Intra-Abdominal Pressure Monitoring (IAP)

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Functional Sub-Group: Clinical Governance

Summary: Intra-Abdominal Pressure Monitoring is an essential measurement tool in the diagnosis, prevention and management of IAH and ACS. IAP monitoring has proven to be of significant importance in improving patient survival among patients in the Intensive Care Unit with IAH and/or ACS.

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Nursing Practice Committee

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Previous Review Dates: 2009

Note:
Sydney Local Health District (SLHD) was established on 1 July 2011 following amendments to the Health Services Act 1997 which included renaming the former Sydney Local Health Network (SLHN). The former SLHN was established 1 January 2011, with the dissolution of the former Sydney South West Area Health Service (SSWAHS).
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Compliance with this Procedural Guideline is highly recommended. This Guideline may contain mandatory components.
Intra-Abdominal Pressure Monitoring (IAP)

1. Introduction
The incidence of IAH may range from 1-50% Intensive Care patients, depending on the patient population studied. The incidence of IAH increases in the more critically ill patient and is associated with significantly increased morbidity and mortality. IAH and ACS develop in the presence of tense abdominal distension. Rise in IAP causes tissue hypoperfusion which can lead to multiple organ dysfunction syndrome and impair the function of nearly every organ system. ACS is potentially fatal, with a mortality rate of 40 - 100%

Intra-Abdominal Pressure Monitoring is an essential measurement tool in the diagnosis, prevention and management of IAH and ACS. IAP monitoring has proven to be of significant importance in improving patient survival among patients in the Intensive Care Unit with IAH and/or ACS.

Definitive diagnosis requires measurement of IAP utilising the transbladder technique, using an indwelling catheter (IDC) as the standard method for screening for IAH. This method is accurate, simple, minimally invasive, uses routinely available supplies and is cost effective. The wall of the bladder acts as a membrane to transduce accurate intra-abdominal pressure when the procedural guideline is followed correctly.

The risks addressed by this guideline:
- Inaccurate measurement of Intra-Abdominal Pressure by clinical staff.
- Late identification of risk factors of Intra-Abdominal Hypertension (IAH) and Abdominal Compartment Syndrome (ACS) predisposing patients to Multiple Organ Dysfunction Syndrome (MODS).

The aims / expected outcome of this Guideline
- Correct set-up and measurement of Intra-Abdominal Pressure (IAP) monitoring
- Identification of risk factors for IAH and ACS
- To educate staff on the clinical importance of IAP monitoring
- Early identification of IAH with the aim to prevent the progression to ACS and the potential impairment of organ systems

2. Procedural Guideline Statement
This guideline will provide nursing staff with the latest evidenced based research and practice guidelines for IAP monitoring including assessment and management algorithms suggested by the World Society of Abdominal Compartment Syndrome (WSACS. www.wsacs.org) aimed at normalising IAP.

3. Principles / Standards / Practices
3.1. Indications for IAP monitoring:
- Patients with signs of ACS: Oliguria, hypoxia, hypotension, acidosis, mesenteric ischaemia, ileus, elevated ICP
- Abdominal surgery (laparotomy closed under tension)
- Abdominal Aortic Aneurysm repair
- Trauma (abdominal trauma or pelvic fractures)
- Pancreatitis / peritonitis
- Retroperitoneal / abdominal wall bleed
- Major burns, particularly those involving the abdomen
• High BMI (with central obesity)
• Gross ascities / peritoneal dialysis
• Large abdominal tumor
• Ileus or bowel obstruction
• Mesenteric ischaemia or necrosis
• Large Blood transfusion > 10 units/24hrs

3.2. Intra-abdominal pressure

Intra-abdominal pressure is the steady state of pressure concealed within the abdominal cavity. Normal IAP for the critically ill patient is 5 - 7mmHg.

As a result of increased intra-abdominal pressure, patients may experience what is known as intra-abdominal hypertension (IAH). Intra-abdominal Hypertension is a sustained intra-abdominal pressure greater than or equal to 12 mmHg. IAH is further categorized into:

Hyperacute IAH = elevated IAP for only seconds (secondary to physical activity, coughing, laughing, sneezing, straining or defecation.

Acute IAH = elevated IAP that develops over hours and can lead to rapid development of ACS (secondary to trauma or intra-abdominal haemorrhage).

Subacute IAH = elevated IAP that develops over days and can also lead to ACS (most common in medical patients).

Chronic IAH = elevated IAP that develops over months or years. Does not cause ACS but patients are at a higher risk if they develop acute or subacute IAH.

