



Anaesthesia for Emergency Surgery

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Outline

- Definitions
- Types
- Preparation
- Intra-operative management
- Post-operative management
- Examples:
 - ATLS
 - Cesarean Section
 - Burns in pediatric

Definitions

- Elective ... ahead of time ... planned
- Ex. Inguinal hernia, Cataract Breast implants

- EMERGENCY : defines a life-threatening situation
- Ex. Intestinal Obstruction

- Urgency: simply refers to a state of priority.
- Ex. Bone fracture

Types

- Traumatic

or

- Non-traumatic:
 - Obstetrical
 - Neurological
 - Vascular
 - Burns
 - Genito-Urinary
 - Gastrointestinal ... etc...

PREOPERATIVE PREPARATION

DEFINITIVE TRAUMA INTERVENTIONS

- The initial history and physical examination, emergency procedures, and evaluations used to determine extent of injury, need for resuscitation, and need for surgical intervention all occur outside the operating room and at times before an anesthesia provider has been alerted.
- Critical initial issues impacting anesthetic management of trauma patients include adequacy of airway and vascular access, ability of the patient to tolerate anesthesia, prevention of hypothermia, access to robust blood bank supplies, and avoidance of crystalloids and vasopressors until hemorrhage is controlled.
- Anesthesiologist participation in the earliest assessment of potentially severely injured trauma patients in the emergency room should be encouraged. ***

- **Anesthesia for emergency situations is unplanned,** hence the time available to evaluate the patient preoperatively and prepare for surgery is short.
- At bare minimum, one needs to have answers to the following questions:
 - Why patient needs emergency surgery?
 - How much time is available for resuscitation?
 - Are there any signs indicating presence of hemorrhage?
 - What are the results of quick airway assessment for difficult intubation?
 - Whether patient will need ventilatory support postoperatively, ICU care, etc.?

Preoperative interview

- Severely injured, conscious, and oriented trauma patients arriving for emergency surgery should have an abbreviated interview and examination, including emphasis on consent for anesthesia , blood transfusions and advice that intraoperative awareness may occur during emergency surgery.

- discussions should be documented in the patient's record.

- Full history and examination if possible
- S – Symptoms
- A – Allergies
- M – Medications
- P – Past medical history
- L – Last oral intake
- E – Events prior to incident

- Lab investigations if possible ... usually done as resuscitation is carried on
- Prepare to manage any uncontrolled co-morbidities
 - Ex. D.M, HTN, ASTHMA

O.R

- The operating room should be as warm as practical.
- Intravenous fluid warmers and rapid infusion devices should be prepared and ready for use..
- Patients arriving for trauma surgery should be presumed to have full stomachs with increased risk for aspiration of gastric contents.
- The presence of a C-collar for cervical spine stabilization may increase intubation difficulty. Alternative airway devices (eg, fiberoptic bronchoscope, videolaryngoscope) and robust suction equipment must be immediately available and ready for use.

Intravenous access

- Intravenous access is usually established in the prehospital setting or emergency department.
- If the existing peripheral intravenous lines are of sufficient caliber and quality for infusing blood under pressure (eg , from a rapid infusion device), a central line may not be necessary for the initial surgical intervention.
- patients may arrive in the operating room so profoundly hypotensive and hypovolemic that peripheral intravenous line placement may be impossible. In these circumstances, a subclavian catheter or intraosseous device should be inserted and blood-based resuscitation initiated.
- The subclavian vein *is often preferred for central venous access for profoundly hypotensive patients due to its position between the clavicle and first rib, which tends to stent the subclavian vein open even in profound hypovolemia.
- The availability of ultrasound devices in anesthesia practice may allow safe placement of large- bore or central venous catheters in jugular veins using ultrasound guidance, even in the presence of profound hypovolemia.

