

A survey of postoperative wound dressing practice before and after implementing national guidelines

Nigel Roberts, Julie Sorrell, Alistair Bielby, Richard Searle

Abstract

Aims: The National Institute of Health and Clinical Excellence (NICE) recommend that at the end of an operation 'surgical incisions anticipated to heal by primary intention should be covered by a film membrane, with or without a central absorbent pad'. The objectives of this project were to measure the usage and acceptability of a postoperative dressing, and evaluate the use of resources and incidence of surgical site infection (SSI). **Methods:** The approach comprised a survey of current practice (non-woven dressings) followed by a further survey with a vapour-permeable film dressing after a programme of education and training in the use of the new product. **Results:** The incidence of SSI was 6.4% (5/78) using the non-woven dressing, and 4.8% (5/104) using the vapour-permeable barrier dressing. **Conclusions:** Using a cost model with conservative assumptions, a cost-saving of £13 per patient was observed after adoption of the vapour-permeable film dressing. **Declaration of interest:** Richard Searle and Alistair Bielby are employees of Smith & Nephew. This project was supported by an unrestricted grant from Smith & Nephew.

KEY WORDS

NICE guidance
Surgical site infection
Postoperative dressings
Education and training
Cost

Within the UK approximately 11 million surgical procedures or interventions are performed per year (Department of Health [DH], 2009; Office for National Statistics, 2010). (In England in 2008–9, there were 16,232,579

finished consultant episodes, 9,268,803 (57.1%) of which involved a procedure or intervention. In mid-2008, England was 84% of the UK population. Therefore, the number of procedures/interventions for the UK in 2008–9 is estimated to be $9,268,803/0.84 = 11,034,289$.) Many of these procedures will result in the deliberate creation of a break in the

Given that the wound has been intentionally created, it is beholden on healthcare professionals to manage the wound in the most effective manner possible so as to expedite healing and avoid potential complications.

integrity of the skin, the body's natural barrier to extrinsic contamination. Given that the wound has been intentionally created, it is beholden on healthcare professionals to manage the wound in the most effective manner possible so as to expedite healing and avoid potential complications.

Historically, the management of postoperative wounds has perhaps received less attention than is merited, with the greatest focus being upon the management of chronic wounds (Cosker et al, 2005).

However, more recently, some authors have turned their attention to the choice of dressing for postoperative wounds. Cosker et al (2005) set out the properties of an ideal post-operative dressing:

- ▶▶ Allow gaseous exchange
- ▶▶ Function as a waterproof barrier
- ▶▶ Allow monitoring of the wound
- ▶▶ Low adherence for easy atraumatic removal
- ▶▶ Able to act as an effective barrier to bacterial contamination.

This combination of features and properties follows from the requirement not only to provide good wound care to allow the wound to heal, but also from the need to reduce the risk of complications such as surgical site infection (SSI). Given that any surgical procedure carries the risk of the patient developing postoperative wound complications such as SSI (Tustanowski, 2009), it is essential to

Nigel Roberts is Cardiothoracic Theatre Manager, Senior ODP, Cardiothoracic Theatres; Julie Sorrell is Clinical Research Sister, both at Northern General Hospital, Sheffield Teaching Hospitals NHS Foundation Trust; Alistair Bielby is Clinical Project Manager; Richard Searle is Health Economics Manager, both at Smith and Nephew Healthcare Ltd, Hull

give due consideration to appropriate management of the wound. Clarke et al (2009) highlighted the fact that there may be a perception among surgeons that complications, such as SSIs, are rare. Although the authors are referring specifically to orthopaedic surgeons, it is probable that this applies across other specialities. In fact, SSIs make up a substantial proportion of healthcare-associated infections (HCAs), accounting for up to 20% of all HCAs, and affect more than 5% of patients that have had surgery (National Institute for Health and Clinical Excellence [NICE], 2008a).

