High-output stomas: challenges with a large laparostomy wound

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Abstract
This article explores the management of patients with high-output stomas fashioned under acute surgical conditions where management may be difficult owing to the presence of a large laparostomy wound. Available products that meet the technical demands required to manage these patients, achieve optimal wound healing, manage high-output stoma and encourage patient independence are considered. A number of strategies to meet the physical and nutritional requirements of these patients are discussed along with the importance of the multidisciplinary team working together to provide holistic care.

Key words: Laparostomy wound • High-output stoma • Wound healing • Convexity • Mouldable technology • AQUACEL

Patients with an open abdomen have their own pathophysiology driven by acidosis, coagulopathy and hypothermia. They undergo the stages of a systemic inflammatory response syndrome and face risks of protein-calorie malnutrition such as poor healing and infections (Becker et al., 2007). With the onset of the open abdomen, whether intentional or secondary to wound dehiscence, gastrointestinal dysfunctions results in an ileus. Swelling and distension of the gut cause gastrointestinal reflux and toleration of enteral feeding may become a problem resulting in malabsorption and deterioration (Becker et al., 2007).

The restoration of homeostasis and the correction of the electrolyte/fluid imbalances follow the rules of modern intensive care. Sepsis is the most common complication often associated with intraabdominal abscesses or secondary skin infection owing to the bacterial contents of the small bowel. Despite this a report from the Health Protection Agency (HPA) (2006) states that the incidence of surgical site infections following large bowel surgery is 9.2%. The presence of a stoma increases the risk of wound infection and so wound management is essential before discharge (Aslam and Hunter, 2009). Sepsis may be influenced or even caused by poor nutritional status compromising immunity and the ability to heal.

Once the decision to leave the peritoneal cavity open is made, technique and experience with temporary closure are crucial. The dressing used should not only contain the visceral mass within the abdomen, but also protect the small bowel surface from any damage. Appropriate dressings must be considered in order to achieve optimal wound healing and the prevention of infections. Simultaneous management of the stoma and midline laparostomy wounds pose a challenge to patients with a new stoma (Aslam and Hunter, 2009). Leakage of the stoma and soiling of the surgical dressing with the high frequency of wound and appliance changes make stoma management stressful for the patient and difficult for them to learn to care independently.

The healing of surgical wounds
Most surgical wounds created as a result of elective or emergency surgical procedures are closed by primary intention using methods such as sutures, clips or liquid tissue adhesive (surgical skin glue). These are considered as acute wounds. Some wounds cannot be closed because of contamination or infection and are left to heal by secondary intention (Foster and Moore, 1998). The natural healing process of any wound can be divided into three stages: inflammatory, proliferative and maturation. The duration of these stages is short in acute, uncomplicated, surgically closed wounds.

The inflammatory process is described by Silver (1994) as a ‘biological emergency’ response with a latent stage of about 12 hours before any obvious healing begins. Once an injury has been sustained, platelets are released, which initiates haemostasis, coagulation of blood leaking from the damaged and inflamed blood vessels (Russell, 1999).

Granulation (which occurs in the proliferative phase), according to Chen and Hutchinson (1998), occurs in deep dermal wounds. Macrophages signal to the dermal fibroblasts to lay fibrils of reticulin across the wound. This is later converted into collagen. New granulation tissue is very vascular owing to capillary loops, which give the tissue its red appearance. As new tissue is laid down, the wound edges contract, then the growth factors interact with the mediator cells that cause the myosin bundles to reduce the wound size (Russell, 2000). This process occurs by the fifth or sixth day after injury.

Once granulation tissue has been laid down, epithelialisation is the final phase in the proliferative wound healing process. The new dermal layer is rich in collagen and epithelialization
is achieved by squamous cells migrating across the wound surface until the deficit is resolved (Chen and Hutchinson, 1998). The final stage, maturation, can take between 24 days to 2 months to complete (Russell, 1999). The new tissue that has been deposited over the wound is fragile and will only regain up to 80% of its strength before the biological injury (Chen and Hutchinson, 1998).

