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Achieving International Consensus for the Prevention of Orthopaedic Wound Blistering; Results of a Delphi Survey

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Abstract

This paper presents the results of an international 2 stage Delphi survey carried out via email, to achieve consensus as to the most effective post-operative wound management to prevent blistering and other complications. 17 prospective participants were invited to be a member of the Delphi Panel of which 13 agreed to be involved. The panel suggested that an ideal wound dressing would conform easily to the wound, be easy to apply and remove, allow for swelling and minimise pain on removal. Participants were in agreement that the primary wound dressing should be left in situ for as long as possible, providing there was no excessive oozing or signs of infection. The authors recognise that the Delphi panel was relatively compact; however, the study arguably provides some useful data that can be used to identify the consequences of wound blistering and important factors that need to be considered when choosing a wound dressing to prevent blistering.

Key Words

Delphi; orthopaedic; ; prevention; wound blistering

Key Points

The incidence of superficial wound problems, such as skin blistering, is a commonly reported problem, especially in orthopaedic surgery

Surgical patients who develop post-operative wound complications including blistering risk a prolonged hospital stay, morbidity/ mortality rates can be adversely affected

Allow for swelling, be flexible and not stick to wound were considered the most important characteristics of a wound dressing

Be available as an anti microbial was considered the least important characteristics of a wound dressing

Introduction

A limited amount of studies have examined the effect of different dressings on wound healing with no conclusive recommendations¹. However we must be aware that irrespective of the healing properties of a dressing, there may at times be unwanted consequences of an adhesive dressing, for example development of blisters on the peri wound skin area. This paper presents results of a two round Delphi survey conducted with an international panel of experts exploring the prevention of post operative wound blistering.

The incidence of superficial wound problems, such as skin blistering, is a commonly reported problem, especially in orthopaedic surgery^{2,3}. Blistering can cause increased pain, delayed wound healing and increased susceptibility to wound infection, as the integrity of the skin has been breached⁴. There is currently conjecture in the literature as to whether dressing choice has an effect on wound complication rates^{1,5}. A prospective clinical audit of orthopaedic wound blistering in Scotland, including more than 1000 hip and knee arthroplasties in 2006, identified that skin blistering was common following the use of traditional adhesive absorbent dressings and demonstrated a blister rate of 19.5%⁶. Tape related injuries causing blistering after hip surgery has been reported as 21.4%⁷. Jester et al.,⁸ reported the incidence of blistering, using a variety of dressings, at 13%, whereas Cosker et al.,³ reported post-operative blistering rates as ranging from 6% to 24% depending on the dressing used.

Why is this study important?

Surgical patients who develop post-operative wound complications including blistering risk a prolonged hospital stay, morbidity/ mortality rates can be adversely affected¹ and costs

associated with healthcare procedures can increase due to increased wound dressing use, medications and nursing care input for wound care. There are a paucity of published studies specifically in the field of wound blistering discussing the treatment of wound blisters in post operative patients. However few of these studies examine prevention of wound blistering. The results of this Delphi survey offer an insight into effective use of wound dressings and consensus of opinion as to the ideal properties of wound dressings to prevent blistering.

Literature review

A search of published literature was undertaken exploring the following databases; The Cochrane Library; MEDLINE (1950 to June 2011); EMBASE (1974 to June 2011); CINAHL (1982 to June 2011) using the key words *wound blistering; orthopaedics; post operative*, ten papers identified were pertinent to our research examining prevention of wound blisters. A number of studies investigated the incidence of wound blisters occurring post-operatively in acute settings rather than prevention of wound blisters, three reviews examined prevention and treatment strategies, two of which were specific to wound blisters^{1,5}. Collins⁵ determined that there was no consistency in the treatment and dressing choice of post-operative orthopaedic wounds, with no one particular set of guidelines applicable with a perceived distinct gain. Polatsch et al.,⁷ suggested from their review that incidence of wound blisters was reported haphazardly in the literature and therefore performed their own retrospective audit from case notes of patients who had undergone surgery for hip fracture. They identified a high incidence of tape-related blisters (21.4%) that they suggested was specific to the type of tape used to secure the dressing rather than the actual wound dressing.

