Management of Burns and Scalds in Primary Care
STATEMENT OF INTENT

Evidence-based best practice guidelines are produced to help health practitioners and consumers make decisions about health care in specific clinical circumstances. Research has shown that if properly developed, communicated and implemented, guidelines can improve patient health outcomes and reduce health care costs. ACC guidelines are developed through a systematic process based on the expertise of the Guideline Development Team.

While guidelines represent a statement of best practice based on the latest available evidence (at the time of publishing), they are intended to provide the health practitioner with a framework for each case.

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Where guidelines are modified for local circumstances, significant departures from the national guidelines should be fully documented and the reasons for the differences explained in detail.

An electronic copy of the full guideline and guideline summary is available for download from http://www.acc.govt.nz or http://www.incap.org.nz (New Zealand Publications) or "Guidelines and Reports" (then "Injuries and Health"). or to get a printed copy please contact the ACC at 0800 352 666 or 04 473 2701.

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ACC
P.O. Box 102, Wellington, New Zealand
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ACC Provider Helpline: 0800 322 970
ACC Patient/Claimant Helpline: 0800 352 666
Kua tawhiti ke to haerenga mai,
kia kore haere tonu
He tino nui rawa ou mahi
Kia kore e mahi nui tonu

SIR JAMES HENARE OF NGATI HINE FROM TE TAI TOKERAU

We have come too far not to go further
We have done too much not to do more
Endorsements

This guideline has been endorsed by the Australian and New Zealand Burn Association (until 2009), the Burn Support Group Charitable Trust, the Counties Manukau District Health Board (until 2009), the Royal New Zealand College of General Practitioners and St John.
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Purpose

The purpose of this guideline is to provide a summary of current New Zealand and overseas evidence informing the assessment and management of burn injuries in the primary care setting in New Zealand. The guideline has been developed for health care practitioners who care for adults or children with burn injuries, and health service provider organisations and funders. It provides a first step in gathering the evidence base and ensuring the coordination of burns care nationally across the health sector in New Zealand.

The focus of the guideline is the appropriate assessment and management of burns in the primary care setting specifically, and appropriate referral practice from primary care to secondary care and regional burns unit services. The guideline specifically excludes consideration of large, full thickness burns that are more likely to be managed in secondary care. Similarly, scar management and associated specialist services provided in secondary care, such as physiotherapy, occupational therapy and speech language therapy, are not a focus of this guideline.

The guideline identifies evidence-based practice for most people, in most circumstances. It thus forms the basis for decision-making by the health care practitioner in discussion with an individual with a burn injury in developing an individualised care plan.
About the guideline

Foreword
The New Zealand Guidelines Group Incorporated (NZGG) is a not-for-profit organisation established to promote effective health and disability services. Guidelines make a contribution to this aim by sharing the latest international studies and interpreting these in a practical way for dissemination and implementation in the New Zealand setting. Guidelines consider both the evidence and the current availability of resources in the publicly funded health system to ensure that the recommendations are realistic, promote best practice, and inform policy and planning.

This guideline was developed by NZGG in partnership with the Counties Manukau District Health Board (CMDHB), with Stephen Mills as Chair of the Guideline Development Team, and was funded by the Accident Compensation Corporation (ACC).

Gaps between current practice and evidence
This guideline for the management of burns and scalds in primary care has been developed to address perceived gaps between current evidence and practice in New Zealand. Although the size of these gaps has not been thoroughly documented, there appear to be uncertainties in treatment, variation in management practices and an under-utilisation of cold water therapy for burns.

Although there are other international guidelines that have been published on the management of burns and scalds, they were not considered to be suitable for use in New Zealand.

First aid management of burns
The New Zealand public appears to have a lack of understanding regarding the benefits of cold water therapy. A prospective observational study of people with burns presenting to Middlemore Hospital in 2002 found that 59.5% of a total 121 people did not receive adequate burns first aid treatment (defined as cold water therapy in either stationary or running water for 10 minutes or more). Further analysis by age and ethnicity suggested that Māori and Pacific peoples, and children were less likely to receive adequate first aid treatment.

The study found that adequate first aid treatment resulted in fewer people with burns requiring split-skin graft procedures. There was also an association with fewer surgical debridement procedures. Scald injuries in particular required fewer procedures following adequate burns first aid treatment. The potential savings estimated in 2002 from scald injury care alone amounted to $75,000–100,000 per annum.

