A Manual of INTENSIVE CARE

Vinod Kumar Singh

Forewords
Keith A (Tony) Jones
Arun K Gupta

JAYPEE

Contents

CHAPTER 2

Basic Care in ICU

Anxiety and Sedation

Anxiety and agitation is common in ICU for variety of reasons. A wide selection of medications are available to reduce this and the choice is patient dependent.

Causes of Anxiety and Distress

- Real or assumed threats by the patient of fear of treatment and treatment facilities, loss of control over situation, suffering and inability to communicate may be some of them
- Pain related to presence of endotracheal tube, tracheostomy, procedures, suctioning, therapy, trauma or surgery can all lead to pain and agitation
- Delirium (can occur in 3/4th of the patients in ICU) can be due to infection, medications, previous mental state or disorientation to the place
- Neuromuscular paralyzing agents usage for procedures or respiratory control will lead to increased use of sedative medications leading to increased agitation and confusion
- Use or withdrawal of drugs can also contribute to delirium and confusion as is common in alcohol abuse patients or drug addicts.

Presentation

- Headache, palpitations, diaphoresis, dyspnea, tachycardia, hypertension in cases of anxiety and pain issues
- Confusion, agitation, disorientation, memory loss, abnormal perception may occur in delirium and drug withdrawal
- Shallow breathing, dyspnea, hyperpnea occurs in ventilator dyssynchrony
- If able to communicate, pain scores should be used.

Treatment

Non-pharmacological Management

- Identify the cause and treat early if possible
- Try maintaining normal physiology with normal sleep cycle and lighting during the day

- Continuous orientation of the patient with family members and familiar empathetic staff helps in reducing delirium
- If on sedation, daily sedation hold with orientation
- Pain should be controlled and ventilation setting made synchronous if dyspnea present
- Medications should be checked regularly for side-effects
- Recognize drug withdrawal like alcohol and treat early
- Over sedation should be avoided and not used unless needed.

Drug Treatment

- For respiratory distress and pain, opioids like fentanyl or morphine are preferred. Painkillers like paracetamol and NSAIDs can be used as adjuncts
- For anxious patients, benzodiazepines can be used
- If delirium is present primarily, haloperidol and alpha agonists like clonidine or dexmedetomidine are preferred alongwith antipsychotics like quetiapine
- Combination of these drugs can be used depending on the etiology
- Sedative medications like propofol are added as appropriate
- Scoring systems like Richmond agitation and sedation scale (RASS) can be used to maintain the score between -2 to 0 and have been shown to reduce the length of mechanical ventilation (Table 2.1).
- Similarly for delirium in ICU, CAM-ICU (Confusion assessment method for the ICU) or similar scores can be used to initiate treatment (Table 2.2).

Table 2.1: Richmond agitation and sedation scale

Score	*Descriptor*	*Characteristics*
+4	Combative	Combative, violent, immediate danger to staff
+3	Very agitated	Pulls or removes tube(s) or catheter(s); aggressive
+2	Agitated	Frequent nonpurposeful movement, fights ventilator
+1	Restless	Anxious, apprehensive but movements not aggressive or vigorous
0	Alert and calm	
–1	Drowsy	Not fully alert, but has sustained awakening to vioce (eye opening and contact >10 seconds)
–2	Light sedation	Briefly awakens to voice (eye opening and contact <10 seconds)
–3		
–4	Moderate sedation	Movement or eye opening to voice (but no eye contact)
	Deep sedation	No response to voice, but movement or eye opening to physical stimulation
–5	Unarousable	No response to voice physical stimulation

Table 2.2: The confusion assessment method for the diagnosis of delirium in the ICU (CAM-ICU) (182, 185)

