

Wound infection, dressings and pain, is there a relationship in the chronic wound?

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ABSTRACT

The focus on quality of life issues in wound care has justly taken a far greater importance. With the acceptance that pain can be a major factor to the patient, and in particular, pain at dressing change comes the opportunity for avoidance and/or reduction strategies. Whilst pain has been associated with wound infection for millennia, it is only much more recently that this has received due attention from research and clinical practice. In this study, the nature of pain, changes in pain and pain associated with infection are the focal points. A Delphi approach, now a frequently used tool in wound care research, has been used to obtain expert opinion on these aspects of management.

Key words: Delphi • Wound infection • Wound pain

INTRODUCTION

Over the past decade, there has been an increasing awareness of the occurrence and significance of wound-related pain. Numerous research studies have been reported showing the association of pain with wound infection, and, with the dressing change procedure in particular (1–4). The link between wound pain, stress, delayed healing and patient quality of life has also been established (5–7). This interest has resulted in two best practice documents from the World Union of Wound Healing Societies (WUWHS 2004, 2008). These

define the occurrence, assessment and management/avoidance of wound-related pain.

The estimated worldwide burden of wounds may be viewed in Table 1 (8).

Viewed in isolation, this estimate clearly avoids qualifying the personal wound burden of patients but rather hints at the encumbrance sustained by society as a whole. One of the more troublesome facets of a wound that is frequently encountered is that of pain. Wound-related pain provides the patient with regular, sometimes constant and intense reminders that healing has yet to be accomplished. We have learnt that the pain experience is best described by the patient from their own subjective stand point and is not something that can

Key Points

- numerous research studies have been reported showing the association of pain with wound infection, and, with the dressing change procedure in particular
- two best practice documents from the World Union of Wound Healing Societies define the occurrence, assessment and management/avoidance of wound-related pain
- we have learnt that the pain experience is best described by the patient from their own subjective stand point and is not something that can be easily or accurately described to, or by, a third party who by definition is unable to place themselves in that self-same pain experience

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Table 1 Estimation of the worldwide burden of wounds (8)

Surgical wounds	40–50 million
Leg ulcers	8–10 million
Burns	7–10 million
Pressure ulcers	7–8 million

Key Points

- the authors of this study have sought to clarify some of the similarities and differences between somatic pain and event related pain and to indicate that intervention by the clinician will need to be adjusted accordingly
- a Delphi study was devised and completed during 2009–2010 with the intention of:
- highlighting any correlation found between infected wounds and increased pain/sensitivity,
- identifying expert clinician response to event-related pain episodes,
- reporting on the impact of dressings/ antiseptics on the somatic and operative influences of wound infection associated pain and
- reporting the Delphi panel rankings of treatments related to wound infection and pain

be easily or accurately described to, or by, a third party who by definition is unable to place themselves in that self-same pain experience (9). Although the epidemiological evidence on wound-related pain is limited it is recognised that wound pain is a common experience (10) and continues to be a major concern of patients and clinicians (2,11–13).

The morbidity/mortality associated with wound infection is a global issue that can affect patients with either acute or chronic wounds. Epidemiological data across all wound types are not readily available because of the disseminated and disparate populations. However, robust data have been collected for surgical site infection (14,15) possibly prompted by the value of such data used as a measure of the quality of patient care.

The wound inflammatory response provides a causal association between pain and infection as the soft tissue responds to the invading microorganisms (1,10,16) and leads to the expression of enzymes and free radicals (17) causing tissue damage.

Clarity in respect of the character and nature of pain that is associated with wound infection has yet to be realised. However, we are aware that

- an increase in pain or a change in the nature of pain (pressure ulcers);
- unexpected pain/tenderness (acute/surgical wounds) and
- onset of pain in a previously pain-free wound (partial/full thickness burn wounds)

have all been identified (18) and may be accepted as clinical signs of wound infection.