Burn size estimation
Estimations of burn size are necessary in the pre-hospital situation in order to assess initial fluid requirements and determine referral criteria. A number of tools can be used to assist health practitioners in estimating the total body surface area (TBSA) (see Chapter 3, Burn size). Three observational studies were found assessing the variability of burn size estimation in the pre-hospital environment. Results of these studies suggest that burn size is often overestimated. As a consequence of this, people with burns may receive inappropriate volumes of fluid and could be transferred to a burns unit unnecessarily. The TBSA estimated in pre-hospital situations is often overestimated where the burnt area is small and underestimated where the burnt area is large. Unfortunately the participants of these studies often had burns that would be more severe than those found in primary care, therefore the findings may not be directly applicable.
Use of dressing products in primary care

International evidence is lacking around the use of dressing products in primary care. Silver sulphadiazine is understood to be widely used at present on burns in primary care. This practice is supported by the expert opinion of the Guideline Development Team for its properties as an anti-infective agent. However, extended use of silver sulphadiazine on non-infected wounds has been shown to have adverse effects on the time to healing in burn wounds. There are a number of randomised controlled trials (RCTs) comparing silver sulphadiazine cream with other dressings and topical treatments. All of these studies found that silver sulphadiazine increased time to healing. However, in these studies silver sulphadiazine cream was applied to the burn wound until complete healing/re-epithelialisation. No studies were found comparing shorter-term use of silver sulphadiazine cream with other dressings or topical treatments.

Expert opinion strongly favours the use of moist wound-healing products for superficial and mid dermal burns, although the evidence is scanty and inconsistent. There is no convincing evidence from primary RCTs that any other dressing product heals wounds significantly faster than paraffin gauze (which is considered a non-moist dressing).

Evidence and recommendation grading system

All studies relating to the benefits or harms of interventions are graded for quality. Each study has been assigned an overall level of evidence: good (+), fair (~) or poor (x). Study details and levels of evidence are summarised in evidence tables, which are used to formulate recommendations. The evidence tables are available at http://www.nzgg.org.nz. Studies with an ‘x’ level of evidence had questionable validity and were not considered relevant to the formulation of recommendations. Descriptive research, included for information, was not graded for quality.

For further details about the evidence and recommendation grading system see Appendix A.

Guideline development process

In 2005, ACC commissioned NZGG to develop an adapted guideline based on reliable and valid evidence-based sources of summarised evidence available internationally. The Guideline Development Team agreed to use two other relevant guidelines5-7 as a template to further define the scope of the project. This approach has allowed the Guideline Development Team to conduct its own systematic reviews of key question areas and to consider the syntheses and synopses of the evidence performed and published by others. This process of adaptation was thought appropriate in a topic area where there are few large, well conducted randomised studies.

The Guideline Development Team was convened by NZGG and CMDHB. This involved formally approaching representative professional colleges and stakeholder organisations to invite them to nominate people to be members of the Team.

Two face-to-face meetings were held in Auckland during August 2005. The goals of the first meeting were to train members of the team in the processes of guideline development, to identify relevant clinical questions and to make decisions about the scope of the guideline.

Individual sub-committee members then searched for new studies in narrowly-focused topic areas and reviewed the evidence. In order to avoid the substantial costs and delays associated with translating foreign language publications, only English language articles were used. Only the most rigorous studies for each question were retrieved for the assessment and extraction of data. Details of the clinical questions, comprehensive search strategy and evidence tables are available on the NZGG (http://www.nzgg.org.nz) website.

The evidence on which the recommendations are based was graded using the grading system developed by NZGG. See Appendix A for more information on the grading system.
The second meeting of the Guideline Development Team was held in November 2005. At this meeting the evidence in each area was presented in evidence tables to the Guideline Development Team and a Considered Judgement process was used to agree levels of evidence and draft recommendations. The Guideline Development Team also drafted an algorithm at this stage.

The statement and recommendations were drafted, reviewed and revised by sub-groups then reviewed by the whole Team. Resources and appendices were drafted in the same way. This process continued until the draft document was at a stage for peer review and consultation. Opinions were sought at this stage about the feasibility of implementing the recommendations in the guideline.

Copies of the draft were sent to key individuals and sector groups for comment and peer review. Māori and Pacific perspectives on burn injuries and their management were incorporated. These comments were approved by the Team and incorporated into the final document. The draft guideline was sent to sector groups for peer review in February 2006 and the final guideline was re-circulated in July 2006.

