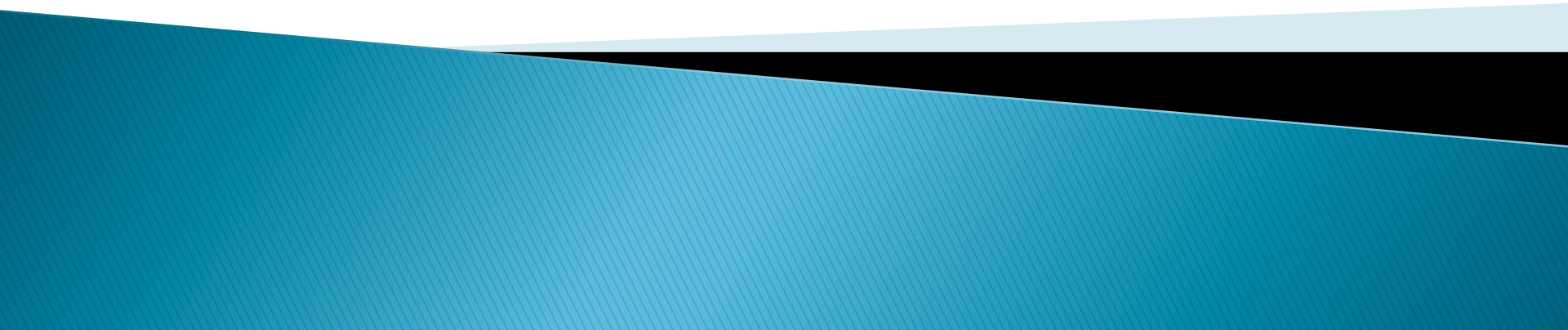
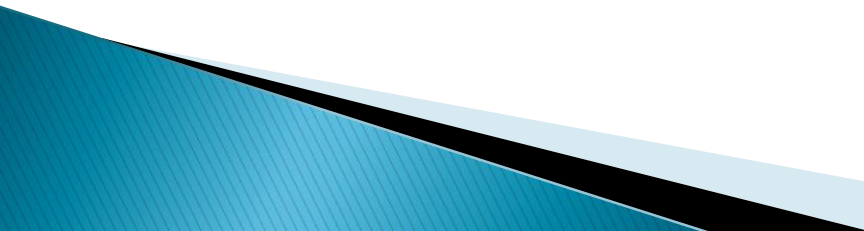