A clinical audit of 116 post-operative patients who had undergone knee arthroplasty during a one year period, using a standardised dressing protocol was recorded ⁹ Bhattacharyya reported 6% of patients developing a blister and stated that this was a result of poor dressing choice. Similarly Jester et al.,⁸ reported in their audit of knee and hip arthroplasty patients, a prevalence of 13% for post-operative wound blisters. They performed analysis of variables within this audit, to determine possible explanations of causation, but found no statistical differences for choice of dressing. They tentatively concluded that wound conforming (elastic) dressings may have a beneficial effect in the prevention of blister formation. Gupta et al ⁴ examined 100 post-operative hip and knee surgery patients and established incidence of blisters at approximately 20%. However they reported considerable variation between 3 dressing choices, in a quasi-experimental study. In a prospective study of patients undergoing hip or knee surgery, the post-operative blistering rate ranged from 6% to 24% depending on the dressing used ³. Of the remaining studies reviewed, two did not focus on orthopaedic surgery and one had too small patient numbers to provide meaningful data to be included in this review ^{9,10,11}.

The review by Tustanowski¹ identified that wound blistering could be associated with a number of factors: movement of the wound site; choice of dressing; tape use; age; gender; type of incision; medications; co-morbidity; cost-effectiveness of dressings¹. However an overall conclusion could not be reached, based on this critical review, other than the accepted principles of good post-operative wound management, and standard properties of wound dressings. It could be argued that calls for further comparative studies of wound dressings will only continue to provide equivocal results. Therefore it was considered that the way forward was to achieve consensus between experts and practitioners as to the

most clinical and cost effective dressings and post-operative wound management to prevent blistering and other complications. An on-line Delphi survey was devised and implemented to address this, and to form a consensus opinion as to best practice in the prevention of orthopaedic wound blistering.

Aims:

- To establish an expert reference group (ERG) to consider the problem of wound blistering.
- To develop and evaluate expert consensus opinion in the prevention and management of orthopaedic wound blistering.
- To establish a working clinical and cost effective guideline and benchmarks for the prevention of wound blistering.

Methods

There were two rounds of the Delphi process held via e-mail. All participants remained anonymous to each other, but did receive data analysis from the 1st round of questionnaires prior to undertaking the second round. The Delphi surveys' aim was to establish a global expert reference group and achieve consensus for statement and guideline development on the prevention and management of wound blistering. This consisted of four steps, detailed below.

Step 1: Clarification of the research problem/ clinical question

Initial consultation and discussion took place between known experts in the field of wound blistering from healthcare practitioners, academic researchers and industry personnel. This discussion determined the clinical question to be answered.

Step 2: Identification of resources and members of the expert reference group (ERG)

Individuals with a known interest in the field of wound care were invited to join the ERG via an e mail request from the lead academic researcher.

Step 3: Establishing the initial round

The initial round took the form of a survey of all the ERG members using open-ended questions to act as probes. The process and aim of the survey was to finalise the clinical question to be answered; discovery of opinions and determination of the most important issues (benchmarks) of the prevention of wound blistering.

Step 4: Establishing the method and process of following rounds

Following the initial round, results were collated and presented to the ERG for agreement and formulation of initial benchmarks. The next stage was a second survey asking for additional ideas, clarifications, and elaborations based on the initial survey responses. The second round of surveys were returned to the researchers for analysis, clarifications and elaborations. The responses were ranked and clarified.

It is envisaged that, due to the continuous nature of research data becoming available, the ERG will continue to evaluate and refine the consensus guideline and benchmarks, via electronic communication.