Patients with a chronically elevated IAP as high as 10 - 15 mmHg, can exist without adverse sequeale, such as the pregnant patient or the obese patient.

Abdominal compartment syndrome (ACS) can develop in the presence of a sustained IAP >= 20 mmHg (with or without Abdominal perfusion pressure (APP) < 60 mmHg that is associated with a new organ dysfunction/failure.

APP = MAP – IAP

It is generally thought that patients with IAP <10 mmHg = generally do not have ACS.

Elevated IAP reduces blood flow to the abdominal viscera. Higher systemic blood pressure = may maintain abdominal organ perfusion when there is an increased IAP, as APP = MAP – IAP. A target APP of at least 60mmHg improves survival from IAH and ACS.

It is important to note that patients with elevate IAP of 10 - 25 mmHg may or may not have ACS depending on their clinical presentation, such as blood pressure and abdominal wall compliance. Increased abdominal wall compliance due to chronic increased girth may be protective against ACS (such as pregnancy, cirrhosis with ascites and morbid obesity). Decreased abdominal wall compliance results in increased IAP. Patients with measured IAP >25 mmHg usually develop ACS.
3.3. Grading of IAH and ACS by the World Society of Abdominal Compartment Syndrome

<table>
<thead>
<tr>
<th>Intra Abdominal Hypertension</th>
<th>Intra Abdominal Pressure</th>
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<tbody>
<tr>
<td>Grade I</td>
<td>12 - 15mmHg</td>
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<tr>
<td>Grade II</td>
<td>16-20mmHg</td>
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<tr>
<td>Grade III</td>
<td>21 - 25mmHg</td>
</tr>
<tr>
<td>Grade IV</td>
<td>&gt;25mmHg</td>
</tr>
<tr>
<td>Abdominal Compartment Syndrome</td>
<td>&gt;20mmHg sustained with new organ dysfunction or failure</td>
</tr>
<tr>
<td></td>
<td>With or without APP&lt;60mmHg</td>
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3.4. Physiologic consequences of IAP and ACS on the function of different organ systems:

Systemic effects of elevated intraabdominal pressure

<table>
<thead>
<tr>
<th>Central nervous system</th>
<th>Gastrointestinal</th>
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<tbody>
<tr>
<td>↑ Intracranial pressure</td>
<td>↓ Celiac blood flow</td>
</tr>
<tr>
<td>↓ Cerebral perfusion pressure</td>
<td>↓ SMA blood flow</td>
</tr>
<tr>
<td>Cardiac</td>
<td>↓ Mucosal blood flow</td>
</tr>
<tr>
<td>Hypovolemia</td>
<td>↓ pH</td>
</tr>
<tr>
<td>↓ Cardiac output</td>
<td>Renal</td>
</tr>
<tr>
<td>↓ Venous return</td>
<td>↓ Urinary output</td>
</tr>
<tr>
<td>↑ PCWP and CVP</td>
<td>↓ Renal blood flow</td>
</tr>
<tr>
<td>↑ SVR</td>
<td>↓ GFR</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>Hepatic</td>
</tr>
<tr>
<td>↑ Intrathoracic pressure</td>
<td>↓ Portal blood flow</td>
</tr>
<tr>
<td>↑ Peak inspiratory pressure</td>
<td>↓ Mitochondrial function</td>
</tr>
<tr>
<td>↑ Airway pressures</td>
<td>↓ Lactate clearance</td>
</tr>
<tr>
<td>↓ Compliance</td>
<td>Abdominal wall</td>
</tr>
<tr>
<td>↓ PaO₂</td>
<td>↓ Compliance</td>
</tr>
<tr>
<td>↑ PaCO₂</td>
<td>↓ Rectus sheath blood flow</td>
</tr>
<tr>
<td>↑ Shunt fraction</td>
<td></td>
</tr>
<tr>
<td>↑ Vd/Vt</td>
<td></td>
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</tbody>
</table>

http://www.uptodate.com/contents/abdominal-compartment-syndrome?source=search_result&search=intraabdominal&selectedTitle=2%7E150
3.5. Procedure: intra-abdominal Pressure Monitoring

3.5.1 Equipment required:

- IDC insitu
- Bedside monitor
- Pressure cable
- Transducer set
- Three way tap
- 500 ml 0.9% Sodium Chloride
- 30 or 50ml syringe with luer lock connector
- Alcoholic Chlorhexidine 0.5%
- Cannula cap
- Sterile dressing pack
- Sterile gloves
- Clamp