Intraosseous access

- An intraosseous device placed with the use of a small bone drill in the proximal tibia or humerus provides direct access to venous complexes through the bone marrow.
- Use of intraosseous access requires that the bone proximal and distal to the insertion site be intact, otherwise extravasation of infused fluids will occur due to the fluid taking the path of least resistance (the fracture site).
- Intraosseous infusions require pressure, not gravity, for infusions to overcome the resistance to flow originating in the bone marrow.

Upon arrival

- 2 large caliber peripheral intravenous lines if not already established ... 16G or 14G ... if difficult... central line
- Routine monitors ... Invasive monitoring per case

Invasive monitoring

- An arterial line is helpful but not mandatory in the initial resuscitation of the trauma victim.
- Even with the assistance of ultrasonography, cannulating an artery in the presence of profound hypotension may prove difficult.
- Attempts at placing invasive monitors can continue as the patient is prepared for incision, to include gowning and gloving the person attempting arterial line placement on the surgical side .
- Although arterial line placement may be a challenge, surgical incision cannot be delayed.
- Surgical control of bleeding and Damage Control Resuscitation (DCR) are the top priorities in trauma resuscitation, not arterial line placement.
- Patients in this degree of hemodynamic compromise can be presumed to have Trauma Induced Coagulopathy (TIC) and be in need of massive transfusion.
- Attempts for arterial line placement can resume, and are more likely to be successful, as blood pressure improves from operative hemostasis and resuscitative transfusion.

Anesthetic Induction & Maintenance

- General anaesthesia
- Neuro-axial anaesthesia Ex for LSCS
- Peripheral nerve block
- Local Anesthesia

Anesthetic Induction & Maintenance

- Major blood loss and hemodynamic instability create a dangerous situation for the conscious trauma patient and a challenging decision for the anesthesia provider planning the induction of general anesthesia.
- Trauma patients with severe injuries may experience profound hypotension following even modest doses (0.25-0.5 mg/kg intravenously) of propofol.
- **Etomidate** preserves sympathetic tone, which makes it a modestly safer choice than propofol.
- **Ketamine** is also a reasonable choice, particularly if given in 10-mg intravenous boluses until the patient becomes unresponsive.
- Scopolamine, 0.4 mg intravenously, should be considered as an amnestic agent for the profoundly hemodynamically unstable but conscious patient at high risk for hemodynamic collapse on induction of anesthesia .
- What is most important is not the particular intravenous anesthetic induction agent chosen, but **the recognition that the hemodynamically unstable trauma patient will tolerate** significantly less medication for induction and maintenance of anesthesia than in normal circumstances.

Complications of difficult airway

- Aspiration
- Hypoxemia
- Trauma to upper airway
- Potential spinal cord injury in cervical injury

Risk of aspiration

- Inadequate fasting time
- Head & neck trauma
- Unable to protect airway [head or spinal injury ,vocal cord injury]
- Pregnancy
- Intestinal obstruction
- Pain
- Intra abdominal mass
- Obesity
- children



FASTING RULES

- **ADULTS**

Elective surgery – the “2-6-8 rule”.

- *Water and other clear fluids: up to 2 hours before induction of anaesthesia.

- *Food (solids, milk and milk-containing drinks): up to 6 hours before induction.

- *Heavy meals containing fat : up to 8 hours before induction.

Consider further interventions for adults at higher risk of regurgitation and aspiration.

- **CHILDREN**

Preoperative children undergoing elective surgery – the “2-4-6 rule”

- Water and other clear fluids: up to 2 hours before induction of anaesthesia.

- Breast milk: up to 4 hours before induction.

- Formula milk, cow’s milk or solids: up to 6 hours before induction.