WOUND INFECTION, DRESSINGS AND PAIN

It is now widely recognised that wound infection causes pain (16), that there is an association between pain and stress (19) and that stress interferes with healing (20,21). What is not so clear is whether patients with a wound infection experience more pain in general than those patients with non infected wounds. This requires clarification, especially in relation to dressing change procedures and related intervention such as debridement as this will facilitate/result in improved care. When infection intervenes, irrespective of how that infection is managed a dressing is required that will

obviate tissue trauma and avoid exacerbating the patients' pain experience. Wound-related pain may be considered from two broad aetiologies, that is, somatic and event-related pain. Somatic pain is nociceptive pain where the nerves detect alterations in temperature, vibration and swelling/pressure in the skin, joints, muscles and deep tissue. Sensory neurones respond to stimuli and often the result is pain that is dull, intense and ongoing in nature. Event-related pain is a result of intervention that is operational, procedural or incident (O.P. or I) in origin being derived from exogenous sources, for example, dressing change procedures and/or debridement, unlike somatic pain which is endogenous. The authors of this study have sought to clarify some of the similarities and differences between these two sources of pain and to therefore indicate that intervention by the clinician will need to be adjusted accordingly. Irrespective of pain aetiology the routine procedures of wound care including debridement, cleansing and dressing changes still have to be conducted. Clinicians should consider, what does pain aetiology mean in practical terms? Does the patients pain impact on clinician thinking, and influence the treatment plan? Importantly, what is the impact of topical applications – including choice of dressing on the patient? Answers to these questions support and provide direction in clinical guidance and best practice. To investigate if a relationship exists between wound infection, dressings and pain in the chronic wound, a Delphi study was devised and completed during 2009–2010 with the intention of:

- highlighting any correlation found between infected wounds and increased pain/sensitivity,
- identifying expert clinician response to event-related pain episodes,
- reporting on the impact of dressings/ antiseptics on the somatic and operative influences of wound infection associated pain and
- reporting the Delphi panel rankings of treatments related to wound infection and pain.

METHODOLOGY

A Delphi approach, or Delphi procedure, is designed to obtain a dependable consensus

from a selected expert panel who respond to several 'rounds' of set questions or statements that are interspersed with controlled feedback (22). Between rounds, panel responses are collated and statistically summarised and used as a basis for the preparation of the next round. These data are then fed back to the individual panel members and provision is made for revision of answers (in light of the group response) returned in the previous round (23). In this study, three rounds were used.

Four characteristics typify the Delphi process:

1. *anonymity* (panel members are unaware of their comembers identity),
2. *iteration* (the process involves a series of rounds),
3. *controlled feedback* (the responses are analysed and fed back) and
4. *statistical group response* (articulation of the degree of group consensus) (23).

These four features provide rigour for this qualitative process where decisions are made by individual panel members and refined by the group as a whole thus ensuring that each participant has a 'equal voice'. Thus, contact between the researcher(s) and the panel members takes place only on an individual basis, usually via email, letter or the internet and where anonymity of panel members is strictly maintained. In this study, the data derived from the Delphi approach are reported generally using summary statistics. Where appropriate, Cronbach's α has been used to test the level of consensus achieved by the panel. Thus Cronbach's α provides an unbiased check on the consistency (consensus) of the panel responses (24).

Delphi panel members

Thirty international experts were selected on the basis of their clinical/publication profiles and were invited to participate. Twenty-one internationally recognised multiprofessional respondents accepted the invitation. The distribution of panel members together with their country of residence may be seen in Table 2.

The panel members were from three disciplines (Table 3).

The experience of the panel members in relation to tissue viability ranged from 5 to 29 years with a mean of 18.5. Four worked in a primary care facility/clinic that was based in

Table 2 Distribution of panel members with their country of residence

Country	Number of participants (n = 21)
Australia	1
Belgium	2
Canada	1
Eire	1
Italy	2
The Netherlands	1
UK	9
UAE	1
USA	3

Table 3 Panel members by discipline

Discipline	Number of participants
Nurses	14
Physicians	6
Physical therapists	1

the community. Thirteen were in a secondary care hospital either inpatient or outpatient facility. One worked in hospice/palliative care sector. One university based, one in a home health care setting and one participant followed patients through from hospital to community care. The number of wound care patients seen in a typical week by each member ranged from 3 to 150 with a mean of 38.

All members had extensive experience in caring for patients with painful and infected wounds.

To explore their views on wound care practice in relation to chronic wounds/infection/pain/dressings a questionnaire was prepared with two distinct sections. The first section related to *somatic or background pain* and the second focussed on *event-related pain* that is O.P.I. pain.