Some factors, such as infection of tissue hypoxia, may lead to increase in the wound size and delayed healing. If it takes more than 3 weeks for a wound to heal, it can be considered chronic. All stages of the healing process are considerably prolonged in chronic wounds.

High-output stomas

A jejunostomy occurs when the jejunum (middle section of the intestine) has been brought out onto the surface of the abdomen and fashioned into a stoma. A jejunostomy may be required following complications such as mesenteric infarct: extensive small-bowel surgery leading to multiple anastomosis requiring the intestine to be 'defunctioned' above the point of surgery, or, severe small-bowel Crohn's disease. Jejunostomies will produce the highest stomal output: around 3-8 litres per 24 hour period. It is vital that the stoma loss is monitored and recorded accurately so that it can be replaced. Most patients who require a jejunostomy will need additional intravenous nutritional support to replace the nutritional and electrolyte imbalance caused by the inability to absorb enterally.

As all of the nutrients and electrolytes needed for metabolic and cardiac function, energy and repair are absorbed within the jejunum (apart from remaining sodium levels that are absorbed within the colon and vitamin B12 in the terminal ileum), an accurate nutritional and electrolyte status must be obtained regularly by reviewing biochemistry and urine sodium levels to allow the gastrointestinal team to address stomal loss, absorption and replacement (Lloyd et al, 2006).

Ileostomy output is determined by where in the ileal tract it has been fashioned. Initially, ileostomy output will be high for a few days following surgery, but this rapidly decreases as the ileostomy adapts (Azzopardi and Ellul, 2011). A normal output has been classified as varying amounts by stoma nurse specialists and is described by Black (2000) as being 600-800mls or by Baker and Greening, (2009), as approximately 600-1200mls (per 24-hour period). A high-output ileostomy is determined by a continual output exceeding 2000mls per 24 hours (Baker and Greening, 2009). A number of factors can result in a high-output ileostomy, including:

- The length of small bowel to the point of the ileostomy
- A high oral hypotonic fluid intake
- Increased gastric secretions
- Sepsis
- Infection.

The initial priority in the management of patients with high-output ileostomies is to ensure that they are receiving and absorbing the right amount of nutrients and electrolytes to sustain a healthy metabolic balance and recover from their surgery, without experiencing the negative effects of a continual high-stomal output in the long term (Lloyd et al, 2006). Certain drugs can be used to reduce the stomal output; however, patients need to be educated on their intended action and how or when these should be administered. In conjunction with the use of medication a diet low in fibre and high in starch, with high calorific intake, is paramount in achieving a lowered stomal output with optimal weight gain and nutritional/electrolyte replacement. The intake of protein, often through supplemented enteral drinks, will improve the healing process. Patients with high-output ileostomies should be jointly managed by all members of the multidisciplinary team to ensure appropriate care.

The gastroenterology team, pharmacist and nutrition nurses will implement necessary changes required to manage the electrolyte and nutritional needs, along with medication to aid reduction in stomal loss. Dietitians educate patients on the diet that should be adhered to while living with a high-output stoma and ensure that specific meal plans and snacks are offered to patients while in hospital. The stoma care nurses are pivotal in the use of large wound managers and other appliances required, along with the education of patients and their carers in changing the appliances to prepare for discharge. A wound manager is a system designed to protect and contain open abdomens and enterocutaneous fistulas with the ability to provide a waterproof drainage system.

High-output stomas with a large laparostomy wound

When it is necessary to fashion a stoma within a laparostomy wound, appliance leaks, often caused by wound exudate, can be a persistent problem and management becomes psychologically debilitating for patients and their carers. Learning to cope can be emotionally demanding for the patient and carers; however, with the right support and advice from health professionals, it is manageable.

