Abdominal Compartment Syndrome as a Complication of Fluid Resuscitation

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KEYWORDS

- Fluid resuscitation • Damage control resuscitation • Crystalloid • Colloid
- Third spacing • Capillary leak • Intra-abdominal hypertension
- Abdominal compartment syndrome

KEY POINTS

- Fluid resuscitation is an important aspect of nurse care in maintaining a patient's hemodynamic stability.
- Excessive fluid resuscitation, particularly with crystalloids, increases the likelihood that multisystem complications occur.
- Third spacing and capillary leak can occur secondary to excessive fluid resuscitation.
- Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) are lethal complications of excessive fluid resuscitation.
- Damage control resuscitation (DCR) and establishing acceptable and measurable endpoints for fluid resuscitation are necessary to reduce overall mortality.

INTRODUCTION/BACKGROUND

ACS has gained increased attention and significance in the literature in recent years, prompting regular revision and updating of practice and nursing management guidelines. Augmented growth of focused research on ACS and related intra-abdominal pressure (IAP) prompted the WSACS - The Abdominal Compartment Society to develop consensus definitions in 2006, with clinical practice guidelines and

Disclosure Statement: Dr B.R. Harrell is a regular content reviewer and item writer for Elsevier. He is regularly reimbursed for this work.

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Nurs Clin N Am 52 (2017) 331–338
http://dx.doi.org/10.1016/j.cnur.2017.01.010 **nursing.theclinics.com**

recommendations for critical research needs following in 2007 and 2009, respectively. Most recently in 2013, the WSACS updated the 2006 definitions and 2007 management recommendations to include pediatric populations and more directed care management, including appropriate fluid resuscitation interventions in critically ill patients. Although the WSACS guidelines integrated the multiple causes of IAH/ACS, this article provides a focused overview of the pathophysiology and clinical correlation between the development of ACS and fluid resuscitation. It is vitally important for nurse clinicians to understand and interpret clinical signs of IAH/ACS and perform advanced assessments, acute management, and judicious fluid resuscitation to optimize patient outcomes and reduce overall mortality associated with ACS.

IAP has been of interest to health care providers for more than 100 years.[1] Initial evidence emerged from animal studies examining the relationship of IAP on respiration, organ function, and urine output.[2,3] These early findings were associated with postoperative complications of abdominal surgery, namely pneumoperitoneum, causing increased pressures within the abdominal cavity.[4] ACS was largely overlooked until the 1980s when Kron and colleagues[5] used the termed ACS. Although clinical examination is inaccurate to detect IAP, the bedside nurse clinician may measure IAP via several different methods, with intravesical (urinary bladder) pressure considered the most efficient and cost effective.[6–13] Increased IAP typically measures between 5 mm Hg and 7 mm Hg in critically ill adults and from 0 mm Hg to 5 mm Hg in otherwise healthy adults.

ABDOMINAL PERFUSION PRESSURE

Abdominal perfusion pressure (APP), a measure of visceral organ perfusion, is a predictor of abdominal organ perfusion as well as a possible guide for resuscitation measures. The APP, which is a surrogate of the intra-abdominal perfusion driving pressure, is obtained by subtracting the IAP from the mean arterial pressure (MAP) using the formula, APP = MAP − IAP. Cheatham and colleagues[14] concluded that APP was statistically superior to both MAP and intravesicular pressure in predicting survival from IAH/ACS, reporting that an APP of 60 mm Hg in patients with ACS was 98% sensitive in predicting survival in a population largely composed of trauma patients. The study also concluded that APP is a more accurate predictor of resuscitation than arterial lactate, MAP, arterial pH, base deficit, or IAP. Although WSACS does not currently recommend using APP to guide resuscitation of critically ill patients with IAH, interpretation from these findings suggest an ideal APP is a value greater than 60 mm Hg. IAH occurs when the IAP ranges between 12 mm Hg and 25 mm Hg. ACS is defined as a sustained IAP greater than 20 mm Hg that is associated with new organ dysfunction or failure.[15]

INTRA-ABDOMINAL HYPERTENSION AND ABDOMINAL COMPARTMENT SYNDROME PATHOPHYSIOLOGY

Causes

Interpreting the pathophysiology of IAH and ACS requires an understanding that the abdominal cavity is a closed compartment, similar to that of the cranium or muscle fascia. The peritoneal compartment is rigidly contained by the costal arch, spine, and pelvis and more flexibly by the abdominal wall and the diaphragm.[15] Considering the containment of a closed compartment, it is understandable that the abdominal cavity is particularly vulnerable to external compression and internal displacement (both solid anatomic and fluid based) leading to pressure shifts. IAH can result from any internal or external cause for elevation of pressure within the abdominal compartment. IAP is affected by extrinsic variables, including blunt abdominal trauma, pressure occurring outside the abdominal wall with abdominal burn eschar, third-space