Abdominal compartment syndrome in a three year old child following a severe burn injury

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ABSTRACT

Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) are recognized complications of burn resuscitation in adults. The incidence, management and outcome of ACS in the pediatric population are less clear. The patient is a 3-year-old male who suffered an 80% total body surface area (TBSA) burn and inhalation injury. He underwent three burn excisions and graftings in addition to standard critical care over the first week. On hospital day 13, he underwent a major burn excision and grafting of approximately 36% TBSA. Postoperatively, he developed hypotension, tachycardia, worsening anemia, and coagulopathy. A bladder pressure was found to be 37 mm Hg. He urgently underwent a decompressive laparotomy in the Pediatric Intensive Care Unit (PICU). Following decompression, his ventilatory status improved, and urine output returned to a normal rate. His abdomen was closed after six days. He went on to make a full recovery with no identifiable sequellae of ACS. Early recognition of abdominal compartment syndrome is crucial in all intensive care settings. Severely burned patients are at particular risk for the development of ACS due largely to the fluid requirement. Recognition of IAH and ACS should prompt changes in fluid management when possible. Decompressive laparotomy can be a live saving measure for patients with refractory ACS.

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Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) are recognized complications of burn resuscitation in the adult population. Little is reported, however, of the incidence, management and outcome of ACS in the pediatric population. Here we present a case of survival of an 80% TBSA second and third-degree burn in a three year old male whose ICU course was complicated by secondary abdominal compartment syndrome.

1. Case report

The patient is a 3-year-old male who was sleeping in his home when a house fire broke out. He was found by his mother and thrown from a second story window into the arms of a family member. He was rushed to our facility, an academic Level I trauma center. His initial assessment revealed an 80% total body surface area (TBSA) burn, nearly all of which was full-thickness. A portion of his abdomen, his genitals and buttock were spared. He had severe burns to his face and evidence of inhalation injury. He was intubated, volume resuscitation with crystalloid was initiated, and he was taken to the Pediatric Intensive Care Unit (PICU) (Fig. 1).

Over the first ten days of his admission, he underwent three separate burn excisions and graftings as well as tissue harvest for the purpose of future cultured tissue grafting. On hospital day 13, he underwent yet another major burn excision and grafting of approximately 36% TBSA. Postoperatively while in the PICU, he developed hypotension and tachycardia. Laboratory data showed a worsening anemia and coagulopathy. He had also developed a worsening leukocytosis without obvious burn wound sepsis. Over the course of the evening despite resuscitation with blood products, he became more acidic. His peak ventilatory pressures increased and his urine output decreased. Given these signs, a bladder pressure was measured and found to be 37 cm H₂O. He went into pulseless electrical activity arrest as his abdomen was being prep-ped. He urgently underwent a decompressive laparotomy in the PICU. He regained a pulse shortly after his abdomen was opened. Copious simple ascites and bowel edema were noted, but there was no evidence of perforation or bowel pathology. A temporary closure device was utilized for his abdomen.

Following decompression, his ventilatory status immediately improved. His urine output returned to a normal rate. His acidosis, anemia and coagulopathy were corrected within 24 h. His abdomen was closed on six days. Though he suffered much of the recognized
complications of severe burns including pneumonia, need for temporary tracheostomy, sepsis, and malnutrition, he went on to make a full recovery with know identifiable sequellae of ACS (Fig. 2).

2. Discussion

Abdominal compartment syndrome is defined as intrabdominal hypertension (bladder pressure greater than 10 mm Hg in children based on World Society of Abdominal Compartment Syndrome recommendation wsacs.org) and evidence of end organ dysfunction, most notably decreased urine output and elevated peak inspiratory pressures. Other manifestations of ACS include hypotension, decreased tidal volumes, splanchnic and hepatic hypoperfusion, and elevated intracranial pressures [1].

ACS in burned children was first reported by Greenhalgh and Warden in 1994 [2]. It has since been established that increased burn size and severity increase the risk of development of IAH and ACS. Burn patients are most likely to develop ACS within the first 24–48 h following presentation [3]. Our case was atypical in that he developed ACS further into his hospitalization. His ACS was, however, precipitated by a second resuscitation following a large burn debridement with blood loss.

Identification and management of ACS are two great challenges of modern pediatric ICU care. The incidence of ACS in children is not known at this time, due largely to a lack of consensus definition of IAH and ACS among practitioners and a general paucity of literature beyond case reports and case series. Single institution reports of ACS estimate the rate to be up to 10% in critically ill children [4] and as high as 20% in severely burned adults. The presence of ACS is associated with increased length of stay, length of ICU stay, morbidity and mortality [3]. ACS related mortality in children is reported to be 60% [4]; adults with severe burns who develop ACS have an expected mortality upward of 88% [5].

The disease states reported to cause ACS in children are widely variable. In neonates, necrotizing enterocolitis and congenital abdominal wall defect repairs are the most commonly reported entities. Burn injury, as in our patient, trauma, Hirschsprung disease, Wilms tumor, large-for-size solid organ transplantation, and malrotation are other common surgical conditions that can result in ACS in older children. In a series of 26 critically ill children from the University of Utah, infectious enterocolitis, along with large volume resuscitation, was the most common etiology of ACS resulting in decompressive laparotomy [6].
Routine monitoring of intra-abdominal pressure in severely burned adults and children is advocated [3,5]. Early identification of IAH prior to the development of ACS allows the astute clinician to intervene before severe end-organ dysfunction develops. Treatment of ACS in burn patients includes both non-invasive and invasive measure. Limitation of crystalloid administration when possible is the primary objective. There is much debate in the literature regarding the optimal fluid resuscitation approach to burn patients. Some studies have advocated the use of colloid, particularly fresh frozen plasma, as the resuscitative fluid of choice [7]. Neuromuscular paralysis should also be utilized in patients with ACS to augment abdominal wall compliance [8].

Burn patients with circumferential trunk burns should undergo escharotomy if signs of IAH present [5]. Some clinicians have utilized percutaneous peritoneal drainage, for example with a peritoneal dialysis catheter, for as long as four days as a temporizing measure. This method has been reported to be particularly successful in children, likely due to their smaller size [8]. Modern literature, however, supports the decompressive laparotomy as the intervention of choice when ACS is refractory to medical management, as peritoneal drains are unlikely to adequately drain the entire abdomen in larger children and adults [5]. Improvement of peak inspiratory pressures, urine output, and other measures of end organ improvement are often noted promptly following decompression. There is not yet data to support a unified method of management of open abdomen following decompression. We chose to utilize a simple bowel bag with OR towels and Blake drains covered by ioban as this is typical in our institution.

3. Conclusion

Early recognition of abdominal compartment syndrome is crucial in all ICU settings. Severely burned patients are at particular risk for the development of ACS due to the fluid resuscitation requirement as the changes in abdominal wall compliance that some burn injuries can produce. Early and frequent checks of the intra-abdominal pressure are indicated in burned children and adults. Recognition of IAH and ACS should prompt changes in fluid management when possible. Decompressive laparotomy can be a live saving measure for patients with refractory ACS.

Consent

Written informed consent was obtained from the patient’s next of kin for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-chief of the journal on request.

Conflict of interest

The authors have no conflicts of interest to report.

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References