The Delphi Survey

Sample

17 prospective participants were invited to be a member of the Delphi Panel from England, Wales, Ireland, Scotland, Scandinavia, India, Australia and the USA. Of the 17 people invited 13 agreed to be involved. There were no respondents from India. Participants were drawn from an expertise-based purposive sample, including orthopaedic medical staff, tissue viability nurse specialists, orthopaedic nurses, nurse academics and researchers. Although the number of respondents was low, we do not feel this is a concern. Of the 13 respondents, all 13 completed the first round but only 9 completed the 2nd round of questionnaires.

Ethical Approval

Ethical approval was received from the School of Human and Health Sciences Research and Ethics Panel, University of Huddersfield. Additionally, Leeds Research and Ethics Committee was contacted concerning permissions. They advised that the Delphi survey did not require NHS associated approval.

Data analysis

Survey data from both rounds was entered into PASW (SPSS) Version 18. Descriptive statistics relating to respondents' opinions of treatment of wound blistering and wound dressing characteristics were derived for each data set independently, with the results from the 2nd round of the analysis being additionally used as a cross-check against results from the 1st round where appropriate. Due to the small size of the samples, inferential statistics were not derived for either round of the survey.

Results

The first round of questions sought to explore the incidence of wound blistering, dressings used immediately post operatively for joint replacement operations and which professional group assessed the wound and decided on the first post operative dressing.

First round analysis

Incidence of wound blistering following total joint replacement surgery

During the first round of questions respondents were asked to state the number of joint replacements undertaken in their institution and the incidence of post operative blistering to allow for understanding of whether there was a problem with blistering in orthopaedic patients. The mean number of knee replacements were 298 (range 42 - 700) and the mean number of hip replacements was 305 (range 100 -500). The mean proportion of wound blistering across all institutions was 15.5%, with proportions of wound blistering ranging from 1% to 55% across institutions. This clearly identified that wound blistering was a concern for the institutions involved in the Delphi.

Most commonly used wound dressing post operatively

Due to the amount of wound dressings currently available on the market the Delphi sought to establish which dressings were most commonly used as the first post operative dressing. The first dressing is applied in the theatre environment by either the surgeon or their assistant. Respondents were therefore asked to identify which wound dressing would be used post operatively on joint replacement wounds. 5 respondents reported using Opsite® as the primary dressing. Mepilex®, Mepore®, Aquacel® and Tegaderm® were reported as the primary dressing by 1 respondent each. 3 respondents did not provide a response to this question.

By weighting each institution by its estimate of frequency of replacement operations , the total proportions of dressing type can be determined and are summarised in table 1.

Table 1: Total proportions of first post operative wound dressing

Wound dressing	Proportion of total use
Mepilex®	49.3%
Tegaderm®	21.5%
Mepore®	0.4%
Opsite®	26.0%
Aquacel®	2.8%

Hence Mepilex® was the most commonly used wound dressing, with its use amounting to about half of all wound dressings.

Choice of dressing during first dressing change

The first wound dressing change often occurs in the ward environment and as such the Delphi sought to establish whether the same type of wound dressing was chosen or if it was changed. Respondents were asked to identify what the choice of dressing would be for the first dressing change. 6 respondents reported that when the dressing was removed for the first time post-operatively, either the same dressing or a different dressing would be applied. 4 respondents reported that the same dressing would be applied. 1 respondent reported that a different dressing would be applied. 2 respondents did not provide a response to this question.

Who should assess the wound and prescribe an appropriate wound dressing?

Wound assessment and choice of treatment tends to be the role of the nurse however there are occasions when this choice is medically led, therefore investigation as to which

professional group assessed the wound and prescribed the wound treatment required clarification. 8 respondents reported that the nursing staff would be most likely to first assess the patient's wound post-operatively. 2 respondents reported that this could be done by either a doctor or a member of the nursing staff. 3 respondents reported that this was likely to be done by either a doctor/surgeon or a member of the nursing staff. In all instances where nursing staff would be most likely to prescribe the choice of wound dressing following first dressing removal, they would also be the first assess the patient's wound post-operatively. 2 respondents stated that if the wound had any signs of clinical infection then the doctor/surgeon would prescribe the first post operative dressing. The remainder of respondents did not report if medical staff would be involved in dressing choice if the wound had signs of infection.

