

Exudate, infection and patient quality of life

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One of the most significant challenges faced by nurses is the efficient and cost-effective management of excessive wound exudate, which can cause extreme distress and negatively impact on patients' and carers' quality of life. The practical issues of soiled clothes and bed clothes, and dislodged dressings combined with the increased potential for cross-infection, lead to labour-intensive, frequent redressing of the wound, inconvenience, and social embarrassment. There are a wide range of products and therapies available for managing excess wound exudate, yet many patients continue to suffer the indignities outlined. The key to achieving moisture balance in a wound is careful, regular, and accurate assessment followed by the appropriate choice and use of dressings or therapies (White and Cutting, 2006). The role of exudate in wound management, its significance, nature, methods for management, and associated skin problems will be explored in this article.

Wound exudate

Exudate, also known as wound fluid or wound drainage, is defined as serous fluid derived from plasma that has passed through the walls of a damaged or overextended vein (Collins et al, 2002). It is produced during the initial inflammatory phase (before the proliferative and maturation phases of healing) and combines with extracellular fluid in normal healing. Current understanding of exudate is limited, but its production is thought to be the response to a complicated interaction between wound aetiology, wound healing physiology, wound environment, and compounding pathological processes (World Union of Wound Healing Societies (WUWHS), 2007).

The production of exudate, a desirable and naturally occurring phenomenon at different stages of healing, is a vital component for healing as the blood vessels dilate following haemostasis. As part of the body's normal inflammatory response, it enables white blood cells in particular, and other substances needed for healing, to migrate to the traumatized tissue. Vasodilation and increased capillary permeability is stimulated by histamine and cytokines released by damaged cells to allow the passage of larger molecules than normal, such as phagocytic white blood cells, to work with proteolytic enzymes in order to remove pathogens and devitalized tissue.

Exudate plays an important role in preventing the micro-environment from dehydrating; enables diffusion of immune and growth factors; assists autolysis; and functions as a transport medium for essential nutrients in cell metabolism (WUWHS, 2007). As a result, the blood vessels appear to 'weep', which reflects the Latin origins of the word, *exsudare*,

Abstract

Efficient and cost-effective management of excessive wound exudate continues to present unique challenges to nurses. Accurate patient and wound assessment is essential to inform the treatment and selection of suitable dressings. The wide range of modern wound management products should be sufficient to meet the needs of every wound type at all phases of healing, and as circumstances change. However, there are still situations in which nurses are having to change dressings a number of times in 24 hours to prevent maceration (i.e. the softening and whitening of skin that is kept constantly wet), soiling, and the potential for cross-infection. There is no easy solution to the problem, but as nurses become more knowledgeable about identifying and managing the causes of excessive exudate, the available management options, and, as dressing materials become more sophisticated, practice should improve in this area.

Key words: Wound exudate ■ Assessment ■ Management ■ Best practice ■ Zetuvit Plus

which means to 'ooze out like sweat' (Barnhart, 1988). Exudate is rich in protein and cells, and is an influential factor in wound healing.

Although the production of exudate to support wound healing is both necessary and desirable, problems arise when exudate becomes excessive and difficult to manage. The theory of moist wound healing requires knowledge with regard to the fine balance between being therapeutically moist and not too wet. However, there is no magic formula on which the optimum level of exudate (dryness or wetness) can be calculated and applied in practice. A dry wound will heal more slowly as moisture is needed for cell migration, whereas an excessively wet wound will cause maceration of the wound and surrounding skin, precipitating wound prolongation (Kindlen and Morison, 1999). Both conditions are less than ideal, but it is possible—following accurate assessment of the wound—to add moisture to a dry wound through the application of moisture-donating dressings (e.g. hydrogels) to rehydrate devitalized tissue. Moisture-absorbing dressings can be used for heavily exuding wounds, but all have a limit to the degree of absorbency so, for example, in a heavily-exuding and infected wound, assessment and dressing application may be very frequent until the infection is controlled. It is