Feature	*Assessment variables*
1. Acute onset of mental status changes or Fluctuating course	Is there evidence of an acute change in mental status from the baseline? Did the (abnormal) behavior fluctuate during the past 24 hours, i.e., tend to come and go or increase and decrease in severity? Did the sedation scale (e.g., SAS or maas) or coma scale (GCS) fluctuate in the past 24 hours?
2. Inattention	Did the patient have difficulty focusing attention? How does the patient score on the Attention Screening Examination (ASE)? (i.e., Visual Component ASE tests the patient's ability to pay attention via recall of 10 pictures; auditory component ASE tests attention via having patient squeeze hannds or nod whenever the letter "A" is called in a random letter sequence)
3. Disorganized thinking	It the patient is already extubated from the ventilator, determine whether or not the patient's thinking is disorganized or incoherent, such as rambling or irrelevant conversation, unclear or illogical flow of ideas, or unpredictable switching from subject to subject. For those still on the ventilator, can the patient answer the following 4 questions correctly? 1. Will a stone float on water? 2. Are there fish in the sea? 3. Does one pound weigh more than two pounds? 4. Can you use a hammer to pound a nail? Was the patient able to follow questions and commonds throughout the assessment? 1. "Are you having any unclear thinking?" 2. "Hold up this many fingers." (examiner holds two fingers in front of patient)? 3. "Now do the same thing with the other hand." (not repeating the number of fingers)
4. Altered level of consciousness (any level of consciousness other than alert (e.g., vigilant, lethargic, stupor, or coma)	*Alert*: normal, spontaneously fully aware of environment, interacts appropriately Vigilant: hyperalert Lethargic: drowsy but easily aroused, unaware of some elements in the environment, or not spontaneously interacting appropriately with the interviewer; becomes fully aware and appropriately interactive when prodded minimally *Stuppor*: difficult to arouse, unaware of some or all elements in the environment, or not spontaneously interacting with the interviewer; becomes incompletely aware and inappropriately interactive when prodded strongly; can be aroused only by vigorous and repeated stimuli and as soon as the stimulus ceases, stuporous subjects lapse back into the unresponsive state. Coma: unarousable, unaware of all elements in the environment, with no spontaneous interaction or awareness of the interviewer, so that the interview is impossible even with maximal prodding

Patients are diagnosed with delirium if they have both Features 1 and 2 either Feature 3 or 4.
"SAS = Sedation-Analgesia Scale, MAAS = Motor Activity Assessment Scale, GCS - Glasgow Coma Scale.

CAM-ICU Scoring System

Golden Tips

- Sedation should be chosen appropriate to the patient. Oversedation should be avoided with intermittent bolus sedation preferable to continuous infusion and daily interruptions should be used whenever possible
- Scoring systems such as RASS and CAM-ICU along with are useful in assessing the agitation and initiating treatment
- Continuous orientation and maintaining good sleep-wake cycle reduces the disorientation in patients.

Depression

Depression related to the ICU admission can occur during their stay in the ICU and can continue after discharge. This can be a form of post-traumatic stress disorder requiring treatment.

Presentation

Reactive depression is common after ICU stay in many patients. The patient will be withdrawn, unhappy, hopeless, have guilt and feel worthless. There will be lack of interest in the disease and its management plans, physical activities and interest, reduced cooperation, and sometimes suicidal ideation. Many patients are not diagnosed due to other medical conditions needed more urgent attention. Post-traumatic stress disorder can be present in up to 30% of patients admitted to the ICU.

Risk Factors

- Previous history of depression
- Prolonged ICU stay
- Presence of chronic disease
- Use of benzodiazepines
- Metabolic diseases like hypothyroidism
- Lack of sleep
- Drug withdrawal including alcohol withdrawal
- History of head trauma.

Management

Regular orientation and involvement of patient and family will reduce the incidence of depression. Sleep quality should be improved and natural lighting is important. Anxiolytics are occasionally helpful in acute episodes but should not be continued indefinately. Psychiatry consult may be obtained once the patient has improved from the initial illness. Some patients will

need antidepressants such as selective serotonin reuptake inhibitors (SSRIs) like paroxetine, sertraline or fluoxetine and tricyclic antidepressants like amitriptyline.

Delirium

Delirium is an acute confusional state seen commonly in the ICU population. There is altered consciousness with difficulty in focusing and attentiveness. This occurs in a short time and is fluctuating. It has to be differentiated from dementia.

Risk Factors

- Older patients
- Presence of brain diseases like dementia, Parkinsonism or stroke
- Malignancy—advanced cancer is an independent factor. This may be related to various medications given for the cancer like opioids
- Medications—opioids, psychoactive drugs, benzodiazepines
- Medical conditions—sepsis, metabolic problems, dehydration, malnutrition
- Postoperative state—due to pain, anesthetic drugs, painkillers, sedation, etc.
- Pain and painkillers—untreated pain can lead to confusion and agitation, while overuse of opioids can also lead to confusion and disorientation
- Previous drug or alcohol abuse
- Renal and hepatic impairment.

