Bladder Pressure Monitoring

**Purpose:**
To assure proper usage of the Abviser Abdominal Pressure Monitoring system
To give guidance in the proper monitoring of the abdominal pressure without the
monitoring system.

**Policy:**
**Abviser Abdominal Pressure Monitoring:**
1. The MD shall order Abdominal/Bladder pressures.
2. The RN shall aseptically prime and place device between the Foley catheter
and drainage bag.
3. The RN shall connect the transducer to the monitor pressure cable and zero
the device.
4. When ready to assess intra – abdominal pressure the nurse shall instill 20cc
of Normal Saline for an adult patient and 1cc/kg for a pediatric patient.
5. The RN assesses for plateaued number. (Number on monitor will initially
fluctuate, then stabilize.)
6. The instilled volume then passively drains into catheter bag.
7. The RN shall assess and document intra – abdominal pressures every 4
hours unless ordered differently.

**Interpreting Intra-Abdominal Pressure:**

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Interpretation* and Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 mm Hg</td>
<td>Normal</td>
</tr>
<tr>
<td>6-11 mm Hg</td>
<td>Minimal elevation, common finding in critically ill</td>
</tr>
<tr>
<td>12-15 mm Hg</td>
<td>Grade I – Mild to moderate IAH.</td>
</tr>
<tr>
<td>16-20 mm Hg</td>
<td>Grade II – Moderate to severe IAH. Beware of ACS. Significant patho-physiologic changes may be present.</td>
</tr>
<tr>
<td>21-25 mm Hg</td>
<td>Grade III – High risk of ACS</td>
</tr>
<tr>
<td>&gt; 25 mm Hg</td>
<td>Grade IV – ACS</td>
</tr>
</tbody>
</table>

* These are general guidelines. Patient co-morbidities and clinical parameters will
enhance the clinical significance of these measurements, and the onset of clinically apparent abdominal compartment syndrome.

**Abviser-AutoValve® Fluid Infusion Volume:**

<table>
<thead>
<tr>
<th>Adults</th>
<th>20 ml (1 syringe) recommended infusion volume in adults.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pediatric</td>
<td>Fluid Infusion Volume = 1 ml/kg + 2 ml (up to 16 kg child). Beyond 16 kg use 20 ml.</td>
</tr>
</tbody>
</table>

**Risk Factors for IAH/ACS:**

1. Diminished abdominal wall compliance
   - Acute respiratory failure, especially with elevated intrathoracic pressure
   - Abdominal surgery with primary fascial or tight closure
   - Major trauma/burns
   - Prone positioning, head of bed=30 degrees
   - High body mass index (BMI), central obesity
2. Increased intra-luminal contents
   - Gastroaparesis
   - Ileus
   - Colonic pseudo-obstruction
3. Increased abdominal contents
   - Hemoperitoneum/pneumoperitoneum
   - Ascites/liver dysfunction
4. Capillary leak/fluid resuscitation
   - Acidosis (pH<7.2)
   - Hypotension
   - Hyperthermia (core temperature < 33°C)
   - Polytransfusion (>10 units of blood/24 hrs)
   - Coagulopathy (platelets < 50000/mm³) OR partial thromboplastin time (PTT)>2 times normal OR prothrombin time (PTT)<50% OR international standardised ratio (INR)>1.5
   - Massive fluid resuscitation (>5 L/24 hours)
   - Pancreatitis
   - Oliguria
   - Sepsis
   - Major trauma/burns
   - Damage control laparotomy
World Society of the Abdominal Compartment Syndrome

Preliminary Consensus Definitions on Intra-Abdominal Hypertension (IAH)
and Abdominal Compartment Syndrome (ACS):
Results from the International ACS Consensus Definitions Conference

1. Intra-abdominal pressure (IAP) is the pressure concealed within the abdominal cavity. IAP varies with respiration. The normal adult IAP is around 5 mm Hg, but can be non-pathologically increased in the obese. Elevated IAP is a common finding among critically ill medical and surgical patients.

2. IAP should be expressed in mm Hg (1 mm Hg = 1.36 cm H2O) and measured at end-expiration in the complete supine position. Ensure abdominal muscle contractions are absent and the transducer zeroed at the level of the mid-axillary line.

3. The current reference standard IAP measurement method is the pressure measured via an indwelling urinary drainage catheter within the bladder.

4. The recommended standard technique for measuring IAP is as follows: 1) connect the culture aspiration port of the urinary tubing to a transducer; 2) clamp the tubing distal to the aspiration port; 3) instil a maximal volume of 50 ml of sterile room temperature saline into the bladder with the patient in the complete supine position; 4) zero the transducer at the mid-axillary line; 5) after a stabilisation period of at least 30-60 seconds, mean IAP is read either on the bedside monitor or as the height of the urine column in the drainage tubing.

5. Abdominal perfusion pressure (APP) assesses not only the severity of IAP, but also the adequacy of the patient's systemic perfusion. APP = mean arterial pressure (MAP) – IAP

6. Intra-abdominal hypertension (IAH) is the pathologic elevation of IAP. IAH is defined by a sustained or repeated IAP ≥ 12 mm Hg or an APP ≤ 60 mm Hg.

7. IAH may be graded as follows:
   - Grade I: IAP between 12-15 mm Hg
   - Grade II: IAP between 15-20 mm Hg
   - Grade III: IAP between 21-25 mm Hg
   - Grade IV: IAP greater than 25 mm Hg

8. According to the duration of symptoms, IAH may also be classified into two types:
   - Acute IAH that develops within hours as a result of trauma or intra-abdominal hemorrhage, OR IAH that develops over a period of days as a result of sepsis, capillary leak, or critical illness.
   - Chronic IAH that develops over months to years as a result of morbid obesity, intra-abdominal tumor, chronic ascites, or pregnancy, in which the abdominal wall adapts progressively to the increase in IAP allowing time for the patient to physiologically adapt to the elevated IAP.

