

Post op complication

schwartz2019

Robotic surgery

- **Device failures** (electrocautery, instrument malfunctions), make up roughly half of the complications
- The challenge for the surgical community is to develop robust and effective **training** programs to allow trainees and practicing surgeons to acquire the **skills** necessary to perform robotic procedures with the highest degree of safety

Central Venous Access Catheters.

- • Ensure that central venous access is **indicated**.
- • **Experienced** personnel should insert the catheter or should supervise the insertion.
- • Use proper **positioning** and sterile technique.
- • **Ultrasound** is recommended for internal jugular vein insertion.
- • All central venous catheters **should be assessed** on a daily basis and should be exchanged only for specific indications (not as a matter of routine).
- • All central catheters should be **removed** as soon as possible

Complications of CVlines

- Pneumothorax
- Arrhythmias
- Arterial puncture
- Lost guidewire
- Air embolus
- Pulmonary artery rupture
- CV line infection

Tube Thoracostomy

- pneumothorax, hemothorax, pleural effusions, or empyema.
- , incomplete penetration of the pleura with formation of a subcutaneous tube track,
- lacerations to the lung or diaphragm
- , intraperitoneal placement of the tube through the diaphragm,
- and bleeding.
- slippage of the tube out of position or mechanical problems related to the drainage system.

Cont,

- In patients with bullous disease, there can be significant intrapleural scarring, and it can be easy to mistakenly place the chest tube into bullae.
- All of these complications can be avoided with proper initial insertion techniques, plus a daily review of the drainage system and follow-up radiographs.
- Tube removal can create a residual pneumothorax if the patient does not maintain positive intrapleural pressure by Valsalva maneuver during tube removal and dressing application.

Neurologic complication

- neurapraxia secondary to improper positioning and/or padding during operations
- Direct injury to nerves during a surgical intervention
- **superficial parotidectomy** (facial nerve), **carotid endarterectomy** (hypoglossal nerve), **thyroidectomy** (recurrent laryngeal nerve), **prostatectomy** (nervi erigentes), **inguinal herniorrhaphy** (ilioinguinal nerve), and **mastectomy** (long thoracic and thoracodorsal nerves).
- The nerve injury may be a stretch injury or an unintentionally severed nerve.
- In addition to loss of function, severed nerves can result in a painful neuroma that may require subsequent surgery.

Table 12-12

Common causes of mental status changes

ELECTROLYTE IMBALANCE	TOXINS	TRAUMA	METABOLIC	MEDICATIONS
Sodium	Ethanol	Closed head injury	Thyrotoxicosis	Aspirin
Magnesium	Methanol	Pain	Adrenal insufficiency	β -Blockers
Calcium	Venoms and poisons	Shock	Hypoxemia	Narcotics
Inflammation	Ethylene glycol	Psychiatric	Acidosis	Antiemetics
Sepsis	Carbon monoxide	Dementia	Severe anemia	MAOIs
AIDS		Depression	Hyperammonemia	TCAs
Cerebral abscess		ICU psychosis	Poor glycemic control	Amphetamines
Meningitis		Schizophrenia	Hypothermia	Antiarrhythmics
Fever/hyperpyrexia			Hyperthermia	Corticosteroids, anabolic steroids

AIDS = acquired immunodeficiency syndrome; ICU = intensive care unit; MAOI = monoamine oxidase inhibitor; TCA = tricyclic antidepressant.

CVA

- Postoperatively,
- **hypotension** and **hypoxemia** are the most likely causes of a cerebrovascular accident.

