Tools to compare the cost of NPWT with advanced wound care: an aid to clinical decision-making

While evidence to date is limited, the economic literature pertaining to negative pressure wound therapy (NPWT) suggests that, when used appropriately, it may have economic benefits compared with conventional wound care. Deciding on the appropriate point to start NPWT and, indeed, when to switch back to advanced wound care, is important and should be primarily based on clinical judgement. However, it may be useful to compare the costs of NPWT with advanced wound care. This article discusses economic considerations for NPWT, and suggests ways in which the weekly cost of treatment can be estimated as an aid to decision-making.

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Negative pressure wound therapy (NPWT) is now in widespread use and is seen by clinicians as a valuable adjunct to conventional wound healing methods. It has been postulated to promote wound healing by increasing local blood flow, reducing interstitial oedema, controlling exudate and stimulating the formation of granulation tissue and cell proliferation while removing healing inhibitors (Thompson, 2008). Funding bodies often perceive the technique as expensive, since the unit costs of renting the pump and purchasing consumables are high compared with traditional wound dressings. For the clinician, deciding on the appropriate point to start NPWT, and indeed when to switch back to advanced wound care is (and should be) primarily based on clinical judgement. However, being able to compare the costs of NPWT with advanced wound care may also be useful. This article will explore some of the economic considerations for NPWT and describe factors useful in the development of simple cost calculators to compare the weekly cost of NPWT with advanced wound care.

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Examples of clinical evidence

A substantial range of articles has been published on the subject of NPWT. These include reports of both comparative and non-comparative clinical studies, case studies, economic analyses, literature reviews and technology assessments. Several randomised controlled trials (RCTs) have been reported, all using the foam-based NPWT system. Some of these trials compared NPWT to advanced wound care, and others to saline-soaked gauze, which is still a commonly-used treatment in the United States. For example, Blume et al (2008) compared NPWT with advanced moist wound therapy for the treatment of diabetic foot ulcers in a 342-patient RCT. In this study, a greater proportion of foot ulcers achieved complete ulcer closure with NPWT within the 112-day active treatment phase (43.2% vs 28.9%, p=0.007) than in the control group. NPWT patients also experienced significantly fewer secondary amputations (p=0.035). The authors reported no significant difference in complications such as infection, cellulitis and osteomyelitis at six months. Armstrong and Lavery (2005) conducted a 162-patient RCT in diabetic foot amputation wounds, comparing NPWT with moist gauze. This study found a higher proportion of wounds closed (56% vs 39%), a faster rate of healing (p=0.005) and a faster rate of granulation tissue formation in the NPWT group (p=0.002). Braakenburg et al (2006) reported a 65-patient RCT comparing NPWT with modern wound dressings, in both chronic and acute wounds. This study found a shorter time to complete granulation (or ready for grafting) for NPWT, although this was not statistically significant. However, patient comfort proved to be an advantage for NPWT. Vuerstaek et al (2006) described an RCT in 60 in-patients comparing NPWT with conventional wound care techniques in venous leg ulcers. This study found a shorter time to healing (median 29 days vs 45 days, p=0.0001) and shorter time to prepare the wound bed (seven days versus 17 days, p=0.005).

Economic analyses

A small number of economic analyses, comparing costs of NPWT to other treatments can be found in the literature,

some of which will be discussed below. In some cases, authors of clinical studies have included cost analysis in their work, including some of the better-quality clinical studies. In addition, several reviews have been published; the review by Trueman (2007) provides a useful summary of published economic evidence. While the evidence to date is limited, the economic literature pertaining to NPWT suggests that, when used appropriately, it may have economic benefits compared with conventional wound care. For example, Flack et al (2008) evaluated the cost-effectiveness of NPWT compared with both traditional and advanced wound dressings in the treatment of diabetic foot ulcers (DFUs) in the United States, using a Markov modelling approach over a one-year period to calculate the cost per amputation avoided and the cost per quality-adjusted life year (QALY). They concluded that NPWT was less costly and more effective than both comparators.

Apelqvist et al (2008) used results from an RCT to estimate the use of resources and direct costs of care for patients treated with NPWT in diabetic patients with post-amputation wounds, using NPWT compared with moist wound therapy. They found no difference between the groups for length of stay, but the number of both dressing changes and outpatient visits were lower in the NPWT group. Overall, the use of resources and the cost of care were lower in the NPWT group.

