

INTRA-ABDOMINAL PRESSURE MONITORING IN PICU - CHW

PRACTICE GUIDELINE[®]

DOCUMENT SUMMARY/KEY POINTS

Note: This procedure is used in **PICU**.

There is a similar document used in Grace Centre for Newborn Care (GCNC). Bladder Pressure Monitoring as it is known in GCNC is used on neonates post-operatively for the repair of anterior abdominal wall defects. Please refer to:

<http://webapps.schn.health.nsw.gov.au/epolicy/policy/5932>

- Abdominal compartment syndrome can occur in children with a tense distended abdomen from any cause.
- Intra-Abdominal Pressure (IAP) monitoring should be performed if the diagnosis is considered.
- Notify the on-call Intensivist if the intravesical (intra-abdominal) pressure is >10 mmHg.

CHANGE SUMMARY

- Grading of IAP in Adults added.
- Procedure section updated to include troubleshooting IAP reading and medical management of increased IAP.

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
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Team Leader:	Quality and Data Manager	Area/Dept: PICU CHW

READ ACKNOWLEDGEMENT

- PICU clinical staff are to read and acknowledge they understand the contents of this guideline.

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1 Introduction

The World Society for the Abdominal Compartment Syndrome (WSACS) defines Intra-abdominal pressure (IAP) as a “steady state pressure concealed within the abdominal cavity”.¹

An increase in IAP can cause (but is not limited to) the following complications:

- Abdominal compartment syndrome (ACS).
ACS in children is defined as ‘a sustained elevation in IAP of greater than 10 mmHg associated with new or worsening organ dysfunction that can be attributed to elevated IAP.’²
- Impaired pulmonary function.
- Renal impairment.

In addition to these complications, pressure monitoring can also provide direction in treatment such as the need for de-compressive surgery.

The intravesical method has been validated and is considered as the gold standard for indirect IAP measurement however patients must have a urinary catheter inserted prior to monitoring⁽³⁾. The intravesical method involves instillation of a predetermined volume of sterile saline into the bladder via a urethral catheter and measuring the transducer IAP.³

2 Responsibilities

- Medical staff must request the commencement of IAP monitoring.
- Nursing staff are to set up and perform IAP monitoring and document measurements in the patient’s Medical Record in the appropriate place (e.g. vital signs page of CCIS flowsheet).
- All measurements are expressed in mmHg.²

3 Indications

IAP monitoring is indicated in the presence of:

- Acute abdominal distension
- Decrease in pulmonary compliance (e.g. elevated peak inspiratory pressures)
- Oliguria
- Hypotension and decreased cardiac output
- Increased Central Venous Pressures (CVP)¹

4 Risk Factors for Abdominal Compartment Syndrome (ACS)^{1,4}

1. Related to diminished abdominal wall compliance

- Mechanical ventilation, especially patient dysynchrony with the ventilator and the use of accessory muscles
- Use of positive end expiratory pressure (PEEP) or the presence of auto-PEEP
- Basal pneumonia
- Pneumoperitoneum
- Abdominal (vascular) surgery, especially tight abdominal closure
- Abdominal wall bleeding or rectus sheath haematomas
- Correction of large hernias, gastroschisis or omphalocele
- Burns with abdominal eschars
- Obesity

2. Related to increased intra-abdominal contents

- Gastroparesis
- Gastric distension
- Ileus
- Volvulus
- Colonic pseudo-obstruction
- Abdominal tumour
- Retroperitoneal/abdominal wall haematoma
- Enteral feeding
- Intra-abdominal or retroperitoneal tumour

3. Related to abdominal collections of fluid, air, or blood

- Liver dysfunction with ascites
- Abdominal ascites (e.g., pancreatitis, peritonitis, abscess)
- Haemoperitoneum
- Pneumoperitoneum
- Major trauma
- Peritoneal dialysis

4. Related to capillary leak and fluid resuscitation

- Acidosis (pH < 7.2)
- Hypothermia (core temp <33°C)
- Coagulopathy (platelet count <50,000/mm³ OR APPT below 50% OR an INR >1.5)
- Major trauma/ burns
- Severe sepsis or bacteraemia
- Septic shock/ massive fluid resuscitation
- Massive transfusion/fluid resuscitation
- Damage control laparotomy
Pancreatitis

Note: The combination of acidosis, hypothermia and coagulopathy has been described in literature as the deadly triad.⁵

5 Guidelines for Paediatric Intra-abdominal Pressure Values

- Normal in spontaneously breathing children is close to zero but in mechanically ventilated children it is 7 ± 3 mmHg.¹
- Note at 10 mmHg (Concerns of Intra-abdominal hypertension >10 mmHg)¹
- IAH defined as sustained or repeated pathological elevation in IAP >10 mmHg²
- IAP >10 mm Hg associated with new organ dysfunction should be considered ACS
- Normal IAP in critically ill adults is: 5-7 mm Hg.^{1,4}
- Grading IAH:^{1,4}
 - Grade 1, IAP: 12-15 mmHg
 - Grade 2, IAP: 16-20 mmHg
 - Grade 3, IAP: 21-25 mmHg
 - Grade 4, IAP: >25 mm Hg

6 Intra-abdominal Pressure Monitoring

Equipment

- Pressure transducer kit and holder (Note: pressure bag NOT required)
- Use 500 ml 0.9% Sodium Chloride for priming pressure tubing (Note: NO heparin is to be added)
- Functioning indwelling catheter (IDC)
- Adaptor for urinary catheter
- Sterile gloves, goggles
- 2% chlorhexidine in alcohol 70% cleaning solution.
- Basic dressing pack
- 20 ml syringe

7 Procedure

Initial steps

1. Explain procedure to patient/family.
2. Place patient in supine position if possible. If patient's position is other than supine when measured, record that position to continue trend.
3. Open sterile equipment onto dressing pack. Hang 0.9% Sodium Chloride bag.