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Table 1. Common acute and chronic wounds

Acute wounds
■ Traumatic wounds
■ Surgical wounds
■ Skin abrasions
■ Burns
Chronic wounds
■ Venous leg ulcers
■ Diabetic foot ulcers
■ Pressure ulcers

paramount that the nursing focus is not just on 'mopping up' the exudate, rather than exploring and identifying why the wound is leaking and managing the contributing factor(s). This will create additional resources in terms of nursing time and the cost of dressings; exudate that is not effectively managed can cause skin damage and unnecessary pain.

Acute or chronic?

In general, wound exudate contains growth factors, wound debris, nutrients, electrolytes, glucose, leukocytes, red blood cells, platelets, macrophages, fibrinogen and fibrin, and has a high protein content with a specific gravity greater than 1.02 as a result (Cutting, 2003). The functions of these components range from facilitating clotting, immune defence, maintaining osmotic pressure, and as an energy source to degrading protein.

The constituents of exudate produced in acute and chronic wounds differ (Table 1). The exudate of an uncomplicated, acute wound contains a number of endogenous proteases, which positively contribute to cell growth, wound closure, and remodelling. The chronic wound is defined as one that has remained unhealed for more than 6 weeks as a result of multiple complex factors (Collins et al, 2002). Duration, however, is less important than the clinical state of the wound either on wounding or discovery of it, compared with the nature of its aetiology which may preempt its chronic nature from day 1.

The high level of inflammatory cells in chronic wound exudate is significant with regard to delayed healing (Herrick et al, 1992). The normal sequential progress through the phases of healing, as seen in acute wounds, is disrupted in chronic wounds, which results in delayed restoration of function and extended healing time. The most commonly encountered chronic wounds are pressure ulcers, diabetic foot ulcers and chronic venous stasis ulcers, which account for over 70% of chronic wounds in the UK (Hardwicke et al, 2008). High levels of chronic wound exudate may lead to the inability of capillaries to cope, and may therefore hinder healing. Chronic wound exudate is more likely to cause periwound skin irritation or allergic contact dermatitis as it is thought to be more corrosive than acute wound exudate (Cameron and Powell, 1997); hence, the need to protect the skin from leaking exudate through rigorous, regular patient and wound assessment, and appropriate dressing selection.

Exudate in an acute wound presents as clear, thin, pale yellow

or straw-coloured in 'modest' amounts (White and Cutting, 2006), but the colour and consistency may alter according to temperature and changes in constituents. The colour can range from red, pink, yellow or brown to amber. Larger wounds usually produce more exudate than small wounds (e.g. extensive, infected chronic venous leg ulceration). More exudate is produced in the early phases of healing, with the exception being with infected, at which time there may be an unexpected increase in the volume of exudate. A number of parameters of exudate should be assessed and documented, including colour, quantity, odour and consistency as these may vary according to whether the wound is (Bates-Jensen, 1997):

- Serous; possible infection, secreting serum
- Bloody; sanguinous, trauma to blood vessels
- Serosanguineous; trauma to blood vessels, consisting of blood and serum
- Purulent and foul purulent; infected, the production of pus.

The longer the inflammatory activity lasts, more fluid will penetrate through the permeable vessels and more exudate will be produced. It may be thick or watery again, according to the phase of healing. In the early phase it may be thick and/or viscous with large numbers of bacterial and damaged cells as a result of autolysis. The volume of exudate will depend on the size of the wound, underlying cardiac disease, peripheral oedema, and the presence of wound infection.

Systemic factors such as concurrent medical conditions and malnutrition, as well as wound infection, the presence of necrotic tissue, and foreign bodies in chronic wounds sustain the activity of inflammatory cytokines, which impede the healing process (Hardwicke et al, 2008). Although understanding is progressing, further insight is needed with regard to the influencing factors and how they impact on the healing processes through further research.