Vuerstaek et al (2006) found that the costs of conventional wound care were higher than for NPWT for the in-patient treatment of chronic recalcitrant leg ulcers. Mouës et al (2005) reported an economic analysis in 2005 based on a 54-patient clinical trial of NPWT versus moist gauze in acute, traumatic, infected and chronic full-thickness wounds in the Netherlands. Although the cost of materials per patient was higher in the NPWT group, the nursing and hospitalisation costs were significantly lower. The total cost per patient was slightly lower for the NPWT group, although the difference was not statistically significant.

Lavery et al (2007) published a retrospective comparison of DFUs treated with NPWT and wet-to-moist therapy at home in the United States. This was undertaken by analysing claims data using a historical control. They found that the expected episode costs were about the same for the two therapies if one nurse visit per day was assumed (lower if two visits per day), concluding that NPWT may improve the proportion of DFUs that reach a successful endpoint and decrease the use of resources compared with wet-to-moist therapy. The RCT of both chronic and acute wounds reported by Braakenburg et al (2006) also investigated costs, and found that nursing costs were lower for NPWT, but total costs were not significantly different.

Overall, the evidence from cost analyses of NPWT indicates the potential for cost savings compared with conventional treatment. Further robust cost-effectiveness analyses in specific wound types would add weight to this conclusion.

Practice development

Practitioners are often asked to justify their use of NPWT, and in particular, year on year expenditure, to hospital finance departments and/or commissioning bodies. The absence of large-scale cost-utility analyses supporting NPWT can make justification difficult for funding bodies. Decisions whether to use NPWT, and when to initiate or discontinue the treatment, should be clinically-driven and based on the desired clinical outcome, taking into account the clinical indications of the therapy. The authors would suggest that alongside this process, it is useful for clinicians to be able to compare the cost of current advanced wound care choices with the proposed cost

Table 1

An illustration of inputs — use of resoures and unit costs

Advanced wound care

Resources used per dressing change		Unit cost
Primary covering dressings	3	£2.50
Packing dressing	5	£5.17
Saline sachets (100ml)	2	£0.71
Gauze swabs	2	£0.10
Nurse time (home visits)	1	£21.00*
Dressing changes per week	7	

NPWT

Resources used per dressing change		Unit cost
Dressing kits	1	£20.70
Canisters	1	£20.70
Pump	1	£84.00**
Nurse time (home visits)	1	£21.00
Dressing changes per week	2	
Canister changes per week	1	

* Cost of community nurse visit estimated by PSSRU, University of Kent, UK

** Based on a long-term rental cost of £365 per month

of NPWT. This is the case not only at the point of initiation of NPWT, but also subsequently, up until the point of discontinuation of NPWT.

With this in mind, it is useful to develop relatively simple tools that can be used to compare the weekly cost of treatment. While other costs incurred as a consequence of extended hospital stay and complications such as infection will also contribute to the total cost of treatment, the weekly cost of dressings and nursing time can provide useful information in a way that is straightforward and easy to use on a regular basis. For example, tools can easily be constructed using a spreadsheet programme on a computer, which can be set up to calculate the weekly cost of materials and nursing time. The usual way to do this is to input the resources (typically dressings and other materials, nurse time, and pump rental) required per week of treatment and multiply these by the appropriate unit cost. For example, the total number of dressings used per week is given by the number of dressings used at each dressing change multiplied by the number of dressing changes per week.

Important inputs to include for NPWT are the frequency of dressing and canister change, the weekly pump cost and the number of visits per week required to change the dressings (as illustrated in *Table 1*). For advanced wound care, both primary and secondary dressings should be considered. The product and size of any dressings used will define the unit cost. Ancillary materials may also be included if they are likely to contribute significantly to the weekly cost. A spreadsheet such as this merely adds up the costs of materials and nursing time from the inputs given, and does not need to make any further assumptions.

A simple 'ready reckoner' could also be constructed on paper. For a given wound, the cost per week of NPWT can be compared with the cost per week of advanced wound care.

