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Intra-abdominal Hypertension and Abdominal Compartment Syndrome : A review

KEYWORDS: Intra-abdominal pressure, Intra-abdominal hypertension,Abdominalcompartmentsynme, Abdominal perfusion pressure

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ABSTRACT *Patients in the intensive care unit (ICU) are at risk of developing of intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS). Aim: This review seeks to define IAH and ACS, identify the aetiology and presentation of IAH and ACS, identify IAP measurement techniques, identify current management and discuss the implications of IAH and ACS for nursing practice. A search of the electronic databases was done. Data derived from the retrieved material are discussed under the following themes: (1) etiology of intra-abdominal hypertension; (2) strategies for measuring intra-abdominal pressure (3) the manifestation of abdominal compartment syndrome;and (4) the importance of nursing assessment, observation and interventions. Intra-abdominal pressure (IAP) and abdominal compartment syndrome (ACS) have the potential to alter organ perfusion and compromise organ function.*

Background

The importance of the diagnosis and management of intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) is increasingly recognised. These conditions can alter organ perfusion and as a consequence end organ function. Complications resulting from IAH and ACS can be life threatening to critically ill patients [1,2]. Intra abdominal hypertension and ACS have been recognised since the 1800 s [1,2] however, it has only been the past 15 years that the physiological complications of IAH and ACS and the impact these can have on patients has been appreciated. Furthermore, there is limited data published specific to the nursing role in IAH and ACS.

The increase in awareness of IAH and ACS is due to improvements in diagnostic practices and changing\ treatment paradigms in patients sustaining traumatic injury and those with critical illness [2,3]. Despite the increase in awareness and guideline recommendations, there remains some resistance to adopting regular screening and monitoring practices [4,5]. Spencer et al. [6], in an Australian survey of 582 critical care nurses that the majority (356 or 62.1%) described their knowledgeof ACS to be non-existent or limited. The incidence of IAH in critical care patients is reported to be 50%, of these 50%, 32.1% develop IAH and 4.2% develop ACS within their first day of ICU [7,8]. The pathology is a frequent occurrence in critical care it is essential for nurses to regularly monitor IAP and organ perfusion to predict adverse consequences and be proactive in the management of patients at risk [2,6]

Diagnosis of intra abdominal hypertension

Intra-abdominal pressure is defined as the pressure created within the abdominal cavity the normal IAP for critically ill adults is 5–7 mmHg [10,11]. Intra-abdominal hypertension is a sustained or repeated IAP > than 12 mmHg [11].

There are various grades of IAH, Grade 1 IAP 12– 15 mmHg, Grade 2 IAP 16–20 mmHg, Grade 3 IAP 21– 25 mmHg and grade 4 an IAP > 25 mmHg [10-12]. The IAP measurement is completed twice over a period of 1 – 6 hours [13]. If IAP measurements are >12 mmHg but >20 mmHg the WSACS suggest IAP measurements.

Etiology of intra abdominal hypertension

There are multiple physiological factors that have the potential to alter an individual's intra-abdominal pressures (IAP). These factors can be categorised as those that are related to;

1. A decr**ease in abdominal wall compliance.**
2. **An increase in intraluminal contents.**
3. **Capillary** leakage or fluid resuscitation

Whilst there are no risk prediction models that will assist in identifying IAH or ACS, elevated peak ventilation pressures, decreased urine output, hypothermia, coagulopathy and acidosis have been described in several studies as the key indicators of an increased mortality [14-17]. These same studies suggest early recognition and management of hypothermia coagulopathy and acidosis could result in an overall reduction in in mortality [14-17].

Causes-

- Pregnancy
- Mechanical ventilation
- Basal pneumonia
- Pneumoperitoneum
- Abdominal surgery
- Pneumatic anti shock garments
- Prone positioning
- Abdominal wall hematoma
- Burns with abdominal eschars
- Gastro paresis
- Gastric distension
- Ileus
- Volvulus
- Bowel pseudo obstruction
- Abdominal hematoma
- Liver dysfunction with ascites
- Abdominal infection (peritonitis, pancreatitis)
- Hemoperitoneum
- Pneumoperitoneum
- Major trauma
- Massive fluid resuscitation (>5 L colloid or > L crystalloid in 24 hours in the presence of capillary leak and a positive fluid balance)

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Intra-abdominal pressure measurement
Measurement of IAP is simple, inexpensive, safe and accurate method in determining the presence of IAH. This measurement can guide patient management [2,10,18,19].

The WSACS has recommended the use of a standardised protocol despite this recommendation across centers there is minimal standardisation of the methods of assessment [7]. Techniques are influenced by measurement accuracy and reproducibility, budget constraints for equipment and staff training and ease of use of the chosen method of measurement [7].