A laparostomy, or ‘open abdomen’, involves a surgeon opening the peritoneal cavity anteriorly and deliberately leaving it open (Leppaniemi, 2010). The reasoning behind the process is similar to draining an abscess with a large incision and leaving it to heal by secondary intention. Laparostomy is used to treat seriously ill patients to facilitate healing or to prevent further complications. It is, however, a morbid procedure and one that requires intensive postoperative care, extensive nursing and good knowledge and skills in order to prevent further complications (Leppaniemi, 2010). The abdominal contents are exposed and protected with a temporary cover. Frequent dressing changes are required to prevent/treat infection and are vital once the wound has started to heal.

When gastrointestinal or colorectal surgery is performed there is a time frame in which re-laparotomy, secondary to surgical complications, can be performed (Draus et al, 2006). This is because of the inflammatory process that occurs as a result of the surgical resection, leading to the intestine swelling and sticking together. It is during this phase, when the inflammation is most acute, that surgical complications at re-laparotomy can occur as the severe swelling and adherence of the intestine make it extremely difficult for the surgeon to work within the abdomen and locate the area that is affected, either by surgical trauma or a
leak at the site of the anastomosis. It is on such occasions that a jejunostomy or ileostomy may be fashioned at the distal end of the laparostomy wound for reasons such as technical difficulty, an acute swollen abdomen or the inability to free up distal ileum in order to fashion a stoma further down in a more appropriate position on the abdomen within the rectus sheath.

The difficulty in managing a high-output stoma within a large laparostomy wound is intensified by the amount of stomal loss, the size and shape of the wound and the level of wound exudate. All of these factors contribute to frequent appliance leaks, excoriation to the surrounding skin, restrictions in the re-mobilization of patients and product selection for both the stoma output and the wound exudate.

Treatment options
A wound manager over the stoma and laparostomy wound is the most common treatment choice. Invariably, this works well and accurate stomal output (the ability to measure and monitor output from the stoma (or fistula) on the fluid balance chart) along with visibility of the wound to monitor healing and infection can be maintained. It is not always possible to determine where the stoma is fashioned in conjunction with length and width of the laparostomy wound, whether the wound and stoma are separate, or whether the stoma is fashioned within the wound bed. Management becomes difficult when the stoma is fashioned within the laparostomy wound, more so when the stoma is at the distal end of the wound as a result of natural skin (apron) creases and excessive tension points on movement.

Within the acute care setting, such as ITU, patients are invariably immobile and nursed on their backs. This cases appliance and large wound manager changes, and reduces the tension placed on the wound manager and appliance, minimizing the risk of leakage. However, in cases of high-output stomas, nursing patients on their backs can often contribute to appliance leaks as faeces does not drain away into a collection chamber efficiently and pools around the base of the appliance/wound manager causing the adhesive border to lift.

Once patients return to the surgical ward, systems implemented by the stoma care team are trialled and all treatments that ensure adherence are considered. The decision is sometimes taken to separate the stoma from the wound, as invariably the exudate prevents the stoma appliances from adhering. Additionally, the high stomal output has a tendency to leak, contaminating the wound dressing. An option with such large wounds is to seal or cover them with a large wound manager and separate the stoma with a two-piece drainable system by cutting out a hole the size of the stoma through the wound management system.

The author believes that it is appropriate to manage patients with a high output stoma on a two-piece system as treatment can be alternated between standard drainable pouches during the day and a high-output pouch placed onto the base plate overnight, to allow the connection of a secondary reservoir collection bag. Connecting a pouch onto a collection bag or flow collector over night should reduce the need to get up and empty the system but also prevent leaks caused by the pouch filling up when a patient is asleep. The author has found a great deal of confidence in the ConvaTec two-piece system (Natura®), as it adheres well to the skin and, in her experience, meets the demands of a high-output stoma placed within a difficult or poor position on the abdomen.