RESULTS

Somatic and event-related pain

Somatic pain associated with chronic wounds is likely to be multifarious in origin, associated with chronic inflammation, the generation of direct pain mediators together with sensitisation of the wound through the lowering of nociceptor thresholds via the production of indirect pain mediators (25). Event-related pain is the direct result of clinical intervention

and therefore careful planning prior to intervention is required.

The precise relationship between wound infection and the occurrence of pain has, to the best of our knowledge, not been thoroughly investigated. This gap in our knowledge led to the construction and inclusion of the following questions which we anticipate will encourage further investigation.

It is clear from these responses (Table 4) that the majority identified a causal relationship between wound infection and the occurrence of pain. This is consistent with the wound infection criteria developed by Cutting and Harding (26) and other studies such as Cutting *et al.* (18) which focussed on the development of clinical criteria of wound infection by indication. However, the relationship expressed overall is not quite so demonstrative in the event-related pain responses. An element of uncertainty appears to be expressed within the four 'not sure' responses (Table 5).

The responses are broadly similar to those of the previous question. Of note, however, is the fact that this is the first published objective evidence of clinicians' views on the degree of pain experienced by patients with and without wound infection viewed from event- and somatic-related perspectives (Tables 6 and 7).

The following responses were obtained in the somatic-related pain category.

Table 4 Do you consider that a causal relationship exists between wound infection and the onset of, or a change in, the nature of pain?

Response	Event-related pain	Somatic-related pain
Yes	15	19
No	2	1
Not sure	4	1

Table 5 Do you consider that patients with a wound infection generally experience more pain than those with non infected wounds?

Response	Event-related pain	Somatic-related pain
Yes	17	17
No	1	1
Not sure	3	3

Table 6 In what proportion of patients do you regard the occurrence of wound pain as diagnostic of infection?

Response (%)	Somatic-related pain
0–25	4
25–50	8
50–75	7
75–100	2

Table 7 In what proportion of patients do you regard the occurrence of pain in a previously painless wound diagnostic of infection?

Response (%)	Somatic-related pain
0–25	0
25–50	2
50–75	6
75–100	12

The responses reported in Table 6 (somatic pain) are consistent with the work published by Cutting and Harding (26) and Cutting *et al.* (18)

The responses in Table 6 suggest that the majority (15) of panel members ($n = 71\%$) consider that pain is diagnostic of infection in 25–75% of patients.

A slightly modified question was posed in respect to event-related pain to take account of the circumstances that apply – O.P.I. pain.

As presented in Table 8, 17 experts (81%) considered that pain in a previously painless wound is diagnostic of infection in 50–100% of patients. This is also consistent with the wound infection criteria developed by Cutting and coworkers (18,26) and validated by Gardner *et al.* (27) who found that increasing pain was diagnostic of wound infection. It is interesting to note that four (19%) of panel members regard the occurrence of pain in a previously painless wound diagnostic of infection in fewer than 50% of cases.

When considering somatic-related pain it can be seen that the majority of respondents, 16 (76%) considered an alteration in pain to be diagnostic of infection in 50–100% of patients. These findings have important implications for patient management and indicate that this feature of 'an increase or change in the nature of pain' should be an obligatory component of wound assessment documentation (Table 9 and 10). This is an important tenet of care

Table 8 In what proportion of patients do you regard the occurrence of pain in a previously painless wound diagnostic of infection?

Response (%)	Event-related pain
0–25	1
25–50	3
50–75	12
75–100	5

Table 9 In what proportion of patients do you regard an increase or change in the nature of pain diagnostic of infection?

Response (%)	Event-related pain
0–25	1
25–50	4
50–75	10
75–100	6

Table 10 In what proportion of patients do you regard an increase or change in the nature of pain diagnostic of infection?

Responses (%)	Event-related pain	Somatic-related pain
0–25	4	1
25–50	6	4
50–75	6	10
75–100	5	6

which is echoed in recent WUWHS consensus documents (28,29) and may also be found in relevant US Federal regulations (30).