Abdominal Compartment Syndrome



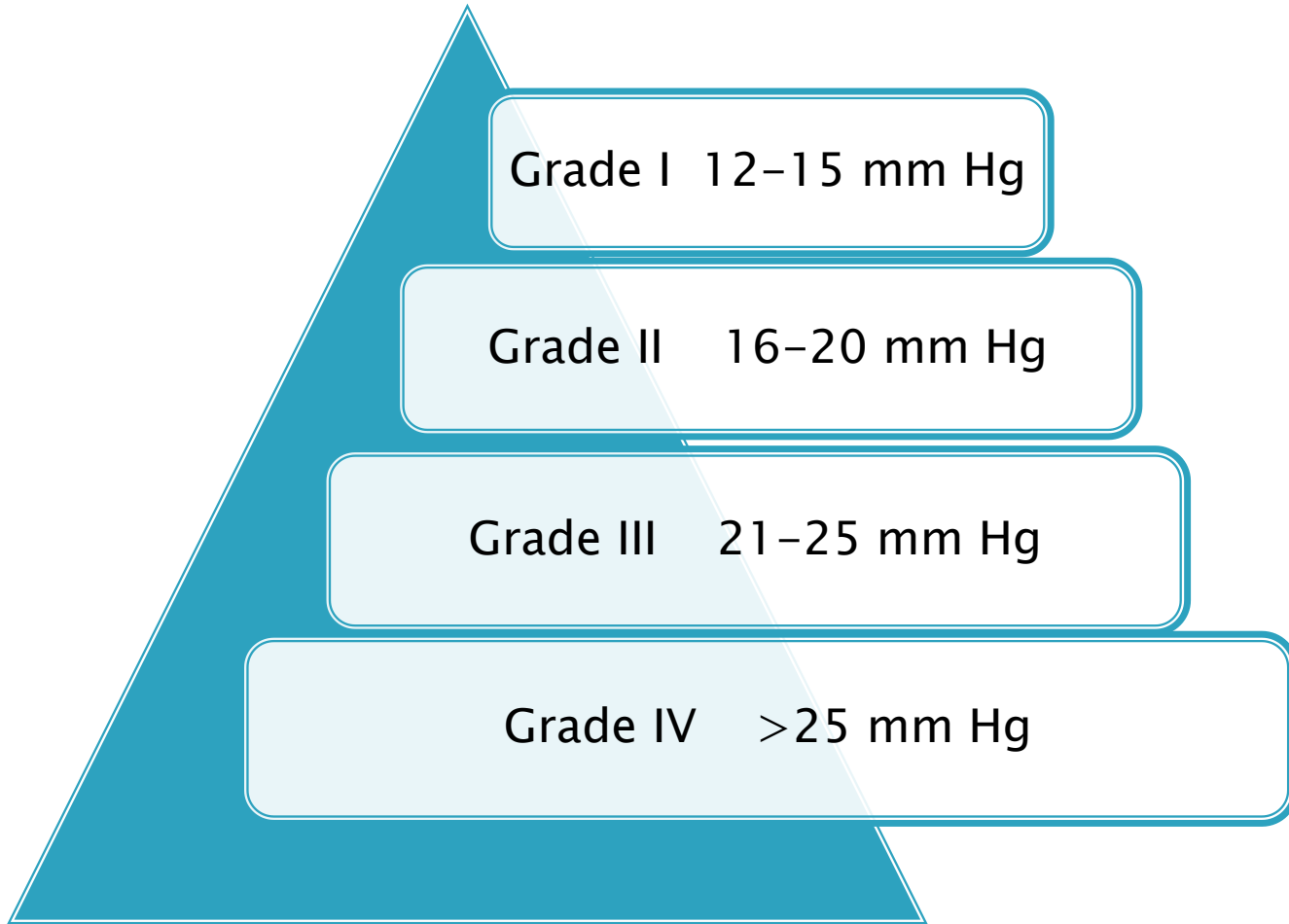
Definition:

- ▶ IAP is defined as the steady-state pressure concealed within the abdominal wall
 - ▶ Normal IAP = 5 to 7 mmHg
 - ▶ In defining the severity of IAP, the World Congress on Abdominal Compartment Syndrome introduced a useful grading system for IAH:
- 

Definitions:

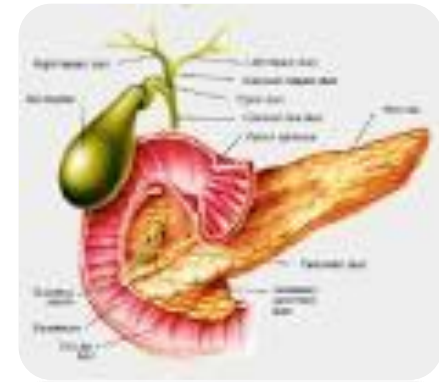
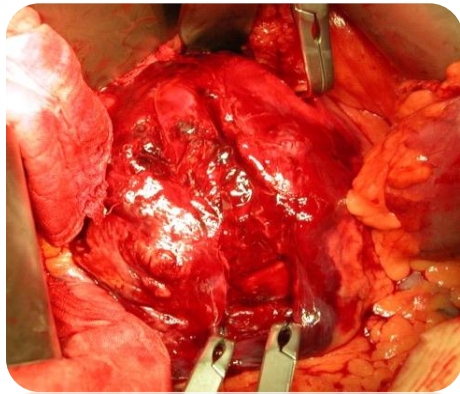
- ▶ Intra-abdominal Hypertension = sustained pathologic increase in intra-abdominal pressure (IAP) > 12 mm Hg
- ▶ ACS =
 - Sustained increase in IAP > 20 mm Hg
 - Associated with new organ dysfunction/failure
- ▶ APP = MAP – IAP
 - Abdo perfusion pressure = mean arterial pressure – IAP
 - Measures perfusion of intra-abdominal organs
- ▶ Appropriate APP = 60mmHg