A range of guidance has been produced regarding a strategy for the prevention of HCAs, including SSI among other possible causes (Pratt et al, 2007). In specific recognition of the potential impacts posed by SSI, guidelines have been issued by NICE on the 'prevention and treatment of surgical site infection' (NICE, 2008a). These guidelines highlight the need for, and importance of, a thorough and effective approach to post-surgical wound management. While NICE guidance encompasses the various facets of care associated with the aetiology of a SSI, it makes specific recommendations regarding postoperative dressing practice. The NICE recommendation is that 'at the end of the operation surgical incisions anticipated to heal by primary intention should be covered by a film membrane, with or without a central absorbent pad' (NICE, 2008b).

Implementing NICE guidance on postoperative dressings

The properties of a vapour-permeable film dressing, as recommended by NICE, align well to the characteristics of the ideal post-surgical dressing as described by Cosker et al (2005). In many cases, current postoperative dressing practice will comprise the use of a vapour-permeable film dressing as NICE suggest. However, in some cases, dressing practice may differ from these guidelines and may encompass the use of various types of wound dressing or coverings, such as non-woven dressings, or simple gauze.

Where postoperative dressing choice is not aligned with current NICE recommendations, trusts may consider proposing a change in practice in order to align their practice with the applicable guideline. It is important, alongside changing the dressing product used, to include product-specific training and more general education so that appropriate staff are well-acquainted with the new products

... SSIs make up a substantial proportion of healthcare-associated infections (HCAs), accounting for up to 20% of all HCAs, and affect more than 5% of patients that have had surgery (NICE, 2008a).

and the reasons behind the change. In principle, such a change is relatively straightforward to implement, and may provide an opportunity to compare practice (and its consequences) before and after the change. The costs and benefits of the change in real clinical practice can then be evaluated.

The first two authors' cardiothoracic unit in a NHS foundation trust perform a range of procedures including coronary artery bypass grafting (CABG), valve repair and atrial septal defect (ASD) repair. The unit performs approximately 1400 procedures per annum and serves a population of some 2.2 million patients.

In early 2009, a project group was established involving representatives from the trust (including the infection control nurse, tissue viability nurse and clinical procurement specialist) and industry, with a view to implementing the NICE guidelines on postoperative dressings and scrutinising the clinical and budgetary implications of doing so.

Methodology

A survey was undertaken of the use of postoperative dressings when applied to sternal wounds and associated drain

sites in the cardiothoracic department, using a bespoke survey tool. The objectives of the survey were to measure the usage and acceptability of postoperative dressings, the use of resources and the incidence of SSI.

Current postoperative dressing practice within the department consisted of the application of a non-woven dressing (Mepore[®], Mölnlycke Health Care) to the sternal wound immediately postoperatively, while the patient was in theatre.

Dressing practice was surveyed in two phases: for six weeks, before and six weeks after the implementation of the NICE postoperative guidelines. This implementation included the introduction of a vapour-permeable film dressing (Opsite[®] Post-Op Visible, Smith & Nephew Healthcare Ltd) and a collaborative programme of education and training.

The bespoke survey form collected details of the dressings used, infections observed and clinician acceptability of the dressings. One form was completed for each cardiothoracic surgical procedure undertaken over a six-week period. The occurrence of SSI was documented not only via the survey form which was completed during the patient's hospital stay, but was also monitored post-discharge according to the protocol for the surveillance of SSI issued by the Health Protection Agency (HPA, 2008).

Infections were subsequently confirmed via microbiological investigation. The data were collated and analysed using Microsoft Excel and SPSS Version 17.0. Costs were from the perspective of the hospital trust, and calculated by multiplying resource use by nationally-published unit costs where possible. In the case of dressings, unit prices were taken from the online and printed versions of the NHS Supply Chain Catalogue, April 2010 (NHS, 2010). The unit cost of nursing time per dressing change was estimated to be £10 (assuming 15 minutes per change, at £40 per hour contact time) (Curtis, 2009).

Results

Seventy-eight incisions were included in the survey before the change in practice, where the wounds were dressed with non-woven dressings (from all surgical procedures undertaken between 1 April and 12 May, 2009). One hundred and four incisions dressed with vapour-permeable barrier dressings were included after the change in practice (from all procedures undertaken between 20 May and 23 June, 2009). The mean age of patients was similar before and after the change in practice (67.8 and 67.2 years respectively), and the majority of patients were male (63.9% and 71% respectively).