Assessing wound exudate

Careful assessment of the characteristics pertaining to colour and the type of exudate can provide useful information about the current wound state and as it changes. However, the accurate assessment of the volume and viscosity of exudate is elusive and can usually be described and documented as +, ++ or +++, indicating minimum to maximum amounts. However, this only provides a rough, subjective assessment which is often unsatisfactory, particularly when accurately balancing a patient's fluid intake and output, and he/she has a large, heavily exuding wound. A grade 4 pressure ulcer (i.e. a full thickness wound penetrating the subcutaneous tissue, exposing muscle and bone or supporting structures) is estimated to result in the loss of between 90 g and 100 g protein in exudate every day (Breslow, 1991). Dietary monitoring and advice is essential in order to assess the amount and type of fluid loss to calculate the correct replacement regimens. As much as 1 litre per day of gastrointestinal fluid and/or wound exudate may flow from a gastrointestinal fistula (Dealey, 2000). Accurate recording of intake and output is paramount if it is to be replaced reliably. Medications may be prescribed to reduce the production of gastrointestinal secretions, and therefore effluent from fistulae (Black, 1995).

Gray et al (2005) developed an assessment tool, the

Wound Exudate Continuum, the use of which is said to assist in the accurate assessment of exudate and inform the decision-making process (White and Cutting, 2006). The aim is to calculate a score based on the viscosity and volume of exudate, which can be compared over time. Inspection of the dressing on removal, noting the frequency of dressing change, the presence of periwound maceration and strike-through, will provide information pertinent to exudate production in a wound. Changes in the amount, type and odour of exudate can also be an important indicator of infection. For example, the characteristic odour and fluorescent green staining of the dressing is indicative of *Pseudomonas aeruginosa* infection.

Badly managed exudate may lead to further breakdown, maceration of the wound bed and surrounding skin, skin sensitivities and excoriation, for which the use of skin barrier preparations may, to some degree, alleviate the damage done to periwound skin by corrosive exudate.

Wound infection

Wound infection is caused by pathogenic microorganisms evading the victim's immunological defences, entering and establishing themselves within the host's tissues, and multiplying, causing a host reaction (Collins et al, 2002). Infection may be systemic, causing generalized illness, or local when it only affects the wound bed and surrounding tissues. The classic signs and symptoms of infection have been extended to include more subtle indications (Cutting and Harding, 1994):

- Pain
- Heat
- Erythema
- Cellulitis
- Oedema
- Pyrexia
- Malodour
- Delayed healing
- Wound breakdown
- Fragile granulation tissue
- Excessive exudate
- Presence of pus.

Many patients who are immunocompromised as a result of a number of disease processes do not display these signs as they do not host a traditional immune response, and therefore need to be monitored very closely and carefully for the less obvious signs of infection.

Yellow or brown haemopurulent exudate may result from abscess formation or systemic infection. Malodorous exudate may be directly owing to colonization or infection, or the result of faeces mixed with the output from a fistula originating in the bowel. Local colonization or infection may result in blood-stained exudate owing to degradation of the tissues.

Early removal of necrotic tissue should reduce the risk of contamination and infection; however, desloughing treatments will temporarily increase the volume of exudate, which will require extra vigilance when protecting the periwound skin.

Accurate management will depend on identifying and treating the infecting organism, which may most commonly be *Staphylococcus aureus* and *P. aeruginosa*. Wound infection should be treated with systemic antibiotics and antimicrobial local dressings, such as those containing silver. During the

early stages, exudate volume is likely to be high so every effort should be made to contain leakage to prevent both skin damage and cross-infection by undertaking frequent dressing changes and close monitoring of the wound.