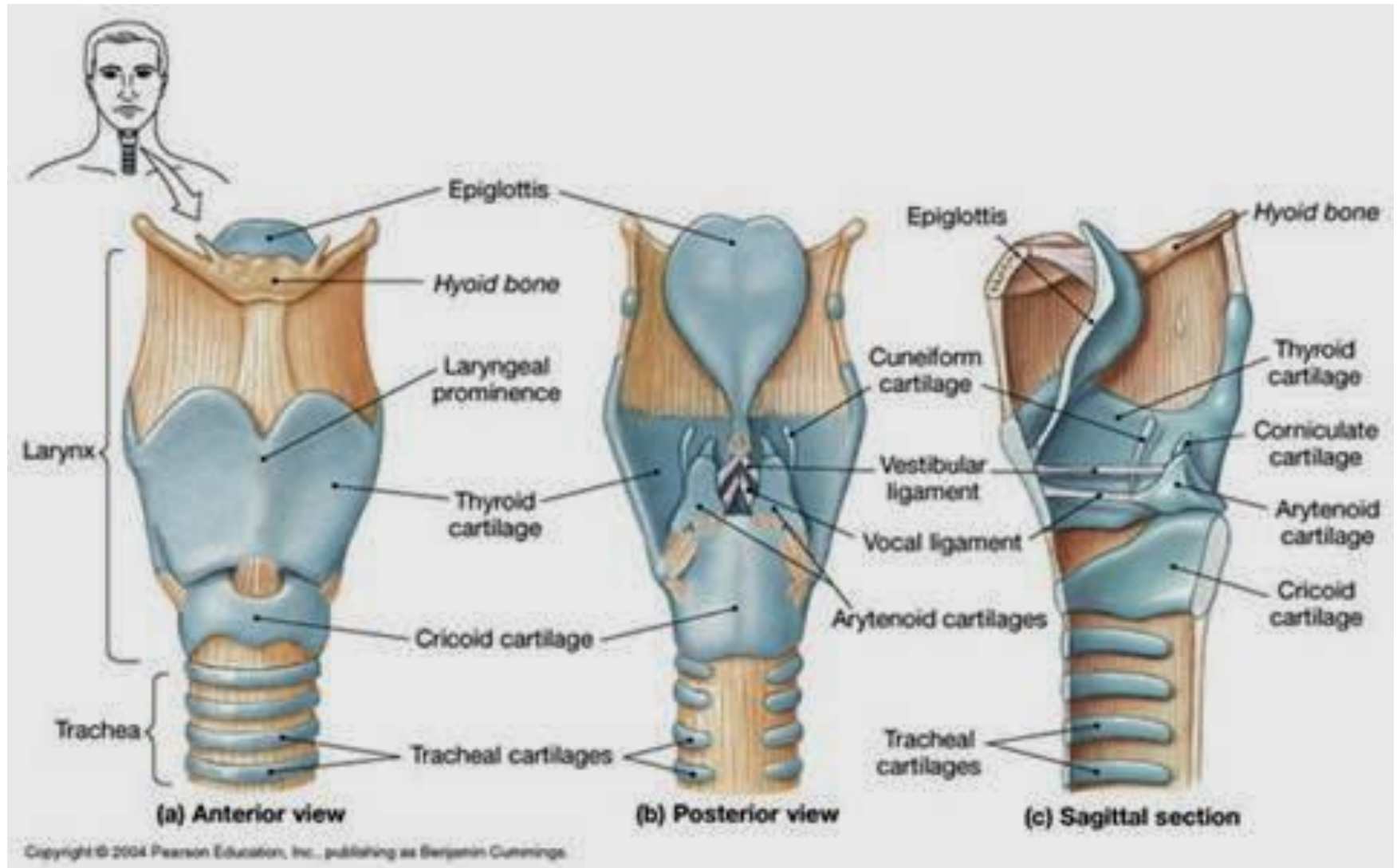
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Rapid sequence induction (RSI)

The aim is to minimizes the risk of aspiration

- The availability of suction must be confirmed before induction.
- Preoxygenation with 100% oxygen for 3-5 minutes or 4 vital breaths.
- Predetermined rapid IV induction agent.
- Followed by rapid acting muscle relaxant (suxcamethonium or rocuronium) without waiting to assess the effect of induction agent.
- Combined (with or without) cricoid pressure to reduce the risk of aspiration.*
- Patient is not artificially ventilated.
- Insertion of NG tube after endotracheal intubation for stomach emptying.*

Why Cricoid Cartilage?



