

Treatment of Abdominal Compartment Syndrome with Subcutaneous Anterior Abdominal Fasciotomy in Severe Acute Pancreatitis

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Abstract

Background: Managing the abdominal compartment syndrome associated with severe acute pancreatitis by the open abdomen method is associated with considerable morbidity and resource utilization.

Methods: A technique of subcutaneous anterior abdominal fasciotomy is described for the first time in two patients with severe acute pancreatitis.

Results: Following the procedure, the intra-abdominal pressure decreased from 30 mmHg immediately to 23 mmHg and to a sustained level of 12–14 mmHg in the first patient, and from 35 mmHg immediately to 23 mmHg and to a sustained level of 14–19 mmHg in the second patient.

Conclusions: The subcutaneous anterior abdominal fasciotomy is a promising method for safe and effective abdominal decompression with sustained effect and avoiding the morbidity associated with the alternative open abdomen techniques.

In patients with severe acute pancreatitis, the extensive inflammatory process in the retroperitoneum and visceral edema caused by the massive fluid resuscitation required to maintain adequate tissue perfusion increase the risk of the development of abdominal compartment syndrome (ACS).^{1,2} Open decompressive laparotomy is the established treatment for severe abdominal compartment syndrome, but the ensuing open abdomen is associated with severe morbidity and subsequent extensive abdominal wall reconstruction, unless primary fascial closure is achieved.³

A feasibility study using a porcine model of ACS demonstrated that subcutaneous endoscopic abdominal fas-

ciotomy appears to lower intra-abdominal pressure (IAP) and increase mesenteric blood flow.⁴ In addition to the benefits of avoiding the open abdomen, leaving the skin mostly intact and avoiding entering the peritoneal cavity could potentially benefit patients with ACS and severe acute pancreatitis provided that the decompressive effect is sufficient and sustained.

This report describes for the first time the technique of anterior abdominal fasciotomy and its effect on IAP in two patients with severe acute pancreatitis.

PATIENTS AND METHODS

The first patient is a 35-year-old man (body mass index, BMI, 34 kg/m²) with alcohol-induced, computed tomog-

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raphy (CT)–confirmed severe acute pancreatitis presenting with a 3-day history of abdominal pain and vomiting, dehydration, lactate acidosis, and oliguria. He was admitted directly to the intensive care unit (ICU) with rapidly progressing multiple organ dysfunction syndrome (MODS) requiring mechanical ventilation and increased dose of vasopressor (norepinephrine 1.7 $\mu\text{g}/\text{kg}/\text{min}$) to maintain arterial blood pressure over 65 mmHg. Urine output stopped, even though a total of 17 l of crystalloids and colloids were administered during the initial 24 hours. The IAP (measured via Foley catheter, with 50 ml sterile saline instilled in the urinary bladder) varied from 15 to 20 mmHg. In spite of maximal intensive care including continuous veno-venous hemodiafiltration, the organ dysfunctions progressed and the IAP rose gradually to 30 mmHg. Thirty-five hours after hospital admission the patient was brought to the operating room to undergo decompressive laparotomy for ACS.

The second patient is a 47-year-old man (BMI 36 kg/m^2) with a one-day history of abdominal pain after excessive and prolonged alcohol abuse. The diagnosis of severe acute pancreatitis was based on clinical, laboratory, and CT evaluations. Although initially there were no apparent organ dysfunctions, the urine output started to decrease in spite of adequate fluid resuscitation within the next 12 hours, and progressive respiratory failure required intubation. The IAP was initially 18–24 mmHg, but it rose gradually to 35 mmHg, and the patient required surgical decompression 49 hours after hospital admission.

SURGICAL TECHNIQUE

Under general anesthesia and complete muscle relaxation, the IAP was measured on the table in each patient, confirming the preoperative values of 30 and 35 mmHg, respectively. With three transverse 2–2.5-cm-long skin incisions placed 10–11 cm, 23–25 cm (cranial to the umbilicus), and 30–35 cm caudal from the xiphoid (caudal to the umbilicus) (Fig. 1), the subcutaneous tissue was incised and the anterior abdominal fascia divided vertically in the midline. The incision was carried out with scalpel and scissors under visual control. In the first patient the fasciotomy was completed under laparoscopic control using a transparent 12 trocar with 30-degree optics. The suction tip and the laparoscopic scissors were inserted outside the trocar, and the fascial incision passed the umbilicus from the left side (Fig. 2). On visual inspection, the peritoneum remained intact in both cases, but there was minor oozing of ascites to the operating field that did not seem to have any significant part in



Figure 1. Locations of the three short transverse skin incisions.