The effect of bacterial infection varies from delayed healing, temporary disability, prolonged hospital stay and loss of productive activity to life-threatening septicæmia and death. The most common cause of death in burn patients was found to be wound infection (Evans, 1975). Although knowledge of the mechanisms by which bacteria interfere with normal cell metabolism is unclear, it is thought that it interferes with collagen synthesis (Niinikoski et al, 1972), decreasing the amount of available oxygen (Bullen et al, 1966; Gottrup, 2004) at the wound site, and leading to decreased local metabolism and death of tissue (Irvin, 1981).

Posnett and Franks (2007) estimated the cost of wound care to the NHS to be between £2.3 billion and £3.1 billion per year, which includes hospital costs, interventions, extended healing times, and increased cost and frequency of dressings. This does not take account of factors such as the extra costs associated with time for dressing wounds, and nutritional and general patient support costs, nor the impact an infected wound will have on the patient's quality of life.

Managing wound exudate

Absorbent dressings have traditionally been used to absorb exudate, such as gamgee tissue, cotton/viscose based pads, foams and alginates, and often combine with the establishment of more recently introduced therapies like topical negative pressure therapy and compression therapy (White and Cutting, 2006).

Any proposed clinical interventions must be agreed with and be acceptable to patients and carers. The first step is to identify and understand the wound aetiology, which involves assessing the patient's underlying disease and contributing factors, and their impact on both the development and current presentation of the wound. Therefore, careful patient and wound assessment should always precede the selection of dressings to identify the cause of the wound and the reason for the excessive production of exudate. Where possible, the underlying cause should be treated alongside local wound and exudate management.

Vowden and Vowden (2002) suggest that dealing with exudate comprises the two related phases of direct and indirect management. Direct management includes the use of absorbent dressings, compression/elevation to eliminate fluid from the wound site, and the use of topical negative pressure; while the indirect measures include the control of bacterial infection or bacterial load, control of oedema and the use of immunosuppression or steroids to control inflammatory exudate in particular types of wounds.

The challenge in managing heavily exuding wounds is to maintain a moist wound-dressing interface, while effectively absorbing and retaining excess exudate, keeping exudate away from the skin, performing under compression bandaging, be easy to remove, and cost-effective (White and Cutting, 2006).

With regard to handling exudate, wound dressings may be designed to absorb, gel, retain moisture or allow the transmission of moisture vapour. For example, foam dressings absorb but not all retain fluid, so that when pressure is applied through compression bandaging or the patient putting weight on the

dressing, the exudate may be expressed (White and Cutting, 2006). Gelling dressings such as alginates require adequate amounts of exudate to function in the process of breaking down devitalized tissue by autolysis. However, unless the dressing is carefully placed within the wound, the periwound skin may become macerated. Hydrofiber dressings, which look similar in appearance to alginate dressings, are able to retain exudate without sideways spread or 'lateral wicking', keeping the exudate clear of the skin and wound base. Moisture–vapour permeability is cited as a way of reducing the amount of exudate held under or within a dressing (Thomas, 1996), such as a film product or foam dressing with a vapour-permeable outer covering, the theory being that a small amount of vapour can escape through microscopic pores in the dressing. However, there is no clinical evidence that this has any direct benefit to exudate management (White and Cutting, 2006).

Zetuvit Plus

Zetuvit Plus is a recently launched four-layer, non-irritant, conformable, air-permeable, highly absorbent pad designed for heavily exuding wounds. It comprises a soft outer non-woven hydrophobic surface that prevents adhesion to the wound surface, and facilitates the rapid passage of fluid into the central hydrophilic cellulose layers. This prevents the accumulation of exudate and as a result reduces the risk of maceration and infection, and the frequency of dressing changes. The central absorbent core of cellulose fluff is responsible for absorbing the exudate and providing soft padding. The manufacturers claim that Zetuvit Plus is capable of absorbing more than double the volume of conventional absorbent dressing pads and of binding, trapping and evenly distributing exudate even under compression bandaging. The outer water-repellent, non-woven, air-permeable layer is marked in green to ensure correct application of the dressing and prevent strike-through. The particular combination of dressing properties makes Zetuvit Plus an efficient, effective, comfortable and cost-effective dressing for heavily exuding wounds.