Although the majority deemed that a change in therapeutic intervention was justified there appears to be a degree of vacillation within the panel, especially in the event-related responses (Table 11). In this study, we have not sought to achieve unanimity of opinion as that would frustrate the Delphi process. A key value of this research methodology is that trends of opinion including majority/minority splits may well come to the fore and this allows individuality of opinion to persevere and not be hidden as may happen in other consensus processes.

Having established the panel's views on the links between pain in both somatic and event-related circumstances the emphasis in the questions changed towards treatment (Table 12).

Table 11 Is a change in the nature of wound pain sufficient indication to justify change in therapeutic intervention (excluding dressings)?

Responses	Event-related pain	Somatic-related pain
Yes	13	17
No	4	3
Not sure	4	1

Table 12 If you answered yes to the previous question would you treat specifically for pain, infection or pain and infection?

Responses	Event-related pain	Somatic-related pain
Pain	2	1
Infection	1	0
Pain and infection	10	16

Previous publications have brought to our attention the fact that dressing change procedures can be most painful for the patient (31,32) and that the effective management of wound-related pain is not an established or widely held skill (25,33). The association of wound infection with pain is, however, established (25) and this has been explored further through the medium of the expert panel. Likewise, the relationship of dressings to wound pain is also recognised (34) and the expert panel explored in relation to wound infection.

Event-related pain and dressings

The responses indicate that the panel members have independently formed a very strong association between pain in a previously painless wound and the need for a change in topical management.

Somatic only – the panel members were asked the following:

The unanimous yes response in Tables 13 and 14 underlines the need for every patient and their wound to have a personalised management plan (35) and also indicates that the clinician should regularly reconsider treatment options. The panel responses also provide a strong association between *new* pain and the need for a review of wound dressing.

Event-related pain only – the panel members were asked the following (Table 15):

The responses clearly indicate that the panel members have independently formed a very

Table 13 Would the occurrence of pain in a previously painless wound require a review of dressing?

Responses	Event-related pain
Yes	20
No	0
Not sure	1

Table 14 Would the occurrence of pain in a previously painless wound or an increase in existing pain require a review of dressing?

Responses	Somatic-related pain
Yes	21
No	0
Not sure	0

Table 15 Would an increase in existing pain require a review of dressing?

Responses	Event-related pain
Yes	21
No	0
Not sure	0

strong association between pain in a previously painless wound and the need for a potential change in topical management. The importance of appropriate selection of dressing in relation to reducing/avoiding pain has been noted before (36).

These findings reflect the experience of the experts, based on their personal clinical practice. It is of interest to note that for event-related pain, only 3 of 21 (14%) were sufficiently convinced to state that there was no positive effect on wound pain. Whereas, 12 (57%) were sufficiently confident to state that topical antimicrobials did have a positive impact on wound pain. Systematic reviews (37–41) of clinical trial data for topical antimicrobials in wound care query the relevance of topical agents in wound care (Table 16). The evidence that we have gathered in this study provides objective verification using a technique with a recognised validity (23) and, in addition, external validity.

Prior to these systematic reviews disagreement arose concerning the safety of topical

Table 16 In your experience, do you think that topical antimicrobials have a positive impact on treating wound pain?

Responses	Event-related pain	Somatic-related pain
Yes	12	18
No	3	0
Not sure	6	2
No response	0	1

antiseptics (42–44), subsequently their use in wound care became highly controversial (45). More recently additional research, clinical findings and commentary (46–48) have helped to clarify the situation allowing a more informed approach to their use. This article has already established a firm link between wound infection and the occurrence of pain so it was considered relevant to ask the panel members to consider their own experience regarding use of topical antiseptics.

The panel's unanimous response supports the notion that some dressings have the potential to cause pain reflects the stark association that is already found in the literature (Table 17) (28,31,49).

Clinical trial data support the use of dressings impregnated with an anti-inflammatory analgesic (Ibuprofen) (Table 18) (50–52). The pragmatic approach taken by this current

Table 17 Do you think some dressing types have the potential to cause pain at dressing change (dressing application or removal)?

Responses	Event-related pain
Yes	20
No	0
Not sure	1

Table 18 In your experience, do you think that dressings containing an analgesic are effective in treating wound pain associated with dressing change?