Treatment

- Recognize and treat the cause of delirium
- Check for endocrine causes
- Regular reorientation and stimulation (family can help in orientation)
- Establishing normal sleep patterns
- Correct oxygenation problems, fluid and electrolyte imbalances
- Treat sepsis aggressively and early
- Recognize drug/alcohol withdrawal and treat appropriately
- Check for medications that might be causing the delirium
- Drugs like haloperidol and clonidine can be used in severe cases, caution should be exercised with drugs and doses as most patients are elderly.

Golden Tips

- Delirium is common in elderly ICU population
- Prophylaxis is not useful in delirium
- Severe agitation may respond to haloperidol and benzodiazepines should be avoided
- Orientation and presence of family reduces the incidence of delirium.

Pain

Critically ill patients can have a lot of pain due to illness, surgical intervention, presence of tubes and lines and other procedures during their stay in the ICU. Many such patients are not able to communicate due to the presence of tubes, confusion, delirium or sedation. Pain increases the metabolic demand of the body too, so should be controlled adequately and quickly. Long-term psychiatric problems can also occur due to uncontrolled pain in ICU.

Assessment of Pain

This becomes easy if the patient is alert and orientated to the surroundings and self. Treatment can then be provided easily. Questionnaires, visual scales or other rating systems can be used for an objective measurement of pain and response to treatment. This becomes more and more difficult if the patient is sedated or confused. If grimacing or abnormal movements are present and patients exhibit sympathetic response like diaphoresis, tachypnea, tachycardia or hypertension, pain should be suspected. The behavioral pain scale or the critical care pain observation tool can also be used (Fig. 2.1).

Treatment of Pain

Painkillers that are used in ICU should have few side-effects and should act quickly without being accumulated. It is desirable to achieve a pain score of 2–3 out of 10 in ICU. Various classes of painkillers are available and used frequently in ICU.

- *Paracetamol*: It can be used in the oral form or intravenous form. Care should be taken to avoid overdose of this medication especially in the intravenous form. It also treats the pyrexia if present.
- *NSAIDs*: It can be used similarly to reduce inflammation and pyrexia. Caution should be exercised as they can lead to renal injury, bleeding in the gut and occasionally flare up bronchoconstriction. They are not as commonly used as paracetamol for this reason in ICU population.