What are the consequences of wound blistering?

Respondents were presented with a range of statements relating to possible consequences of wound blistering and asked to rate their response using a likert scale ranging from strongly agree to strongly disagree . The maximum score achievable for each statement was 60, representing uniform strong agreement by all respondents. The scores achieved by all statements are summarised in the table 2.

Table 2: Consequences of wound blistering

Characteristic	Score
Choice of dressings is important	56
Post-operative blistering is a problem	48
Post-operative blistering leads to longer hospital stays	46

Blistering main reason for nurse to visit patient on discharge	34
Blistering leads to wound infection	36
Blistering leads to increased pain	52
Blistering associated with macerated skin	45
Blistering associated with reduced mobility	41

The strongest agreement was found with the statement that choice of dressing was important. The strongest disagreement was found with the statement that blistering had been the main visit for the district nurse to visit the patient on discharge.

What are the characteristics of an ideal wound dressing?

Respondents were presented with a range of statements relating the characteristics of an ideal wound dressing. Using a likert scale ranging from strongly agree to strongly disagree respondents were asked to identify which characteristics they thought were important. The maximum score achievable by each characteristic was 60. The scores achieved by all characteristics are summarised in table 3.

Table 3: Characteristics of an ideal wound dressing

Characteristic	Score
Easy to apply	58
Conform to the patient's wound	57
Allow for swelling	59

Easy to remove	57
Be flexible	59
Pain-free on removal	56
Not stick to the wound	59
Be transparent	50
Be able to control exudate	54
Be available as microbial	42
Be able to remain in place for 7-14 days	48
Available in variety of sizes	58
Cost effective	55
Supported by research	56
Available in acute and primary health care	56

While the majority of characteristics were considered to be important, *allow for swelling*, *be flexible* and *not stick to wound* were considered the most important. *Be available as an anti microbial* was considered the least important.

Second Round Analysis

The second round of questionnaires sought to clarify opinions from the first round. In order to assess the strength of feeling concerning the statements given in part 1, a scoring system

was devised, in which “Agree” was scored 1; “Disagree” was scored 0 and “Neither agree nor disagree” was scored 0.5. Hence each statement could be scored out of a maximum of 9. It was found that respondents were fairly consistent in their responses to these statements, with almost all statements being scored either consistently highly or consistently poorly.

A full list of the scores of all statements is presented in table 4.

Table 4: Results of all statements

Nursing staff first to assess wound post-operatively ¹	7.5
Nursing staff should choose appropriate dressing ¹	7.0
Medical staff first to assess wound post-operatively ²	2.0
Medical staff should choose appropriate dressing ²	2.0
Dressing removed after 24hrs and assessed ²	0.0
Dressing removed after 72hrs and assessed ²	2.0
Dressing left intact as long as possible ¹	7.0
Dressing removed on medical orders ²	0.5
Post-operative blistering problem	5.5
Blistering extends hospital in-patient stay	6.0
Blistering main reason for visit from nurse on discharge ²	0.5

Blistering leads to wound infection ²	2.0
Blistering leads to increased pain ¹	8.0
Blistering leads to macerated skin	6.5
Blistering reduces mobility	6.0

¹= Strong agreement

²= Strong disagreement

The highest scoring statements were:

- Wound blistering increases pain (score 8/9)
- Registered nursing staff should be the first to assess the wound post-operatively (score 7.5/9)

The lowest scoring statements were:

- Wound dressing should be removed 24 hours post-operatively and the wound assessed (score 0/9)
- Wound dressing should be removed only on medical orders (score 0.5/9)
- Wound blistering is main reason for a community nurse to visit a patient on discharge (score 0.5/9)

Natural Groupings of Statements

Within the 15 statements some natural groupings could be found.