There are several sources of unit costs for inclusion in calculations such as this. For dressings, nationally-published unit prices (such as those found in the NHS Drug Tariff or NHS Supply Chain catalogue) can be used. Unit costs of nursing time are also published annually by the Personal Social Services Research Unit (PSSRU) at the University of Kent, UK (Curtis, 2009). For community care, this takes travelling time into account, and makes an assumption about the patient contact time. If necessary, the cost of nursing time can also be calculated in a more detailed way to allow for differences in travelling distance or in the time taken to change the dressing. If known, local costs specific to a given organisation can also be used.

The total cost can be broken down into material costs and the cost of nursing time (*Table 2*). Nursing time is an important contributor to the total cost of wound care, and should be included where possible.

On the basis of our experience of having used a cost calculator in several clinical instances to date, the main drivers of cost for advanced wound care are the number of dressings per dressing change and the frequency of dressing changes. For some large wounds treated with advanced wound care, many dressings are used at each change, and where the rate of exudation is high, these dressings need to be changed frequently. For NPWT, the method of purchase of NPWT is an important factor, with purchased devices usually representing a more affordable day-by-day price.

Such calculators can be used as an aid to decision-making when considering switching from advanced wound care to

Table 2

An illustration of results — cost per week

Advanced wound care

Item	Number of items per week	Cost per week
Primary covering dressings	21	£52.50
Packing dressings	35	£180.95
Saline sachets (100ml)	14	£9.94
Gauze swabs	14	£1.40
Total materials		£244.79
Nurse time (home visits)	7	£147.00
Total		*£391.79*

NPWT

Item	Number of items per week	Cost per week
Dressing kits	2	£41.40
Canisters	1	£20.70
Pump	1	£84.00
Total materials		£146.10
Nurse time (home visits)	2	£42.00
Total		*£188.10*

NPWT or vice-versa, and can also be used as treatment progresses at regular intervals to ascertain the point at which the weekly cost of advanced wound care falls below the cost of NPWT.

To illustrate the calculations, *Tables 1* and *2* show an example where, if advanced wound care were to be used, dressings would need to be changed on a daily basis. *Table 1* shows the input data and *Table 2* illustrates the results. In this case, the use of NPWT would result in reduced weekly materials expenditure and a substantial reduction in nursing resources.

NPWT use in acute care has been established over the past 15 years in the UK, but growing pressure on hospital beds has increased the use of NPWT in community settings. A recent publication from the UK Department of Health has suggested that as a result of advances in tissue viability, more complex wound care can now be provided in the community setting and that therapies such as NPWT should be commonplace. Tissue viability professionals should be appointed to direct service provision and ensure high standards (DH, 2009). While this is a major step forward, the fact remains that commissioners of care in community settings require evidence to allow clinicians to use certain therapies. NPWT is often perceived to be more expensive than advanced wound care — this perception may be based more on unit price considerations than on a comparison of the total cost of treatment.

Conclusion

There is a substantial body of comparative clinical and economic evidence for NPWT in several wound types. The type and quality of studies are mixed: alongside RCTs there is evidence in 'real world' clinical practice, in the form of retrospective clinical studies. Taken as a whole, the evidence suggests that although the unit cost of NPWT may be perceived to be high, there is a real possibility that materials and rental costs can be offset by, for example, reduction in length of stay, lower frequency of dressing change, and a reduction in complications and further surgical interventions. Further robust cost-effectiveness studies will be essential to provide evidence for future technology appraisals conducted on behalf of funding agencies. Tools such as the calculator described here will help to ensure that NPWT is used wisely. They offer clinicians an aid to decision-making in the clinical setting, using real life data with no underlying assumptions. WUK

Declaration of interest: Richard Searle and Jeanette Milne were both employees of Smith & Nephew at the time of writing.

Key points

- Negative pressure wound therapy (NPWT) is now in widespread use and is seen by clinicians as a valuable adjunct to conventional wound healing methods.
- NPWT is often perceived to be more expensive than advanced wound care — this perception may be based more on unit price considerations than on a comparison of costs.
- It may also be useful as part of the decision-making process to be able to compare the costs of NPWT with advanced wound care.
- The economic literature pertaining to NPWT suggests that, when used appropriately, it may have economic benefits compared with conventional wound care.
- This article discusses economic considerations for the use of NPWT, and suggests ways in which the weekly cost of treatment can be estimated.

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