Abdominal compartment syndrome

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epidemiology & risk factors

at-risk patients & types of abdominal compartment syndrome

- **Primary abdominal compartment syndrome**: Intra-abdominal process
  - Severe pancreatitis
  - Trauma, abdominal surgery
  - Ascites
  - Retroperitoneal or intraperitoneal hemorrhage
  - Severe ileus, colonic pseudo-obstruction, or obstruction
- **Secondary abdominal compartment syndrome**: Any critically ill patient who receives large-volume resuscitation:
  - Major burn injuries
  - Septic shock
  - Hemorrhagic shock (especially with excess crystalloid resuscitation)
  - Elevated intra-thoracic pressure (e.g. high plateau pressure on ventilator)
abdominal compartment syndrome is common

- Medical ICU
  - Series vary, reporting frequencies varying between ~2-8%.
  - Likely represents a complication from over-resuscitation of septic shock or pancreatitis.
- Surgical ICU: higher rates than medical ICU.

The initial manifestation may vary depending on the patient’s underlying physiology. For example, a patient with tenuous renal function could manifest with renal failure. Alternatively, a patient with pulmonary comorbidities might present with respiratory distress.

**manifestations**

The incidence of abdominal compartment syndrome is surprisingly high among medical ICU patients with risk factors. This may represent an under-recognized, occult driver of multi-organ failure.

**cardiovascular**

- Shock and hypotension, due to reduced preload.

https://emcrit.org/ibcc/abdominal-compartment-syndrome/
Mesenteric ischemia causes bacterial translocation into the bloodstream, which may cause systemic vasodilation and hypotension.

**respiratory**

- Pressure on the diaphragm reduces thoracic compliance
  - A non-intubated patient may experience increased work of breathing.
  - For an intubated patient, this may manifest as increased peak pressure on the ventilator.
- Atelectasis and hypoxemia may occur, due to compression of the lung bases.

**renal**

- Renal failure with reduced urine output is often the first sign of abdominal compartment syndrome.
- Increased pressure may compress the kidney directly and also cause renal congestion (due to impaired drainage of blood out of the kidney).

**elevated intracranial pressure**

- Increased abdominal pressures will translate into increased intrathoracic pressures and increased central venous pressures. This can actually cause elevated intracranial pressure.

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**diagnosis**

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**abdominal compartment pressure**

- Estimation by physical examination is insensitive.
  - Abdominal pressures can be elevated despite finding a soft abdomen.
  - Examination demonstrating tense abdomen is ~80% specific.\(^4\)
- Measurement using a Foley catheter:
  - Patient must be fully supine and passive (e.g. not coughing or bucking ventilator).
  - Measured at end-expiration.
  - May be inaccurate in the context of pelvic pathology (e.g. hematoma directly compressing the bladder).

**interpreting the abdominal pressure**

- General concepts:
  - 2-7 mm: normal for a non-obese person.
  - >12 cm: defined as intra-abdominal hypertension.
  - > 15-20 mm: can cause organ failure.
  - > 25-30 mm: usually causes organ failure, may require emergent decompression.
- Technical grading scale is shown here:

<table>
<thead>
<tr>
<th>IAH</th>
<th>Definition</th>
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<tr>
<td>Grade I</td>
<td>IAP 12-15 mm Hg</td>
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<tr>
<td>Grade II</td>
<td>IAP 16-20 mm Hg</td>
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<tr>
<td>Grade III</td>
<td>IAP 21-25 mm Hg</td>
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<tr>
<td>Grade IV</td>
<td>IAP &gt;25 mm Hg</td>
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<tr>
<td>ACS</td>
<td>Sustained elevation of IAP of &gt;20 mm Hg with new organ dysfunction</td>
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**Table 1. Definitions**

Abbreviations: ACS, abdominal compartment syndrome; IAH, intra-abdominal hypertension; IAP, intra-abdominal pressure.

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**diagnostic criteria for abdominal compartment syndrome**

- Diagnosis requires two components:
  - (1) Sustained intra-abdominal pressure > 20 mm.
  - (2) Organ failure attributable to elevated intra-abdominal pressure.
- **Note** The kidneys are one of the most sensitive organs to increased abdominal pressure. If the urine output is adequate, it's considerably less likely that the patient has abdominal compartment syndrome.
- This diagnosis requires clinical judgement, since critically ill patients invariably have other causes of organ failure.
- Sorting out whether organ failure is caused by abdominal compartment syndrome versus other causes can be murky and subjective.

### Treatment

#### #1. defend the abdominal perfusion pressure

Abdominal Perfusion Pressure = MAP − (Abdominal Compartment Pressure)

- Abdominal perfusion pressure is the *pressure gradient* between the MAP and the abdominal compartment. This is the pressure that drives perfusion of all intra-abdominal organs (e.g. the kidney).
- It is probably best to maintain an abdominal perfusion pressure >60mm.\(^5\) However, there is no strong evidence to support this.
  - The ideal target MAP could be 60 mm *plus* the abdominal compartment syndrome.
- Hemodynamic interventions may be tailored to the particular patient. This will generally require vasopressors, because additional crystalloid may merely aggravate matters.\(^6\)