- Conjunctivitis
- Epistaxis
- otitis& ototoxicity

Thyroid and Parathyroid Glands

- ECG(shortened P-R interval),
- muscle spasm (tetany, Chvostek's sign, and Trousseau's sign), paresthesias, and laryngospasm.
- Treatment includes calcium gluconate infusion and, if tetany ensues, chemical paralysis with intubation

- Dissection near the inferior thyroid artery is a common area for **RLN injury**
- The cord on the affected side will be in the **paramedian** position
- With bilateral RLN injury, the chance of a successful extubation is poor
- If paralysis of the cords is not permanent, function may return 1 to 2 months after injury

- **Superior laryngeal nerve injury** is less debilitating, as the common symptom is loss of projection of the voice

- The diagnosis of **bronchial plugging** is
- based on chest X-ray and clinical suspicion with acute pulmonary decompensation with increased work of breathing and hypoxemia.
- **Fiberoptic bronchoscopy** can be useful to clear mucous plugs and secretions

pulmonary problems

- Malnutrition,
- inadequate pain control,
inadequate mechanical ventilation,
inadequate pulmonary toilet,
and aspiration

- Pneumothorax
- Hemothoraces
- Pulmonary atelectasis

- An increase in FRC by 700 mL or more can be accomplished by sitting patients up to greater than 45°.

- For mechanically ventilated patients, simply placing the head of the bed at 30° to 45° elevation and delivering adequate tidal volumes (8–10 mL/kg) improves pulmonary outcomes

Aspiration complications

- **pneumonitis** and **pneumonia**.
- The treatment of pneumonitis is oxygenation with general supportive care. Antibiotics are not indicated.
- Hospitalized patients who develop aspiration
- pneumonitis have a **mortality** rate as high as **70% to 80%**.
- Early, aggressive, and **repeated bronchoscopy** for suctioning of aspirated material from the tracheobronchial tree will help minimize the inflammatory reaction of pneumonitis and facilitate improved pulmonary toilet.

Ventilator-associated pneumonia (VAP)

- occurs in **15% to 40%** of ventilated ICU patients
- The 30-day **mortality** rate of nosocomial
- pneumonia can be as high as **40%**
- *Two most common*
- *Pseudomonas* and *Acinetobacter*
- spp.,

Epidural analgesia

- This method of pain control improves pulmonary
- **toilet** and the early return of **bowel function**;
- Lower the potential for aspiration and for acquiring pneumonia.

- The routine use of epidural analgesia results in a lower incidence of pneumonia than patient-controlled analgesia

Table 12-13

Inclusion criteria for the acute respiratory distress syndrome

Acute onset

Predisposing condition

$P_{aO_2}:F_{iO_2} < 200$ (regardless of positive end-expiratory pressure)

Bilateral infiltrates

Pulmonary artery occlusion pressure < 18 mmHg

No clinical evidence of right heart failure

F_{iO_2} = fraction of inspired oxygen; P_{aO_2} = partial pressure of arterial oxygen.

Hypoventilation

- PaCO₂ greater than 45 mm Hg
- clinically apparent only when the PaCO₂ is greater than **60 mm Hg** or arterial blood pH is less than **7.25**
- **Signs** are varied and include excessive or prolonged somnolence, airway obstruction, slow respiratory rate, tachypnea with shallow breathing, or labored breathing. Mild to moderate respiratory acidosis causes tachycardia and hypertension or cardiac irritability (via sympathetic stimulation), but a more severe acidosis produces circulatory depression .
- **Causes:** most commonly (Opioid).... Inadequate reversal, overdose, hypothermia, pharmacological interactions .. metabolic factors ...diaphragmatic dysfunction.... Increased CO₂ production from shivering, hyperthermia, or sepsis...
- **Treatment:** underlying cause ... endotracheal intubation.. naloxone

Hypoxemia

- most important respiratory complication after anaesthesia and surgery. It may start at recovery and in some patients persist for **3 days** or more after surgery.
- The presence of cyanosis is very **insensitive** and when detectable the arterial *PO₂* will be (55 mmHg), a saturation of 85%.
- **Causes** : alveolar hypoventilation; V/Q mismatch within the lungs ... diffusion hypoxia... pulmonary diffusion defects...ARDS...a reduced inspired oxygen concentration... postoperative **pneumothorax** .
- **TREATMENT:** Oxygen therapy

- An **excess of carbohydrate**
- may negatively affect **ventilator weaning**
because of the abnormal RQ due to higher CO₂
production and altered pulmonary
- gas exchange

- Although not without risk, **tracheostomy** decreases the pulmonary dead space and provides for **improved pulmonary toilet**.
- When performed before the **tenth day** of ventilatory support, tracheostomy may decrease the incidence of VAP, the overall length of ventilator time, and the number of ICU patient days.