The most common surgical procedure was CABG, as shown in *Table 1*. Valve repair procedures were also undertaken, and in about one-tenth of cases, both procedures were carried out together.

The American Society of Anesthesiologists' classification of physical status (ASA scores) (Woodfield et al, 2007) were recorded for each procedure (*Table 2*). For the first phase (dressed with the non-woven dressing), 89% of cases scored 3 (i.e. patient with severe systemic disease that is not incapacitating), or 4 (patient with an incapacitating systemic disease that is already life-threatening, and not always correctable by operation), whereas for the second phase (dressed with the vapour-permeable film dressing), 97% of cases scored 3 or 4.

Incidence of infection

Five sternal infections were observed in each phase of the survey. Hence, the incidence of infection was 6.4% (5/78) using the non-woven dressing, and 4.8% (5/104) using the vapour-permeable barrier dressing (*Table 3*). One of the infections before the change in practice was deep, the remaining four being superficial, and two of the five patients whose wounds became infected were readmitted to hospital as a consequence of SSI. After the change in practice, all five infections were superficial, with one SSI-related readmission.

One wound before the change

Table 1
Surgical procedures

Procedure	First phase		Second phase	
	Frequency	Relative frequency (%)	Frequency	Relative frequency (%)
CABG	46	60.5	53	52.0
Valve repair	17	22.4	34	33.3
CABG + valve repair	9	11.8	11	10.8
ASD	1	1.3	0	0.0
Other	3	3.9	4	3.9
Sub-total	76	100.0	102	100.0
Not recorded	2		2	
Total	78		104	

Table 2
ASA scores

ASA score	First phase		Second phase	
	Frequency	Relative frequency (%)	Frequency	Relative frequency (%)
1	1	1.8	0	0.0
2	5	9.1	2	2.4
3	35	63.6	71	84.5
4	14	25.5	11	13.1
Sub-total	55	100.0	84	100.0
Not recorded	23		20	
Total	78		104	

required negative pressure wound therapy (NPWT), compared with no requirement for this treatment after the change.

Use of resources

The number of dressings used and the number of dressing changes required were calculated. Each patient had an

initial dressing application in theatre, and potentially further additional dressing changes on the wards after surgery. In some cases (seven cases before the change in practice and six after the change), additional dressing changes on the wards had been recorded, but it was clear that there was some missing data relating to the