Fluid management

- Fluid management in major trauma resuscitations **emphasizes blood products rather than crystalloid fluids.**
- An Massive Transefusion Protocol should be requested and followed, with the blood immediately available upon the arrival of the patient to the operating room.
- All fluids should be warmed, except for platelets. When blood products are rapidly infused, ionized calcium quickly declines and must be replaced.
- **Vasopressors should not be used, if possible, until the source of bleeding is controlled.** Studies suggest that raising the blood pressure with vasopressors during hemorrhage disrupts fresh clots, resulting in more bleeding.

Damage Control Surgery

- if a trauma patient requires emergent laparotomy for intraabdominal hemorrhage, the trauma surgeon will perform an abbreviated procedure termed damage control surgery (DCS).
- Surgical intervention is intended to stop hemorrhage and limit gastrointestinal contamination of the abdominal compartment.
- After making a midline incision, the surgeon quickly searches for sources of bleeding through a quadrant-by-quadrant examination.
- Definitive repair of complex injuries is not part of DCS.
- Identification of injured blood vessels and solid organs, as well as inspection of injuries in areas relatively inaccessible to midline approaches but potentially addressed by interventional radiology techniques (eg, deep liver lacerations, retroperitoneal hemorrhage), occurs during DCS.
- Hollow viscus injuries are addressed with resection, stapling, or both. Leaving the intestines disconnected until the patient is more stable reduces intraabdominal contamination and operating time.
- Communication among the entire trauma team is essential during DCS. The surgeon must know if the patient is becoming unstable, hypothermic, or coagulopathic. The anesthesia team must speak up when there is a need to pause the surgical procedure to allow resuscitation.

...Damage Control Surgery

- Pausing surgery results in the surgeon compressing or packing an area of bleeding during times of profound hypotension until transfusion restores acceptable systolic blood pressure (80-90 mm Hg).
- If this interruption of surgery is unsuccessful in improving blood pressure, the surgeon can directly compress the aorta. This intervention provides the surgeon direct feedback as to the effectiveness of transfusion---a soft aorta suggests profound hypovolemia, whereas the return of a pulsatile aorta suggests a more acceptable circulating blood volume.
- A brief episode of bradycardia/asystole may accompany direct aortic compression.
- When transfusions are ineffective maintaining perfusion, the operation should be interrupted, the bleeding areas packed, and a decision should be made between the surgeon and anesthesia team as to whether the patient can be transferred to the interventional radiology suite to treat bleeding from surgically-inaccessible sites or to the intensive care unit where rewarming, correction of coagulopathy and hemodynamic stabilization may occur.
- A key component of DCS is planned re-operation once the patient is more stable. At a later time. bowel continuity can be restored or a colostomy can be done.

Analgesia

- Effective analgesia ASAP
- Titrated to the desire of the Patient
- Respiratory depression
- No NSAIDS for hypovolemic patients*
- Regional Anaesthesia (Hemodynamic instability, Coagulopathy)

- Heat Loss should be prevented in all ages (delayed recovery, delayed extubation, coagulopathy)
- Invasive monitoring should be applied when required
- Local or Regional Anesthesia should be used when feasible

Summary

- Inadequate History and Investigations
Inadequate Preparation
 - a- Not Fasting – Requires Rapid Sequence Induction of Anaesthesia
 - b- Untreated Pre-Existing Diseases – Requires Resuscitation and Careful Choice of Anesthetic Drugs and Techniques
 - c- Unavailability of Appropriate Investigations – Requires Depending on Clinical Impression and Minimal Investigations
 - d- Unavailability of Appropriate Cross-Matched blood – Requires use of Type-Specific blood or Group O-Neg blood transfusion in life saving procedures until proper Cross-Matched blood is available

POST-OPERATIVE MANAGEMENT

- Decision for extubation depends on patient's haemodynamic status
- In stable patient, before extubation Direct laryngoscopy is performed and secretion or debris are removed*. If nasogastric tube is in situ, it is aspirated.