Thromboembolic disease.

- Upto 20% of patients that stay longer than 7 days can develop DVT
- Highest in women on ocp + pelvic surgery
- Majority will not be clinically apparent .

Pulmonary emboli(PE)

- Clinical findings include
 - elevated central venous pressure,
 - hypoxemia, shortness of breath, hypocarbia secondary to tachypnea, and right heart strain on ECG.
- **Ventilation–perfusion nuclear scans** are often indeterminate in patients who have an abnormal chest **X-ray** and are less sensitive than a **CT angiogram** or **pulmonary angiogram** for diagnosing PE

- **Sequential compression devices** on the lower extremities
- and **low-dose subcutaneous heparin** or low molecular weight heparinoid administration are routinely used to prevent DVT
- risk of PE.
- **Neurosurgical** and **orthopedic**
- patients
- **obese** patients at **prolonged bed rest**.

Cardiac System.

- **Atrial fibrillation** is the most common arrhythmia_s and occurs between postoperative **days 3 to 5** in high-risk patients.
- This is typically when patients begin to mobilize their interstitial fluid into the vascular fluid space (R)
- **Beta** blockade and/or **calcium** channel blockade , **digoxin** , **cardioversion**

Acute Myocardial infarction

- ECG and cardiac enzyme measurements.
- The patient should be transferred to a
- monitored (telemetry) floor.
- *Morphine*, supplemental oxygen,
- *nitroglycerine*, and *aspirin* (MONA) are the initial therapeutic maneuvers

Gastrointestinal System.

- . Surgery of the esophagus
- transhiatal resection and the transthoracic (Ivor-Lewis)
- .in ivor lewis The reported mortality is about 50% with an anastomotic leak,
- and the overall mortality of the procedure is about 5%, which is similar to transhiatal resection

Postoperative ileus

- Epidural anesthesia

limited use of nasogastric tubes and the initiation of early postoperative feeding

metoclopramide and erythromycin

Alvimopan, a newer agent and a μ -opioid receptor antagonist,

Neostigmine

Small bowel obstruction

- adhesions are usually the cause.
- Internal and external hernias,
- technical errors,
- and infections or abscesses are also causative.

Fistulae

FRIENDS (Foreign body, Radiation, Ischemia/Inflammation/Infection, Epithelialization of a tract, Neoplasia, Distal obstruction, and Steroid use.

Hypotension

- can be due to a variety of factors, alone or in combination, that reduce the cardiac output, the systemic vascular resistance or both:
- **Hypovolaemia (most common)** : Reduced peripheral perfusion, Tachycardia , Hypotension, Inadequate urine output ($<0.5\text{mL/kg/h}$),
- **reduced myocardial contractility** : The commonest cause is ischaemic heart disease : poor peripheral circulation , tachycardia; tachypnoea , distended neck veins , basal crepitations, wheezes, triple rhythm on auscultation of the heart
- **Tx**: sit patient upright,, O2 ,, ECG
- **Vasodilatation**: common during spinal or epidural anaesthesia , prostate surgery , septic shock**Tx** : administration of fluids , vasopressors(ephedrine). Antibiotic

Gastrointestinal (GI) bleeding

- a poorly tied suture,
- a nonhemostatic staple line,
- or a missed injury
- The source of bleeding is in the **upper GI tract** about **85%** of the time and is usually detected and treated endoscopically.
- **Surgical control of intestinal bleeding is required in up to 40% of patients**