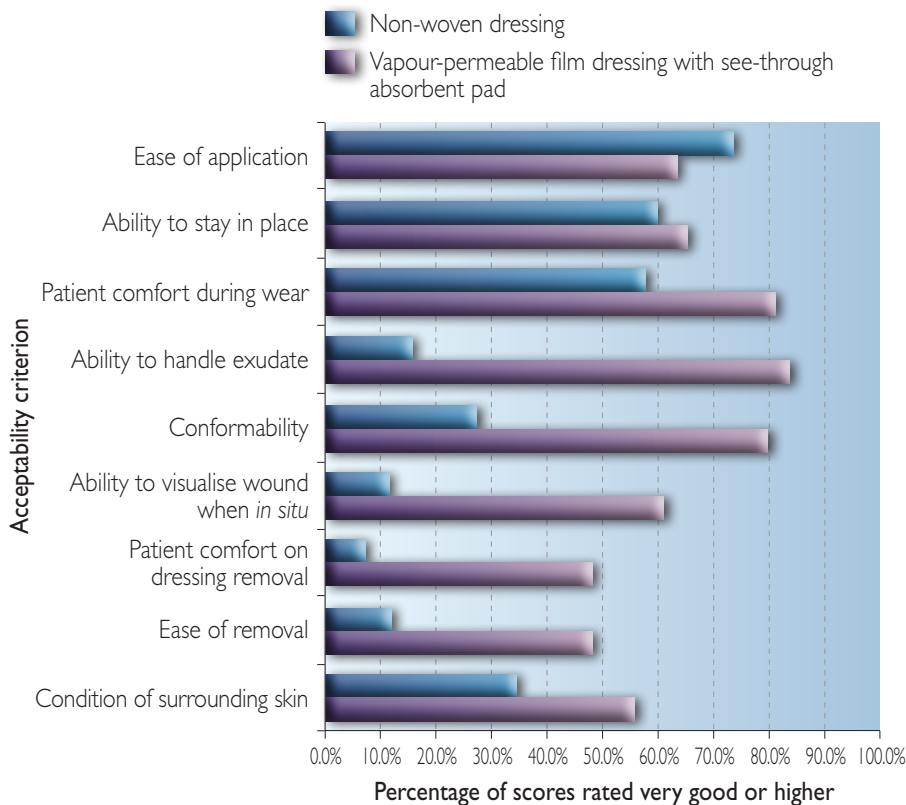


Figure 1. Clinician acceptability of the dressings.

dressing type and size. In these cases, as a conservative estimate, one dressing of the smallest available size within the relevant range of the appropriate dressing was assumed to have been applied at each dressing change.

At each dressing change the number and size of the dressings used was variable, depending on the incision length and position of the drain sites. 241 non-woven dressings were applied before the change in practice (a mean of 3.1 dressings per patient), and 330 of the vapour-permeable film dressings were applied after the change in practice (a mean of 3.2 dressings per patient). In addition, some use of non-woven dressings was recorded in the second part of the survey: in total, 18 non-woven dressings were used. The number of additional dressing changes was 66 (a mean of 0.85 per patient) in the first phase and 57 (a mean of 0.55 per patient) in the second phase. Hence, the total number of dressing changes (including the initial application in theatre) was 144 in the first phase (a mean of 1.85 per patient) and 161 in the second phase (a mean of 1.55 per patient).

... clinicians should be able to clearly visualise the incision line while the dressing is in place, enabling them to inspect for clinical evidence of complications.

Clinicians were asked to document their opinion of the performance and acceptability of the dressings against nine criteria. The results are shown in *Figure 1*.

Discussion

NICE have recommended that at the end of an operation 'surgical incisions anticipated to heal by primary intention should be covered by a film membrane, with or without a central absorbent pad' (NICE 2008b: 1). Film membrane type dressings offer a number of advantages over the non-woven dressing type, as they:

- ▶ Provide a barrier to extrinsic contamination
- ▶ Allow postoperative inspection of the periwound area (and also, in the case of one product, inspection of the wound itself)

- ▶ Allow straightforward removal as a result of their low adhesion to the wound
- ▶ Allow showering
- ▶ Maintain a moist wound environment.

As a consequence of the properties described above, the switch to the vapour-permeable film dressing should deliver observable benefits from the clinicians' perspective. *Figure 1* illustrates the differential between the two products when clinicians evaluated their performance against the nine criteria. In eight of the nine criteria, the film dressing was rated as superior. In one category (ease of application), the non-woven dressing was rated more highly. This possibly reflects the relative unfamiliarity of clinicians with the newly introduced dressing, and emphasises the need for sustained product-specific training.

For the majority of criteria, where the vapour-permeable film dressing rated more highly than the non-woven dressing, the largest differences between clinician rating of the two products were observed in the categories of:

- ▶ Exudate management
- ▶ Conformability
- ▶ Comfort on removal
- ▶ Ease of removal
- ▶ Ability to visualise the wound.

In the latter criterion, the vapour-permeable film dressing has a considerable advantage over the non-woven dressing, in the form of a see-through central absorbent pad. In consequence, clinicians should be able to clearly visualise the incision line while the dressing is in place, enabling them to inspect for clinical evidence of complications. This offers a distinct advantage over non-woven dressings. As Tustanowski (2009) recently pointed out, 'spotting signs of wound complications and infection in the early stages can be difficult because the wound is generally obscured by the dressing'.

