INTRA-ABDOMINAL PRESSURE MONITORING

PURPOSE

Intra-abdominal (IAP) pressure monitoring is performed on patients to monitor for intra-abdominal hypertension (IAH), to address abdominal compartment syndrome and to minimize related complications. Although IAP monitoring may assist in the diagnosis of Abdominal Compartment Syndrome (ACS), a numerical number alone does not determine a diagnosis of ACS.

Indications for IAP monitoring may include:
- Postoperative abdominal surgery
- Patients who have sustained open or blunt abdominal trauma
- Distended abdomen and clinical assessment consistent with abdominal compartment syndrome:
  - Oliguria
  - Hypoxia
  - Increased peak end expiratory pressures
  - Hypotension
  - Change in neurological examination results

Expected outcomes of intra-abdominal pressure monitoring include:
- Accurate IAP measurements are obtained,
- IAP trends are monitored and support clinical decision making,
- Intra-abdominal Hypertension (IAH) is identified and treatment is initiated, and
- Child is free from complications related to IAP monitoring (infection (UTI), inaccurate urine output measurement, hematuria)

Note: recommendations and parameters are based on adult populations; limited research is available regarding pediatric populations.

POLICY STATEMENTS

Patients requiring intra-abdominal pressure monitoring require continuous cardiorespiratory monitoring.

The frequency of IAP monitoring will depend on the stability of the patient. The recommendations are to monitor IAP every 4 hours. Patients in a rapidly fluctuating physiologic state (e.g. sepsis), every 1 – 2 hours may be more appropriate.

SITE APPLICABILITY

Intra-abdominal pressure monitoring is predominately done in the Pediatric Intensive Care Unit and may be considered in other critical care areas.

PRACTICE LEVEL/COMPETENCIES

Intra-abdominal pressure monitoring is considered an advanced critical care skill and is practiced after the practitioner has the required critical care education and has had his/her learning validated at the bedside with the appropriate clinical support person.

Practitioners performing intra-abdominal pressure monitoring will be competent in invasive monitoring skills.

DEFINITIONS

Intra-abdominal pressure (IAP) – the pressure within the abdominal cavity, measured at end expiration, expressed in millimeters of mercury (mmHg), with the child supine and the transducer zeroed at the midaxillary line.

Intra-abdominal Pressure parameters-
- Normal: 0–5 mmHg
- Minimal elevation: 6–11 mmHg (commonly found in critically ill patients)
- Mild to moderate intra abdominal hypertension: 11–15 mmHg
- Moderate to severe intra abdominal hypertension: 16–20 mmHg
Abdominal perfusion pressure (APP) – Abdominal perfusion pressure is determined by the arterial inflow pressure (Mean Arterial Pressure [MAP]) and the intra-abdominal pressure that resists blood delivery to the abdominal organs. \[ \text{APP} = \text{MAP} - \text{IAP} \]

Intra-abdominal Hypertension (IAH) – An IAP of 12 mmHg or more with use of three standardized measurements obtained 4–6 hours apart or an APP of 60 mmHg or less with use of two standardized measurements obtained 1–6 hours apart.

Common causes of IAH include:

- Blunt abdominal trauma with intra-abdominal bleeding
- Pelvic trauma
- Bowel obstruction
- Abdominal masses
- Peritonitis
- Abdominal surgery
- Liver transplant
- Interstitial edema as a result of a massive fluid resuscitation

Pathophysiological effects of IAH on body systems include:

- Decreased cardiac output related to decreased venous return
- Impaired respiratory function related to increased intrathoracic pressure that results in decreased lung compliance, increased airway pressures, and decreased tidal volumes
- Renal dysfunction related to decreased cardiac output, resulting in decreased renal plasma flow and decreased glomerular filtration rate
- Increased intracranial pressure (ICP) from increased ventral venous pressures (increased ICP have been noted with IAP greater than 25 mmHg)
- Venous stasis in legs

Abdominal Compartment Syndrome (ACS) – cardiopulmonary or renal dysfunction that occurs as a result of an acute increase in IAP.

- ACS is defined as abdominal distention with an IAP above 15 mmHg with or without APP of less than 50 mmHg with use of two standardized measurements obtained 1–6 hours apart and single or multiple organ system failure not previously present. ACS diagnosis does not absolutely have to have an IAP measurement for diagnosis; diagnosis can also be made using clinical and/or ultrasound suspicion.
  - **Primary ACS** – condition associated with injury or disease or the abdomino-pelvic region or a condition that develops after abdominal surgery.
  - **Secondary ACS** – conditions that do not originate from the abdomen (e.g. sepsis or capillary leak, burns) that result in signs and symptoms seen with primary ACS

### EQUIPMENT

- Foley catheter (if patient not already catheterized)
- AbViser Autovalve® intra-abdominal pressure monitoring device
- 0.9% saline solution
- 2% chlorhexidine in 70% alcohol solution swabs

### PROCEDURE

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Rationale</th>
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<tbody>
<tr>
<td>1.</td>
<td><strong>DETERMINE</strong> that you have the relevant competencies and <strong>CHECK</strong> chart for prescription.</td>
<td>Ensures identification mechanism is present to ensure treatments, medications, and procedures are appropriate.</td>
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<tr>
<td>2.</td>
<td><strong>IDENTIFY</strong> patient and <strong>EXPLAIN</strong> process of IAP monitoring. <strong>ENSURE</strong> patient and family understand</td>
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- **Procedure and questions are answered.**
  - Provided to the correct patient. Reduces child and family’s anxiety. Evaluates and reinforces understanding of previously taught information.