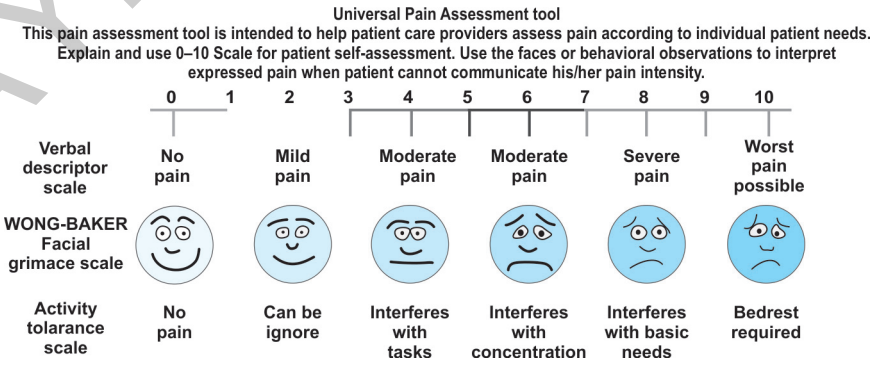

FIGURE 2.1: Universal pain assessment tool

- *Ketamine*: It is a NMDA receptor antagonist. This is occasionally used in ICU patients as an adjuvant. It has opioid sparing properties, but can lead to psychotropic effects in some patients.
- *Gabapentine*: It is a GABA analog and used in neuropathic pain. Pregabalin is another such drug.
- *Clonidine and dexmedetomidine*: These are alpha agonists with some painkilling and sedative effects. These have recently been used more in postoperative patients for fast-track extubations with some success. Clonidine can cause a drop in the blood pressure whereas dexmedetomidine is more cardiostable.
- *Opioids*: It remain the mainstay for treatment of pain in the ICU. They have a predictable and definite effect on the pain. Many drugs are available for use depending on the requirement and patient characteristics. This can range from ultra-short acting opioids like remifentanil to longer acting like diamorphine and morphine amongst others. Fentanyl and morphine are the most used opioids for pain in ICU. The side effects include sedation, respiratory depression, GI disturbances, hypotension, bradycardia and chest wall rigidity amongst others. They can also lead to tolerance and dependence occasionally. Judicious use is warranted and bolus doses preferred to infusions due to the risk of accumulation.
- Other techniques like local anesthetic infiltration, regional blocks, neuraxial techniques like epidural analgesia should be considered in all the patients to reduce the requirements of opioids and other painkillers.

Golden Tips

- Assess the pain in all the patients with visual or numeric scale and treat appropriately
- Opioids remain the mainstay for treatment of pain. Bolus doses should be preferred to continuous infusions
- Caution should be exercised especially in renal failure patients due to risk of accumulation.

Nutrition in Intensive Care Unit

Nutrition is very important for the recovery of critically-ill patients. The main aim of nutritional support is to supply necessary nutrients to meet the needs of these patients. This is more important if the patients cannot eat and drink properly on their own due to a variety of reasons.

Concepts

The initial phase of acute illness is characterized by increased metabolic demand and catabolism. Substrate utilization is altered and carbohydrates preferred to fats. Increased muscle breakdown occurs in intensive care unit

(ICU) due to inflammatory mediators and increased demand. This increases further in sepsis, burns, head injury, postoperatively and trauma. Recovery phase is an anabolic phase and during this some of the muscle repair and nutritional stores are replenished. Early nutrition will counterbalance this demand and reduce the catabolism, whereas reduced support increases loss of muscle mass, organ failure, infection, prolonged stay and mortality.

Routes for Nutrition

Enteral route of nutrition is preferred wherever possible. This reduces the incidence of infection and other complications associated with parenteral nutrition. Early enteral nutrition may reduce the incidence of infectious complications compared to late enteral nutrition. This may relate to preservation of gut immune function and reduced inflammation. Parenteral route should only be used when enteral feeding is not possible. This is because of increased infectious complications and mechanical complications associated with the parenteral route. The choice of nutrition type depends on the individual patients. Malnourished and obese patients should both have enteral nutrition if possible.

Complications

- Aspiration pneumonitis
- Diarrhea
- Refeeding syndrome (if malnourished for long time: start feeds slowly and monitor the electrolytes)
- Mechanical complications associated with insertion of nasogastric tubes and central lines for access.
- Catheter related bloodstream infections: Increased chances as total parenteral nutrition is a culture medium due to nutrients present.
- Thrombus/bleeding/embolism.

Contraindications

- Hemodynamically unstable patient on multiple inotropes/vasopressors with signs of perfusion issues
- Bowel obstruction or recent surgery
- Active GI bleed
- Parenteral nutrition is contraindicated if the patient is volume overloaded, has electrolyte imbalances and has not been tried to fed enterally.

Management

- Nutritional support should be started as soon as possible (if possible within two days of admission).
- Preference should be given to enteral nutrition over parenteral nutrition.

- If enteral route is contraindicated, parenteral nutrition should be chosen and started within a week of admission. This should be started early in case of malnourished patients with caloric deficit.
- The benefits of enteral route are reduced risk of infection, reduced electrolyte and glucose alterations, cost and regeneration of enterocytes.
- Parenteral route has the benefit of starting at any time, as it doesn't depend on gut function.
- Expert dietician support should be sought to calculate the caloric requirement along with protein, fat and carbohydrate contents of the feeds. In patients of burns, sepsis and trauma the requirements will be more, while patients who are malnourished are at risk of refeeding syndrome.
- Insulin is often needed when parenteral nutrition is started.
- If ileus present prokinetic drugs like erythromycin and metoclopramide can be tried before parenteral nutrition is started.

Requirements

- Patients weight should be taken into consideration for the calculation of nutrition requirements. For malnourished patients, their actual weight should be used; while for normal or overweight patients, their ideal weight should be used.
- Feeding can be started with 20 kcal/kg/day calorie diet and increased appropriately depending on the demand and state of patient.
- Protein requirements are around 0.8–1.2 g/kg/day but many patients especially burns patients may require up to 2g/kg/day.
- Lipids and electrolytes are added to the above regime as required.