Grades of IAP



Classification ACS :

- ▶ **Primary (intra-abdominal cause)**
= abdominal trauma, pancreatitis, mesenteric venous obstruction, ascites, retroperitoneal hemorrhage/ruptured AAA





- ▶ **Secondary** (extra-abdominal)

results from massive bowel oedema from sepsis, capillary leak, massive fluid resuscitation, or burns

Pathophysiology

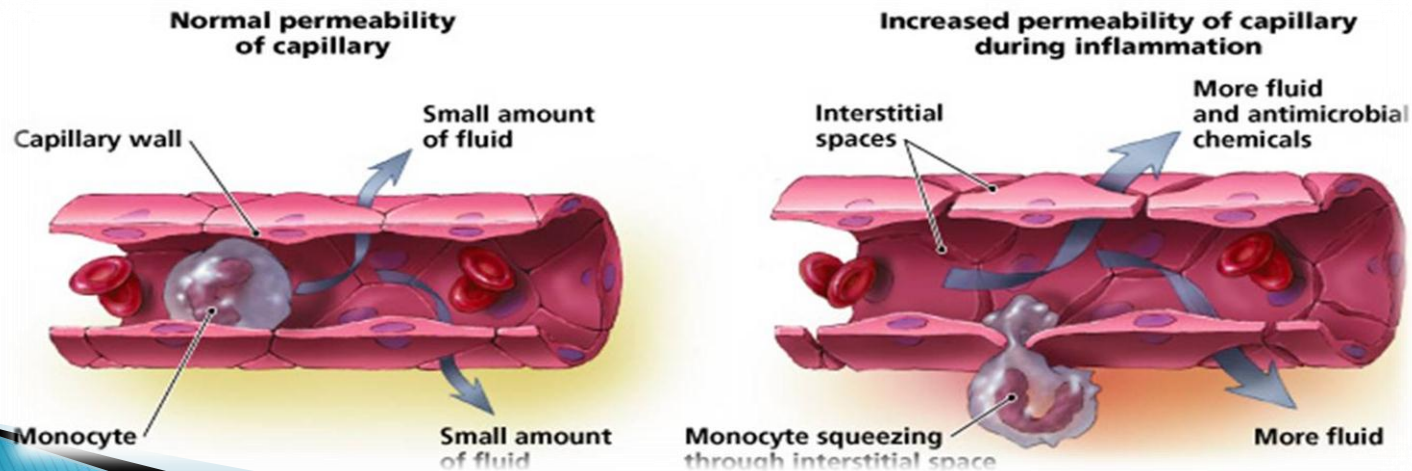
In shock blood is shunted away from GIT to the heart and brain



Leads to cellular hypoxia within the tissues of the intestine



Leads to release of proinflammatory cytokines that promote vasodilation increased capillary permeability, leading to oedema



After cellular reperfusion, oxygen free radicals are generated, which results in insufficient oxygen delivery to the tissues, limiting ATP and impairing cellular activity



The Na-K pump fails, and sodium leaks into the cells drawing water into the cell



The cell swells, the membrane loses its integrity, and intracellular contents are then spilled into extracellular space causing inflammation, increased capillary permeability, and oedema



IAP quickly increases and intestinal perfusion is impaired



IAH affects multiple organ systems

Consequences

- ▶ Raised thoracic pressure & Diaphragmatic elevation
 - Decreased chest wall compliance, TLC, FRC
 - Hypoxia, hypercapnia
- ▶ Compression of IVC & PV:
 - Decreased preload
 - Decreased cardiac output




Consequences

- ▶ Decreased cardiac output:
 - Prerenal azotemia therefore renal insufficiency
 - Decreased mesenteric blood flow therefore Intestinal ischaemia and infarction
- ▶ Renal parenchymal compression:
 - Increased renal vascular resistance
 - Decreased renal blood flow