- Atropine and neostigmine are given and patient will breathe in 100% oxygen.*
- Because of the risk of aspiration, extubation is performed only when there is recovery of airway reflexes. (when the patient is fully awake).

- Some patients may require continuation of ventilatory assistance postoperatively.
- They will be sent to ICU for further resuscitation and ventilation.

Indications for Postoperative ICU Admission

- Severe chest injury
- Evidence of aspiration pneumonia
- Unstable hemodynamic status
- Severe head injury for cerebral protection
- Massive blood loss with massive blood transfusion with DIC
- Polytrauma

ATLS

TRAUMA

- Trauma is a leading cause of morbidity and mortality in all age groups

ATLS

- PRIMARY SURVEY
- SECONDARY SURVEY
- RESUSCITATION
- DEFINITIVE TRAUMA INTERVENTIONS

PRIMARY SURVEY

- A..... Airways, It is rather an Ac
- B.....Breathing
- C.....Circulation
- D.....neurological Dysfunction
- E..... Exposure

A..... Airways

- There are three important aspects of airway management in the initial evaluation of a trauma patient:
 - (1) The need for basic life support intervention.
 - (2) The presumed presence of a cervical spinal cord injury until proven otherwise.
 - (3) The potential for failed endotracheal intubation.

A..... Airways

- Effective basic life support, by improving oxygenation and reducing hypercarbia in the unresponsive trauma patient, may be sufficiently effective in improving a patient's level of consciousness to remove the need for endotracheal intubation.
- In those with persistent unresponsiveness, effective basic life support skills improve preoxygenation and reduce the risk for hypoxia during airway management interventions.*
- All trauma patients should be presumed to have a full stomach and thereby be at increased risk of pulmonary aspiration.

A..... Airways

- (2) Presumed cervical spinal cord injury until proven otherwise ... neck pain ... any significant head injury ... neurological signs or symptoms ... intoxication ... loss of consciousness ... cervical collar (“C-collar”) ...

Manual In Line Stabilization (MILS) is mandatory
during intubation : do not remove c-collar or stop MILS

(3) Potential failed tracheal intubation ... alternative airway devices are now approved for resuscitation.





B.....Breathing

- Pulmonary injury may not be immediately apparent upon the trauma patient's arrival to the hospital.
- In the patient with blunt or penetrating injury, providers should maintain a high level of suspicion for pulmonary injury that could evolve into a tension pneumothorax when mechanical ventilation is initiated.
- Peak inspiratory pressure and tidal volumes should be monitored throughout the initial resuscitation.
- **Abrupt cardiovascular collapse shortly after instituting mechanical ventilation may signal the presence of a pneumothorax.** Any trauma-related cardiovascular collapse is managed by disconnecting the patient from mechanical ventilation and performing bilateral needle thoracostomies.
- **No trauma patient should die without having potential tension pneumothorax relieved.**

C.....Circulation

- Pulse and Blood pressure
- Capillary refill
- Urine output

C.....Circulation

- The absence of a pulse following trauma is associated with dismal chances of survival.
- An emergent ultrasound evaluation of the chest and abdomen is indicated for any patient arriving after trauma in cardiac arrest, as is bilateral needle chest decompression.
- The ultrasound evaluation will focus on the presence of an empty heart or massive blood collections in the chest or abdomen, which are indications of lethal injuries.
- **Hemorrhage, not limb ischemia and limb function, is the most pressing threat to life, and it should be controlled by any effective measure at the earliest possible opportunity.**

D.....neurological Dysfunction

- L.O.C ... pupillary size and reaction ...
lateralizing signs ... signs of spinal cord injury
- Glucose level
- Alcohol intoxication ... illicit or prescribed
medications ... hypoperfusion ... hypercapnia

E..... Exposure

- The patient must be fully exposed and examined in order to adequately assess the extent of injury.
- This physical exposure increases the **risk of hypothermia**, which is associated with increased bleeding in the trauma patient.
- The resuscitation area and operating room must be maintained near body temperature (uncomfortably warm), all intravenous fluids and blood products (except platelets) should be warmed during administration, and under-body forced air patient warmers should be utilized.
- While these interventions are important in addressing hypothermia, trauma team efficiency in identifying life-threatening injuries is critical for patient survival.
- In most urban trauma centers, the initial major trauma evaluation is completed within 20 min of patient arrival.