Common causes of upper and lower gastrointestinal (GI) hemorrhage

UPPER GI BLEED	LOWER GI BLEED
Erosive esophagitis	Angiodysplasia
Gastric varices	Radiation proctitis
Esophageal varices	Hemangioma
Dieulafoy's lesion	Diverticulosis
Aortoduodenal fistula	Neoplastic diseases
Mallory-Weiss tear	Trauma
Peptic ulcer disease	Vasculitis
Trauma	Hemorrhoids
Neoplastic disease	Aortoenteric fistula Intussusception Ischemic colitis Inflammatory bowel disease Postprocedure bleeding

- It is important to keep the gastric pH greater than 4 to decrease the overall risk for stress gastritis in patients mechanically ventilated for 48 hours or greater and patients who are coagulopathic

Hepatobiliary-Pancreatic System

- **Early recognition** of bile duct injury(cut) in LAP.CHOL and **immediate repair** of an injury are important because delayed bile duct leaks often require a more complex repair
- **Ischemic injury** due to devascularization of the common bile duct

BILOMA

- abdominal pain and hyperbilirubinemia.
- The diagnosis of a biliary leak can be confirmed by **CT scan**, **ERCP**, or radionuclide **scan**. Once a leak is confirmed, a retrograde biliary **stent** and **external drainage** are the treatment of choice

cirrhotic patient

- Ascites leak

resuscitation should be maintained with crystalloid solutions.

bleeding complications due to coagulopathy are common.

operative mortality in cirrhotic patients is 10% for Child class A, 30% for Child class B, and 82% for Child class C patients

Pyogenic liver abscess

- retained **necrotic liver tissue**,
 - **occult intestinal perforations**,
 - benign or malignant **hepatobiliary obstruction**,
 - **sepsis**,
- hepatic arterial occlusion.**
- The treatment is **long-term antibiotics** with **percutaneous drainage** of large abscesses.

Pancreatitis

- **post-ERCP**(rectal indomethacin)
- **Traumatic injuries**(postkidneys, GI tract, and spleen surgery)
- Management of these fistulae initially includes ERCP with or without pancreatic **stenting**, percutaneous **drainage** of any fistula fluid collections, total parenteral nutrition (**TPN**) with **bowel rest**, and **repeated CT scans**

Renal System

- **Postrenal failure**, or obstructive renal failure, should always be considered when low urine output (oliguria) or anuria occurs.
- (e.g., colon resection for **diverticular disease**) or a large retroperitoneal hematoma (e.g., **ruptured aortic aneurysm**).

Urinary electrolytes associated with acute renal failure and their possible etiologies

	FE_{Na}	OSMOLARITY	UR_{Na}	ETIOLOGY
Prerenal	<1	>500	<20	CHF, cirrhosis
Intrinsic failure	>1	<350	>40	Sepsis, shock

CHF = congestive heart failure; FE_{Na} = fractional excretion of sodium; UR_{Na} = urinary excretion of sodium.

- Minimum of urine output in surgical patient is 0.5cc/kg/h
- The treatment of renal failure due to myoglobinuria has shifted away from the use of sodium bicarbonate for alkalinizing the urine,
- to merely maintaining brisk urine output of 100 mL per hour with crystalloid fluid infusion. Mannitol and furosemide are not recommended.

Musculoskeletal System

- **Compartment syndrome** of the extremities generally occurs after a closed fracture
- aggressive **fluid** resuscitation can exacerbate the problem
- **Pain** is hallmark and **anterior compartment** of the leg is usually the first compartment to be involved.

- If the pressures are greater than **20 to 25 mmHg** in any of the compartments, then a **four-compartment fasciotomy** is considered. Compartment syndrome can be due to ischemia-reperfusion injury, after an **ischemic time of 4 to 6 hours**. Renal failure (due to myoglobinuria), tissue loss, and a permanent loss of function are possible results of untreated compartment syndrome

Decubitus ulcers

- Ischemic changes in the microcirculation of the skin can be significant after **2 hours** of sustained pressure.
- The treatment of a decubitus ulcer in the noncoagulopathic patient is **surgical debridement**.
- Once the wound bed has a viable granulation base without an excess of fibrinous debris, a **vacuum-assisted closure dressing** can be applied. Wet to **moist** dressings with frequent dressing changes is the alternative and is labor intensive.. If the wounds fail to respond to these measures, soft tissue coverage by **flap** is considered

Contractures

- due to trauma,
- amputation, or
- vascular insufficiency

- prevented by physical therapy and splinting
- contracture releases may be required for long-term care.