Clinical manifestations:

- ▶ Distended and tense abdomen
 - ▶ Increased airway pressures with progressive hypoxia and hypercapnia
 - ▶ Increased heart rate with hypotension
 - ▶ Impaired renal function with oliguria that progresses to anuria without appropriate therapy.
 - ▶ Increased intracranial pressure has also been described, probably caused by an increased intrathoracic pressure resulting in a functional obstruction to cerebral venous outflow.
- 

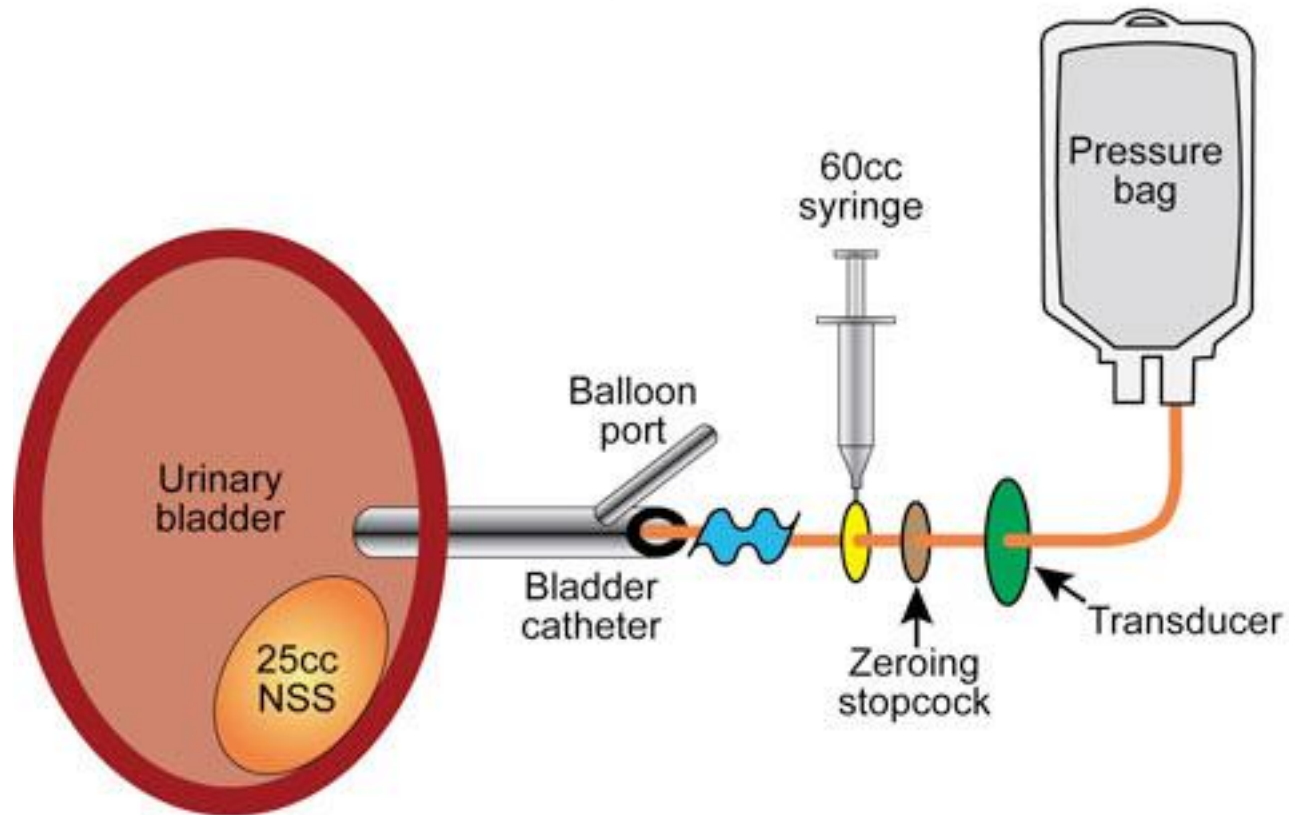
Measurements:

- ▶ Measuring the bladder pressure is considered gold standard

Measurements:

- ▶ Adequate sedation and analgesia during bladder pressure measurement to prevent muscle contractions
- ▶ ~10–25ml fluid volume infused
- ▶ Infusion of higher volumes can lead to falsely elevated pressures.
- ▶ IAP at the end of expiration, 30–60s after fluid infusion
- ▶ Measuring IAP every 4–6hrs recommended if IAH present
- ▶ IAP should be measured hrly if ACS present
- ▶ Serial measurements of IAP can be terminated when value <10 mmHg for 24–48 hrs

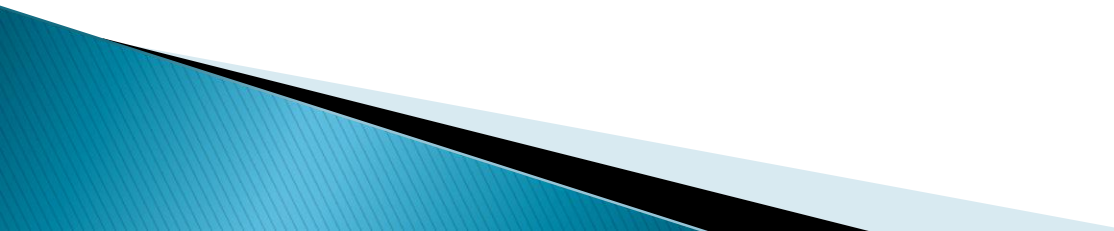
Measurements:



Intravesical pressure monitoring involves measuring bladder pressure after infusing 25 mL of 0.9% normal saline.

Predisposing factors

- ▶ 4 categories:

1. Decreased abdominal wall compliance,
 2. Increased intraluminal contents
 3. Increased abdominal contents
 4. Fluid resuscitation.
- 

Predisposing factors

- ▶ Independent risk factors for primary ACS:
 - Administration of $> 5\text{L}$ crystalloid infusion within 24 hrs
 - Transfusion of > 10 units pRBC within 24 hrs
 - Hypothermia (Temp $< 33^{\circ}\text{C}$)
 - Acidosis (base deficit < 14 mmol/L; pH < 7.2)
 - BMI > 30

- ▶ Independent risk factors for secondary ACS:
 - Pts with burns: $> 30\%$ total body surface area

Non-operative Management

- ▶ Medical management focuses on reversing the factors that have contributed to increased IAP:
 - Fluid overload
 - Increased abdominal and intraluminal contents
 - Decreased abdominal wall compliance
- ▶ Non-operative management strategies should be used only with grades 1 to 3 IAH
- ▶ Grade 4 IAH should have immediate surgical intervention.

Non-operative Management

▶ Optimize Fluid Balance:

- Patients who especially benefit from reduced volume resuscitation include patients with end-stage liver disease, end-stage renal disease, and congestive heart failure.

▶ Improve Abdominal Compliance

- Negative fluid balance also can improve abdominal wall compliance.
- Pain, agitation, intrinsic and extrinsic positive end-expiratory pressure lead to diminished abdominal wall compliance
- Treatment: sedation, analgesia

Non-operative Management

▶ Evacuate Intraluminal Contents

- Nasogastric tube suctioning
- Rectal tube with enemas
- Prokinetic agents (erythromycin, metoclopramide, neostigmine)
- Correct EUCs in ileus