9. Abdominal Compartment Syndrome (ACS) is present when organ dysfunction occurs as a result of IAH. ACS is defined by a sustained or repeated IAP ≥ 20 mm Hg and/or APP < 50 mm Hg in association with new-onset single or multiple organ system failure. In contrast to IAH, ACS is not graded, but rather considered as an "all or nothing" phenomenon.

10. ACS may be further classified into three types:
   - Primary ACS that develops due to conditions associated with injury or disease in the abdomino-pelvic region requiring emergent surgical or angiographic intervention (damage control laparotomy, bleeding pelvic fractures, massive retroperitoneal hematomas, failed non-operative management) or following elective abdominal surgery (secondary peritonitis, liver transplantation).
   - Secondary ACS that develops due to conditions outside the abdomen (sepsis, capillary leak, major burns, other conditions requiring massive fluid resuscitation).
   - Recurrent ACS that redevelops following initial successful surgical or medical treatment of either primary or secondary ACS following closure of a previous decompressive laparotomy.

For further details on these Consensus Definitions as well as educational materials and information on World Society of the Abdominal Compartment Syndrome membership, please go to [www.wsacs.org](http://www.wsacs.org).
CONSENSUS DEFINITION ADDENDUM

Examples of appropriate IAH and ACS classification

<table>
<thead>
<tr>
<th>Patient Scenario</th>
<th>IAH Class</th>
<th>IAH Grade</th>
<th>ACS Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blunt thoracoabdominal trauma with severe liver injury, hypotension, and high airway pressures. Initial IAP 40 mmHg</td>
<td>Acute</td>
<td>Grade IV</td>
<td>Primary</td>
</tr>
<tr>
<td>Penetrating cardiac injury with cardiorespiratory collapse requiring massive resuscitation. Cardiac injury is repaired, but IAP increases to 21 mmHg on hospital day three.</td>
<td>Acute</td>
<td>Grade III</td>
<td>Secondary</td>
</tr>
<tr>
<td>Septic shock due to intestinal perforation. IAP 25 mmHg</td>
<td>Acute</td>
<td>Grade IV</td>
<td>Primary</td>
</tr>
<tr>
<td>Severe burns to abdomen / chest. Patient develops an IAP &gt; 20 mmHg on day 7.</td>
<td>Acute</td>
<td>Grade III</td>
<td>Secondary</td>
</tr>
<tr>
<td>Chronic liver failure complicated by variceal bleeding and cardiorespiratory collapse. IAP 18 mmHg</td>
<td>Chronic</td>
<td>Grade II</td>
<td>Primary</td>
</tr>
<tr>
<td>Blunt abdominal trauma with severe liver injury. Damage control laparotomy performed with successful resuscitation of primary ACS. Abdominal closure is performed 2 weeks later. Oliguria develops on post-operative day 3 with IAP 28 mmHg and APP &lt; 50 mmHg</td>
<td>Acute</td>
<td>Grade IV</td>
<td>Recurrent</td>
</tr>
</tbody>
</table>

Data Analysis and Statistical Guidelines for Future Studies

- The prevalence and incidence of IAH/ACS should be based on the above listed definitions and classifications.
- Results should be given for mean, median and maximal IAP values on admission and during the study stay.
- IAP thresholds should be based on the analysis of receiver operating characteristics (ROC) and the area under the ROC curve.
- Studies examining new devices to measure IAP should always compare the new IAP measurement method with the currently accepted reference standard.
- Validation of new techniques should not be limited to the analysis of (significant) correlation coefficients, but should also include a Bland & Altman analysis.

Indications for IAP monitoring

- Postoperative abdominal surgery patients with a distended abdomen
- Patients with abdominal trauma
- Mechanically ventilated patients with other organ dysfunction as assessed by daily Sequential Organ Failure Assessment (SOFA) score
- Patients with a distended abdomen and signs or symptoms consistent with Abdominal Compartment Syndrome
  - Oliguria
  - Unexplained acidosis
  - Hypotension
  - Unfractionated heparin
  - Elevated intracranial pressure (ICP)
- Patients with abdominal packing after temporary abdominal closure for multiple trauma or liver transplantation
- Patients with an open abdomen, especially if they have an IV bag ("Bogota bag") closure (such patients may develop recurrent ACS despite their "open" abdomen)
- Patients who have not had an operation, but have received large volumes of fluid resuscitation in the context of an underlying capillary leak problem (pancreatitis, septic shock, trauma, etc.)

Etiologic factors for IAH

- Acidosis (pH below 7.2)
- Hypothermia (core temperature below 33°C)
- Polytransfusion (> 10 units of packed red cells / 24 hours)
- Coagulopathy (platelet count below 50000/mm³ OR an activated partial thromboplastin time (APTT) more than 2 times normal OR a prothrombin time (PTT) below 50% OR an international standardised ratio (INR) more than 1.5)
- Sepsis (as defined by the American - European Consensus Conference definitions)
- Bacteraemia
- Liver dysfunction with ascites
- Mechanical ventilation

- Use of positive end expiratory pressure (PEEP) or the presence of auto-PEEP
- Pneumonia
- Abdominal surgery, especially with tight abdominal closures
- Massive fluid resuscitation (> 5 liters of colloid or crystalloid / 24 hours)
- Gastroperitonitis / gastric distension / ileus
- Haemoperitonium
- Pneumoperitoneum