

Use of topical negative pressure in laparostomy

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Abstract

A man with a history of moderate to severe Crohn's disease since early childhood contracted leishmaniasis and then underwent further surgery for Crohn's disease. Postoperatively he developed severe peritonitis and required laparostomy, which was managed using topical negative pressure. The controversial nature of this form of management is discussed together with other issues for nurses' consideration when caring for a long-term patient.

Keywords: laparostomy, topical negative therapy, patient work.

Background

When only three years old, Mr L had been diagnosed with Crohn's disease and by the age of 35 years had undergone duodenal bypass, proctocolectomy and formation of an ileostomy, and had a shortened small bowel. Other operations were for further ileal resections and division of adhesions. Despite all this he was in full-time employment and in a steady relationship. While holidaying overseas, he was bitten by a sand fly and contracted visceral leishmaniasis, which caused diarrhoea, gastrointestinal bleeding, liver failure and a susceptibility to bacterial infections. Now aged 48, he was admitted for freeing of adhesions and further small bowel resection but postoperatively he developed a major anastomotic leak and diffuse peritonitis.

He required laparostomy, with return to theatre several times for abdominal lavage, drainage of enteric leaks, wound debridement and tracheostomy. He was in hospital for eight months, during which time he required total parenteral nutrition; replacement of central lines due to development of multiple upper limb deep vein thromboses; pneumonia; and abdominal wall haematoma. His laparostomy was treated with topical negative pressure (TNP) therapy and although the wound size reduced dramatically, he developed multiple enteric fistulae. Six months after admission, he underwent further laparotomy, division of adhesions, resection of the loop of bowel from which the fistulae had arisen and closure of the abdominal wall. Postoperatively he bled profusely due to coagulopathy and required 14 units of blood. He developed two further fistulae, which were managed with ostomy appliances.

This case presentation was discussed at a nurses' seminar and raised many questions.

What is laparostomy?

During the past 20 years, laparostomy (open abdomen) has developed as a lifesaving intervention in surgical emergencies where immediate abdominal closure is not possible or desirable, particularly in those with diffuse peritonitis, necrotising pancreatitis or trauma for closure would threaten abdominal compartment syndrome and wound dehiscence. Goals of management include containment of the abdominal viscera, removal of exudate, estimation of third space fluid loss, infection control and prevention of intestinal fistulae¹⁻⁴.

When these open abdominal wounds include an enteric fistula they are even more difficult to manage. The enteric contents can spill onto the abdominal viscera and surrounding skin,

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Figure 1. Laparostomy after seven days, before use of TNP.

leading to inflammation, infection and possibly sepsis. The skin around the wounds may become so damaged that dressings are painful and may fail to adhere, causing a vicious cycle or leakage, further skin damage and unmeasured fluid loss.

Management methods have evolved over time and have included one or more of the following:

- Layers of absorbent dressings changed frequently and weighed with some type of waterproof secondary dressing.
- 'Parcel dressings' whereby the absorbent dressings can be changed without taking off the outer waterproof covering each time.



Figure 2. Laparostomy after 12 days showing development of enteric fistula.

- Use of sump drainage to remove fluid.
- Application of fibrin glue into the fistula.
- Application of large ostomy appliances/fistula bags to contain the effluent and allow it to be measured accurately as well as protecting the peri-wound skin.
- Local surgical repair of fistulae.
- Use of octreotide to reduce fistula output.
- TNP (usually 125 mmHg continuously) used to treat the wound bed (Figure 3).
- TNP (usually 125 mmHg continuously) while the fistula is 'segregated' from the rest of the wound (Figure 4).



Figure 3. TNP system used to treat the whole wound bed.



Figure 4. TNP used to treat peri-fistular wound with fistula segregated.

Failure of management is common. However, cases of successful management using one or more of the above techniques have been described at stomal therapy conferences and in journals⁵⁻⁸. These case studies indicate that patients are often very ill, requiring resuscitation in an intensive care unit followed by long-term total parenteral nutrition. The length of wound healing can be very long, sometimes requiring hospitalisation for months. Another major, long-term problem is the development of a large abdominal hernia if the wound has been closed by mesh and skin graft but has a fascial defect.

Delayed abdominal wall reconstructions with fascial component separation and/or prosthetic mesh closure are difficult, painful operations with less than stellar outcomes (p. 431)⁹.

Unfortunately death is not uncommon in the published cases, though it must be remembered that these cases are often discussed and published because they are so 'difficult' or memorable. Some review papers cite studies where length of stay is considerably shorter, allowing closure of laparostomy far more quickly (9–49 days)^{3,4}.

What is the benefit of TNP therapy in laparostomy?

Use of TNP reduces the burden for carers because the wound is dressed less frequently and the volume of fluid lost is easier to assess, but evidence of its effectiveness from randomised trials is lacking. Stevens⁴ critically reviewed literature about TNP assisted closure of laparostomy wounds. He considers case series as offering a body of observational data that could be compared against future trials. However, he notes that in these case series the lack of a comparison group prevents objective evaluation of the effect of the variable of interest (TNP) so the authors' inferences about its effect are biased by pre-established expectations.