Responses	Event-related pain
Yes	4
No	7
Not sure	3
No response	7

Delphi panel is not wholly consistent with this and reflects that product innovation do not always readily translate into widespread use.

These results reflect the panel's consideration for holistic care within wound management (Table 19). The narrow approach often advocated towards healing as being the only important outcome (53,54) obviously fails to consider the patient centred quality of life issues.

Event-related pain

Panel members were asked to rate dressings which in their opinion had the potential to cause pain at dressing change. Ratings were on a scale of 1–9, where 1 represented no potential and 9 represented high potential (Table 20).

Not all authorities support the view that traditional dressings are more likely to be associated with causing pain (55). Others have associated this pain with trauma at dressing change (36) as a result of adhesion to the wound

Table 19 In your experience, do you think that wound dressings have a role to play in managing wound pain that is associated with the onset of wound infection?

Responses	Somatic-related pain
Yes	17
No	0
Sometimes	4

Table 20 Dressing – rate mean and SD

Dressing	Mean	SD
Foams	4.2	2.4
Super absorbent dressings	4.4	1.8
Cadexomer iodine	4.6	2.3
Alginates	4.7	2.2
Silver dressings	4.8	1.6
Fibrous dressings	5.0	2.1
Capillary dressings	5.1	2.0
Honey	5.7	2.1
Semi-permeable films	5.8	2.0
Basic contact dressings	6.0	2.7
NPWT drapes/foams	6.4	2.2
Tulle dressings	6.4	2.2
Gauze	8.2	1.0
Adhesives (dressings or tapes)	8.4	0.7

NPWT, negative pressure wound therapy; SD, standard deviation.

Table 21 Dressing – rank mean and SD

Dressing	Mean	SD
Hydrophobic dressing	3.53	1.93
Hydrocolloids	3.90	1.97
Honey	4.10	1.92
Povidone iodine	4.71	1.90
SSD topical cream	5.52	1.99
Ibuprofen impregnated dressings	5.57	2.13
Cadexomer iodine	5.62	1.66
PHMB	5.65	1.73
Sheet hydrogel	5.70	2.15
Silver dressings	5.76	1.67
Silicone	5.86	1.96

PHMB, polyhexamethylene biguanide; SD, standard deviation; SSD, silver sulfadiazine.

bed (dressing drying out) or adverse effects of dressing adhesive border to the periwound skin. Our findings, however, indicate that pain can be caused not only by these factors but also by the dressing materials used, for example, tulle and gauze. A Cronbach's α was calculated at 0.80. Nunnally and Bernstein (56) postulate that a value of 0.70 or greater can be considered as an acceptable reliability coefficient, therefore this value indicates a high level of agreement between the panel members.

Panel members were asked to rank the significance of dressings in managing wound pain for the 11 dressings that had been previously identified. Ratings were on a scale of 1–9, where 1 represented no potential and 9 represented high potential. The summary statistics [mean and standard deviation (SD)] for these rankings shown in Table 21, a Cronbach's α of 0.77 again indicates a high level of agreement between the panel members.

The panellists were asked to rank those dressings previously identified which they considered to be relevant to managing wound pain associated with the onset of wound infection.

Although the overlapping SDs may suggest that there is not a substantial difference in rankings of the dressings as shown in Figure 1, Cronbach's α was calculated as 0.77 indicating a strong level of agreement between the panel members for each dressing type.

The panel members were asked to identify and then rank any important dressing-related issues that would influence dressing selection (Figure 2). It is interesting to note that the 'value' to patients features heavily and echoes the sentiments as portrayed in Table 19.

Q5: Significance of dressings in managing wound pain that is associated with the onset of wound infection - Rankings (mean + sd)