The first 4 statements related to opinions on which staff should assess and choose a wound dressing. A clear preference for nursing staff, rather than medical staff, to perform these tasks was noted. Questions 5 – 8 elicited opinions on removal of dressing. The statement

that the wound dressing should be left intact for as long as possible was clearly in line with respondents' opinions; the other 3 questions all scored very low. All respondents disagreed with the statement that the dressing should be removed post-operatively after 24 hours and the wound assessed. The final 7 questions were concerned with the problems associated with wound blistering. Here the strongest agreement was found with the statements that wound blistering: increases pain (consistent with a similar finding from the 1st round of questionnaires), leads to macerated skin, extends hospital stay, and reduces patient mobility.

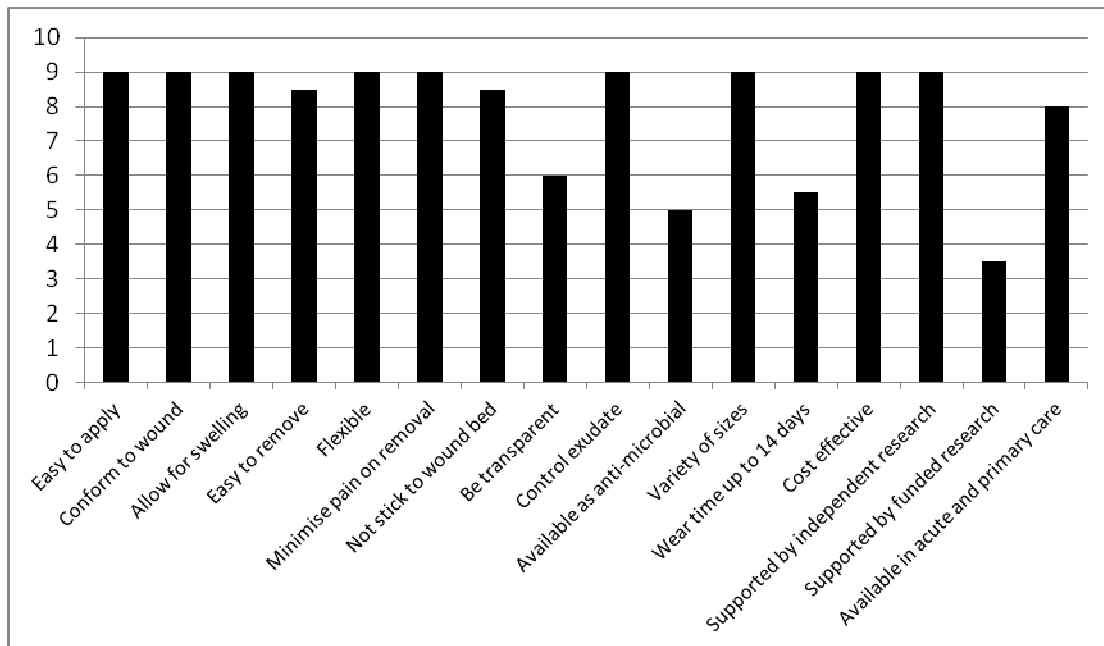
Strong disagreement was found in the statement that blistering had been the main visit for the district nurse to visit the patient on discharge. This finding is consistent with the findings of a similarly worded statement from the 1st round of questionnaires.

Despite clear agreement that wound blistering causes the specific problems mentioned above, the general statement "Post-operative wound blistering is a problem" was scored at only 5.5 out of 9.

Wound Characteristics

The same scoring system was devised for the wound characteristics questions, in which respondents were invited to state their agreement level with 16 statements relating to wound characteristics. The statements and level of agreement are presented in figure 1.

Figure 1: Summary of scores



Many statements elicited a response of *Agree* from all 9 respondents, and only 4 statements scored less than 8 out of 9:

- A wound dressing should be transparent (score 6/9)
- A wound dressing should be available as an anti-microbial (score 5/9)
- A wound dressing should have a wear time of up to 14 days (score 5.5/9)
- A wound dressing should be supported by research funded by the manufacturer (score 3.5/9)

Hence the respondents could be said to be in broad disagreement only with this last statement. It may be seen that on the findings of this section alone, there are many statements which elicit identical levels of agreement.

