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 integrity of the skin, the body’s natural barrier to extrinsic contamination. Given that the wound has been intentionally created, it is behooven 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 postoperative 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...
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 specialties. In fact, SSIs make up a substantial proportion of healthcare-associated infections (HCAIs), accounting for up to 20% of all HCAIs, 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 HCAIs, 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 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 performs a range of procedures including coronary artery bypass grafting (CABG), valve repair and atrial septal defect (ASD) repair. The unit performs approximately 1,400 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 (NHHS, 2010). The unit cost of nursing time per dressing change was estimated to be £1.0 (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 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

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Table 1
Surgical procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>First phase</th>
<th>Second phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Relative frequency (%)</td>
<td>Frequency</td>
</tr>
<tr>
<td>CABG</td>
<td>46</td>
<td>60.5</td>
</tr>
<tr>
<td>Valve repair</td>
<td>17</td>
<td>22.4</td>
</tr>
<tr>
<td>CABG + valve repair</td>
<td>9</td>
<td>11.8</td>
</tr>
<tr>
<td>ASD</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>3.9</td>
</tr>
<tr>
<td>Sub-total</td>
<td>76</td>
<td>100.0</td>
</tr>
<tr>
<td>Not recorded</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>78</td>
<td></td>
</tr>
</tbody>
</table>

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Table 2
ASA scores

<table>
<thead>
<tr>
<th>ASA score</th>
<th>Frequency</th>
<th>Relative frequency (%)</th>
<th>Frequency</th>
<th>Relative frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1.8</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>9.1</td>
<td>2</td>
<td>2.4</td>
</tr>
<tr>
<td>3</td>
<td>35</td>
<td>63.6</td>
<td>71</td>
<td>84.5</td>
</tr>
<tr>
<td>4</td>
<td>14</td>
<td>25.5</td>
<td>11</td>
<td>13.1</td>
</tr>
<tr>
<td>Sub-total</td>
<td>55</td>
<td>100.0</td>
<td>84</td>
<td>100.0</td>
</tr>
<tr>
<td>Not recorded</td>
<td>23</td>
<td>100.0</td>
<td>20</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>78</td>
<td></td>
<td>104</td>
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</tr>
</tbody>
</table>
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, as they:

- 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.

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.

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,
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.

Table 3

<table>
<thead>
<tr>
<th>Observed result</th>
<th>Before change in practice</th>
<th>After change in practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of superficial infections</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Number of deep infections</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total number of sternal infections</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Incidence of sternal infection (%)</td>
<td>6.4</td>
<td>4.8</td>
</tr>
<tr>
<td>Number of infection-related readmissions</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 4

<table>
<thead>
<tr>
<th>Cost per patient</th>
<th>First phase</th>
<th>Second phase</th>
<th>Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dressing</td>
<td>£1.03</td>
<td>£3.56</td>
<td>-£2.53</td>
</tr>
<tr>
<td>Nurse time</td>
<td>£18.46</td>
<td>£15.48</td>
<td>£2.98</td>
</tr>
<tr>
<td>Readmission</td>
<td>£18.46</td>
<td>£15.54</td>
<td>£12.92</td>
</tr>
<tr>
<td>Total</td>
<td>£37.95</td>
<td>£24.58</td>
<td>£13.37</td>
</tr>
</tbody>
</table>

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.

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).

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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,
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 (£288x 5/78) 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 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.

References
NHS Supply Chain Catalogue, April 2010