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Abdominal Compartment Syndrome in the Medical Patient

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Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) have been well-described in trauma, surgical, and burn patients, but occur with similar frequency in medical patients. The mortality of IAH/ACS in critically ill medical patients is significantly greater than that of surgical patients. This may be a result of pre-existing comorbid conditions that limit the medical patient's ability to successfully respond to critical illness. Early recognition of IAH/ACS and application of multi-modality therapy to correct organ dysfunction and failure significantly improves survival in such patients.

Introduction

Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) have been increasingly recognised in the surgical literature over the past two decades. The managemento this spectrum of disease has changed significantly as well. The majority of the scientific literature published on IAH/ACS deals with trauma, surgical and burn patient populations (Offner et al. 2001; Cheatham and Safcsak 2010; Raeburn et al. 2001). IAH/ACS is not specific to these patient populations, however, and this article will briefly review the published data regarding IAH/ACS in the medical patient.

Definitions

Normal intra-abdominal pressure (IAP) is slightly negative or near 0 mmHg. Normal physiologic elevation of IAP can occur in hospitalised patients with ranges of up to 5-7 mmHg. Pathologic elevation of IAP occurs in critically ill medical and surgical patients. The World Society of the Abdominal Compartment Syndrome (WSACS) recommends serial IAP monitoring for patients with risk factors for IAH/ACS (Cheatham et al. 2007). IAP is easily determined using intravesicular pressure measurements via an indwelling urinary catheter and a bedside pressure transducer. IAH is defined as an IAP ≥ 12 mmHg.

Impaired organ perfusion begins with IAP elevations of 12-15 mmHg. A precipitous decrease in splanchnic blood flow occurs with IAP's increasing above 20-30mmHg. ACS is defined as sustained elevation of IAP > 20 mmHg with new onset organ dysfunction or failure. Signs of ACS include metabolic acidosis, hypotension, oliguria, elevated peak airway pressures, refractory hypercarbia and hypoxemia, and elevated intracranial pressure. ACS is classified as primary, secondary, or recurrent. Primary ACS is associated with injury or disease within the abdomino-pelvic region and is typically seen in surgical patients. Secondary ACS involves processes outside of this region, such as capillary leak syndrome, multisystem organ failure, and sepsis, making it the most common form of ACS encountered in medical patients. Secondary ACS is more gradual and insidious in onset as compared to the more dramatic primary ACS. The development of secondary ACS in the medical patient population can be easily missed if recommended IAP screening does not occur. Recurrent ACS occurs when IAH-induced organ failure recurs in patients who have already been treated for ACS. Prompt recognition and treatment of IAH/ACS is imperative to reduce morbidity and mortality. Untreated ACS has a mortality of up to 100%.

Medical Causes of IAH/ACS

The disease processes that are associated with "medical" IAH/ACS do not inherently suggest to practitioners that IAH/ACS is also present; hence the need for serial IAP measurements. Common medical causes include pneumonia, bacteremia, sepsis, acute renal failure, pancreatitis, acidosis, coagulopathy, poly-transfusion, hypothermia, liver dysfunction/failure, acute respiratory failure, and aggressive mechanical ventilatory support, especially with high positive end-expiratory pressures. A high index of suspicion for elevated IAP and a low threshold for measuring IAP are essential in these patients.

Prevalence

An epidemiologic study by Malbrain et al. in 2005, enrolled 265 consecutive mixed intensive care unit (ICU) patients to evaluate the incidence of IAH/ACS. The reported mean IAP was 10 ± 5mmHg for all measured IAPs. Upon ICU admission, 32% of patients had an IAP ≥ 12 mmHg and 4.2% patients had ACS. The prevalence of ACS in patients with IAH was 12.9%. Seventy-three patients (27.5%) died. The demographics of nonsurvivors included significant differences in age (older patients fared worse), higher mean IAP, SAPS II, APACHE II, and SOFA score at admission. Development of IAH during the ICU stay was identified as an independent predictor of mortality. Medical admission to the ICU was associated with a higher risk of death (Odds Ratio 2.5 [95% confidence interval (CI) 1.2-5.6; p= 0.01]). The mortality rate for medical patients was 40.3%, emergency surgery patients 36.4%, trauma patients 8.7%, and elective surgery patients 6.7%. A recent study by Cheatham et al. confirmed that medical patients have a significantly higher mortality following IAH/ACS (67%) compared to surgical patients (trauma 28%, emergency surgery 44%, and burns 45%; p<0.0001) (Cheatham et al. 2011).

Cothren et al. reviewed cases of secondary ACS (SACS) over a seven-year period (Cothren et al. 2007). Fifty-four patients developed SACS, 41 of which were post-injury patients and 13 medical patients. There were no significant differences in demo- graphics between the two groups. The authors did find differences in transfusion requirements with the post-injury patients requiring more packed red blood cells (14.5 ± 2.0 units vs. 3.7 ± 1.8 units; p<0.05). Medical patients had a significantly increased time to abdominal decompression (21.0 ± 3.6 hours vs. 6.5 ± 1.9 hours; p<0.05). There was also a trend in increased use of vasoactive medications in medical patients (54% vs. 34% of patients; p=NS). The number of medical patients who had primary fascial closure was significantly less (54% vs. 83%; p<0.05). Multiple organ failure was significantly higher in medical patients (62% vs. 57%; p<0.05). There was a strong trend towards increased mortality in the medical group (54% vs. 34%; p=NS).