SECONDARY SURVEY

- Head to Toe Examination
- Scalp .. Face .. Ears .. Neck
- Chest
- Abdomen .. Pelvis
- Extremities

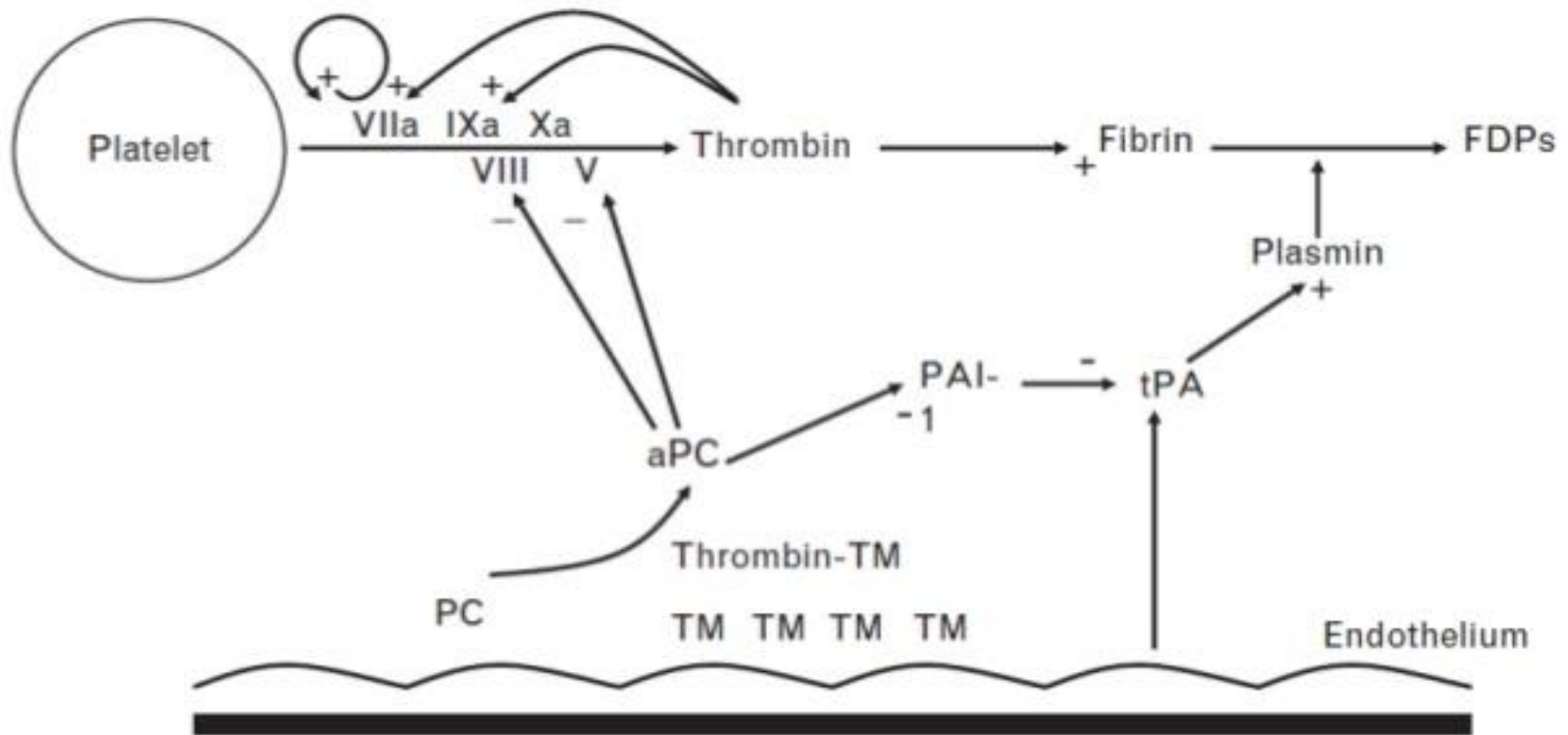
Goals for Resuscitation of The Trauma Patient