Case studies

The following case studies represent the problems regularly encountered by patients with heavily exuding wounds, and demonstrate the challenges faced by district nurses managing these types of wounds in the community. All case studies illustrate the importance of an holistic assessment and care-planning in partnership with patients and their carers, necessary to achieve best practice.

Case study 1

Mr P is a 45-year-old gentleman with learning difficulties. He was referred to the tissue viability service on 30 June 2010 by the district nurse who had been providing care for him in his residential home. Mr P had a history of leg ulceration and the current ulcer had been present for 6 months. Mr P had signs of venous disease and his ankle brachial pressure index (ABPI) excluded arterial disease.

The main problem, reported by the district nurse, was exudate management. Despite the dressings and compression bandages being changed daily, there was still strike-through. The district nurse had, at various points, used alginates,



Figure 1. Case study 1. Silver deposits in the wound, with areas of over-granulation

polyurethane foams, and a hydrofiber.

At the time of referral, a silver alginate was being used under four-layer full compression, and changed daily. Figure 1 shows silver deposits in the wound, with areas of over-granulation tissue. Following assessment, Mr P began using a simple, low-adherent primary dressing, with Zetuvit Plus as a secondary dressing under the existing compression system. Mr P's carers were asked to encourage him to use the recliner chair in the shared lounge.

During the first week, the frequency of dressing changes reduced from daily to alternate days. At week two they were further reduced to every third day; by week three the dressings were being changed twice per week; and by week four dressing changes were reduced to weekly, with no strike-through. Exudate management was reported by the district nurse as very good, with excellent clinical outcome (Figure 2). In addition to improved comfort and clinical



Figure 2. Case study 1. Improvements seen with Zetuvit Plus. Exudate management reported as very good, with excellent clinical outcome



Figure 3. Case study 2. Extensive moisture lesions resulting in copious exudate

outcome for the patient, Zetuvit Plus offered a cost-effective alternative to the trust.

Case study 2

Mr W is a 75-year-old gentleman who has multiple health problems, including chronic heart failure and extensive osteoarthritis. He lives home alone with support from home carers and the district nursing service.

He was referred by the district nurse to the tissue viability service for exudate management. Mr W had extensive moisture lesions (Figure 2) resulting from copious exudate, secondary to cardiac oedema and from sleeping in a chair with his legs



Figure 4. Case study 3. Fungating wound secondary to rectal carcinoma

dependant 24 hours every day. Owing to poor cardiac function, Mr W was not suitable for compression therapy. He expressed his depression at always having wet, sore and stinging legs.

The district nurse had used a variety of dressings to manage the exudate, including viscopaste PB7, foams, alginates, basic wound pads, and a hydrofiber. These were covered with a layer of orthopaedic wool bandage and secured with a cotton crepe bandage. Although dressings were being changed twice daily, there was still strike-through. Mr W had also been treated for recurrent infections on a number of occasions.

Mr W began using a simple, low-adherent primary dressing and Zetuvit Plus was used as the secondary dressing, secured with a cotton crepe bandage. During the first week, dressing frequency was reduced to daily, and in week two reduced further to alternate days. The district nurse reported that there was no strike-through on this regimen, and that Mr. W had stated that he felt more comfortable and his legs did not sting so much. The district nurses reported that the condition of Mr W's skin had greatly improved. Mr W was also pleased that he did not need to have the dressings changed twice every day, and had some time to himself.

Unfortunately, prior to the planned review visit from the tissue viability service, Mr W was admitted to hospital where he sadly died.

Case study 3

Mr T is a 72-year-old gentleman with a fungating wound (Figure 4) secondary to rectal carcinoma referred by the district nurse. Mr T expressed to the author (JS) at assessment that all he wanted was 'a comfortable pad that would soak up all the muck that was causing his poor wife so much extra washing, and not a sticky one as it was uncomfortable'.