Hematologic System.

- optimal hemoglobin level 7 mg/dL or the
- hematocrit reaches 21%
- .
- HCT 30% or more in patient with
- symptomatic anemia,
- have significant cardiac disease,
- *critically ill*

transfusion reaction

- simple fever, pruritus, chills, muscle rigidity,
- and renal failure due to myoglobinuria secondary to hemolysis.
- Discontinuing the transfusion and returning the blood products to the blood bank is an important first step,
- administration of
- antihistamine and possibly steroids may be required to control the reaction symptoms.

Rate of viral transmission in blood product transfusions^a

HIV	1:1.9 million
HBV ^b	1:137,000
HCV	1:1 million

^aPost-nucleic acid amplification technology (1999). Earlier rates were erroneously reported higher due to lack of contemporary technology.

^bHBV is reported with pre-nucleic acid amplification technology.

Statistical information is unavailable with post-nucleic acid amplification technology at this writing.

Note that bacterial transmission is 50 to 250 times higher than viral transmission per transfusion.

- Patients on **warfarin** (Coumadin) who require surgery can have anticoagulation reversal by administration of **fresh frozen**
- **plasma.**
- Each unit of fresh frozen plasma contains **200 to 250** mL of plasma and includes **one unit** of coagulation factor per milliliter of plasma.

- Thrombocytopenia may require platelet transfusion for a platelet count less than **20,000/mL** when invasive procedures are
- performed,
- or when platelet counts are low and ongoing bleeding from raw surface areas persists
- . **One unit of platelets** will increase the platelet count by **5000 to 7500** per mL

- Complications of **heparin-induced thrombocytopenia II** can be serious because of the diffuse thrombogenic nature of the disorder.
- Simple precautions to limit this hypercoagulable state include **saline solution** flushes instead of heparin solutions and limiting the use of heparin-coated catheters.
- The treatment is anticoagulation with synthetic agents such as **argatroban**

hypercoagulopathic patients

- Those who carry congenital anomalies
- such as the most common
- **factor V Leiden deficiency,**
- as well as **protein C and S deficiencies,**
- are likely to form thromboses if
- inadequately anticoagulated, and these patients should be managed in consultation with a hematologist.

Abdominal Compartment Syndrome.

- Multisystem trauma,
- thermal burns,
- , and surgery related to the
- Retroperitoneumretroperitoneal injuries
- RupturedAAA, major pancreatic injury and resection, or multiple intestinal injuries
- a large volume of IV fluid resuscitation puts these patients at risk for intra-abdominal hypertension.

- progressive **abdominal distention** followed by
- **increased peak airway ventilator pressure**
-
- **oliguria** followed by anuria, and an
- insidious development of **intracranial hypertension**

- Measurement of abdominal pressures is easily accomplished
- by transducing bladder pressures from the urinary
- catheter after instilling 100 mL of sterile saline into the urinary
- bladder....

- A pressure greater than constitutes intraabdominal **20 mmHg** hypertension,

- but the diagnosis of ACS requires intra-abdominal pressure greater than **25 to 30** mmHg, with at least one of the following:
- compromised respiratory mechanics and ventilation,
- oliguria or anuria,
- or increasing intracranial pressures

The treatment of ACS

- **open** any recent abdominal
- incision to **release** the abdominal fascia or to open the fascia directly if no abdominal incision is present.
- Immediate improvement
- in mechanical ventilation pressures, intracranial pressures,
- and urine output is usually noted.