Comparison of 1st and 2nd rounds of questionnaires

Responses to certain questions from the second round may be compared with similarly worded set of questions on the first round of the questionnaire.

A comparison of the scores relating to the characteristics of an ideal wound dressing given in the two rounds is provided in table 5.

Table 5: Comparison of the scores given in the first and second rounds

Statement	Round 1 score	Round 2 score	Round 1 %	Round 2 %
Easy to apply	58	9	97	100
Conform to patient's wound	57	9	95	100
Allow for swelling	59	9	98	100
Easy to remove	57	8.5	95	94
Flexible	59	9	98	100
Minimise pain on removal	56	9	93	100
Not stick to the wound	59	8.5	98	94
Transparency	50	6	83	67
Control exudate	54	9	90	100
Available as anti-microbial	42	5	70	56
Remain in place for 14 days	48	5.5	80	61
Variety of sizes	58	9	97	100
Cost-effective	55	9	92	100
Supported by research (generic)	56	-	93	-
Supported by research (independent)	-	9	-	100
Supported by research (manufacturer)	-	3.5	-	39

Available in acute & primary care	56	8	93	89
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In the first round, the maximum score achievable by each statement was 60, while in the second round, the maximum score achievable by each statement was 9. Hence for ease of comparison, percentage scores are also given in both cases. It may be seen that there are few significant changes in the levels of agreement of most statement between the two rounds of the study.

An additional score for each statement was derived as a sum of the rankings allocated to that statement by each respondent. Hence a low score indicated a statement that respondents considered to be of greater importance. The scores obtained are summarised in table 6.

Table 6: Rankings allocated to each statement by respondents

Statement	Score	Rank order
Easy to apply	49.5	=2
Conform to patient's wound	47	1
Allow for swelling	49.5	=2
Easy to remove	50.5	4
Flexible	56	7
Minimise pain on removal	51	5
Not stick to the wound	53	6
Transparency	88.5	13
Control exudate	64.5	10

Available as anti-microbial	106.5	=15
Remain in place for 14 days	60	9
Variety of sizes	96	14
Cost-effective	58.5	8
Supported by research (independent)	70	11
Supported by research (manufacturer)	106.5	=15
Available in acute & primary care	79	12

The responses to the 2nd round of questionnaires showed some degree of overlap with responses to the 1st round. The rank ordering in this table should be interpreted with caution, as the implicit assumption that ranks from different statements are additive and may not be accurate. However, it may be tentatively stated that the first 4 statements in the list (*easy to apply, conform to wound, allow for swelling and easy to remove*), plus the statement *minimise pain on removal*, all of which were scored at either 9/9 or 8.5/9 on the previous section, appear to be considered the most important characteristics.

Of the questions relating to wound blistering, the majority of respondents agreed that nursing staff should be the first to assess the wound and choose the dressing, that wound dressing should be left intact for as long as possible, and that wound blistering increased pain, led to macerated skin, extended hospital stay and reduced patient mobility. In general these findings were consistent with similar findings from the 1st round of questionnaires.

Discussion/ Recommendations

The English Department of Health ^{12, 13} clearly identified and highlighted the need for health care services to be cost effective and efficient ensuring the patient is involved in all aspects of care provision, using the ethos '*no decision about me without me*' ¹³ . This has led to increasing pressure in health care services to maintain and improve patient outcomes and reduce costs without reducing the level of quality care delivered. Harle et al., ¹⁴ identified that that dressing costs represent about 0.02% of the total cost of a hip replacement operation, which may seem inexpensive unless that first dressing causes the development of a wound blister; an extended hospital in-patient stay or extra community nurse visits to treat wound blisters. Added to these financial costs are the costs to patients associated with increased pain; reduced mobility; risk of infection and macerated peri wound skin .