In addition to investigating the acceptability of the new dressing,

Table 3
Incidence of sternal infection

Observed result	Before change in practice	After change in practice
Number of superficial infections	4	5
Number of deep infections	1	0
Total number of sternal infections	5	5
Incidence of sternal infection (%)	6.4	4.8
Number of infection-related readmissions	2	1

Table 4
Cost saving

Cost per patient	First phase	Second phase	Saving
Dressing	£1.03	£3.56	-£2.53
Nurse time	£18.46	£15.48	£2.98
Readmission	£18.46	£5.54	£12.92
Total	£37.95	£24.58	£13.37

the survey recorded data on the use of resources, such as dressings used and the number of dressing changes performed and the incidence of postoperative SSIs. The latter was evaluated both during inpatient stay and also via a post-discharge patient questionnaire. The aetiology of SSIs is complex and multifactorial and, as a result, the most effective prevention strategies are likely to be those that involve numerous elements, of which the appropriate choice of postoperative dressing is an important part (NICE, 2008a). In this survey, a lower incidence of SSI was observed in the second phase, in which the vapour-permeable film dressings were used (4.8% versus 6.4%). In the authors' opinion, this represents an encouraging trend and, if maintained in the long term, could result in substantial clinical and economic benefits for the trust.

The survey demonstrated that the

made in order to align practice with the NICE recommendations. However, it is interesting to investigate whether this cost can be offset by savings in other areas, such as the costs associated with the treatment of SSIs. With this in mind, a cost analysis was undertaken from the perspective of the hospital trust.

In the second phase of the survey there was a mean incremental cost of dressings of £2.53 per patient, compared with the first phase (£1.03 in the first phase vs £3.56 in the second phase). This represents the additional acquisition cost of dressings required to be compliant with the NICE guidelines. As a proportion of the total cost per case, this is a relatively small amount, since the total cost of a cardiothoracic surgical procedure such as those included in this survey is substantial. For example, the cost of a first-time coronary artery bypass graft (CABG) procedure in England is estimated in the NHS National Reference Costs to be £7,959 (DH, 2008). The incremental cost of dressings per patient to switch from a non-woven to a vapour-permeable film dressing represents approximately 0.03% of this total cost. Assuming that the incremental materials costs would be similar across different specialities, even for simpler procedures such as hernia repair (£2,313) or appendectomy (£1,871), the incremental cost of dressings would be a relatively small proportion of the total (0.11% and 0.14% respectively).

In any evaluation of resources used, it is important to consider all relevant elements which contribute to the cost incurred by the care provider. In this case the cost of dressings, the labour cost of dressing application (clinical staff time), and the costs incurred as a result of SSIs are all appropriate for consideration. Since the dressings are applied and changed by clinical staff, it is essential that the opportunity cost of clinician time is taken into account. The average number of dressing changes per patient was 1.85 in the first phase, compared with 1.55 in the second. This suggests that by switching to the vapour-permeable film dressing,

In any evaluation of resources used, it is important to consider all relevant elements which contribute to the cost incurred by the care provider. In this case the cost of dressings, the labour cost of dressing application (clinical staff time), and the costs incurred as a result of SSIs are all appropriate for consideration.

number of postoperative dressings used on a per-patient basis was virtually identical in both phases (3.1 and 3.2 respectively). Given the differences in unit cost between the two dressings used, this implies that an additional investment in the cost of dressing materials per patient would need to be

30 fewer dressing changes would be required per 100 patients treated. A possible reason for this difference may be that the film dressing includes a see-through absorbent pad, which facilitated assessment of the incision line with the dressing *in situ*.

In the facility in which the survey was undertaken, approximately 28 procedures per week are performed, suggesting that annually, across 1456 procedures, a total of 434 fewer dressing changes would be required after the adoption of the vapour-permeable film dressing. For each phase, the number of dressing changes undertaken was multiplied by the estimated unit cost of clinician time to give a total cost of clinician time. In the case of the first phase, the cost of clinician time was calculated to be £18.46 per patient, whereas for the second phase the figure was £15.48. Across a facility undertaking 1456 procedures per year, this would suggest an annual saving of 108.5 hours. It is important to recognise that this time-saving can be valued as an opportunity cost; in this case, the associated estimated annual cost-saving would be £4,340.