- Abdominal wall **closure** should be attempted every **48 to 72 hours** until the fascia can be reapproximated.
- If the abdomen cannot be closed within 5 to 7 days following release of the abdominal fascia, a large incisional hernia is the net result

Wounds, Drains, and Infection

- **Prophylactic** use of antibiotics before 24 h
- **Irrigation** with an antibiotic-based solution has not demonstrated significant benefit
- in controlling postoperative infection.
- skin preparation with chlorhexidine gluconate with isopropyl alcohol remain more advantageous

- The strict definition of wound (soft tissue)
- 5
- infection is more than 10CFU per gram of tissue
- The clinical signs of wound infection include *rubor, tumor, calor, and dolor*
- (redness, swelling, heat, and pain).
- Once the diagnosis of wound infection has been established, the most definitive treatment
- remains **open drainage** of the wound. The use of **antibiotics** for wound infection treatment should be limited..

vacuum-assisted closure dressing

- decrease local wound edema and to promote healing through the application of a sterile **dressing** that is then covered and placed under **controlled suction** for a period of **2 to 4 days at a time**

Risk Factors for Development of Surgical Site Infections

Older age

Immunosuppression

Obesity

Diabetes mellitus

Chronic inflammatory process

Malnutrition

Peripheral vascular disease

Anemia

Radiation

Chronic skin disease

Carrier state (e.g., chronic *Staphylococcus* carriage)

Recent operation

Drain Management

- • To **collapse surgical dead** space in areas of redundant tissue (e.g., neck and axilla)

To provide focused **drainage of an abscess** or grossly infected surgical site

- To provide early warning **notice of a surgical leak** (either bowel contents, secretions, urine, air, or blood)—the so-called sentinel drain
- **To control** an established fistula leak
- Closed suction devices can exert a negative pressure of **70 to 170** mmHg at the level of the drain

Urinary Catheters

- The most frequent nosocomial infection is urinary tract infection (UTI)
- Cultures with more than **100,000** CFU/mL should be treated with the appropriate antibiotics and the catheter changed or removed as soon as possible.
- Undertreatment or misdiagnosis of a UTI can lead to urosepsis and septic shock

Empyema

ethiology

- overwhelming pneumonia
 - retained hemothorax,
 - systemic sepsis,
- esophageal perforation from any cause,
- infections with a predilection for the lung (e.g., tuberculosis)

diagnosis

- chest X-ray or CT scan, followed by aspiration of pleural fluid for bacteriologic analysis.
- Gram's stain,
lactate dehydrogenase,
protein,
pH, and
cell count are obtained,

- **broad-spectrum antibiotics** are initiated while the laboratory studies are performed.
- Once the specific organisms are confirmed, anti-infective agents are tailored appropriately.
- Placement of a **thoracostomy tube** is needed to evacuate and drain the infected pleural fluid,
- but depending on the specific nidus of infection, video-assisted **thoracoscopy** may also be needed

Abdominal Abscesses

- Postsurgical intra-abdominal abscesses

vague complaints of intermittent abdominal pain, fever, leukocytosis, and a change in bowel habits.

Depending on the type and timing of the original procedure, the clinical assessment of these complaints is sometimes difficult, and a CT scan is usually required.

When a fluid collection within the peritoneal cavity is found on CT scan, antibiotics and percutaneous drainage of the collection is the treatment of choice.

Initial antibiotic treatment is usually with broad-spectrum antibiotics such as piperacillin-tazobactam or imipenem.

Necrotizing Fasciitis.