The challenge in using a large wound manager incorporating a two-piece high-output system lies in the continual support and care that the patient will require once discharged. A great deal of nursing time is needed in addition to the time spent managing leaks from the wound and stoma. The community nursing team may not be able to offer a service that matches that received in hospital and patients often feel neglected and become deeply frustrated. This is not the fault of the community support team, however, to tackle this, a system that will remain intact for at least 24 hours, and allow management to be more realistic and achievable is necessary.

The author has found that photographic care plans are paramount in such cases. They allow the community and ward nursing team to follow a step-by-step guide with points of reference and provide comparisons when measuring the healing process. In specific cases, patients and carers can be taught to manage the wound and stoma independently and the availability of a photographic care plan will act as a prompt or reminder for them to follow.

ConvaTec Mouldable Technology™ and high-output systems
Within the author’s place of work, the product that will adhere and ensure comfort and adhesion will invariably be a ConvaTec two-piece system. The ability to alternate the pouches to allow the patient to use a smaller drainable pouch during the day which will maintain dignity by hiding their pouch is an obvious benefit when selecting a product.

Stomas will alter in their shape and size throughout the day. This is a natural process of the intestine as it contracts and expands to pass effluent/stool. For patients who experience regular appliance leaks, the use of ConvaTec Mouldable Technology™ (CMT) is key. The technology was first developed to provide a ‘snug’ fit around the stoma to significantly reduce leaks and prevent excoriation of the peristomal skin. There is no need to cut out the template which makes the process easier for patients with poor eyesight and dexterity. CMT technology assists in the changes of the stoma size while still providing significant adherence. The CMT base plate achieves continual customized fit of the stoma.

Case study
A 62-year-old gentleman with no surgical or significant medical history, other than hypertension, was taken to his local hospital and admitted with unknown increasing abdominal pain. On examination, he was taken to theatre where an emergency Hartmann’s procedure was performed to repair a sigmoid perforation secondary to a diverticular abscess.

The initial postoperative recovery for this gentleman was good, but he soon became medically unstable and was taken back to theatre for a re-laparotomy caused by suspected peritonitis. A small-bowel perforation was discovered and so the decision was taken to resect the affected area and anastomose the two ends together. To protect the anastamosis
an ileostomy was fashioned, but the inflammation within the intestine and abdominal cavity meant an optimal position could not be achieved and the ileostomy was fashioned at the distal end, within the laparotomy incision. The decision to keep the abdomen open (laparostomy) was taken to allow the inflammation and sepsis to settle without further complications.

The gentleman had a lengthy stay in the ITU secondary to sepsis and to ensure the nursing care required to manage his critical care needs. The output from the ileostomy was so high that it was deemed to be a jejunostomy and suitable scan images would not determine the location of the stoma owing to inflammation and oedema.

Intravenous nutrition was required to replace the stomal loss, meet the nutritional requirements as a result of poor absorption and maximize wound healing. Management of the wound and stoma with leaks was time consuming. Once ready to be discharged from the ITU back to the ward, further management issues arose. By now oral intake was being encouraged along with mobility aided by the physiotherapy staff. Appliance leaks became even more frequent, occurring over five times in one day, causing wound contamination. The introduction of food and drink orally increased the stoma output to an average of 6 litres per 24-hour period and he was struggling to maintain electrolytes. The decision was taken to transfer this gentleman to a specialist gastrointestinal/
Assessment

On arrival to the specialist centre a full assessment was undertaken to establish the total loss of weight and body mass with an accurate recording of oral intake and stomal and urine output. By now inflammation had settled within the abdomen and intestine. Tests, such as a CT scan of the abdomen and pelvis, barium follow-through and contrast studies, could be implemented to ascertain the length of intestine up to the point of the stoma and the remaining intestine distal to the stoma, to the point of the terminal ileum. From the results of these tests it was established that the stoma was in fact an ileostomy, albeit fashioned quite high up within the ileum, causing the large volumes of stomal loss. Biochemistry and urine sodium tests would allow the nutrition and gastroenterology team to decide on the optimal route of nutrition and the amount required to replace loss. Biochemistry would also determine what and how much was being absorbed.

