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Gauze packing of open surgical wounds: empirical or evidence-based practice?

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ABSTRACT

INTRODUCTION Most surgical wounds are closed primarily, but some are allowed to heal by secondary intention. This usually involves repeated packing and dressing of the raw wound surfaces. Although the long-term care of such wounds has devolved to the care of nurses in the community or out-patient setting, the initial wound dressing or cavity packing is done by the surgeon in the operating theatre. Many surgeons are unaware of the growth of the discipline of wound care, and still use traditional soaked gauze for dressing and packing open surgical wounds and cavities.

RESULTS This review summarises the some of the modern alternatives available and the evidence – or the lack of it – for their use in both the acute and chronic setting.

KEYWORDS

Gauze – Dressing – Open wounds

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Infected, sloughy or necrotic wounds need thorough surgical debridement, usually in the operating theatre. Such wounds are then often allowed to heal by secondary intention or delayed primary intention. They can be superficial or deep, and there can also be varying amounts of exudate, requiring frequent dressing changes. The ubiquitous surgical gauze has been used by generations of surgeons for the initial packing and dressing such wounds. On the other hand, specialist nurses (*e.g.* tissue viability nurses) favour more modern dressings for both acute and chronic surgical wounds.

Choosing the appropriate dressing, however, is difficult, as a recent Cochrane review deplored the paucity of robust evidence in this field.[1] Indeed, a Medline search using the keywords 'wound dressing' yielded over 6400 citations, but less than 8% of these were randomised, controlled trials. Most were expert reviews, case reports, or small non-comparative trials. This is because of the difficulty in conducting trials and standardising outcome measures. Furthermore, most of the comparative studies relate to dressing chronic wounds – pressure sores, venous ulcers or diabetic ulcers – where it has been shown that gauze dressings are not conducive to wound healing,[2] not cost-effective[3] and uncomfortable for the patient when it comes to changing the dressing.[4] Alternatives to surgical gauze are discussed below, in terms of their physical properties, and their use in both the acute and chronic setting.

The 'modern' alternatives

Hydrocolloids

Hydrocolloids (*e.g.* Granuflex®, Tegasorb®) were first used in wound management in the 1960s. They consist of two layers. The inner, hydrocolloid adhesive layer has particles that absorb exudate to form a hydrated gel over the wound, creating a moist environment that promotes healing and protects new tissue. The outer layer (film, foam, or both) forms a seal to protect the wound from bacterial contamination, foreign debris, urine, and faeces; it also maintains a moist environment and helps prevent shearing.[5]

The use of hydrocolloids in packing the acute surgical cavity has not been studied and, therefore, cannot be recommended. In the chronic setting, hydrocolloids require infrequent dressing changes, and can be used on wounds in various stages of healing. They are suitable for use on necrotic, sloughy, granulating and epithelialising wounds,[6] but are not the dressing of choice in wounds with copious amounts of drainage.[7] There are few comparative studies of hydrocolloid dressings, but one study[8] found no significant difference in terms of rate of healing or cost-effectiveness between hydrocolloid to saline-gauze dressings in treating pressure ulcers.

Alginates

Alginates (*e.g.* Kaltostat®, Sorbsan®) were originally derived from seaweed and are thought to have haemostatic

properties. Although they have been produced commercially since the middle of the 20th century, their surgical use only really took off in the 1980s. These dressings were initially a loose fleece formed primarily from fibres of calcium alginate, but some products also now contain a significant proportion of sodium alginate to improve the gelling properties. Once in contact with an exuding wound, an ion-exchange reaction takes place between the calcium ions in the dressing and sodium ions in serum or wound fluid. When a significant proportion of the calcium ions on the fibre have been replaced by sodium, the fibre swells and partially dissolves forming a gel-like mass.[9]

Alginates have been used extensively in the acute surgical setting to dress skin graft donor sites, and even for packing areas of soft tissue loss with exposed bone.[10] In terms of packing surgical cavities, one study compared gauze and alginate rolls for anal packing in 50 post-haemorrhoidectomy patients.[11] Although there were no differences in bleeding or discharge from hospital, alginate rolls caused less pain at removal and first bowel action than gauze rolls. Another study (n = 34) confirmed less patient discomfort when removing alginate packing of abscess cavities compared to gauze packing.[12]

