Open abdomen procedure in managing abdominal compartment syndrome in a child with severe fungal peritonitis and sepsis after gastric perforation

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Abstract

Abdominal compartment syndrome with increased abdominal pressure resulted in multi-organ dysfunctions can be lethal in children. The open abdomen procedure intentionally leaves the abdominal cavity open in patients with severe abdominal sepsis and abdominal compartment syndrome by temporarily relieving the abdominal pressure. We reported our experience of open abdomen procedure in successfully treating a 4-year old boy with abdominal compartment syndrome caused by severe fungal peritonitis and sepsis after gastric perforation.

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Abdominal compartment syndrome (ACS) is defined as multi-organ dysfunction including hemodynamic, pulmonary and renal compromise resulting from increase of intra-abdominal pressure (IAP). Common causes of ACS included severe abdominal trauma, acute pancreatitis and severe abdominal sepsis. Abdominal compartment syndrome in children can be lethal and develop rapidly lead to cardiovascular and respiratory failure [1-5].

The open abdomen procedure intentionally leaves the fascial edges apart and the abdominal cavity open. The intra-abdominal contents are temporarily protected by the artificial coverages. This technique can be useful in some patients with severe abdominal sepsis by temporarily relieving the abdominal pressure and drainage of toxic peritoneal fluid until definitive surgery [1,4].

In this article, we present the application of open abdomen procedure in successfully treating a 4-year old boy with abdominal compartment syndrome caused by severe fungal peritonitis and sepsis after gastric perforation.

1. Case

A 4-year old boy was admitted to our hospital with one-day history of abdominal pain. On admission his heart rate was 160–180/min and blood pressure was 62/45 mm Hg. Physical examination revealed signs of acute peritonitis. CT scan showed accumulation of free gas and fluid in the peritoneal cavity. After emergent fluid resuscitation he was sent to the operating room for laparotomy. The peritoneal cavity had been heavily polluted by gastrointestinal contents. A 5-mm perforated site was identified on the posterior wall of the stomach near the lesser curvature about 3 cm away from the gastro-esophageal junction. The remaining GI tract was intact. Perforated gastric wall were repaired with double-layer sutures (full-layer and seromuscular-layer). Thorough abdominal cavity cleaning was performed and drainages were placed in the omental bursa and pelvic cavity. A bladder stoma was made because of difficulty of urethral catheterization. He was extubated one day after surgery. Imipenem and vancomycin were used. Pathological exam of the circumferentially excised gastric wall showed no evidence of tumor or congenital gastric wall defects. Microbiological cultures and his blood culture on the day of surgery both resulted in Candida Albicans. Miconafungin was used according to the sensitive test. The boy had stable vital signs, normal abdominal signs and was afebrile until the 4th post-operative day. Five days after the initial surgical procedure, fever and abdominal distension quickly developed. His pulse increased to 170–190/min and oxygen saturation dropped to 70–75% thus was intubated again. We measured his intra-abdominal pressure through the intra-vesicular tube. His abdominal pressure ranged between 28 and 37 mm Hg. With the increasing intra-abdominal pressure and worsening cardiovascular...
parameters. Large amount of intra-peritoneal fluid decreased with improved circulatory parameters and ventilation drainage from the 2nd to 3rd surgery.

Intra-abdominal pressure (IAP), heart rate, blood pressure, urine output and 24-h fluid drainage were measured by gauze dressings and drain tubes on the 2nd surgery and peritoneal fluid cultures of 140 patients with gastrointestinal perforation revealed that 48.6% of them had Candida positive cultures. 70.5% of patients with abdominal distension, prompt measurement of IAP should be important for early recognition of ACS and to apply early surgical interventions.

The present case was a typical example of tertiary peritonitis which was defined as a severe recurrent or persistent intra-abdominal infection >48 h after apparently successful and adequate surgical source control of secondary peritonitis [1]. Increased nosocomial infectious rates were noticed in tertiary post-surgical day as intra-abdominal pressure began to increase. His IAP elevated from 28 to 37 mm Hg within just 8 h. Emergent decompressive laparotomy should be performed as soon as possible when the diagnosis of acute compartment syndrome had been made. A recent case series of 27 pediatric patients receiving decompressive laparotomy emphasized this clinical importance [2]. We did the emergent surgery within 8 h after intensive monitoring of his clinical manifestations and continuously measuring his abdominal pressure through the bladder catheter. Obvious clinical improvements occurred after decompression by temporarily covering the abdominal wall using the artificial bag. Improved general condition including circulation and oxygenation was accompanied by gradually decreased IAP. For patients with abdominal distension, prompt measurement of IAP by applying an arterial line to apply early surgical interventions.

2. Discussion

Increased intra-abdominal pressure can lead to abdominal compartment syndrome including cardiovascular and respiratory failures. To evaluate and manage abdominal hypertension, IAP was classified into four categories: Grade I IAP 12–15 mm Hg, Grade II 16–20 mm Hg, Grade III 21–25 mm Hg and Grade IV > 25 mm Hg [01,02,04]. In the present case, this boy had obvious clinical deteriorations as his intra-abdominal pressures increased. His circulatory and respiratory conditions worsened rapidly in the 5th post-surgical day as intra-abdominal pressure began to increase. His IAP elevated from 28 to 37 mm Hg within just 8 h. Emergent decompressive laparotomy should be performed as soon as possible when the diagnosis of acute compartment syndrome had been made. A recent case series of 27 pediatric patients receiving decompressive laparotomy emphasized this clinical importance [2]. We did the emergent surgery within 8 h after intensive monitoring of his clinical manifestations and continuously measuring his abdominal pressure through the bladder catheter. Obvious clinical improvements occurred after decompression by temporarily covering the abdominal wall using the artificial bag. Improved general condition including circulation and oxygenation was accompanied by gradually decreased IAP. For patients with abdominal distension, prompt measurement of IAP by applying an arterial line to apply early surgical interventions.

The present case was a typical example of tertiary peritonitis which was defined as a severe recurrent or persistent intra-abdominal infection >48 h after apparently successful and adequate surgical source control of secondary peritonitis [1]. Increased nosocomial infectious rates were noticed in tertiary peritonitis including Candida infection. A study of abdominal fluid cultures of 140 patients with gastrointestinal perforation revealed that 48.6% of them had Candida positive cultures. 70.5% of patients with gastroduodenal perforations had Candida positive cultures [6]. Timely anti-fungal therapy should be given. Severe fungal peritonitis and fungal sepsis causing acute
compartment syndrome developed in this boy. Lessons should be learned from this case that early initiation of anti-fungal treatment would be of vital importance and might prevent following clinical declines. Posterior gastric wall perforation was relatively rare thus complete gastrointestinal tract exploration should be carefully performed.

We applied the easy and inexpensive ‘Bogota bag’ method [1]. The advantages of using 3 L saline bag were that it was cheap and easily available while minimize fluid and heat loss. We used the interrupted sutures to allow the peritoneal fluid leak out of the abdominal cavity. This resulted in great effects of draining the infected peritoneal fluid thus reducing abdominal pressure. We concluded that the decompression and drainage provided by this bag were most important. Other methods including vacuum assisted closure (VAC) had also been applied, which were more expensive and required special equipment [1]. We also recommended that one-layer interrupted suture with tension sutures to be used to close the abdominal cavity. This method allowed drainage through the inter-suture space after closure.

References