Golden Tips

- Enteral route should be preferred as far as possible and started early
- If patients are unstable and on multiple inotropes/vasopressors, consider reducing or stopping enteral feeds.
- Aggressive feeding in a malnourished patient may lead to fluid and electrolyte abnormalities (refeeding syndrome).

Blood Sugar Control in ICU

Raised glucose levels in intensive care unit (ICU) can be due to many reasons including previous history of diabetes, stress response (cortisol, catecholamines, glucagon), drugs (steroids, catacholamines, parenteral nutrition) and insulin resistance. Poor control can lead to increased morbidity and mortality.

Concepts

Hyperglycemia is associated with worse outcomes in multiple group of ICU patients including trauma, medical and surgical patients. This may be related

to its effect on white cell function, increased risk of infection, cardiac effects, polymyoneuropathy—all leading to increased morbidity and length of stay in the hospital. It is accepted now that hyperglycemia should be controlled, but the actual level of blood sugar control remains controversial. Strict control (80–110 mg/dL) may be beneficial but leads to increased risk of hypoglycemia. Meta-analysis of the trials supports a less stringent control of blood sugar to avoid hypoglycemia and mortality in the intensive control group. Most centers would now prefer a glucose target range between 140–180 mg/dL. This avoids hypoglycemia episodes and the morbidity associated with it.

Methods of Glucose Control

Various methods of glucose control are used in the ICU. The best approach would be to start an insulin infusion in acutely ill patients with regular monitoring of blood glucose levels. This is because of poor absorption from subcutaneous tissue and rapid changes in intrinsic catecholamine/hormone levels and use of extrinsic drugs. Once the glucose is controlled and the acute situation improves, this can be transitioned to sliding scale insulin subcutaneously and then longer acting insulin depending on the nutrition and glucose levels. Oral drugs can then be established in consultation with the endocrinologists.

Golden Tips

- Target the blood glucose between 140–180 mg/dL compared to the strict target of 80–110 mg/dL
- Preferably use the insulin infusion to start with in an acutely sick patient, slowly transitioning to sliding scale or long acting insulin
- Regular blood glucose measurements should be done for better control of blood glucose.

Prevention of Gastric Ulcer in ICU

Stress ulcers in intensive care unit (ICU) patients generally occur in the body or fundus of the stomach. They are generally shallow with superficial oozing, but deep lesions may occur occasionally leading to catastrophic bleeding. Erosions may be present in up to 20% of ICU patients, but bleeding can occur in up to 10% patients. Severe complications are rare (up to 1% patients).

Causes and Risks

Stress ulcers can be caused due to impaired defence mechanism or increased acid secretions. Multiple physiological derangements may lead to the above including impaired perfusion, uremia and other toxins; head injury per se may increase the acid secretion. The presence of *Helicobacter pylori* infection may also contribute as defence mechanisms are compromised.

Risk factors for development of GI bleed are:

- Coagulopathy
- Head or spinal trauma
- Mechanical ventilation
- Hepatic or renal failure
- Coagulopathy
- Previous history of peptic ulcer disease or upper GI bleed
- Multiple trauma
- Shock/sepsis
- Burns
- Steroid/NSAID/aspirin use.

The presence of GI bleeding increases the morbidity and mortality in ICU patients.

Ulcer Prophylaxis

Ulcer prophylaxis should be used in ICU patients with any of the major or 2 or more minor criteria:

Major

- Mechanical ventilation for >2 days
- History of GI bleed or ulcer in past 1 year
- Coagulopathy.

Minor

- Sepsis
- ICU admission lasting >1 week
- Occult GI bleed >5 days
- Glucocorticoid therapy.

This should also be considered in major burns patients and patients with head injury or spinal injury. Patients on enteral feed have reduced risk of ulceration and hence this is not routinely recommended.