Management

The author’s main priority was to achieve adherence of a suitable system that would incorporate both the large laparostomy wound and the stoma. It would have to be able to cope with high volumes of watery effluent and at the same time reduce both leakage onto the laparostomy wound and contamination. Patients with large enterocutaneous fistulas in cases such as this one, are generally managed differently owing to the shape and structure in which they have been surgically fashioned. It is difficult to manage the wound aseptically because of the effluent lying on the wound surrounding the fistula, therefore, a ‘clean’ technique was adopted.

With the right support and encouragement patients can be taught to manage their wound and stoma independently, or at least take on most of the task with help and guidance from their stoma nurse and/or carer (Slater, 2011). In the long term, patients and their families will cope better if they take on the responsibility of their appliance changes (Slater, 2011). A photographic care plan can be really helpful for the management in the community but before this is implemented the system needs to achieve adherence of 24–48 hours for it to be deemed successful.

Initially, when the author first saw the patient, he was managed with a large wound manager (Option Wound Manager Square, OakMed) covering both the wound and the stoma (initially a convex base plate was not used to separate the stoma from within the wound manager). This system worked well but would be placed under great tension and leak during patient mobilization. To adapt and improve it, large seals (Salts Management Square, OakMed) (Figure 1e) were applied around the entire wound and stoma to increase adhesion. The author also noticed that frequency in appliance leaks was increased by nursing staff not using the photographic care plan.

Adherence

Maintenance of adherence was then achieved by incorporating the use of a wound manager with a convex CMT two-piece system. Convexity is used when the length of the stoma spout is not sufficient to allow drainage into an appliance causing effluent to sit around the base and seep under the base plate (Cronin, 2008). Convexity exerts enough pressure to force effluent to sit around the base and seep under the base plate, which allowed the convex base plate to adhere (Figure 1h). The wound manager was then placed over the entire wound and the stoma, and an aperture the size of the connecting ring of the base plate, was cut out from the wound manager pouch (Figure 1f). The high-output drainable pouch was then used to seal off the stoma by clicking it onto the base plate and trapping the surface of the wound manager within it (Figure 1g).

Separating the stoma and wound

The process of separating the stoma and the wound while managing them both was achieved by building up a dry, flat surface at the base of the stoma, which allowed the convex base plate to adhere (Figure 1h). The wound manager was then placed over the entire wound and the stoma, and an aperture the size of the connecting ring of the base plate, was cut out from the wound manager pouch (Figure 1f). The high-output drainable pouch was then used to seal off the stoma by clicking it onto the base plate and trapping the surface of the wound manager within it (Figure 1g).
Figure 2. The wound dressing and the convex baseplate

was still sloughy. When the wound was physically examined the author found that the wound was undermining: the subcutaneous tissue was not healing onto the deep-layer tissue covering the rectus abdominus muscle (Figure 1a). Pockets were also noted around the distal end of the wound. The decision was taken to stop using gauze dressings and instead implement the use of AQUACEL® Hydrofiber® to improve the rate and efficiency of granulation and healing, and absorb the exudate. Surgeons have used gauze dressings on large surgical wounds for many years, however, specialist nurses (mainly tissue viability) tend to favour more modern dressings for both acute and chronic wounds (Dinah and Adhikari, 2006). AQUACEL was chosen instead of an alginate in this case because of its ability to absorb and retain exudate and prevent skin maceration.

AQUACEL was used over the entire surface of the wound ensuring that it was also placed between the layers of tissue that were not granulating sufficiently (including the pockets). It was then covered with soft gauze for extra absorbency (Figure 1c). At the distal end of the wound DuoDERM® Extra Thin was used to provide a waterproof barrier and surface for the convex base plate to adhere to, preventing the exudate from absorbing into the gauze and lifting the convex base plate (Figure 1d). Large protective seals and paste were used to frame the wound and fill any creases or dips to increase the effect of the adhesion (Figure 1c) and the wound manager was, as before, placed over the wound and stoma and ‘sealed off’ with the high-output pouch (Figure 1g). This method provided excellent results and the length of time between appliance changes was 48–72 hours. The next consideration was teaching the patient and community nursing team how to manage the system at home.