Foams

Foams (*e.g.* Allevyn®, Lyofoam®) have been used since the 1970s, and the most common types are silicone elastomers (silastic sponges), polyurethane foam sponges or other hydropolymer dressings. In the UK, these foam dressings are currently the most widely used absorbent dressings,[13] and some can contain up to 10 times their dry weight in water.[14] Studies have found these foams to be better than hydrocolloids, but equivalent to alginates at handling the moderate to large exudates from superficial to deep pressure sores.[15,16]

The use of foam rather than gauze for packing surgical wounds (*e.g.* from laying open pilonidal abscesses and sinuses, and excision of hydradenitis suppurativa) has not been shown to affect time to healing.[17] However, using foam rather than gauze packing is associated with significantly earlier discharge from hospital,[18,19] reduced patient discomfort at dressing change,[18,19] and reduced costs, both in terms of materials and of labour time.[17–20] Similar findings have been reproduced in packing wounds left open after abdominoperineal resection.[21]

Hydrogels

Hydrogels (*e.g.* Novogel®, Hydrosorb®) have been used since the 1980s in wound management. They have a three-dimensional net structure made up of hydrophilic polymers, but require a secondary dressing because of their gelatinous nature. Hydrogels can donate water molecules to dehydrated tissue while allowing passage of water vapour and oxygen to the surface.[22] They thus maintain a moist wound interface and aid the debridement of slough and necrotic tissue. They can be used on clean granulating or epithelialising wounds, but are not suitable for infected wounds or those with large amounts of exudates, and ulcers of arterial origin.[22]

Hydrogels have not been studied in the acute setting, but have an established place in managing chronic wounds. One randomised, controlled trial (n = 32) compared treatment of pressure sores with either hydrogel or wet saline gauze dressings. The relative volumes (from the initial 100%) of hydrogel-treated wounds were significantly less (26 ± 20%; $P < 0.02$) than those of saline treated wounds (64 ± 16%) in the last week of the study. Also, the hydrogel-treated wounds needed less frequent weekly debridement than the saline-treated wounds.[23] Another study also found hydrogels to be more cost-effective in terms of the time required to achieve debridement, time to change dressings and amount of materials needed.[24]

Hydrofibres

Hydrofibres (*e.g.* Aquacel®) emerged in the late 1990s and improved fluid handling with vertical wicking of exudates to prevent skin maceration.[25] They are relatively new materials with properties that overlap with those of the hydrocolloids, and thus require a secondary dressing. In an animal model of partial thickness wounds, hydrofibres were better than tulle gauze materials, which got embedded in the wound, causing a disturbed pattern of epithelialisation.[2] There is also experimental evidence than hydrofibres 'lock away' pathogenic bacteria from the wound surface by trapping them in a cohesive gel as well as in the actual dressing fibres, better than alginates.[26]

In the acute setting, clinical studies have found modern hydrofibre dressings are better than proflavine-soaked gauze in terms of cost-effectiveness[27] and pain at dressing changes.[28] However, in chronic surgical wounds, a trial comparing 'wet-to-dry gauze' and modern hydrofibre dressing groups did not find any difference in the rate of healing of open surgical wounds.[29]

Negative pressure topical dressings

Negative pressure topical dressings (*e.g.* Vacuum-Assisted Closure® [VAC] system) involve controlled negative pressure application via polyurethane or polyvinyl foam dressing to wound surfaces. This continuously removes wound exudates, reducing extravascular, interstitial fluid and improving blood supply during this phase of inflammation. The mechanical tension from the vacuum may directly stimulate cellular proliferation of reparative granulation tissue.[30] However, in an acute animal full-thickness wound model, histopathological observations did not support more rapid wound healing in VAC-treated wounds compared with the traditional saline-wet-to-dry

dressings.[31] Nevertheless, some clinical studies do support its use in open wound management.