PARAMETER	GOAL
Blood pressure	Systolic 80 mmHg, mean 50-60mmHg
Heart rate	< 120 bpm
Oxygenation	SaO2 > 95%
Urine output	0.5ml/kg/h
Mental status	Following commands
Lactate level	<1.6mmol/l
Base deficit	> -5
Haemoglobin	>8.0g/dl

Trauma-Induced Coagulopathy

- Common following major trauma
- Trauma-induced coagulopathy is an **independent risk factor** for death
- Acute traumatic coagulopathy is only related to severe metabolic acidosis (base deficit ≥ 6 mEq/L)

Feed back for hemostasis & Hyperfibrinolysis



Complications of Coagulopathy

- Uncontrolled bleeding
- Hemorrhagic shock
- Death

Haemostatic Resuscitation

- Damage control resuscitation
- Blood products in equal portions early in resuscitation has become an accepted approach
- PRBCs : FFP: PLATELETs in (1 : 1 : 1) ratio
- O-negative ... type-specific ...cross matched

CAESAREAN SECTION

Special Precautions

- Supine Hypotensive Syndrome
- Pregnancy Induced (Associated) Hypertension
- Fetal Hypoxia
- Acidic Resting Stomach Juice
- Regurgitation

- C/S rate 14-15% at US *(as emergency)
- Anesthesia: 3-12% maternal death
- Majority during G/A: failed intubation, ventilation, oxygenation and pulmonary aspiration of gastric content

- Risk factors:
 - Obesity
 - Hypertensive disorder of pregnancy
 - Emergently performed procedure

BURN IN PEDIATRIC PATIENTS

- Burns represent a unique but common traumatic injury that is second only to motor vehicle accidents as the leading source of accidental death.
- Temperature and duration of heat contact determine the extent of burn injury.
- Children, because of their high body surface area to body mass ratio, and the elderly, whose thinner skin allows deeper burns from similar thermal insult, are both at greater risk for major burn injury.
- The pathophysiological and hemodynamic responses to burn injuries are unique and warrant specialized burn care that can be optimally provided only at burn treatment centers, particularly when more than 20% of a patient's total body surface area (TBSA) is involved in second- or third-degree burns.
- A basic understanding of burn pathophysiology and of resuscitation requirements, especially early initiation of therapies such as oxygen administration and aggressive fluid resuscitation. will improve patient survival.