- **Group A streptococcal** (M types 1, 3, 12, and 28) soft tissue infections, as well as infections with **Clostridium perfringens** and *C. septicum*,
- carry a mortality of **30% to 70%**.
- Septic shock can be present, and patients can become hypotensive less than 6 hours following inoculation. Manifestations of a group A *Streptococcus pyogenes* infection in its most severe form include
- **hypotension, renal insufficiency, coagulopathy, hepatic insufficiency, ARDS, tissue necrosis, and erythematous rash.**

R/

- wide debridement of the necrotic tissue to the level of bleeding, viable tissue
- Typically, the patient requires serial trips to the OR for wide debridement until the infection is under control
- penicillin, is the drug of choice

Systemic Inflammatory Response Syndrome, Sepsis, Multiple-Organ Dysfunction Syndrome

Mortality associated with patients exhibiting two or more criteria for systemic inflammatory response syndrome (SIRS)

PROGNOSIS	MORTALITY (%)
2 SIRS criteria	5
3 SIRS criteria	10
4 SIRS criteria	15–20

Inclusion criteria for the systemic inflammatory response syndrome

Temperature $>38^{\circ}\text{C}$ or $<36^{\circ}\text{C}$ ($>100.4^{\circ}\text{F}$ or $<96.8^{\circ}\text{F}$)

Heart rate >90 beats/min

Respiratory rate >20 breaths/min or $\text{Paco}_2 <32$ mmHg

White blood cell count <4000 or $>12,000$ cells/ mm^3 or $>10\%$ immature forms

Paco_2 = partial pressure of arterial carbon dioxide.

- . SIRS is the result of proinflammatory cytokines (interleukin (IL)-1, IL-6, and tissue necrosis factor (TNF)) related to tissue malperfusion or injury

Other mediators include nitric oxide, inducible macrophage-type nitric oxide synthase, and prostaglandin I₂

- Sepsis is SIRS plus+ infection
- Sepsis is categorized as
 - sepsis, severe sepsis, and septic shock
- Severe sepsis is sepsis plus signs of cellular hypoperfusion or end-organ dysfunction.
- Septic shock is sepsis plus hypotension after adequate fluid resuscitation
- MODS is the culmination of septic shock and multiple end-organ failure

Management of SIRS/MODS

- aggressive global resuscitation and support of end-organ perfusion,
- correction of the **inciting etiology**,
- control of **infectious complications**
- and management of iatrogenic complications.
- Drotrecogin- α , or **recombinant activated protein C**, appears to specifically counteract the cytokine cascade of SIRS/MODS, but its use is still limited.
- Other adjuncts for supportive therapy include
- **tight glucose control, low tidal volumes in ARDS, vasopressin in septic shock, and steroid replacement therapy**

Nutrition-Related Complications.

- Patients who are fed via **nasogastric tubes** are at risk for aspiration pneumonia because these large-bore tubes stent open the gastroesophageal junction, creating the possibility of **gastric reflux**
- . complications of **TPN**, such as **pneumothorax**, **line sepsis**, upper
- extremity **DVT**, and the related **expense**
- . These **electrolyte errors** include deficits or excesses in sodium, potassium, calcium, magnesium, and phosphate.
- **Acid-base abnormalities** can also occur with the
- improper administration of acetate or bicarbonate solutions.

- In patients who have had any type of nasal intubation who are having high, unexplained fevers, **sinusitis** must be entertained as a diagnosis.
- **CT scan** of the sinuses is warranted, followed
- by **aspiration** of sinus contents so the organism(s) are appropriately treated.

refeeding syndrome

- , characterized by severe **hypophosphatemia** and **respiratory failure**.
- Slow progression of the enteral feeding administration rate can avoid this complication

- The most common cause for **hypernatremia** in hospitalized
- patients is **under-resuscitation**,
- and, conversely, **hyponatremia** is
- most often caused by fluid **overload**.

hyponatremia

- Treatment for is **fluid restriction** in mild or moderate cases and the administration
- of hypertonic saline for severe cases.

- An overly rapid correction of the sodium abnormality may result in central pontine
- **myelinolysis**, which results in a severe neurologic deficit
- overcorrection of hyponatremia can result in severe **cerebral edema**, a neurologic deficit, or **seizures**.

Glycemic Control.

- When targeted goals of 180 mg/dL are
- achieved, fewer occurrences of hypoglycemia have been documented,
- and improved survivorship has been achieved

Metabolism-Related Complications.