4. 2 minute hand wash using 2% chlorhexidine gluconate and don sterile gloves.
5. Attach the transducer kit to the green portion of the urinary catheter adaptor (ensure you discard the white portion from the green adaptor).
6. Ask second nurse to hold and twist open 0.9% sodium chloride bag open, ready to be spiked.
7. Prime the transducer kit with 0.9% Sodium Chloride and attach a 20 ml syringe to the port of the transducer.
8. Swab the area between the end of the indwelling urinary catheter (IDC) and the drainage tubing with 2% chlorhexidine in alcohol 70%.

At this stage flush the catheter if required, to ensure IDC is patent.

9. Using gauze squares to hold the catheter and drainage tubing, disconnect and attach the transducer connection to IDC. Reconnect the ends (Figure 1).
10. Attach the green adaptor to urinary catheter bag.
11. Ensure the patients' bladder is empty, then turn the tap off to the drainage bag and proceed with the process of obtaining the IAP reading as described below.

Measuring intra-abdominal pressure

12. Before any measurements are collected, the bladder should be empty. Ensure patency of the IDC prior to attempting to gain a bladder pressure reading.
13. The 20 ml Luer lock syringe connected to the transducer allows for the instillation of sterile 0.9% Sodium Chloride into the bladder from the closed pressure line system prior to each bladder pressure reading being obtained (Figure 2). The designated volume of 0.9% Sodium Chloride is obtained by squeezing the transducer wings to allow the syringe to fill.
14. An aliquot of 1 ml/kg sterile 0.9% Sodium Chloride is instilled into the bladder, with a minimal instillation volume of 3 ml and a maximum instillation volume of 25 ml.²
15. For intra-abdominal pressure measurement, the stopcocks are turned so that the catheter is closed both to drainage and to the instilling syringe and open to the pressure transducer. A continuous column of fluid between the bladder and the transducer is thus achieved.
16. If the transducer requires re-zeroing due to this being an initial reading or patient position change, this is done with the patient lying flat and supine. The transducer is zeroed to the level of the midaxillary line.⁴
17. Measurements should be taken.²
 - i. 30-60 seconds after instillation to allow for bladder detrusor muscle relaxation.
 - ii. In the absence of active abdominal muscle contractions.
 - iii. Whilst the patient is in the supine position²
 - iv. With the transducer zeroed to the level of the midaxillary line⁴

After ensuring the 20 ml syringe is removed from transducer port to allow the transducer to be zeroed to atmospheric pressure

v. the transducer must be zeroed before each IAP measurement¹

18. The pressure should be displayed as a pressure trace on the patient's monitor.

IAP is recorded in mmHg².

1. An increased IAP reading should be rechecked to ensure there is no technical problems. Example: a blocked catheter.

19. **If any patient is found to have an IAP of greater than or equal to 10 mmHg, the consultant Intensivist should be immediately informed, and appropriate medical action initiated.**

20. IAP \geq 12 mm Hg consider the following management strategies after discussing with intensivist on service:

- i. **Improve abdominal wall compliance:-** Provide adequate sedation and/or analgesia, neuromuscular blockers.
- ii. **Evacuate intraluminal contents:-** Consider enteral decompression with nasogastric tube.
- iii. **Fluid administration:-** Avoid excessive fluid resuscitation, unless clinically indicated (Discuss with intensivist on service).
- iv. **Monitoring:-** Monitor hemodynamics, urine output, renal function, liver function, lactate and arterial blood gas.
- v. **Imaging:** Consider abdominal ultrasound to identify abdominal space occupying lesions/ ascites.
- vi. **Surgical consultation:** Persistent elevated IAP, with new organ dysfunction or failure, strongly consider surgical consultation.

21. Once the pressure reading is obtained, the volume of the 0.9% Sodium Chloride is released from the bladder into the urine bag by manipulating the three way tap (off to the transducer, open to the urinary drainage bag).

22. This process is repeated 4-6 hourly or at hourly intervals as clinically indicated.⁴

23. Remember for fluid balance; deduct volume instilled from the hourly output total.

CAUTION

There is increased risk of urinary tract infection due to insertion of IDC, breaking of IDC circuit integrity and injection of fluid into the bladder.

- Use strict aseptic technique when inserting IDC and intra-abdominal measuring equipment.⁶

Figure 1

Connection of monitoring kit to IDC – kit located in medication fluid room



Figure 2

Complete circuit



8 Useful Resource

- World Society of the Abdominal Compartment Syndrome website:
<http://www.wsacs.org/images/2013%20Guidelines%20slide%20set.pdf>

9 References

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