* *Pressure bag or an extension line for transducer tubing NOT required**

3.5.2 Set up:

1. Check medical order for IAP measurement
2. Explain the procedure to the patient
3. Connect the pressure cable to bedside monitor with appropriate scale (0 - 60 mmHg)
4. Perform complete hand wash and open up dressing pack and equipment on a sterile field
5. Pour Chlorhexidine into the dressing tray onto gauze
6. Place equipment onto sterile dressing pack
7. Place 500ml bag of normal saline on flat surface
8. Place the patient in a supine position
9. Ensure the bladder is empty

3.5.3 Procedure:

1. Adhere to universal precautions and aseptic technique
2. Perform surgical hand wash and don sterile gloves
3. Spike labelled 500 ml bag of normal saline (see below) with the transducer line and hang. Prime the whole line including the three way tap of transducer.
Figure 2 & 3: Fluid labelling

*Extension line and pressure bag NOT required*

4. Place sterile drape from dressing pack under the IDC injection port, clean the IDC injection port with chlorhexidine.

5. Attach the end of transducer access line to the IDC injection port (Luer lock connection)

Figure 4: Attach transducer line to IDC luer connector

6. Clamp the catheter tubing proximal to the injection port, between the port and catheter bag

Figure 5: Attach clamp to IDC

Figure 6: Attach syringe, open 3 way tap to fluid & fill
7. Ensure three way tap is off to the patient, then attach a 30 or 50 ml syringe with luer lock connector to the three way tap

8. Using the syringe, withdraw 25mls normal saline from the 500 ml NaCl bag, do this by aspirating the syringe whilst pressing the flush button- see figure 5

9. Turn the three way tap to 'open ' to the patient and slowly instill the 25ml into the bladder

10. With the patient in a supine position, connect the transducer to the pressure cable, ZERO the transducer at any point along the mid-axillary line. Mark the reference point along the axillary line on patient’s skin for subsequent measurements, this allows a consistent zero reference point

11. Wait for 30 - 60 seconds, this allows time for the patient’s detrusor muscles to relax. Obtain IAP measurement at the end of expiration.

12. Remove and discard the 30 ml or 50 ml syringe from transducer and place a white cannula cap to keep the circuit line sterile

13. Ensure three way tap is turned off to IDC, leave the circuit attached for subsequent measurements

14. Unclamp catheter and subtract 25ml from the urine output
15. Document measurement, patient position, amount of fluid, zeroing reference point in patients notes and measurement on flow chart Notify ICU team of abnormal findings. **Measurement Frequency** is in accordance with ICU team orders

16. Repeat steps 8 - 16 for subsequent measurements. **Ensure the three way tap port is “scrubbed” for 30 seconds, with alcoholic chlorhexidine swabs before and after use to ensure removal of micro-organisms and particulate matter.** Allow 15 seconds for the hub to dry before accessing.

17. Fluid to be changed every 24 hours, line changed at 96hrs.

**Additional care of the patient with IAH/ACS**

- IAP monitoring should be assessed along with frequent abdominal assessments
- Haemodynamic monitoring, respiratory monitoring and strict hourly fluid balance
- Electrolyte monitoring and replacement
- Educate patient and family

Attached are several guidelines for the assessment, and management of Intra-abdominal hypertension. Use of a particular pathway will depend on clinician preference.

3.6.1 Guide for Intra-abdominal hypertension assessment algorithm

**INTRA-ABDOMINAL HYPERTENSION (IAH) ASSESSMENT ALGORITHM**

- Patients should be screened for IAH/ACS risk factors upon ICU admission and with new or progressive organ failure.
- If two or more risk factors are present, a baseline IAP measurement should be obtained.
- If IAH is present, serial IAP measurements should be performed throughout the patient’s critical illness.

![IAH Assessment Algorithm Diagram](image)

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Website: http://www.wsacs.org

Compliance with this Procedural Guideline is highly recommended. This Guideline may contain mandatory components
3.6.2 Guide for Intra-abdominal hypertension (IAH)/ Abdominal compartment syndrome (ACS) management algorithm

Management of IAH and ACS initially consists of supportive care and, when needed, abdominal decompression. Surgical decompression of the abdominal cavity is considered definitive management.

**Goals of Supportive Care in patients with IAH:**

- This includes: the reduction of intra-abdominal volume through evacuation of intraluminal contents; Evacuation of intra-abdominal space occupying lesions (ascites, haematoma) when possible; Promote measures to improve abdominal wall compliance; Nasogastric aspirates and drainage and Rectal drainage reduce IAP in patients with bowel distention.
- Patient positioning: patient’s should be placed in a supine position as elevation of the head of the bed >20° increases intra-abdominal pressure.
- Abdominal wall compliance can be improved with adequate pain control and sedation, and if required, chemical paralysis may be needed for optimal abdominal wall relaxation and ventilator support.