- “Stress dose steroids” have been advocated for the perioperative treatment of patients on corticosteroid therapy,
- recent studies strongly discourage
- the use of supraphysiologic doses of steroids when patients are on low or maintenance doses (e.g., 5–15 mg) of prednisone
- Daily
- When patients are on steroid replacement doses equal to or
- greater than 20 mg per day of prednisone, it may be appropriate to administer additional glucocorticoid doses for no more than
- 2 perioperative days
- the complication of
- performing major surgery on an adrenally insufficient patient is
- sudden or profound hypotension that is not responsive to fluid
- resuscitation.

Hypothyroidism

- the so-called *sick-euthyroid syndrome* are more commonly recognized in the critical care setting.
- When surgical patients are not progressing satisfactorily in the perioperative period,
- screening for thyroid abnormalities should be performed.

Hypothermia

- core temperature **less than 35°C** (95°F) and is divided into subsets of
- **mild**
- (**35°C–32°C** [95°F–89.6°F]),
- **moderate** (**32°C–28°C** [89.6°F
- –82.4°F]),
- **severe** (<**28°C** [<82.4°F]) hypothermia

- **Shivering**, the body's attempt to reverse the effects of hypothermia,
- occurs between **37°C and 31°C** (98.6°F and 87.8°F), but ceases at temperatures below 31°C (87.8°F).
- Patients who are moderately
- hypothermic are at higher risk for complications than are those who are more profoundly hypothermic.

- Hypothermia creates a **coagulopathy** that is related to platelet and clotting cascade enzyme dysfunction.
- This triad of metabolic acidosis, coagulopathy, and hypothermia is commonly
- found in **long operative cases** and in patients with **blood dyscrasias**

- The most common cardiac abnormality is the development of **arrhythmias** when body temperature drops below **35°C**
- (95°F).
- **Bradycardia** occurs with temperatures below **30°C**
- (86°F)

- hypothermia may induce CO₂
- retention, resulting in **respiratory acidosis**

- . Renal dysfunction of hypothermia manifests itself as a **paradoxical polyuria** and is related to an increased glomerular filtration rate, as peripheral vascular constriction creates central shunting of blood

- . Placing **cooling blankets** on or under the patient or **ice packs** in the axillae or groin may be effective in cooling the skin,
- and when this occurs, a subsequent feedback loop triggers the hypothalamus to raise the internally regulated set point, **thus raising core temperature even higher.**
- This paradoxical reaction may be why those who feel the need to treat a fever in the ICU by cooling the skin and arguably the core have worse outcomes.

- Complications with induced hypothermia include, but are not limited to,
hypokalemia,
diuresis,
DVT (due to catheter-related vein injury),
arrhythmias,
shivering,
undiagnosed catheter-related bloodstream infection,
and bacteremia
Neurologic dysfunction

- Methods used to warm patients include
- **warm air circulation** over the patient and **heated IV fluids**, as well as more aggressive measures such as **bilateral chest tubes** with warm solution lavage, **intraperitoneal** rewarming lavage, and **extracorporeal** membrane oxygenation. A rate of temperature rise of **2°C to 4°C** (3.6°F–7.2°F) **per hour** is considered adequate,

Hyperthermia

a core temperature greater than **38.6°C**
(101.5°F)

Malignant hyperthermia occurs intraoperatively after exposure to agents such as **succinylcholine** and some **halothane** based inhalational anesthetics.

Common causes of elevated temperature in surgical patients

HYPERTHERMIA	HYPERPYREXIA
Environmental	Sepsis
Malignant hyperthermia	Infection
Neuroleptic malignant syndrome	Drug reaction
Thyrotoxicosis	Transfusion reaction
Pheochromocytoma	Collagen disorders
Carcinoid syndrome	Factitious syndrome
Iatrogenic	Neoplastic disorders
Central/hypothalamic responses	
Pulmonary embolism	
Adrenal insufficiency	