation and Analgesia
13. Deep vein thrombosis (DVT) Prophylaxis
14. Stress ulcer prophylaxis
15. ICU agitation and delirium
16. Nutrition
17. Physiotherapy
18. Prognostication

skin color, and capillary refill time. Biochemical monitoring needs to be done as per assessment outcome. Goal directed fluid therapy should be practiced. Based on clinical signs aided by monitoring would guide the need of fluid and drugs.

16.5 Systemic Examination: Head to Toe and also Include Other System Examination

Patient needs to be examined from head to toe and systemic examination for assessment of various body systems like cardiovascular, respiratory system, etc. The assessment needs to be repeated for any change as per need of the patient and specific time frame cannot be suggested. It is prudent to assess after any intervention is done to check for the response and further planning.

16.6 Abdominal Examination in Abdominal Surgery

After abdominal surgery, abdominal girth should be monitored regularly. Abdominal pain, distension, firmness, and abdominal drain output can guide regarding abdominal complications. It may affect not only perfusion of bowel but also may compromise the renal function.

16.7 Temperature

Usually, patients are shifted after surgery in hypothermic state. Heat is lost due to vasodilatation, infusion of cold fluids or blood products, surgical site loss, and low operating room temperature. Hypothermia is associated with an increased risk of coagulopathy, arrhythmia, and other metabolic abnormalities in the form of acid base imbalance. All patients with hypothermia of less than 36 °C should be kept well covered and actively warmed using forced air blankets and fluid warming devices.

16.8 Nursing Care

Nursing care is paramount for an optimal outcome in critically ill patient. The ratio of 1:1 nurse to patient ratio should be there to manage patients on mechanical ventilation in ICU for monitoring and pharmacological support. Nurses need to provide general care, oral care, beddings, monitoring, informing doctors about alarms or investigations as a team member, caring of tubes, lines or catheters, blood transfusion and providing pharmacological support. Patients' position should be changed every 1–2 hourly to prevent development of pressure sores.

16.9 Glucose Control

Hyperglycemia is very common in postoperative period due to stress induced release of counter regulatory hormones like glucagon and epinephrine. Hyperglycemia may also occur due to use of corticosteroids and diuretics. It is associated with increased morbidity, increased risk of infection, polyneuropathy, and delayed wound healing. Target blood glucose levels in ICU should be less than 180 mg/dL. Other measures preventing hyperglycemia should be instituted like avoiding unnecessary dextrose infusion and overfeeding.

Insulin is the most effective way to control blood glucose by sliding scale or continuous infusion.

16.10 Antibiotics in ICU

Sepsis in ICU is a major challenge for an intensivist and requires prompt action to deal with it. Septic shock is a common cause of death in ICU set up in surgical patients. Appropriate antibiotics in post-operative patients are started based on the site of surgery and probable pathogens suspected. The choice of antibiotics should be decided based on institutional policies and as per antibiogram. Antimicrobial prophylaxis is started based on evidence based guidelines. Suitable antibiotics should be started early and de-escalation should be considered each day depending on the condition of the patient. The intensivist should always consider the dose, dose adjustment depending on the comorbidities, drug interactions, antibiotic resistance and its side effects. In ICU, intravenous route is the preferred route. In case of suspected infection, cultures should be sent as soon as possible before the start of antibiotics and antibiotics to be modified based on the culture reports. In mechanically ventilated patients, Gram negative organisms and *Staphylococcus aureus* are the commonest cause of VAP. Intra-abdominal infection requires immediate consultation with the surgeons. At times, focal source of infective pathology should be ascertained specifically when occurs after some delay of the surgical intervention. If present, then appropriate measures for its drainage needs to be considered. Antifungals can be started if fungal infection is anticipated as in cancer, neutropenia, burns, organ transplantation, and parenteral nutrition.

16.11 Ventilator Settings and Parameters

Mechanical ventilation supports oxygenation and reduces the work of breathing. If the patient requires mechanical ventilation, ventilator parameters like tidal volume, fraction of inspired oxygen (FiO2), modes of mechanical ventilation, airway pressures, end-tidal carbon dioxide, respiratory rate, minute ventilation, positive end-expiratory pressure (PEEP), and auto-PEEP should be monitored at constant intervals. The mode of ventilator is based on patient need and plan for weaning. Fully controlled mode is required for patient who are hemodynamically unstable and need controlled mode of ventilation. However, controlled mode may be shifted to supported mode at the earliest and when weaning is planned. ABG may be required in selected cases as it provides information on oxygenation, ventilation, and acid base balance. Pulse oximeter and end-tidal capnometer should be continuously used to monitor such patients. Patient ventilator interaction can be assessed by observing the patient directly and by vital signs. Ventilator alarms should be set to monitor for ventilator parameters and detect any adverse events. Patients on mechanical ventilation are at risk of developing venous thromboembolism, VAP and gastric stress ulcer and appropriate measures should be taken to prevent them.