Stevens cites a classification system in which a laparostomy wound is classified as type III but once it contains a fistula it is classified as type IV. Those of us who have seen type III wounds shrink with the use of TNP will possibly not hesitate to use it, but once it contains a fistula we may be less sure, particularly those who remember that in the early days of its use, TNP was specifically contraindicated in wounds involving fistulae to organs or body cavities¹⁰.

In 2006 Mendez Eastman¹¹ promoted the use of TNP to "strangulate" acute enteric fistulae and to be used on the peri-wound area of "segregated" chronic fistulae. Stevens⁴ cites five papers reporting the use of TNP in type IV wounds. One of them is a paper¹² which describes five cases where TNP was not used to close the fistula, it was used on the



Figure 5. Development of multiple enteric fistulae in laparostomy treated with TNP.

"peri-fistular environment", that is, the open wound, and the fistula was isolated ('segregated') using ostomy appliances. This is also the system described in detail, together with clear photographs, by Farrugia⁷ and Joon and Gilmour⁵. Horwood³ reviewed 27 patients who underwent emergency laparostomy and application of immediate negative pressure therapy and declared it to be: "a robust and effective system to manage patients with intra-abdominal catastrophes"³ (p. 681).

However, these tales of "success" are countered by "a cautionary note" from Fischer¹³ who proposes that use of TNP in type IV wounds has been reported to be associated with subsequent fistula development¹⁴ which may, in turn, be associated with subsequent death. He admits that the TNP systems are only used in those cases where fluid drainage is difficult to manage and this may bias results because they are the more complex cases anyway. Thus he agrees with Stevens' point that we do not know whether the patients would have developed these fistulae anyway, because there have been no randomised controlled trials. Patients certainly developed fistulae in open abdomens long before the use of TNP.

How is TNP therapy applied to a laparostomy?

The technique is time-consuming, usually needing two pairs of hands, but is relatively straightforward. The skin around the wound is cleaned and some skin barrier applied to protect the wound edges from maceration. The wound bed is debrided and cleansed with saline. A second nurse (or the patient) uses a suction catheter to try to mop up any fluid coming from the fistulae during the procedure. The black foam is cut to the shape of the wound and placed over the

wound bed. This is then sealed onto the wound with an airtight, transparent drape. A small hole is cut into the drape and the connector placed over the hole. The other end of the connector is attached to the vacuum machine, which is turned initially to 125 mmHg suction. This leads to visible shrinking of the foam and suction of fluid into the canister.

Initially the foam covered the whole wound bed (Figure 3), but after a fistula developed it was segregated from the rest of the wound (Figure 4) and drainage collected using an ostomy bag. This is a technique well described by Joon and Gilmour⁵.

What are the benefits of using TNP compared with dressings or ostomy bags?

Although application of a TNP system is time-consuming, because it is done infrequently (48–72 hourly) there is overall saving of time for nurses. There is also less likelihood of soiling of bed linen and clothing and a greater ability to accurately estimate the fluid lost and this facilitates fluid replacement. Some patients like the feeling of the suction and the fact that the wound is totally covered; when suction is turned off they feel as though their abdomen is 'bloated', indeed after many months of therapy some are almost dependent on it.

TNP accelerates wound healing. This is important because these wounds are large and take a long time to heal (even when using TNP). It is important that the patient be able to exercise and avoid known complications of immobility such as development of deep vein thromboses, pneumonia and pressure sores.



Figure 6. The same enteric fistulae when the wound was almost closed.

Without the use of negative pressure, laparostomy wounds usually heal by secondary intention, using mesh and skin grafts and patients are then left with large fascial defects and huge hernias. The use of negative pressure makes it more likely that the wound will be able to be closed by primary intention, thus avoiding development of large hernias. These patients should wear a support belt and not lift heavy items for some months following final wound closure.

How does TNP promote wound healing?

The precise mechanism by which TNP works is still unclear; however, some believe that actively removing excess interstitial fluid improves local blood supply, bringing with it nutrients and oxygen that are needed for tissue repair³. The application of negative pressure collapses the foam between the wound edges and this force promotes tissue granulation at the wound/foam interface. Use of the negative pressure therapy is associated with decreased wound sepsis, possibly by lowering the bacterial load in the wound³. The system also allows for the containment of abdominal contents, while permitting drainage of purulent material and exudates.

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TNP does speed up wound healing and may facilitate wound closure; thus, in these patients, avoiding ventral hernia. This may ultimately reduce the length of stay in hospital.

What other issues are likely to arise during the care of people with laparostomy?

Output from the wound, ileostomy and fistulae is frequently excessive (three to six litres/day in Mr L's case), necessitating intravenous replacement and accurate fluid balance. Patients are frequently given nil orally and fed with total parenteral nutrition, which requires monitoring because this therapy is not without its risks and complications; for example, Mr L had several infections related to central lines and developed several deep venous thromboses in his upper limbs.