There are a wide range of wound management products available, and matching dressing selection to patient need is a major component of appropriate, clinically effective wound care¹⁵. It is therefore essential that the professional group who assesses the patient's wound and chooses the dressing has the knowledge and skills base to be able to make an informed judgement for the planned treatment. Recommendations from the Delphi identified that nursing staff should be the first professional group to assess a wound post-operatively, and as wound care dressings account for more than £120 million in England alone each year ¹⁶ it is vital that a suitable dressing is chosen immediately. Interestingly Fletcher ¹⁷ stated that it was widely believed that optimal care could only be successfully achieved by a multidisciplinary team: however, in reality, the majority of day-to-day wound care is provided by nurses. Indeed Bianchi ¹⁸ suggested that the ultimate goal of nursing is to be clinically effective by delivering the best possible care to patients, with Timmons¹⁹ arguing that areas that provide tissue viability specialists means that patients are much less likely to experience poor quality wound care as good practice is promoted.

The Delphi panel suggested that an ideal wound dressing that would help to prevent formation of wound blisters should conform easily to the wound, be easy to apply and remove, allow for swelling and minimise pain on removal. Previous authors have suggested that an ideal post-operative orthopaedic wound dressing should promote a moist environment; be absorbent; be protective; be permeable; able to remain in situ while the patient is bathing; be transparent so the wound bed can be observed without the need to remove the dressing; be low adherent; act as a complete barrier to bacteria and water and be cost effective^{3, 9, 20}. Additionally Harle et al.,¹⁴ recommended that a post-operative dressing which prevented restriction of limb movement and accommodated post-operative oedema, was particularly important in hip and knee arthroplasty patients, where post-operative swelling was common.

Results of the Delphi highlighted that the highest proportion of respondents (49.3%) stated they used Mepilex® as a primary dressing. Mepilex incorporates a Safetac® wound contact layer which prevents the dressing from sticking to the wound and peri wound area, thus reducing the risk of blister formation. The Delphi survey revealed OpSite Post-Op as the second most popular choice of dressing (26% of respondents). This dressing was compared to a standard absorbent dressing in a clinical audit undertaken by Bhattacharyya et al²¹ in which no OpSite Post-Op patients experienced a tape blister, signs of inflammation at suture removal or wound infection. Therefore it would appear that the majority of respondents were choosing dressings that had evidence to support their use in preventing damage to the skin. Delphi participants were in agreement that the primary wound dressing should be left in situ for as long as possible, providing there was no excessive oozing or signs of infection. This is supported by Leaper²² who stated that frequent dressing changes can be a potential risk factor for infection as bacteria may contaminate the wound during the procedure.

Conclusions

The majority of respondents stated that nursing staff should be the first to assess a wound post-operatively and to choose the appropriate wound dressing. The majority of respondents agreed that the wound dressing should be left intact for as long as possible and that pain was the main consequence of wound blistering.

Respondents strongly agreed that post-operative wound blistering could lead to increased pain; macerated skin; lead to wound infection; reduce mobility and increase a length of stay as an in-patient. They did not rate strongly that wound blistering was the main reason for a district nurse to visit patients on discharge home; perhaps this was because patients remained in hospital for a longer period of time to allow for the blister to heal. The most important factor in preventing a wound blister was the choice of post-operative wound dressing.

Summary

Respondents of this Delphi survey agreed that the top 5 ideal constituents of a wound dressing to prevent the formation of a blister were:

1. Ability to conform to the wound
2. Easy to apply
3. Allow for swelling
4. Easy to remove
5. Minimise pain on removal

The 5 lowest ranked constituents of a wound dressing by the Delphi panel were:

1. Supported by research (independent)

2. Supported by research (manufacturer)
3. Transparent
4. Available as anti-microbial
5. Available in acute and primary care

Although the ERG was relatively compact, this study arguably provides some useful data that can be used to identify the consequences of wound blistering and the important factors that need to be considered when choosing a wound dressing to prevent blistering.

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