Historically physical observation and measurement of abdominal girth were used to determine the presence of IAH. This method of measurement is inaccurate due to a high risk of variability and low inter-rater reliability [19,20]. A range of approaches to measure IAP include intra gastric, intra rectal, inferior vena cava and via a urinary indwelling catheter pressure monitoring systems [18,20].

The WSACS advocates the use of the modified Kron technique as the gold standard of IAP measurement [2,10,11]. The Kron method assesses the IAP via bladder pressure measurement using a maximum instillation of 25 ml of sterile saline [11].

The measurement is taken;
1. With the transducer zeroed and positioned in line with the iliac crest and mid-axillar.
2. With the patient in a supine position.
3. At end-expiration.
4. With an instillation volume of no greater than 25 mL of saline (for bladder technique)
5. 30–60 seconds after instillation to allow for bladder detrusor muscle relaxation (for bladder technique) [1,10-12,16,20-22].

What is abdominal compartment syndrome
Abdominal compartment syndrome is defined as a sustained IAP greater than 20 mmHg with a new organ dysfunction or failure regardless of abdominal perfusion pressure (APP) [1,2,6,10,12,13,15]. For example, the development of renal failure, respiratory failure or an unexplained metabolic acidosis. The WSACS suggests using these absolute value as a guide when defining ACS recommending that if the patient exhibits signs of new organ dysfunction or failure that this is more clinically significant than an absolute value [10,11]. Abdominal compartment syndrome is further classified into three groups primary, secondary and recurrent ACS.

Manifestations of intra abdominal hypertension (IAH) and abdominal compartment syndrome (ACS)

Cerebral
- An Increase in IAP forces the diaphragm up decreasing intra-thoracic space, increasing the intra-thoracic pressure.
- Jugular venous pressure elevates.
- Venous return decreases.
- Intra cerebral pressure will increase.
- Cerebral blood flow decreases. Cardiac function
- An increase in IAP causes increased pressure on the inferior vena cava, intra abdominal circulation and perfusion.
- Venous return is impaired and peripheral oedema occurs.
- Increase in central venous pressure.
- Increased pulmonary artery wedge pressures as the myocardium is placed under an increasing workload.

Respiratory function
- An increased in IAP forces the diaphragm up decreasing intra-thoracic space and restricts respiration.
- Result in an increase in intra thoracic pressure particularly with mechanically ventilated patients.
- Left uncorrected will result in a decrease in lung compliance, functional residual capacity a VQ mismatch and hypoxia.

Renal function
- Defined as oliguria and anuria despite aggressive fluid resuscitation.
- Increase in abdominal pressure decreases renal blood flow coupled with a reduction in cardiac output.
- The rennin angiotensin system is activated further adding to intra- abdominal pressure and cardiac workload.

Gastrointestinal function
- Increased intra- abdominal pressure results in an increase in vascular resistance and decreased cardiac output.
- Results in a decrease in tissue perfusion.
- Ultimately tissue ischemia.

Peripheral perfusion
- Increased intra- abdominal pressure is said to increase femoral venous pressure increase peripheral vascular resistance and reduce femoral artery blood flow by up to 60%.

Implications for further research
The research surrounding the care of the patient with IAP and ACS is limited and hence, further research is required. This research will;

1. Improve the body of knowledge about IAH and ACS within nursing.
2. Provide nurses with the knowledge to identify patients at risk.
3. Improve patient outcomes.

Intra-abdominal hypertension and ACS are potential life threatening conditions to critically ill patients. Critical care nurses have the ability to identify IAH and ACS, implement and evaluate management interventions. Nurses should provide a standard of care in managing patients who are at risk of IAH and ACS from pre-hospital, emergency, operating theatre and intensive care areas Further research is required on the minimum volume of fluid needed to measure IAP via the intra bladder technique, the assessment of the reliability of a single IAP measurement, and a comparison of intra bladder and intra gastric IAP to establish the validity of an alternative route in measuring IAP.

Conclusion
The pathological characteristics of IAH and ACS have the potential to cause multi organ failure and subsequently increase patient mortality. Monitoring IAP and APP for signs of ACS has become an inexpensive and useful diagnostics tool for identifying complications. An integrated approach to screening and monitoring for IAH may improve patient outcomes and decrease hospital costs. Due to the high incidence of IAH and ACS, it is essential for critical care nurses to regularly monitor IAP and APP. Critical care nurses require advanced clinical practice, skills, knowledge and awareness of the pathological signs, symptoms and com-

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plications of IAH and ACS.

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