Commonly used Agents

- *H2 blockers*: They reduce the gastric acid secretion by acting on the H2 receptors on parietal cell. Oral and intravenous formulations are available. Ranitidine is the most commonly used drug in this class
- *Proton-pump inhibitors*: They block the acid secretion by inhibiting the H-K pump. Oral and intravenous formulations are available and omeprazole is the commonly used agent
- *Sucralfate*: this coats and protects the mucosa, without altering the pH and secretion. This can be given 1g four times a day. Small risk of aluminium toxicity exists but is not commonly seen. Also its higher volume and granularity may preclude its use.

- *Antacids*: Similar use as sucralfate. Difficulty in administration through nasogastric (NG) tube.
- *Others*: Misoprostal has been used in NSAID induced ulceration. Limited data on use and safety.

Data suggests that proton pump-inhibitor (PPI) have a lower rate of bleeding compared to H2 blockers; which in turn has a lower rate compared to antacids and sucralfate. Small risk of increase in pneumonia exists with pH lowering medications though. Overall PPIs and H2 blockers are recommended for ICU patiens with a case by case selection of the agent.

Golden Tips

- Ulcer prophylaxis should be used if any major or 2 or more minor criteria are present in ICU patients
- H2 blockers or PPI are both effective but may increase the incidence of pneumonia
- Patients on full enteral feeds do not need ulcer prophylaxis generally
- Prophylaxis should be discontinued when possible as the risk reduction is minimal in normal patients.

Thromboprophylaxis in ICU

Venous thromboembolism (VTE) remains the most common preventable cause of morbidity and mortality in the hospitals. The difference in outcomes exists between surgical and medical patients; with surgical patients benefiting with use of thromboprophylaxis more than the medical patients. This may be due to the difference in coexisting and complex medical problems in medical patients. There has been a massive drive to consider thromboprophylaxis in all hospital patients to reduce the risk of venous thromboembolism.

Risk Factors for Developing VTE

- *Hospitalization*: This increases the risk due to the medical condition, reduced mobility and medications
- *ICU stay*: This increases the risk further. Even with the used of prophylaxis, the incidence remains high
- *Pregnancy*: It is a hypercoagulable state. The incidence is more common in patients having cesarian section in the postoperative period
- Obesity
- Previous VTE
- Inherited or acquired prothrombotic state
- Cancer
- Immobility
- Presence of invasive lines.

The above combined with release of prothrombotic cytokines, stasis and stress hormone release increases the risk of VTE. Surgical patients have a hypercoaguable state leading to VTE with an even higher chance in patients with long bone fractures.

Risk Assessment

Various scoring systems can be used for selecting the appropriate patients for prophylaxis. For medical patients, this includes IMPROVE and Padua Prediction Score. In surgical patients, Caprini score is used most commonly. IMPROVE score uses the following criteria to define the estimated risk of acute symptomatic VTE:

- Previous VTE (risk of 3.1%)
- Thrombophilia (risk of 3.1%)
- Current cancer (risk of 1%)
- Age more than 60 years (risk of 1%).

If there is presence of more than one factors, the risk will be synergistic. Caprini score uses age, type and severity of surgical insult, obesity, vasculopathy, presence of sepsis or lung disease, trauma, malignancy, limb surgery or fracture, etc. to calculate a score. The therapy is then started depending on the score calculated.

Prophylaxis and Prevention

Primary prophylaxis will depend on individual risk of VTE. Drugs and mechanical methods are used to prevent DVT. Secondary prevention is used to detect and treat developed DVT and PE in a patient. Caution should be exercised and risk-benefit assessed in patients who are at high-risk of bleeding.

- Ambulation of the patient as early as possible will reduce the incidence of VTEs. This is enough for very low-risk patients
- Mechanical methods should be used in everyone admitted to the hospital unless there are contraindications. This includes use of graduated compression stockings and sequential compression devices. This is used in all patients with more than very low-risk and also in patients where medications are contraindicated. Caution should be exercised in patients with varicose veins or vasculopathy as this may hamper the blood supply to the limbs
- Moderate to high-risk patients should all have pharmacological prophylaxis. The drugs commonly used include:
  - *Low molecular weight heparin*: This is the most common drug used for prophylaxis. Depending on the weight and indication this can be given once or twice a day and doesn't need monitoring. Various drugs are available including enoxaparin, tinzaparin.
  - *Unfractionated heparin*: Due to shorter half life, this needs to be given 2–3 times a day. It is useful if a patient has renal dysfunction and can be monitored easily with INR. It is less efficacious compared to LMWHs.