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**INTRA-ABDOMINAL HYPERTENSION (IAH) / ABDOMINAL COMPARTMENT SYNDROME (ACS) MANAGEMENT ALGORITHM**

- **Patient has IAH (IAP ≥ 12 mmHg)**
  - Monitor IAP with serial measurements for 4 hours while patient is critically ill.
  - IAP < 12mmHg consistently? NO YES
  - Patient has ACS

- **IAH has resolved**
  - Discontinue IAP measurements and monitor patient for clinical deterioration.
  - Medical treatment options to reduce IAP
    1. Improve abdominal wall compliance
    2. Administer analgesia
    3. Abdominal wall taping
    4. Avoid head of bed >30 degrees
    5. Elevate intra-abdominal contents
    6. Nasogastric decompression
    7. Rectal decompression
    8. Intravenous tanoesic agents
    9. Elevate IAP
    10. spontaneous ventilation
    11. Prevent supine positioning
    12. Avoid abdominal fluid resuscitation
    13. IAP > 20 mmHg with nasogastric aspiration

- **Patient has ACS**
  - Perform / review abdominal decompression with temporary abdominal closure as needed to reduce IAP.
  - Continue medical treatment options to reduce IAP
    - Measure IAP/AAP at least every 4 hours while patient is critically ill.
    - Perform balanced resuscitation of patient/predominantly cathartic and efferent using crystalloid / colloid / vasopressor medications
    - Avoid excessive fluid resuscitation

- **Can AAP be maintained ≥ 30 mmHg?**
  - NO YES
  - IAP < 12 mmHg consistently?

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World Society of the Abdominal Compartment Syndrome (WSACS)

[Additional text at the bottom of the page]
3.6.3 Guide IAH/ACS management algorithm

IAH / ACS MEDICAL MANAGEMENT ALGORITHM

- The choice (and success) of the medical management strategies listed below is strongly related to both the etiology of the patient’s IAH / ACS and the patient’s clinical situation. The appropriateness of each intervention should always be considered prior to implementing these interventions in any individual patient.
- The interventions should be applied in a stepwise fashion until the patient’s intra-abdominal pressure (IAP) decreases.
- If there is no response to a particular intervention, therapy should be escalated to the next step in the algorithm.

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3.7 Summary

Rising IAP or sustained IAP may lead to a poor prognosis, and the development of ACS. Monitoring the IAP and preventing IAH may prevent ACS. Diagnosis of ACS requires that intra-abdominal pressure be measured as symptoms, physical signs, and imaging findings are insufficient to diagnose ACS. CVP is increased by 3 - 6mmHg when IAP is increased by 10mmHg, and therefore correct interpretation of pressures is supported by IAP monitoring. Management initially consists of careful observation and supportive care such as ventilatory and cardiovascular support. Abdominal compartment decompression may be required.

4. Use of the guide
This Guideline is intended to be used by all Nurses in Concord Repatriation hospital.

5. Definitions

**Intra-abdominal pressure (IAP):** the pressure concealed within the abdominal cavity, pressure is measured mid-axillary line in the supine position at end-expiration. Maximal volume of 25mL of sterile saline instilled via the bladder. Normal IAP is approximately 5-7 mmHg in critically ill adults.

**Abdominal perfusion pressure (APP):** Mean arterial pressure (MAP) - IAP.

**Filtration Gradient (FG):** Glomerular filtration pressure (GFP) - proximal tubular pressure (PTP) = MAP - 2 * IAP.

Intra-abdominal hypertension IAH: A sustained or repeated pathologic elevation of IAP >= 12 mmHg. Grade I: IAP 12-15 mmHg, Grade II: IAP 16-20 mmHg, Grade III: IAP 21-25 mmHg, Grade IV: IAP > 25 mmHg

**Abdominal compartment syndrome (ACS):** Sustained IAP > 20 mmHg (with or without an APP < 60 mmHg) that is associated with new organ dysfunction / failure.

**Primary ACS:** Associated with injury or disease in the abdomino-pelvic region that frequently requires early surgical or interventional radiological intervention.

**Secondary ACS:** Conditions that do not originate from the abdomino-pelvic region.

6. References and links


Compliance with this Procedural Guideline is highly recommended. This Guideline may contain mandatory components.


7. Custodian

Intensive Care Clinical Nurse Consultant

**Author:** Melissa Woolford RN ICU

**Reviewed by:** Katina Skylas ICU CNC

8. Associated Procedures

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<tr>
<th>Title</th>
<th>Entity/ Department</th>
<th>Custodian / Author</th>
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