

Vacuum-assisted closure of the open abdomen in a resource-limited setting

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Summary

Aim. We describe our experience of developing a modified vacuum-assisted closure (VAC) dressing for open abdomens.

Background. We see a high volume of trauma in our department. Massive delays in presentation of patients with acute abdomen are common. Closure at initial laparotomy is not possible in many cases, either because the patient has or will develop abdominal compartment syndrome, or because several re-look laparotomies will be required. A significant proportion of our patients who have undergone laparotomy therefore spend some of their stay in hospital with an open abdomen. The management of these patients is particularly labour intensive for nursing staff. The Opsite sandwich or Bogota bag invariably leaks, and sometimes needs changing daily. If a patient also has a temporary ileostomy, application can be difficult. The commercial VAC dressing is an improvement on the Opsite sandwich, but is prohibitively expensive. Financial constraints and the volume of abdominal trauma and sepsis we see mean that commercial VAC dressings for laparotomy are not affordable in our setting.

Methods/results. We describe our adapted VAC dressing. It is inexpensive and easy to apply, has made a big difference in the nursing of patients with an open abdomen, and has enabled us to increase the rate of delayed primary closure (i.e. we have reduced the rate of ventral hernia).

Conclusion. The modified VAC dressing is now our department's method of choice for temporary abdominal closure.

an open abdomen, owing to intra-abdominal hypertension, uncontrolled sepsis or planned re-laparotomy. Many methods of temporary abdominal containment are described in the literature.² To deal with the large numbers of laparotomies in our resource-limited setting we have designed our own vacuum-assisted closure (VAC) dressings, which solve the problems we experienced with other techniques.

We employ the 5-step approach to damage control¹ for patients with severe penetrating or blunt abdominal trauma, as well as for delayed presentations with an acute abdomen:

1. Patient selection:

- moribund trauma patients, who require immediate laparotomy to stop the bleeding
- packs left in abdomen
- unable to close abdomen
- patient who will require multiple relaparotomies

2. Damage control surgery

3. Restoration of physiology in the ICU

4. Definitive surgery

5. Abdominal closure.

The intended purpose of our VAC technique of abdominal closure (adapting an Opsite sandwich) includes:

- mechanical containment of abdominal contents
- active removal of wound and visceral exudates
- control of infection
- promotion of granulation tissue formation
- facilitation of delayed primary closure.

We aimed to find a cheap and easy-to-change method of temporary abdominal closure that would not leak or require frequent changes and that would facilitate delayed primary closure.

Methods

None of the techniques previously described in the literature is without disadvantages.³ The Opsite sandwich is the least uncomfortable method for the patient in that no sutures are required, and it is also the quickest, but a suction system must be applied to ensure that peritoneal fluid is removed from the surface of the dressing.

We recently adapted the tube suction method to negate disadvantages experienced with other techniques. We use the top of a Porto-Vac closed drainage container, sliced off and simply placed on the centre of the abdominal swab before the top Opsite is placed over the whole abdomen. In order

Temporary abdominal wound closure is the endpoint of a successful damage control laparotomy. Temporary closure aims to prevent abdominal compartment syndrome and should facilitate delayed primary closure.¹

Ngwelezane Hospital is a 550-bed regional hospital draining most of northern KwaZulu-Natal. Large numbers of stab and gunshot wounds and acute abdomens are seen in the surgical department, often with a significant delay in presentation. Many of our patients who have undergone laparotomies therefore spend part of their hospital stay with

to achieve an air- and water-tight seal around the drainage port of the Porto-Vac it is necessary to cut appropriate holes in the top Opsite so that the adhesive membrane sits flat and flush on the surface of the Porto-Vac. Suction tubing is then connected up to the drainage port in the usual way, and the vacuum is achieved (Fig. 1).

These dressings may still 'lift' and leak in the groin area, and a belt of Elastoplast can be strapped across the groin to prevent this. It should not be circumferential, but go from buttock to buttock. Dressing changes are only required every 72 hours.

We have found this adaptation of the original Johannesburg 'Opsite sandwich' to be very effective in keeping the patient dry from peritoneal fluid. The Bogota bag, which invariably leaks around its sutured edge, can be adapted in a similar way. Repeat dressing changes can be performed in the ICU if necessary, and this makes for good relations with nursing staff.

Discussion

The first reference to prosthetic temporary abdominal closure was made in 1940 by Ogilvie,⁴ who successfully used canvas sutured into the abdominal wall to deal with an open abdomen. Currently several options for mesh closure are available. Because of the local inflammatory process, all these prostheses are likely to cause formation of adhesions with the potential for development of a fistula. Nevertheless, they provide abdominal support and allow respiratory rehabilitation to proceed. In using a mesh the surgeon is, however, committed to dealing with a large ventral hernia at a later date rather than opting for delayed primary closure during initial admission. With our technique, we achieve primary closure in approximately 65% of our patients. Even so there are still cases in which definitive abdominal closure is not achieved, and skin grafting and then surgery for ventral hernia at a later date are required.

The Bogota bag and Opsite sandwich are readily available and simple methods of abdominal containment.⁵ However, without vacuum assistance these approaches deal poorly with the large volumes of fluid lost from the open abdomen. Both techniques are easily adapted to vacuum-assisted dressings.



Fig. 1. Modified Vac dressing – adaptation of an Opsite sandwich.

In most cases we use the Opsite sandwich as a base, but when there is significant evisceration of swollen bowel the Bogota bag acts as a higher-volume silo.

The modified sandwich vacuum pack technique recommended by Navsaria *et al.* utilised an opened 3-litre urological irrigation bag.⁶ They used two large-bore nasogastric tubes placed into the middle of the wound, one into each apex, between the opened plastic irrigation bag and the nylon sutures, and then exiting through plastic sheeting. We did not find this method to be satisfactory, as wrapping the plastic sheeting around the tubing invariably leaves a small remaining leak of air, thereby making a proper vacuum seal impossible and necessitating more frequent dressing changes.

The technique of vacuum-assisted dressing described by Barker *et al.* and Lee and Peitzman involved tunnelling suction drains through the skin to prevent vacuum loss.^{7,8} In our experience the two wounds where the drains exited often became infected and were not easy to re-use for further dressings.

Vacuum packs and vacuum-assisted closure devices have become standard techniques for temporary closure on the basis of relatively high rates of abdominal closure (49 - 52%) and low fistula rates (1.6 - 4.4%) compared with other techniques.⁹ The overall cost of commercially available VAC devices is high (more than 10 times that of our dressing). For those working in a resource-limited environment the cost is prohibitive. In our experience these VAC dressings, while producing much the same result as our technique, are also more time-consuming to apply.

Conclusion

Our modified vacuum-assisted dressing is highly effective in keeping a seal; it is also simple to apply and easy to change. This adaptation allows better drainage of fluids, increases the lifespan of the dressings, and therefore reduces exposure to infection. Compared with dressings we have used previously it keeps the patient much drier and therefore makes the nurse's job easier. It is our department's temporary abdominal closure of choice.

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