Being a patient can at any time be hard work. Christensen¹⁵ reminds us that in the multidisciplinary team, the patient is the most important member. She describes the "work" of the patient while negotiating a surgical hospitalisation including: becoming a patient, managing self, affiliating with experts, surviving the ordeal and interpreting the experience (Table 1). Nurses' work is not merely to manage the technical equipment and the daily tasks and care, it is to support the patient as they try to do their "work".

Much is expected of patients, even when undergoing routine surgery. Experiencing a life-threatening illness, requiring resuscitation and intensive care followed by months of hospitalisation is a much harder role, which will be dealt with differently by different people and will often cause some psychological problems. Mr L used a range of coping mechanisms when "managing self", including anxiety, depression, denial, aggression, impatience and perceived "lack of appreciation". At times he was emotionally labile. He had regular counselling sessions with a psychologist, as did his partner and family. These sessions helped them use coping mechanisms more effectively.

While Mr L was willing to listen and discuss plans with the team, he was not always willing to 'acquiesce' to their expertise. He determinedly maintained his autonomy, occasionally upsetting some nurses who found him manipulative and dictatorial about some aspects of his care such as the timing for sleep, bathing and dressing changes. He negotiated routines to suit himself as much as possible.

As an intelligent man he was well able to monitor events and developed considerable expertise in his wound management and nutritional support systems. The dressing changes were time-consuming and often painful. There was a three-week period when he wore a fistula management bag instead of the TNP, but the bags leaked several times and he didn't like

Table 1. The work of the patient and the nurse. Adapted from Christensen¹⁵.

The work of the patient	The work of the nurse
Becoming a patient:	
Suspending social roles	Admitting
Revealing self	Appraising
Managing self:	
Centring on self	Attending
Harnessing resources	Being present
Maintaining equanimity	Ministering
	Listening
	Comforting
Affiliating with experts:	
Acquiescing to expertise	Enabling
Fitting in	Coaching
Retaining autonomy	Conserving
	Extending
	Harmonising
	Encouraging
Surviving the ordeal:	
Enduring hardship	Interpreting
Tolerating uncertainty	Anticipating
Possessing hope	
Interpreting the experience:	
Monitoring events	Responding
Developing expertise	
Leaving the hospital:	
Maximising readiness	Appraising
Making arrangements	Supplementing
Discovering requisites	
Resuming control	

the way they 'dragged' when partially full. He asked that the TNP system be reinstated.

Surviving the ordeal has been the most difficult part of his work. Physically he has had many hardships to endure including fevers, pain and weakness. He suffered fatigue and tiredness due to long-term disturbed sleep patterns, particularly after his times in the intensive care unit. He was moved to a single room at the end of the corridor in the hope that it might be quieter for him. Boredom was also a problem.

Although he read and watched television, and a considerable time was taken up with routine dressings, changing total parenteral nutrition bags, physiotherapy and general care, this hardly compared with his usual life as a busy accountant. He didn't even have regular meal times to anticipate and so looked forward greatly to regular visits from his partner.

The sight of his laparostomy was abhorrent to him and he had major difficulty in adjusting to the altered body image, referring to "it" as though not a part of himself. He required counselling to manage this aspect of his illness and maintain a positive sense of embodiment. Nurses were careful to acknowledge positives about his appearance and not focus attention on the negatives.

Socially there were ongoing issues. He was made redundant at work and then started using his savings to pay for his care. His family live interstate but travelled to visit and his partner and friends supported him as much as possible. This has all placed a burden on their time and resources and had psychological effects on them too.

Tolerating uncertainty and maintaining hope were both major hurdles. He was quite dictatorial about when things would be done, striving to set boundaries and have some control of those things about which there was even the remotest possibility of certainty. He was allowed weekend leave to test his readiness for discharge home, each visit equipping him more for his discharge. This helped him be more positive and hopeful of regaining some normality in his life.

In reality we don't know what the future will hold and after 43 years of ongoing Crohn's-related problems, it is unlikely things will improve greatly. Overall this is not a success story, but it is important that nurses and doctors involved in such care discuss individual cases and their problems and failures, as much as their successes, because these are complex matters with physical, psychological, sociological and spiritual effects on the patient and those who care for and about them.

As we share with each other critical events in life, we come to realise that individual crises are usually collectively experienced situations¹⁶ (p. 464).

The ward nurses were also experiencing the crisis. Over time they came to know him well. They felt sorry for him, although at times they found his behaviour demanding. They tried to manage the psychosocial aspects as well as the physical care. They allowed negotiation of timing of cares, but drew boundaries when his demands interfered with the care of other patients. Over time he became entrenched in 'his' room so when he went to intensive care for a week, they relocated him to another similar room on the other side of the

ward in an attempt to 'start afresh'. They rostered nurses so he had continuity but no one nurse was over-burdened. After his final surgery there was talk of moving him to a different ward, but the nurses asked that he remain:

"We started this journey with him, we should finish it with him too ... although we are unsure how the journey will end."¹⁷

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