16.12 Weaning from Mechanical Ventilation

Weaning in ICU should be attempted after hemodynamic stability, normalization of gas exchange abnormalities, resolving acidosis, return of consciousness, return of airway reflexes, and attainment of adequate tidal volume. Patients should be daily assessed clinical readiness for weaning. Spontaneous breathing trial should be done daily to promote early weaning.

16.13 Preventing Ventilator-Associated Pneumonia (VAP)

Ventilator bundle should be followed to prevent VAP in mechanically ventilated patients. Health care personnel should be educated regarding VAP bundle and regular surveillance for its compliance should be done. Patients in the postoperative period should be encouraged to cough, practice deep breathing, early ambulation, and start of

incentive spirometry. Patients should be kept in semirecumbent position by elevating the head of bed by more than 30°. Elevating head prevents gastro esophageal reflux and there is thus less risk of aspiration and VAP. Hand washing should be encouraged in ICU by both doctors and paramedics. Any procedure in ICU should be performed with full barrier protection. Prevention and management of septic patients may be as per the surviving sepsis guidelines.

Endotracheal tube with additional drainage tube from the subglottic area above the cuff has been proven to decrease the risk of VAP. Orotracheal intubation is preferred over nasotracheal intubation. Oral hygiene should be maintained by daily rinsing mouth of the patients with chlorhexidine. Daily evaluation should be done for weaning from mechanical ventilation. Use of non-invasive ventilation should be encouraged. Gastric over distension should be avoided. Any condensate collecting in the ventilator tubing system should be discarded periodically.

16.14 Sedation

Patients requiring postoperative mechanical ventilation require adequate sedation to tolerate endotracheal tube. This improve endotracheal tube tolerance, prevent patient ventilator asynchrony, prevent accidental endotracheal extubation, better compliance with invasive procedures, tracheal suctioning, cough suppression, physiotherapy, chest X-rays, dressings, positioning, and nursing care. It also prevents psychological complications and post-traumatic stress disorder. In addition, good sedation also prevents hemodynamic changes, decreases anxiety and irritation, and improves metabolic and stress responses.

The deep sedation prolongs weaning, increases the length of hospital stay, increased risk of ventilator-associated pneumonia (VAP), the risk of neuromuscular alterations, increased cost and morbidity. Also, inadequate sedation increased stress, discomfort, anxiety, agitation, increased catabolism, immune suppression, increased sympathetic outflow, and hypercoagulability affecting patients morbidity. Agents like midazolam, propofol, opioids, and dexmedetomidine are often used alone or in combination to achieve this goal. Choice of sedative agents depends upon the indication, sedative goals, pharmacology of drugs, and total cost. Daily interruption of ICU sedation should be done preferably in the morning and daily assessment should be done for readiness to wean from mechanical ventilation. This practice decreases the duration on ventilator and length of hospital stay. Sedation scales, such as the Ramsay and Richmond Agitation Sedation Scale can be used in ICU to monitor sedation and to promote early recovery from mechanical ventilation.

16.15 Analgesia

Pain assessment in ICU is a difficult task due to sedation or mechanical ventilation. Analgesia in ICU is provided by combination of acetaminophen, NSAIDS, and opioids. Opioids can be given by various routes like intrathecal, epidural, oral, IV bolus, continuous infusion or patient controlled analgesia (PCA). Side effects of opioids should be simultaneously monitored. Adequate analgesia facilitates cough and deep breathing and prevents sympathetic response. Pain should be regularly assessed and documented. Pain in mechanically ventilated patients can be assessed by hemodynamics and grimacing. Various pain scales in ICU like critical care pain observation tool (CPOT) and behavioral pain scale (BPS) have been used to assess pain in patients who cannot report their pain themselves in addition to unidimensional pain measurement tools like visual analog scale or numerical rating scale.