Additional information was obtained from the survey which can be used to inform the estimation of the cost of treating SSI. There were two readmissions to hospital in the first phase, with a length of stay totalling five days, whereas in the second phase there was one readmission with a length of stay of two days. Given the small patient numbers it remains to be seen whether this encouraging trend becomes significant over a longer time-frame with more substantial numbers of patients.

Using a unit cost of £288 per day of hospital stay (based on Vowden et al, 2009), the expected additional cost per patient for the treatment of SSI would be £18.46 for the first phase (£288x5/78) and £5.54 for the second phase (£288x2/104), a difference of £12.92. Therefore, the savings in nurse time and hospital stay associated with SSI more than offset the additional dressing

acquisition costs, resulting in a cost-saving of £13 per patient (Table 4).

It is important that both the clinical and economic consequences are considered in any analysis. This provides a balanced account which enables the reader to draw relevant conclusions

To make informed decisions which involve changing healthcare policy or practice, in addition to the benefits conferred by the change, it is important to consider the cost implications.

to make appropriately informed decisions. However, given the minimal incremental cost of dressings compared with the total procedure costs, the user feedback presented in Figure 1 suggests that the additional cost might be more than justified, even without the additional cost analysis shown above.

Sensitivity analysis

The unit cost of nurse time in the analysis above was based on dressing changes being undertaken by a staff nurse, registered nurse or registered practitioner. The cost per dressing change is dependent on the grade of the personnel involved. For example, the rate per hour of patient contact for a senior staff nurse or ward team leader would be £62 (Curtis, 2009). Using this unit cost in the analysis above would result in a reduction in nursing costs of £4.62 for the second phase compared to the first phase, an overall saving of £15.01 per patient.

If the time taken to undertake a dressing change were 10 rather than 15 minutes, the reduction in nursing costs would be £1.99 for the second phase compared to the first phase, an overall saving of £12.38 per patient.

As a more conservative approach, the readmission cost associated with an SSI was estimated by combining the data across both phases, to eliminate the effect of differences in

readmission rate and length of stay across the two phases. Combining data for both phases, the total length of stay for the readmissions associated with 10 SSIs was seven days, giving an average of 0.7 days per infection, and a cost of hospital readmission of £201.60 per SSI (£288x0.7). Under these assumptions, the expected cost of readmission per patient (averaged across all patients) for the treatment of SSI would be £12.92 for the first phase (£201.60x5/78) and £9.69 for the second phase (£201.60x5/104), a difference of £3.23. In this case, the cost-savings from reduced nurse time and readmission costs again more than offset the additional dressing acquisition costs, resulting in a cost-saving of £3.68 per patient. In this case, the reduction in nursing costs alone is sufficient to produce an overall cost-saving. This reduction in nursing costs reflects the opportunity cost of nurses' time. Therefore, with conservative assumptions, even with a small reduction in SSI incidence, a decision to change from the non-woven to the film dressing may be justified.

Limitations

Survey methodology is a well-established approach for evaluating practice in real-world situations, but it is subject to the constraints that would be implicit to any non-trial approach. Nevertheless, it can give valuable insights into both practice and outcomes, as an aid to decision-making. Further work of this kind should be encouraged in other trusts, in addition to research, to confirm and build on the results presented in this article.

The cost analysis presented here was based on the perspective of the hospital trust. It presents a relatively conservative approach, and the cost of treating an SSI is likely to be an underestimate. For example, the costs did not include any outpatient attendances by patients with symptoms of SSI. The national average unit cost of a cardiothoracic outpatient non-consultant led first attendance without hospital admission is £214 (DH, 2008). Furthermore, if the analysis were conducted from the perspective of

the NHS, other costs such as GP visits, district nurse time and antibiotics prescribed in the community would need to be taken into account.

Conclusions

Guidelines issued by the Department of Health recommend, 'at the end of the operation surgical incisions anticipated to heal by primary intention should be covered by a film membrane, with or without a central absorbent pad'. The switch to the recommended dressing type should in theory deliver observable benefits in clinical practice. This survey demonstrated that when clinicians evaluated the performance of a vapour-permeable film dressing compared with a non-woven dressing, in eight of the nine criteria used, the film dressing was rated as superior. The greatest advantage of the film dressing over the non-woven dressing was observed in the categories of exudate management, conformability, comfort on removal, ease of removal and the ability to visualise the wound. In the latter criterion, it is likely that the high rating of the specific film dressing used is related to the see-through central absorbent pad. A difference was also observed in the incidence of SSI between the non-woven dressing (6.4%) and the film dressing (4.8%).