One study looked at 75 lower-extremity wounds with exposed tendon, bone, or orthopaedic hardware, that were treated with immediate postoperative application of VAC therapy. A 48-h dressing change protocol subsequently greatly reduced the surface area of the wound, with granulation tissue covering bone and hardware. This allowed primary closure, skin grafting or rotational flap coverage without complication in 71 of 75 patients.[32] Yet another observational study looked at trauma patients requiring postoperative open abdominal wound management. Fascial closure rate in those undergoing VAC therapy was 88% (38/45), with a mean time of 9.5 days. This obviated the need for subsequent hernia repair in most patients.[33] Similar findings have also been documented by other investigators.[34]

Negative pressure dressings have also been studied in the chronic setting. In a small comparative trial, ten surgically debrided diabetic foot ulcers were randomised to either VAC therapy or saline-moistened gauze dressings. Satisfactory healing in the VAC group was achieved in 22.8 ± 17.4 days, compared to 42.8 ± 32.5 days in the control group.[35] However, a Cochrane review in 2001 only found weak evidence that topical negative pressure was superior to saline gauze dressings.[36] Furthermore, although application can be performed as a bed-side procedure, the device does not replace the need for formal debridement of necrotic tissue in the operating theatre.[37]

Other dressings and costs[38]

Low-adherence dressings (*e.g.* Mepitel®, Jelonet®) are used as interface layers and secondary absorbent dressings. They vary from impregnated cotton or viscose fibres to fenestrated silicone dressings, and help to make dressing changes less painful.

Vapour-permeable films and membranes (*e.g.* Opsite®, Tegaderm®) allow the passage of water vapour and oxygen, but not water or micro-organisms. They are commonly used to cover acute surgical wounds, but are not suitable for heavily exuding wounds.

Odour-absorbent dressings (*e.g.* Carboflex®, Lyofoam C®) contain activated charcoal to neutralise odours. They are used mainly in the chronic setting for malodorous infected or fungating wounds.

The actual and relative costs of the dressings discussed in this review are compared in Table 1. Plain surgical gauze is much cheaper than all the modern dressings, some of which are over 50 times more expensive. However, the figures do not take into consideration the materials required for frequent dressing changes, nor indeed the labour costs. According to NICE, the total costs of wound care are very sensitive to the frequency of dressing change, especially when home wound care requires a visit by a nurse.[39]

Table 1 Actual and relative costs of surgical dressings

Dressing		Actual cost per unit 10 x 10 cm (approx.)	Relative cost
	Gauze swab	5.5p	1
Alginate	Kaltostat®	173p	31
	Sorbsan®	152p	28
Hydrocolloid	Granuflex®	233p	42
	Tegasorb®	221p	40
Hydrogel	Novogel®	290p	53
	Hydrosorb®	274p	50
Hydrofibre	Aquacel®	231p	42
Foam	Allevyn®	263p	48
	Lyofoam®	112p	20
Low-adherence	Jelonet®	34p	6
	Mepitel®	270p	49

Conclusions

In the acute setting, most surgeons still favour the humble surgical gauze for initial wound dressing and packing. This is readily available at the time of operation, and most surgeons are familiar with it. However, it often becomes a hard adherent mass, making dressing changes a prolonged and painful ordeal for both the patient and the nurse. Indeed, alginates and foams are more cost-effective and kinder to the patient than simple surgical gauze when it comes to initial packing of surgical cavities. Negative pressure dressings may also have a role in dressing large cavities with copious amounts of exudates. These special dressings may have to be pre-ordered, as they may not be routinely available in the operating theatre. As for superficial wounds, low-adherence dressings can be used in conjunction with gauze to make dressing changes more comfortable.

In the chronic setting, surgical gauze has been superseded by the many modern alternatives discussed above. Hydrogels are useful in debriding sloughy wounds, while hydrofibres and foams are indicated where large amounts of exudates are expected. Although a Cochrane review in 2004 concluded that there was insufficient evidence to determine which dressing or topical agent affected healing rates of open surgical wounds, it found that foam was the best studied alternative to gauze. Foam appeared to be preferable in terms of pain reduction, patient satisfaction and nursing time. NICE guidelines state that alginates, foams, hydrocolloids and hydrogel dressings (as well as

maggots) may reduce the pain from 'difficult-to-heal' surgical wounds.[39] However, there was insufficient evidence to support one debriding agent over another.

Nowadays, there is a bewildering array of surgical dressings, and most hospitals have a tissue viability nurse to advise on the management of complex wounds. However, surgeons are still responsible for the initial wound dressing or packing. They should, therefore, become acquainted with the indications and limitations of the alternatives to the traditional surgical gauze.

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