Medical and surgical patients with septic shock were studied by Reguiera et al. in 2008. The goal of the study was to serially collect IAP's and monitor for the development of IAH/ACS. There were 81 consecutive patients enrolled. The most common diagnoses included intra-abdominal infection (44.5%), pneumonia (27%), urinary tract infections (8.6%), soft tissue infections (8.6%), obstetric infections (4%), and oncologic infections (6%). The incidence of IAH was lower in medical patients than surgical patients (73% vs. 92%; p<0.009). Maximal IAPs were higher in non-survivors (survivors 17.2 ± 5.3, vs. non-survivors 19.9 ± 5.6 mmHg; p< 0.04). Septic shock patients required more frequent mechanical ventilation and higher doses of vasoactive medications. These patients also had significantly lower abdominal perfusion pressures (APP), higher arterial lactate levels, and higher creatinine levels when IAH was present.The incidence of IAH was 82% in this septic shock patient population. The mean reported incidence of IAH in a mixed ICU population approaches 60% (Malbrain et al. 2004). As mentioned previously, Reguiera found that medical patients with septic shock had a 73% incidence of IAH and a 21% incidence of ACS (Cothren et al. 2007). This is higher than the IAH incidence of 54.4% and ACS incidence of 2% reported in medical patients by Malbrain et al.

These differences can be explained due to the predisposing nature of septic shock. These patients present commonly with bacteremia, hypotension (leading to decreased APP), massive fluid resuscitation, acidosis, coagulopathy, intra-abdominal infections, need for aggressive mechanical ventilation, ileus, and interstitial oedema due to capillary leak syndrome. All of these entities can contribute to increased volume within the abdomen and decreased abdominal compliance thereby raising IAP.

Intensivist Awareness

Early recognition of IAH/ACS is extremely important to improving survival in the critically ill, especially patients with septic shock. A survey performed by Kimball et al. was sent to 4,538 Society of Critical Care Medicine (SCCM) members of which 35.7% (1,622) responded (Kimball et al. 2006). A ten-item questionnaire addressing ICU type, training, and management of IAH/ACS was used to determine national trends in knowledge of and treatment for ACS. Surgical intensivists managed the majority of ACS cases (47% managed 4-10 cases, and 16% managed >10 cases). 25% of medical and paediatric intensivists reported never having seen a case of ACS. Respondents agreed that intravesicular pressure measurements were needed to assess for IAH/ACS. Only 2% percent of surgical intensivists were unaware of the procedure for intravesicular pressure measurement as compared with 24% (p<0.001) of paediatric and 23% (p<0.001) of medical intensivists. 33% of paediatric intensivists and 19.6% of medical intensivists (p<0.001 for both groups) indicated they would never use abdominal decompression as a treatment for ACS compared with 3.6% of surgical intensivists. The authors concluded that a significant gap exists between the medical and surgical intensivist communities with regard to the awareness of and management methods for IAH/ACS.

Discussion

Critically ill medical and surgical patients clearly differ in the contributing factors that result in their illnesses. Patients in the trauma/surgical spectrum usually lack the significant comorbidities that are common in medical patients. The need for trauma/surgical ICU admission is typically because of acute injury or surgical disease in a patient that is often otherwise healthy.The organ systems of these patients are usually normal at baseline prior to the traumatic event. As a result, they usually possess significant physiologic reserve that allows them to respond to their critical injury / illness. Medical ICU patients differ in that their acute injury process (infection, myocardial infarction, sepsis, etc...) is commonly compounded by the presence of multiple comorbidities (cardiac, pulmonary, renal, endocrine, etc...). As their baseline health status is less optimal, they may not be able to respond to critical illness as well.This may explain the significant increases in IAH/ACS mortality witnessed in medical patients. The compounding effects of intestinal, renal, pulmonary, and cardiac dysfunction brought about by ACS in the medical patient may lead to a worse prognosis when compared to a young, healthy trauma or emergency surgery patient with previously normal physiologic reserve. Given the under-recognition, high prevalence, and significant morbidity and mortality of IAH/ACS in the medical patient population, additional education regarding the detrimental impact of IAH/ACS in medical ICU pa- tients is mandatory.

Conclusion

A multi-modality approach towards the treatment of IAH/ACS has been demonstrated to significantly improve patient survival following IAH/ACS in both medical and surgical patients (Cheatham and Safcsak 2010). Such an approach is certainly with-in the scope of practice of most intensivists. It is imperative, however, that medical patients developing IAH refractory to these less invasive measures receive timely evaluation by a surgeon familiar with IAH/ACS and management of the open abdomen. This practice should improve outcomes by enabling patients to receive early abdominal decompression, which leads to decreased rates of organ failure and mortality as well as earlier primary fascial closure. In this fashion, we can significantly improve upon the previously poor survival rates encountered in the medical ICU population who develops IAH/ACS.

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