#### #2. volume removal if possible

- Theoretically, volume removal is beneficial:
  - In many patients, compartment syndrome may be caused by volume overload.
  - Efforts to remove volume (e.g. diuresis or dialysis) may be helpful.\(^7\)
- Unfortunately, in *established* abdominal compartment syndrome, the patient is often intravascularly volume depleted (despite tissue edema). This may make it difficult or impossible to remove fluid without worsening hemodynamics.
  - A more realistic fluid target might be to achieve a net even fluid balance.
- Cautions:
  - (1) Abdominal compartment syndrome may compress the inferior vena cava (IVC), making it look empty!
  - (2) Avoid fluid administration. This may help temporarily, but fluid will often rapidly transudate into the tissues – which worsens swelling and increases intra-abdominal pressure (futile cycle shown below).
#3. decompress the abdominal compartment as able

- Ascites may be drained. An indwelling percutaneous drainage catheter may remove this more completely than intermittent therapeutic paracentesis.\(^8\)
- Nasogastric or orogastric tube suction may be used to manage gastric distention.
- Colonic distention may be managed with stimulant laxatives, suppositories, neostigmine, colonoscopy with decompression, and/or rectal tube drainage.

#4. decompress the thorax

- Reduction of PEEP and plateau pressure on the ventilator may decrease intra-abdominal pressure.
  - Permissive hypercapnia may allow for liberalization of ventilator settings.
  - If a large pleural effusion is present, drainage could be beneficial.
- **Beware of intubation!**
  - Intubation converts the thorax from a negative-pressure system to a positive-pressure system. This may acutely increase abdominal pressures and lead to a poly-compartment syndrome, with hemodynamic collapse.

#5. sedation & paralysis

- Agitation (e.g. bucking the ventilator) will increase intra-abdominal pressures. Adequate analgesia and sedation may be helpful, perhaps to a slightly deeper level than the average ICU patient.
- Short-term paralysis may be considered, but this doesn't appear to cause persistent improvement. Paralysis may be used temporarily as a bridge to another intervention (e.g. laparotomy).\(^9\)

#6. surgical decompression

- Release of the abdominal fascia is definitive treatment, albeit invasive.
- Postoperatively, patients will be left with an open abdomen. Ideally this may be closed after 1-2 weeks following resolution of primary process.

checklist

Treatment for abdominal compartment syndrome

- **Hemodynamics**
  - Target MAP > (60 mm + abdominal compartment pressure)
  - Don’t give additional fluid
  - Consider diuresis/dialysis, if possible
- **Decompress the abdomen**
  - Ascites: Drain (indwelling catheter might be ideal approach)
  - NPO, Gastric tube to suction
  - Decompress the colon (e.g. stimulant laxatives, suppositories, neostigmine for megacolon)
- **Decompress the thorax (especially if intubated)**
  - Large pleural effusion: consider drainage
  - Reduce airway pressures as able (e.g. target low PEEP & plateau pressures)
  - Avoid intubation if able
- **Sedation & paralysis (if intubated)**
  - Start with analgesia/sedation to target a passive state on ventilator
  - Paralysis may be used as a short-term therapy
- **Surgical decompression**
  - Fascial release is definitive treatment, but most invasive. Reserve for failure of above measures.

podcast


The Podcast Episode

Want to Download the Episode?

Right Click Here and Choose Save-As (http://traffic.libsyn.com/ibccpodcast/IBCC_EP_28__Abdominal_Compartment_Syndrome_Final.mp3)

questions & discussion

To keep this page small and fast, questions & discussion about this post can be found on another page here (https://emcrit.org/pulmcrit/abdominal-compartment/).
Adopting the mindset that the only treatment for abdominal compartment syndrome is laparotomy. This leads practitioners to ignore the diagnosis (“well, surgery isn’t going to operate on them anyway…”). However, there are numerous non-operative therapies which may be quite effective.

Failure to consider abdominal compartment syndrome (this is a common phenomenon in all types of critically ill patients, not just surgical patients).

Over-interpretation of bladder pressure obtained in patients who aren’t supine and breathing passively.

Abdominal compartment syndrome compresses the inferior vena cava (IVC), making it look empty. This may lead to erroneous decisions regarding fluid administration.

Avoid intubation of patients with borderline abdominal compartment syndrome if possible (pressurization of the thorax may increase intra-abdominal pressure).

**Going further:**

- IBCC chapter on pancreatitis (https://emcrit.org/ibcc/pancreatitis/).
- Killer resuscitation: Abdominal hypertension as an occult driver of multiorgan failure (https://emcrit.org/pulmcrit/abdominal-hypertension/)(PulmCrit)
- Abdominal Compartment Syndrome (https://lifeinthefastlane.com/ccc/abdominal-compartment-syndrome/) (Chris Nickson, LITFL)
- Abdominal Compartment Syndrome (http://www.tamingthesru.com/blog/annals-of-b-pod/june-2017/abdominal-compartment-syndrome/) (Shaun Harty and Jessica Baez, Taming the SRU)
- Abdominal Compartment Syndrome (https://wikem.org/wiki/Abdominal_compartment_syndrome) (WikiEM)
- Abdominal Compartment Syndrome: When should it be on your differential? (http://www.emdocs.net/abdominal-compartment-syndrome-when-should-it-be-on-your-differential/) (Erica Simon, emDocs)
- Epic lecture by Thomas Scalea on poly-compartment syndrome:

**References**