- *Fondaparinux*: This can be used in patients reacting to heparins. This can be given once a day again and is sometimes preferred if concomitant ischaemic heart disease exists.
- *Warfarin*: Warfarin is used when long-term anticoagulation is warranted because of either pre-existing use or presence of DVT/PE.
- *Others*: Drugs like aspirin are not useful for prophylaxis, though can be used if other drugs are contraindicated. Other direct thrombin and factor Xa inhibitors (rivaroxaban) are being studied in selected patients.
- *Inferior vena cava filter*: This has been used in patients with high-risk of DVT/presence of DVT, where thromboprophylaxis is contraindicated.

Golden Tips

- All patients admitted to the hospital or ICU should be assessed for the need of thromboprophylaxis using one of the scoring systems
- Low molecular weight heparins are preferred due to better efficacy, single daily (or twice daily) dosing and absence of need for monitoring
- In renal failure, unfractionated heparin should be used
- Mechanical methods should be used in all patients unless contraindicated.

Suggested Reading

1. Barr J, Fraser G, Puntillo K, et al. Clinical practice guidelines for the management of pain, agitation and delirium in adult patients in the intensive care unit. Critical Care Med. 2013;41(1):263-306.
2. Caprini JA. Thrombosis risk assessment as a guide to quality patient care. Dis Mon. 2005;51(2-3):70-8.
3. Davydow DS, Gifford JM, Desai SV, Bienvenu OJ, Needham DM. Depression in general intensive care unit survivors: a systemic review. Intensive Care Med. 2009;35:796-809.
4. Guillamondegui OD, Gunter OL, Bonadies JA, et al. Practice management guidelines for stress ulcer prophylaxis. Eastern Association for the Surgery of Trauma (EAST), Chicago. 2008. Pp. 1-24.
5. http://www.outcomesumassmed.org/IMPROVE/risk_score/vte/index.html. Accessed on 15th Feb, 2014.
6. McClave SA, Martindale RG, Vanek VW, et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and enteral nutrition (ASPEN). J Parenter Enteral Nutr. 2009;33(3):277-316.
7. Mularski RA. Pain management in the intensive care unit. Crit Care Clin. 2004;20(3):381-401.
8. Pisani MA, McNicoll L, Inouye SK. Cognitive impairment in the intensive care unit. Clin Chest Med. 2003;24(4):727-37.
9. The NICE-SUGAR Study Investigators. Hypoglycemia and risk of death in critically ill patients. N Engl J Med. 2012;367:1108-18.
10. Van den Berghe G, Wouters P, Weekers F, et al. Intensive insulin therapy in critically ill patients. N Engl J Med. 2001;345(19):1359-67.

A Manual of
INTENSIVE CARE

Salient Features

- A concise yet informative manual
- Overviews the subject of critical care medicine and intensive care in a systematic manner
- Covers the essential topics related to intensive care medicine and emergency management of critically ill patients
- Presents the text in a simple language with elaborated illustrations and diagrams
- Provides an easy explanation of the procedures and techniques relevant to intensive care practice
- Serves as a quick reference tool for medical students, resident doctors, nursing staff, physicians and other healthcare professionals.

Vinod Kumar Singh MD MRCP FRCA FFICM is Assistant Professor in the Department of Anesthesiology and Perioperative Medicine, University of Alabama at Birmingham (UAB) School of Medicine, Birmingham, Alabama, USA.

He is a member of the Royal College of Anaesthetists, American Society of Anesthesiologists, International Anesthesia Research Society, Society of Critical Care Medicine, The Faculty of Intensive Care Medicine, Alabama State Society of Anesthesiologists, General Medical Council, and Ophthalmic Anesthesia Society.

His clinical interests include neurocritical care and neuroanesthesia. He is also actively involved in ophthalmic anesthesia at UAB. His research interests include the study of subarachnoid hemorrhage and vasospasm, refractory epilepsy, and trauma and pneumonia.

Available at all medical bookstores
or buy online at www.jaypeebrothers.com

JAYPEE BROTHERS
Medical Publishers (P) Ltd.
www.jaypeebrothers.com

Join us on facebook.com/JaypeeMedicalPublishers

Shelving Recommednation
ANESTHESIA

ISBN 978-93-5270-085-1