This represents an encouraging trend, and, if maintained over a longer timescale, could result in substantial clinical and economic benefits.

To make informed decisions which involve changing healthcare policy or practice, in addition to the benefits conferred by the change, it is important to consider the cost implications. In order to do so, relevant costs were estimated which contribute to the total cost incurred by the care provider, including the cost of dressings, the labour cost of dressing application (clinical staff time) and the costs incurred as a result of SSIs. When these costs were considered using a cost model with conservative assumptions, a cost-saving of £13 per patient was observed after adoption of the vapour-permeable film dressing. The incremental acquisition costs of

the vapour-permeable film dressing compared with the non-woven dressing were estimated to be 0.03% of the total procedure costs.

The difference in total cost between the two alternatives is driven both by the difference in incidence of SSI and the difference in nursing costs. In this instance, the survey documented an incidence of 6.4% where the non-woven dressing was used, compared with 4.8% where the film dressing was used. However, even under conservative assumptions, a cost-saving could be achieved through reduced nursing costs alone. Hence, a decision to adopt the film dressing in routine practice is likely to be justified. **WUK**

References

- Clarke JV, Deakin AH, Dillon JM, Emmerson S, Kinninmonth AW. (2009) A prospective clinical audit of a new dressing design for lower limb arthroplasty wounds. *J Wound Care* 18(1): 5–8,10–1
- Cosker T, Elsayed S, Gupta S, Mendonca AD, Tayton KJJ (2005) Choice of dressing has a major impact on blistering and healing outcomes in orthopaedic patients. *J Wound Care* 14(1): 27–9
- Curtis L. (2009) *Unit costs of health and social care*. PSSRU, University of Kent.
- Department of Health (2008) *NHS National Reference Costs 2008–9*. DH, London
- Department of Health (2009) *Hospital episode statistics*. The Health and Social Care Information Centre, London
- Health Protection Agency (2008) *Protocol for the Surveillance of Surgical Site Infection version 4*. Surgical Site Infection Service. HPA, London
- National Institute for Health and Clinical Excellence (2008a) *NICE clinical guideline 74: Prevention and treatment of surgical site infection*. NICE, London
- National Institute for Health and Clinical Excellence (2008b) *Press release: NICE guidelines are set to improve the prevention and treatment of surgical site infections (SSI)*. Department of Health, London
- NHS Supply Chain Catalogue, April 2010
- Office for National Statistics (2010) *Population estimates for UK, England and Wales, Scotland and Northern Ireland*. HMSO, London

Key points

- ▶▶ Guidelines highlight the importance of a thorough and effective approach to post-surgical wound management.
 - ▶▶ The vapour-permeable film dressing provides a barrier to extrinsic contamination while allowing inspection of the incision line and peri-wound area.
 - ▶▶ Clinicians rated the usability and acceptability of the vapour-permeable film dressing more highly than the non-woven dressing for the majority of criteria.
 - ▶▶ A cost-saving of £13 per patient was observed after adoption of the vapour-permeable film dressing.
- Pratt RJ, Pellowe CM, Wilson JA, Loveday HP, et al (2007) epic2: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. *J Hospital Infect* 65: S19–S22
- Tustanowski J (2009) Effect of dressing choice on outcomes after hip and knee arthroplasty: a literature review. *J Wound Care* 18(11): 449–58
- Vowden K, Vowden P, Posnett J (2009) The resource costs of wound care in Bradford and Airedale primary care trust in the UK. *J Wound Care* 18(3): 93–4, 96–8, 100 *passim*
- Woodfield JC, Beshay NMY, Pettigrew RA, et al (2007) American Society of Anesthesiologists classification of physical status as a predictor of wound infection. *ANZ J Surg* 77(9): 738–41