16.16 Prevention of Venous Thromboembolism and Deep Venous Thrombosis

All patients after surgery should be considered for mechanical or anticoagulant based DVT prophylaxis. Risk of postoperative thromboembo-

Table 16.4 Drugs used for venous thromboembolism and deep venous thrombosis

Drugs for DVT Prophylaxis	Dose
Unfractionated heparin	5000 U sc BD
Enoxaparin	40 mg sc OD or 30 mg sc BD
Dalteparin	5000 U OD
Fondaparinux	2.5 mg sc OD

lism is increased in patients with cancer, prior history of thromboembolism, obesity, advanced age, immobilization, and hypercoagulability. DVT prophylaxis is usually provided with low molecular weight (LMW) heparin, unfractionated heparin, and fondaparinux (Table 16.4). Anticoagulant should be used with caution in patients having epidural catheters in situ. Mechanical DVT prophylaxis should be considered in patients with increased risk of bleeding and neurosurgical patients. Patients should be monitored for heparin induced thrombocytopenia which can occur 5–7 days after initiating heparin.

16.17 Stress Ulcer Prophylaxis

All patients in ICU are provided with stress ulcer prophylaxis to prevent gastrointestinal bleeding. Patients at increased risk of stress ulcers are patients on mechanical ventilation, sepsis, steroids, burns, coagulopathy, and increased length of ICU stay. Proton pump inhibitors and histamine 2 receptor antagonists provide mucosal protection by decreasing gastric acid secretion. Commonly used proton pump inhibitors are pantoprazole and lansoprazole and commonly used histamine blockers are ranitidine and famotidine.

16.18 Dealing with ICU Agitation and Delirium

Critical illness is associated with delirium and is a major problem in ICU patients after the surgery. It is associated with increased ICU stay, increased morbidity, and postoperative cognitive dysfunction (POCD). It occurs in 70–80% of ICU patients and is often undiagnosed. It occurs due to an increase stimulatory neurotransmitters like dopamine and decrease in GABA and cholinergic activity. Old age, sepsis, metabolic disturbances, pain, hypoxemia, hypoglycemia, hypotension, use of benzodiazepines, opioids, antipsychotics, and anticholinergics are associated with an increased risk of delirium. It can be prevented by adequate pain control, maintenance of oxygenation and sleep wake cycle, correcting metabolic abnormalities, meeting time with family members, and early ambulation. Treatment includes use of haloperidol and antipsychotics like olanzapine and risperidone.

Nutrition In postoperative patients, nutrition plays an important role because of increased demand by wound healing and anastomotic function. Nutrition provides energy for metabolic processes and prevents further protein catabolism. Nutritionist should be involved in calculating the total energy requirement of such patients. Feeding should be started within 24–48 hours of surgery. Patients usually require 25–35 mg/kg/day of calories. Oral route is preferred over enteral and enteral nutrition is preferred over parenteral nutrition. Enteral nutrition is associated with decreased risk of infections, decreased length of hospital stay and cost effective as compared to parenteral nutrition. Enteral nutrition preserves the gut function by reducing gut mucosal atrophy and thus improves gut immunity. Sometimes, enteral nutrition is not feasible due to the site of surgery and risk of anastomotic leak.

Parenteral nutrition is started if the patient is malnourished and is not able to tolerate enteral nutrition for 7 days or enteral nutrition is not able to provide more than 60% of daily nutritional requirement. Total 1.5 g/kg/day of protein intake should be supplemented daily. Nutrition can be started orally and via Ryles tube or feeding jejunostomy. After giving the test dose, enteral nutrition is started and gradually increased to meet the nutritional requirement. If residual gastric volume remains more than 250 ml on more than two

occasions 6 hours apart, enteral feeding should be temporary stopped and measures should be taken to improve gastric motility. Gastroparesis is a common problem postoperatively and can be improved with metoclopramide.

Summary ICU care involves multidisciplinary teams including intensivist, nurses, physiotherapist, ICU technician, and dietician. Once ICU care is no longer required, patients should be transferred to a step down unit. ICU care allows better patient and family satisfaction, decreased complication, and decreased length of hospital stay providing morbidity benefit. The FAST HUG mnemonic (**F**eeding, **A**nalgesia, **S**edation, **T**hrombo-prophylaxis, **H**ead-of-bed angle, **U**lcer prophylaxis and **G**lucose control) was proposed as checklist to be considered at least daily for all ICU patients.

Suggested Reading

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