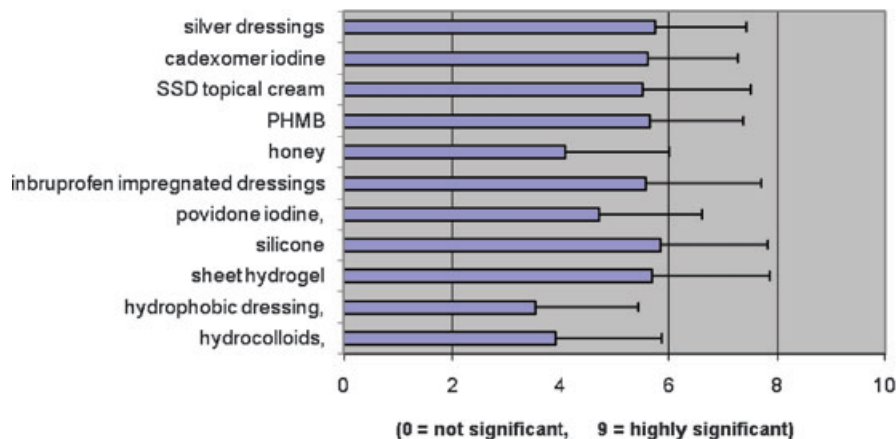


Figure 1. Significance of dressings in managing wound pain that is associated with the onset of wound infection – rankings (mean + standard deviation).

Significant dressing related issue

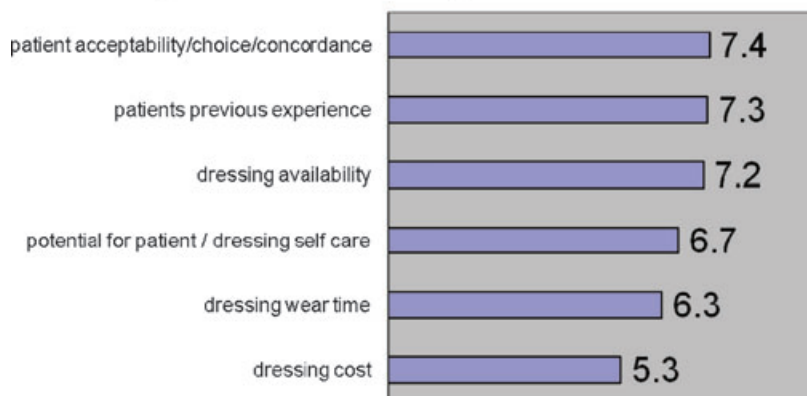


Figure 2. Significant dressing-related issue.

DISCUSSION

In this study, we have gathered objective evidence that a causal relationship exists between wound infection and the onset of, or a change in, the nature of pain from 21 international wound experts. Likewise, expert opinion that patients with a wound infection generally experience more pain than those patients with non infected wounds. To the best of our knowledge this is the first objective evidence to that effect. This merits incorporation into care plans.

In light of the evidence concerning an increase in existing pain and review of dressing it is clear that it is no longer acceptable to neglect regular patient/wound evaluation, and, is a requirement to reconsider dressing

selection. The panel is emphatic that topical antimicrobials have a positive impact on treating wound pain. This is widely regarded as being attributable to reduction of bioburden. A systematic review of the evidence for antimicrobial agents has been judged to be lacking at an evidential level (57). However, their objective was to establish the effects of silver containing wound dressings in ‘preventing wound infection and healing of wounds’ neither of which is recommended purpose of these products.

CONCLUSIONS

Wound dressings are generally regarded as either ‘traditional’ or ‘advanced’ in design

and function with traditional dressings been relatively unsophisticated, often gauze-based and inexpensive. Advanced dressings are designed on the principle of moist wound healing, are manufactured from a range of materials both natural and synthetic and relatively speaking more expensive. Advocates of the traditional dressings approach claim that use of advanced wound dressings in terms of cost and time to healing outcomes cannot be justified. This stance does not take into account the patient experience in relation to quality of life.

This study was designed to compare event-related pain with somatic pain and, without prejudgement, we were intrigued to see what the experts would conclude. For optimal clinical management of wound-related pain it is important that the practitioner be aware of both event-related and of somatic pain as this will facilitate best practice in the management of the patient.

As a result of this research, clinicians are therefore duty bound to differentiate the cause of wound-related pain, both event-related and somatic, and then to adjust intervention accordingly.

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Key Points

- advocates of the traditional dressings approach claim that use of advanced wound dressings in terms of cost and time to healing outcomes cannot be justified
- this stance does not take into account the patient experience in relation to quality of life
- as a result of this research, clinicians are therefore duty bound to differentiate the cause of wound-related pain, both event-related and somatic, and then to adjust intervention accordingly

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