The rule of nine:- adults vs pediatrics

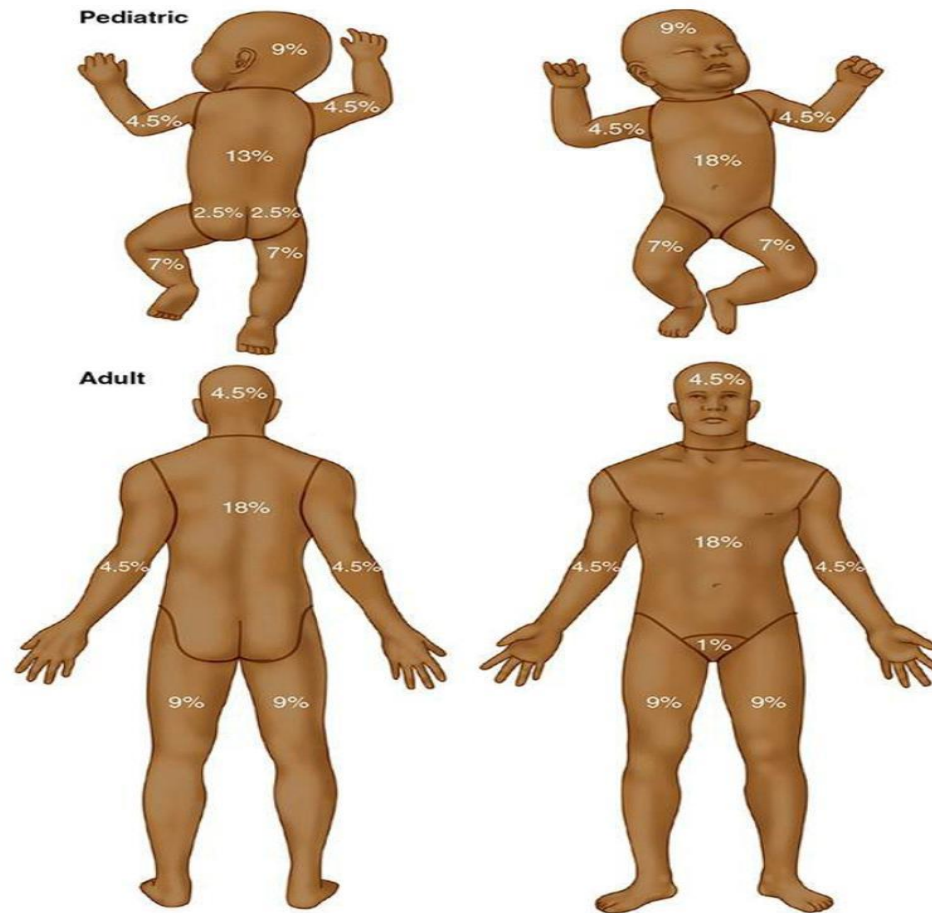


FIGURE 39-6 The Rule of Nines, utilized to estimate burned surface area as a percentage of total body surface area (TBSA). (Reproduced with permission from American College of Surgeons. *ATLS: Advanced Trauma Life Support for Doctors (Student Course Manual)*. 9th ed. Chicago, IL: ACS; 2012.)

Burn management considerations

- Fluid creep*
- Abdominal Compartment Syndrome.
- Pulmonary complications.
- Carbon monoxide and cyanide poisoning.

Anesthetic Considerations for Burn Therapy

- A primary characteristic of all burn patients is an inability to regulate temperature.
- The resuscitation environment must be maintained near body temperature through the use of a radiant warming, forced air warming devices, and fluid warming devices.
- All burn care environments must be maintained near 40°C.
- Assessment of the burn patient begins with inspection of the airway. Although the face may be burned (singed facial hair, nasal vibrissae), facial burns are not an indication for tracheal intubation.
- **The need for urgent airway management, mechanical ventilation, and oxygen therapy is indicated by hoarseness of voice, dyspnea, tachypnea, or altered level of consciousness.** Arterial blood gas determination should be obtained early in the treatment process for assessment of HbCO level.

Anesthetic Considerations for Burn Therapy

- Mechanical ventilation should be adjusted to achieve adequate oxygen saturation at the lowest tidal volumes.
- **Tracheal intubation in the early period following burn injury (up to the first 48 h) can be facilitated with succinylcholine for muscle relaxation.** In patients with significant burns (20% TBSA.), injury and disruption of neuromuscular end plates occurs, followed by upregulation of acetylcholine receptors. Beyond 48 h after significant burn injury, succinylcholine can produce lethal hyperkalemia.
- This risk for succinylcholine-induced hyperkalemia persists for up to 2 years following burn injury.

Analgesia

- Analgesia for burn patients is challenging.
- Considerations and concerns regarding opioid tolerance and psychosocial complications of burn therapy are commonplace.
- **Multimodal approaches** are often advantageous. Regional analgesia may provide benefit, although in the early post-burn period this technique may mask the symptoms of compartment syndrome or other clinically significant signs and symptoms related to the primary burn injury.

Thank You

for listening