Discharge

By the time this gentleman was fit for discharge an appropriate system had been established. He was deemed competent in the management of the wound dressing and ileostomy appliance and a full care package of community nurses with his local stoma-care team had been arranged. The wound had healed at such a rate that the use of the wound manager had been discontinued and a dressing of AQUACEL, gauze and Tegaderm™ (3M™) was being implemented (see Figure 2). There was no evidence of slough on the surface of the wound, the ‘pockets’ and areas of the wound not healing onto the rectus abdominus muscle had all granulated together and the exudate was now low to moderate.

The wound was dressed first and the products and convex base plate were placed over the stoma. Both were initially cleaned with warm water and the peri-stomal/wound skin was dried. AQUACEL sheets were placed over the wound surface and then the gauze applied to cover the AQUACEL. DuoDERM Extra Thin was then placed at the distal end of the wound, but not too close to the base of the stoma because of the risk of leakage. Tegaderm was then used to seal the proximal end of the wound, providing a waterproof cover and preventing the wound from drying out, providing a moist environment for optimal healing. A large seal was then stretched out and placed around the base of the stoma over the DuoDERM Extra Thin. A small amount of paste was placed onto the seal where creases could be identified. The CMT convex base plate was then rolled out to the desired size and placed over the stoma. Although the stoma itself was a good size in diameter, because of its position it did not have a decent length spout and was affected by deep creases on the lower end of the abdomen near the inguinal area, the convexity corrected this.

Patient update

This gentleman went home for 3 months and returned to hospital for elective surgery on the 29 December 2011. An elective laparotomy, extensive division of adhesions, reversal of ileostomy and closure of laparostomy wound was undertaken. At the time of his elective admission for surgery the wound measured 7cm in length and 5cm in width. The laparotomy wound was closed with sutures. Recovery was excellent and the colostomy started passing stool on day 4 post surgery and discharge was achieved by day 10.

This gentleman is continuing to recover well and managing his colostomy independently. An elective reversal of his Hartmann’s procedure (reversal of the colostomy) has been planned for June 2012.

Conclusion

Management of high-output stomas continues to be a challenge to health professionals and becomes more complex when appropriate and successful wound care is a component of required care. This case study has highlighted that wound care with optimized healing by means of appropriate dressings can be incorporated in patients that have poorly positioned high-output ileostomies.

The case study reported in this article suggests that AQUACEL is an appropriate dressing to use in the management of wounds with moderate to high volumes of exudate and can achieve successful granulation and healing of large laparostomy wounds. Advice should be sought from the tissue viability nurses for continued use and when to implement this.

Convexity appliances provide excellent support in the prevention of appliance leaks and, as this case study has
highlighted, the use of two-piece CMT convex appliances can increase the desired effect while maintaining comfort for the patient. The convex CMT system reduced the frequency of appliance leaks, which led to a significant reduction in excoriation of the peristomal skin.

It is paramount to consider the bigger picture when managing patients such as the one presented in this article. The provision of community support and patient compliance is always a determining factor in the type of system and appliance that is to be used on and after discharge (Slater, 2011). What may work in the hospital setting may not be an appropriate care package within the community and on occasions some appliances cannot be obtained within the community as a result of prescription allowances and availability on the Drug Tariff.

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**KEY POINTS**

- Laparostomy wounds are a form of acute surgical management that require time and knowledge of wound care and the healing process to manage them appropriately and effectively
- High-output stomas can be difficult to manage because of their complexity and require a full multidisciplinary approach
- Convexity is a safe and appropriate system that is suitable for use with high-output stomas that are poorly situated
- CMT systems are appropriate in the management of all stomas for the prevention of peristomal skin excoriation and are easy to use among patients that have poor dexterity