TNP-assisted fascial closure in a patient with acute abdomen and abdominal compartment syndrome

Topical negative pressure was applied to prevent abdominal compartment syndrome in a patient following surgery for an acute abdomen. It delayed fascial closure, protected the underlying bowel and enabled easy abdominal re-entry

abdominal compartment syndrome; open abdomen; fascial closure

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Management of the open abdomen has become a challenge for surgeons performing damage-control surgery (defined as a series of operations performed to accomplish definitive repair of abdominal injuries in accordance with the patient's physiological tolerance). Trauma surgeons focus more on the patient's physiological reserve than the anatomy of the lesions. The damage control approach is associated with the complexity of injury, the high rate of patient mortality and complications such as intra-abdominal hypertension or abdominal compartment syndrome (ACS). This syndrome is defined as increased pressure within the abdominal cavity, and is reported to occur in as many as 14% of patients who undergo laparotomy and who have serious intestinal or hollow organ injury.[1] The acute expansion of the intra-abdominal contents affects the cardiovascular, renal and pulmonary systems.[2] A pressure greater than 30mmHg is associated with oliguria due to a decreased renal blood flow and with a 30–40% decrease in cardiac output.[3] An intra-abdominal pressure of 25mmHg can also increase intracranial pressure by increasing central venous pressure.[3]

Abdominal closure is performed post-surgery when oedema has resolved sufficiently to allow closure without tension. When this is not immediately possible, temporary closure is necessary, which can be achived using a Bogota bag,[4] zipper,[5] Vacuum Assisted Closure (VAC),[6] absorbable or non-absorbable mesh,[7] polytetrafluoroethylene patches,[7] and sandwich (Vaspac) techniques.[8]

Topical negative pressure (TNP) devices have been used to aid healing of many wound types. They are believed to hasten wound healing by maintaining a moist environment, removing wound exudate, increasing local blood flow, increasing formation of granulation tissue, applying mechanical pressure to promote wound closure, and reducing the bacterial loads in the wound.[9] Vacuum Assisted Closure (KCI) maintains a sterile environment with an easily quantifiable and controlled egress of fluid.[10] Many authors have reported closure rates of 88–100% and closure times of 4–21 days in patients who underwent VAC or modifications of it.[11,12]

We report the use of VAC in an overweight woman who underwent open management of the abdomen to prevent abdominal compartment syndrome.

Case report

An overweight 67-year-old woman (body mass index: 41) had emergency surgery, because of an acute abdomen, on the 10th postoperative day following total hysterectomy and adnexectomy for cancer of the endometrium.

The physical findings of patients with acute abdomen depend on the aetiology and duration. Hypotension and tachycardia are common, the patient may appear anxious and dehydrated with rapid respiration, and fever is noted. The abdomen is distended with hypoactive or absent bowel sounds, while tenderness to percussion and palpation is present. The most common causes of acute abdomen are inflammation, obstruction, perforation and ischaemia.

During the exploratory laparotomy, a perforated sigmoid colon was found. A Hartmann's colostomy was performed and, due to the abdominal compartment syndrome, the visceral and retroperitoneal oedema and the extensive oedema of the colon, the abdominal wall was left temporally open using a Bogota bag. The patient admitted to the surgical intensive care unit (ICU) for further resuscitation.

On the 5th postoperative day, the visceral and retroperitoneal oedema was reduced and the patient returned to the operating room for fascial closure. However, this was physically impossible due to adherence of the bowel to the abdominal wall and

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Fig 1. The initially open abdomen with the excessive ventral hernia and the deficiency of skin

Fig 3. The abdomen after the VAC stabilization

Fig 2. The sponge is stabilized

Figure 4. The completely closed abdomen

the 40 x 35cm skin defect with the bowel underneath (Fig 1). We therefore decided to use VAC to achieve secondary closure of the fascia (Figs 2 and 3). The VAC dressing was changed every 48 hours at the bedside using a sterile technique. As the wound was pulled together and oedema resolved, the number of sponges used reduced.

Fascial closure occurred 21 days after the initial placement of VAC (Fig 4). The patient made an uneventful recovery and underwent reconstruction of the colostomy and the ventral hernia three months later.

Discussion

In patients with an open abdomen for abdominal compartment, survival can be a challenge due to acidosis, hypothermia and coagulopathy, rather than the lack of definitive surgical repair.[13,14] Furthermore, visceral or retroperitoneal oedema makes safe fascial closure impossible, while abdominal compartment syndrome in the face of shock and resuscitation or intra-abdominal injury produces significant cardiopulmonary and renal dysfunction.[11]

Topical negative pressure (TNP) was firstl described by Argenta and Morykwas[15] and by Brock et al.[16] It has proven a safe and effective method of temporary abdominal closure, allowing the control and measurement of abdominal fluid drainage. Miller et al.[11] reported that closure rate was 88%, with closure time up to 21 days. Garner et al.[17] suggested that it can safely achieve early fascial closure in more than 90% of trauma patients with open abdomens and reduce the need for future hernia repair.

Our patient was candidate for temporary abdominal closure. Managing her open abdomen was an important part of our strategy after the 'damage control' laparotomy and abdominal compartment syndrome associated with fascial reapproximation. No complications such as bleeding or infection were noted, and in the intensive care unit she remained haemodynamically stable and the need for vasopressor drugs to control blood pressure reduced. Before the application of TNP therapy, she had required approximately 8–9 litre/day of fluids, plus a small dose of noradrenaline to achieve a mean arterial pressure of 80mmHg. After application, these requirements were severely reduced. This can

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be attributed to the reduction of fluid loss from the open abdomen via the action of the therapy.

Delayed closure of the fascia occurred at 21 days after the initial placement of TNP. The patient often underwent bladder pressure monitoring. This allowed for the early identification and treatment of high intra-abdominal pressure which elevated above 15mmHg. Furthermore, it allowed us to re-approximate the abdominal fascia by tightening the VAC in a controlled fascia.

In our patient, the use of TNP prevented fascial retraction and visceral adherence. This technique allowed us to achieve delayed closure of the abdominal fascia, avoiding the complications of abdominal compartment syndrome: large granulating open abdominal wounds, intra-abdominal abscess and enterocutaneous fistula. Furthermore, the use of VAC allowed for sequential closure when possible, protected the underlying bowel, allowed for easy abdominal re-entry, and for control and measurement of abdominal fluid drainage. The only complication was the ventral hernia, which was repaired with the reconstruction of the colostomy three months later.

Conclusion

Several methods for open abdomen management have been recently developed. The VAC technique was remarkably successful in our patient. When applied, it allows a delayed fascial closure reducing the complication of the open abdomen and abdominal compartment syndrome in critically ill patients.

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