▶ Evacuate Abdominal Contents

- Paracentesis for ascites
- Abscess or fluid collection drainage

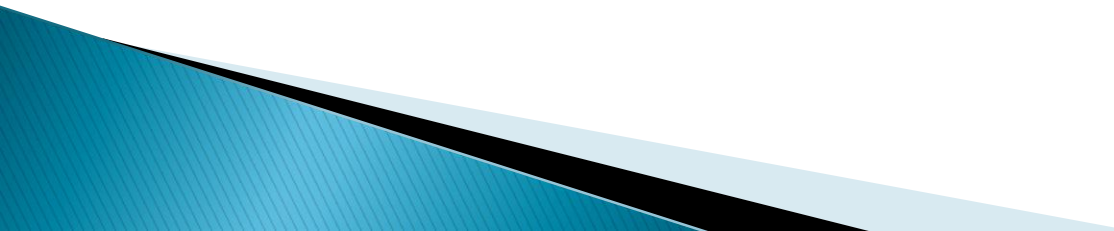
▶ Maintain Goal APP

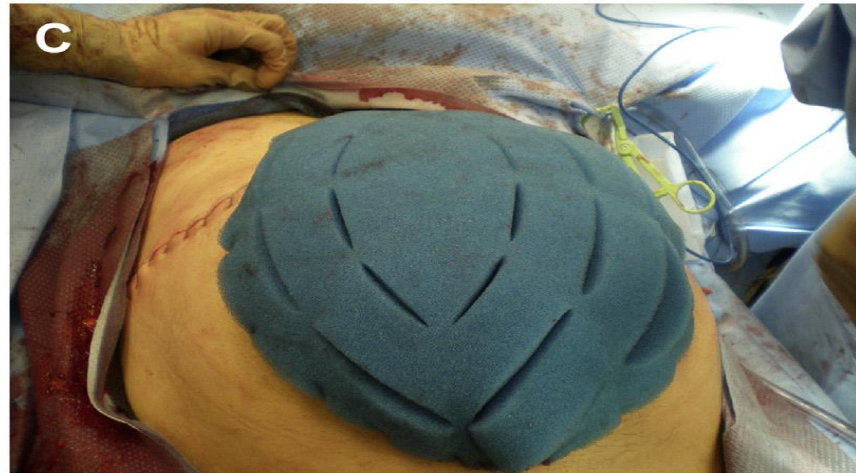
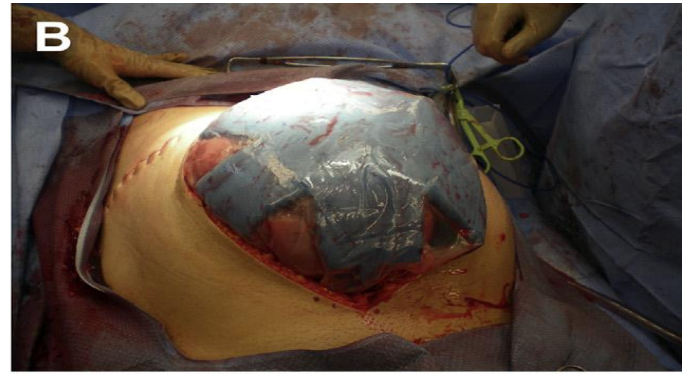
- Maintain adequate MAP

Operative Management

- ▶ Definitive treatment of ACS:
abdominal decompression by means of laparotomy
- ▶ Challenge to surgical intervention is timing
 - Considerable disagreement RE: threshold for IAP
 - Some sources cite an IAP range of 11–25 mmHg
 - ? ≥ 20 mmHg
 - ? ≥ 25 mmHg
 - ? Any IAH with organ dysfunction

Temporary abdominal wall closure

- ▶ VAC Dressing (Atrium)
 - ▶ Bogota bag
 - ▶ Absorbable mesh
 - ▶ Velcro/Zipper type closure
- 



- ▶ **Bogota bag:** Limited role in presence of sepsis
 - Doesn't allow effective drainage of intra-abdominal toxin-rich fluid
 - Doesn't decrease bowel oedema



- ▶ Absorbable mesh:
 - Subsequent skin grafting
 - Results in incisional hernia



▶ Velcro/Zipper-type:

- Preserves abdo wall domain and facilitates fascia closure
- Should not be used in presence of sepsis



Summary:

- ▶ ACS is present with sustained IAP > 20 mmHg associated with any new organ dysfunction or failure
 - ▶ Measuring bladder pressure is considered gold standard
 - ▶ Organ dysfunction: Respiratory/CVS/Renal
 - ▶ Non-operative management options for IAP Grade 1 to 3
 - ▶ Operative management for IAP Grade 4
- 