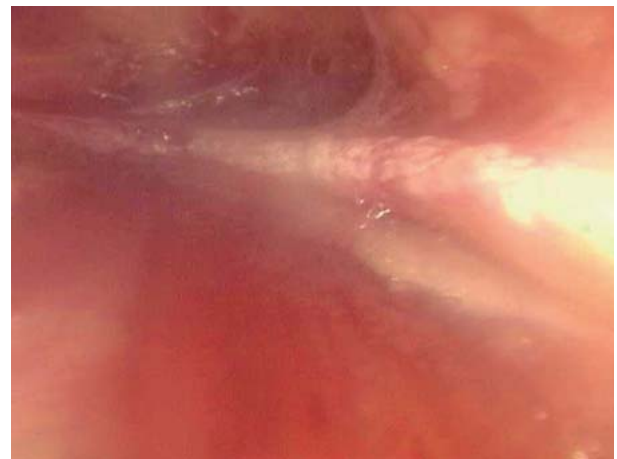


Figure 2. Laparoscopic view showing the white incised fascial margin.

decreasing the intra-abdominal pressure. The fasciotomy extended from about 1 cm caudal to the xiphoid to about 1 cm cranial to the symphysis pubis. The width of the fascial diastasis measured at the incision levels was 8–10 cm in both patients. A vacuum drain was placed in the subcutaneous space through a separate incision in the first patient and the skin wounds were closed with nylon sutures. The operation times were 59 and 30 minutes, respectively.

RESULTS

In the first patient, the IAP measured on the operating table immediately after the fasciotomy under complete muscle relaxation had decreased from 30 mmHg to 23 mmHg. Within 6 hours the patient's condition had



Figure 3. Computed tomography scan demonstrating the sustained diastasis of the anterior abdominal fascia at the midline.

improved significantly; the dose of norepinephrine could be lowered, and the acidosis was corrected with rapidly decreasing serum lactate values. Intra-abdominal pressure continued to decrease, reaching 14 mmHg 8 hours after the operation, and urine output increased to 40–60 ml/h.

During the next week, this patient's IAP remained at 12–14 mmHg. Although he was still on the ventilator, he required no vasopressors. The SOFA (sequential organ function assessment) score (at postoperative day 10) was 9, daily urine output was 3500 ml (intermittent hemodialysis was terminated), and there were no signs of infection in the peripancreatic fat necrosis specimen obtained with the ultrasound-guided aspiration technique. A CT scan 7 days postoperatively demonstrated the sustained diastasis of the anterior fascia (Fig. 3).

In the second patient, the IAP decreased immediately after the fasciotomy from 35 mmHg to 23 mmHg, and the peak airway pressure decreased markedly. During the next 10 days, the urine output increased from 0 to 3120 ml/day, the SOFA score decreased from 16 to 6, and the IAP remained at 14–19 mmHg. The bacterial specimen from the peripancreatic fat necrosis one week postoperatively was negative.

DISCUSSION

Infected peripancreatic necrosis is the main indication for pancreatic necrosectomy, ideally postponed beyond the third week into the disease, and it is associated with 6%–12% mortality in larger series.^{5,6} Promising results

have been obtained with minimal-access pancreatic necrosectomy, which seems to be well tolerated and beneficial for the patient when compared with open surgery.⁶

At present, it is estimated that about 10% of the patients with severe acute pancreatitis develop ACS.² The method of abdominal decompression described above seems to be safe and effective, and it provides a sustained decompressive effect, but avoids the excessive morbidity and costs associated with open abdomen. Open surgery in such cases requires complex closure techniques, whether carried out gradually with a vacuum-assisted device or according to a complex delayed reconstructive surgery protocol involving all layers of the abdominal wall. Obviously, the hernia created by the fasciotomy requires delayed repair.

In addition, the subcutaneous anterior abdominal fasciotomy can potentially avoid the risk of peritoneal contamination associated with open decompressive laparotomy and persistent open abdomen that could increase the risk of infection of the peripancreatic necrotic tissues. Furthermore, this procedure does not preclude subsequent open necrosectomy, although its combination with the minimal-access pancreatic necrosectomy could be ideal.

Anterior abdominal fasciotomy is a promising technique for abdominal decompression in patients with severe acute pancreatitis, but its further use requires well-designed studies comparing it with the traditional open technique.

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