The district nurse had tried two different silicone adhesive dressings with the aim of containing the exudates and reducing the potential for pain at dressing changes. Dressings were changed daily, but did not manage the exudate, resulting in soiled clothes and bedding. The district nurse also reported that the dressing had often lifted prior to the visit, but Mr T had declined twice-daily visits. The district nurse added standard wound pads over the top of the primary dressing, which Mr T found very uncomfortable and still did not prevent the soiling of his clothes.

Following discussion with Mr T, it became clear that he wanted a large pad that could be held in place by underwear, as he had found the different adhesive dressings used in hospital and in the community particularly uncomfortable. Therefore, a plan was agreed to use a soft silicone primary dressing covered with a large Zetuvit Plus pad, secured with elastic net-type continence pants to be changed daily. It was agreed that the district nurse would visit Mr T at a set time to allow him to shower before his/her visit for wound care and administration of medication

On review 1 week later, Mr T had requested after 4 days that the original primary dressing was stopped and expressed his preference to have the Zetuvit Plus dressing placed directly on the wound. Mr T stated that he found the dressing comfortable and it had stopped the leaking.

While Zetuvit Plus may not necessarily have been the initial dressing of choice by health professionals, it met the expressed



Table 2. Costing and sizing comparisons of wound dressings

Kerramax		Drymax Extra		Sorbion Sachet S		Eclipse		Flivasorb		Cutisorb Ultra		Zetuvit Plus	
Size	Price (p)	Size	Price (p)	Size	Price (p)	Size	Price (p)	Size	Price (p)	Size	Price (p)	Size	Price (p)
10cm x 90		10cm x 199		10cm x 225				10cm x 212		10cm x 199		10cm x 60	
10cm		10cm		10cm				10cm		10cm		10cm	
10cm x 119		10cm x 328		20cm x 373				10cm x 355		10cm x 333		10cm x 83	
22cm		20cm		10cm				20cm		20cm		20cm	
				12cm x 189		15cm x 97						15cm x 95	
				5cm		15cm						20cm	
20cm x 210		20cm x 616		20cm x 700				20cm x 668		20cm x 625		20cm x 130	
22cm		20cm		20cm				20cm		20cm		25cm	
				30cm x 537									
				10cm									
30cm x 240		20cm x 886		30cm x 1007		20cm x 214		20cm x 945		20cm 942		20cm x 200	
20cm		30cm		20cm		30cm		30cm		30cm		40cm	
						60cm x 815							
						40cm							
						Eclipse Boot							
						60cm x 1354							
						70cm							

Prices as per Drug Tariff, October 2010

requirements of Mr T, demonstrating how important it is to listen to patients.

Evidence of effectiveness

Zetuvit Plus offers a cost-effective alternative (Table 2) to other high absorbency dressings available in the drug tariff. Zetuvit Plus met the requirements in the case studies for exudate management to the satisfaction of the patients and the district nurse. The patients reported that they found it soft and comfortable.

Conclusions

The management of patients with exuding wounds places unique demands on the nurses who care for them and nurses, in turn, demand high standards in terms of dressing products that do what is required and meet their professional responsibilities. This article has explored the issue of wound exudate, what it is, and the problems associated with patient and wound management. Exudate is not ‘bad’, nor does it always relate to infection; rather, it is a necessary component for healing. Regular, ongoing patient and wound assessment, and appropriate interventions to correct or alleviate medical conditions that increase exudate production, and managing exudate correctly can prevent many of the uncomfortable, undignified and inconvenient complications that patients experience. BJN

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KEY POINTS

- Exudate is a necessary part of the healing process
- An understanding and knowledge of exudate production will help the nurse to provide effective management
- A number of dressings and therapies are designed to cope with exudate
- Excess exudate can cause inconvenience, loss of dignity, extended healing and embarrassment, as well as increased costs to the NHS if not managed effectively