<table>
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<tr>
<th>Step</th>
<th>Action</th>
<th>Reason</th>
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<td>3.</td>
<td><strong>ENSURE</strong> appropriate cardiorespiratory monitoring.</td>
<td>Ensures appropriate monitoring. Establishing alarm settings and limits is essential to patient safety.</td>
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<tr>
<td>4.</td>
<td><strong>PERFORM</strong> hand hygiene.</td>
<td>Standard/routine precautions; reduces transmission of micro organism.</td>
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<tr>
<td>5.</td>
<td>Using aseptic technique, open AbViser Autovalve® kit and <strong>ENSURE</strong> connections are secure. <strong>SPIKE</strong> 0.9% saline solution. Using the syringe, <strong>PRIME</strong> the entire system ensuring the tubing, transducer and stopcocks are fluid filled and free of air.</td>
<td>Fluid filled system is required to transmit pressure reading and waveform to monitor display. Extra tubing included in kit is not non compliant tubing and may interfere in obtaining accurate results.</td>
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<td>6.</td>
<td><strong>CONNECT</strong> the transducer system to the bedside monitor and ensure system is functioning. <strong>LABEL</strong> waveform and <strong>SELECT</strong> an appropriate scale.</td>
<td>Allows display of IAP reading and waveform.</td>
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<td>7.</td>
<td>If necessary, <strong>INSERT</strong> indwelling urinary catheter.</td>
<td>Bladder catheter is used to obtain indirect IAP measurement.</td>
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<td>8.</td>
<td><strong>PLACE</strong> sterile drape under patient’s foley/drainage bag connection. <strong>CLAMP</strong> foley catheter to prevent leakage. <strong>CLEAN</strong> foley/drainage bag connection with 2% chlorhexidine in 70% alcohol solution swab, <strong>SCRUB</strong> X 30 seconds and let dry X 1 minute. <strong>DISCONNECT</strong> foley catheter from drain bag and <strong>ATTACH</strong> foley catheter and drain bag to AbViser Valve connection (see below diagram). <strong>SECURE</strong> connection with blue tape (or water proof tape) provided in kit to prevent inadvertent disconnection.</td>
<td>Adds IAP monitoring capacity to foley catheter system. Standard/routine precautions; reduces transmission of micro organism.</td>
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9. **MOUNT** transducer to pole or to patient at the level of the iliac crest in the mid axillary line. *Levels transducer to the bladder.*

10. **ZERO** transducer by turning stopcock ‘off’ to patient and (using aseptic technique) removing infusion tubing for flushes exposing system to atmospheric pressure. **PRESS** ‘zero’ button on monitor and **VERIFY** a zero pressure reading on monitor display. *Establishes atmospheric pressure as zero reference point.*

**TO MEASURE INTERMITTENT INTRA-ABDOMINAL PRESSURE:**

11. **PLACE** patient flat in supine position. **NOTE**: If patient cannot tolerate being flat, document the degree of elevation of the head of bed and obtain all IAP measurements at the same level of elevation. The pressure will be higher than if patient in flat, supine position. *Avoids downward pressure on bladder that results in an inaccurate reading.*
12. **RETRACT** the infusion syringe in the AbViser system until the desired volume of 0.9% normal saline is in the syringe (see #2 in diagram below).

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<th><strong>Instill volume</strong></th>
<th><strong>Studies suggest that the instill volume that results in the most accurate IAP measurement is 1mL/kg to a maximum of 20mL. The additional 2mL fills the green diaphragm in the system.</strong></th>
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<tr>
<td>= 1mL/kg + 2mL (not to exceed 20ml)</td>
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13. Briskly (within 10 seconds) **INFUSE** the instill volume of 0.9% normal saline into the bladder via AbViser AutoValve® system.

14. Allow the system to equilibrate and **OBTAIN** the IAP measurement at the end expiration as a mean pressure reading. The IAP reading will last approximately 2 minutes, then the valve will open and allow urine and the instill volume of normal saline to drain.

**NOTE:** measurement should be obtained when patient is relaxed without abdominal contractions.
15. **SUBTRACT** the volume of saline solution instilled in the bladder from next hour’s urine output measurement to determine actual urine output.

Saline solution is allowed to passively drain into urine collection system: known volume of saline instilled must be subtracted from total volume of output to reflect accurate urine output measurement.

**DOCUMENTATION**

Following IAP measurement, **DOCUMENT**:

- IAP measurement
- Degree of elevation of head (if not flat)
- Urine output
- Patient’s tolerance of procedure
- Unexpected outcomes and related treatment

**REFERENCES**