Guideline Development Team

This guideline was developed by a multidisciplinary team of practitioners, selected to represent professional, cultural and consumer perspectives. The Team members were:

Stephen Mills (Chair)
Plastic and Reconstructive Surgeon, Middlemore Hospital

Chris Goodie
Adult Burns Clinical Nurse Specialist, Middlemore Hospital

Debbie Murray
Paediatric Clinical Nurse Specialist, Middlemore Hospital

Linda Jackson
Clinical Nurse Educator, Middlemore Hospital

Andrew Jull
Research Fellow, Clinical Trials Research Unit, University of Auckland

Anna Munnoch
Emergency Care, Clinical Nurse Educator, Middlemore Hospital

Vera Steenson
Auckland Burn Support Group, consumer perspective

Frances James
Clinical Psychologist, Middlemore Hospital

Kate Middlemiss
National Burns Centre Establishment Manager, Middlemore Hospital

Carolyn Bradbrook
Regional Burns Centre Manager, Hutt Valley District Health Board

Maureen Allan
Te Tai Tokerau Primary Health Organisation, Māori perspective

Carol Ford
Primary Care and Rural Nursing, Ngāti Porou Hauora

Heidi Muller
General Practitioner, Health Pacifica, Ta Pasefika, Pacific perspective

Rob Kofoed
Convenor, New Zealand Accident and Medical Practitioners’ Association

Larry Skiba
General Practitioner, Royal New Zealand College of General Practitioners
NZGG team
Rob Cook
Project Manager and GP
Catherine Coop
Researcher/Project Manager from February 2006
Mark Ayson
Researcher
Anne Buckley
Medical Editor/Writer
Mai Dwairy
Researcher until March 2006
Anne Lethaby
Senior Researcher
Jane Marriott
Researcher
For first meeting training/presentations:
Cindy Farquhar
NZGG Board
Anne Lethaby
NZGG Project Manager and Effective Practice, Informatics and Quality Improvement (EPIQ) Researcher
Sue Wells
Senior Lecturer Clinical Epidemiology, University of Auckland
ACC observers:
James Chal
Manager Research and Information Services
Zhi-ling ‘Jim’ Zhang
Evidence Based Healthcare Researcher, Research Services
Chrissie Cope
Manager Primary Care Services, Healthwise
Sonya Murray
Evidence Based Healthcare Researcher, Research Services

Declarations of competing interests
There have been no competing interests declared for this guideline.

Consultation
At the start of the guideline development process, a number of organisations with a specific interest in the management of burns and scalds nominated team members to be part of the Guideline Development Team. Feedback was sought from these organisations after they had reviewed a draft of the guideline. During this period of consultation the draft was also distributed widely to other interested individuals and they were invited to comment on the draft.

Comments were received from the following organisations or individuals:
• Anna Knuckey, Product Manager, Jackson Allison Medical and Surgical Limited, Auckland
• Antonia Rippey, Occupational Therapist, CMDHB, Auckland
• Bice Awan, Chief Executive, Skylight, Wellington
• Bernard Hoste, Export and Business Development, Scarban, Triclast NV, Belgium
• Caitlin Harvey, Occupational Therapist, Waikato District Health Board, Hamilton
• Chris Adams, Consultant Plastic Surgeon, Wellington Regional Plastic Surgery and Burns Unit, Hutt Hospital, Wellington
• Connie Mahu, Whānau Support Worker for Māori Health, Middlemore Hospital
• Glen Charlett, Director, Access Health Care Limited
• Heather Cleland, Director, Victoria Adult Burns Service, Alfred Hospital, Melbourne
• Janet Copeland, Research Liaison Officer, New Zealand Society of Physiotherapists Inc, Wellington
• Jason Wasiak, Research Officer, Victoria Adult Burns Service, Alfred Hospital, Melbourne
• Kirsten Taylor, Senior Physiotherapist, Middlemore Hospital, Auckland
• Marilyn Rosewane, Member New Zealand College of Practice Nurses, Tauranga
• Rhys Jones, Senior Lecturer in Māori Health, The University of Auckland, Auckland
• Siobhan Molloy, Executive Director, New Zealand Association of Occupational Therapists, Wellington
• Stewart Sinclair, Clinical Director, Plastic Surgery Department, Christchurch Hospital, Christchurch
• Tony Smith, Medical Advisor, St John Northern Region, Auckland
• William Levack, Lecturer in Rehabilitation, Department of Medicine, Wellington School of Medicine and Health Science, University of Otago, Wellington

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Funding
This guideline was commissioned and funded by ACC and development and production were independently managed by NZGG. ACC staff members were co-opted onto the Guideline Development Team to provide advice about ACC internal processes. All evidence appraisals, reporting and formulation of recommendations are independent of ACC, and NZGG retains editorial independence.
Summary

Key messages

• Children under the age of five are most at risk of burns and scalds.
• All burns and scalds should be cooled immediately in running tap water (8–15°C) for at least 20 minutes.
  – Avoid hypothermia: keep the person with the burn as warm as possible; consider turning the temperature of the water up to 15°C (tepid).
• Gel pads or other fluids can be used as an alternative to running tap water where water is unavailable or not practical.
• If there has been a delay in starting cooling, this should still be started up to three hours after injury.
• Initial management should include an antimicrobial dressing or cream and, following this, dressings should encourage re-epithelialisation by moist wound healing.
• Burn injuries constitute significant trauma and can cause or exacerbate psychological distress.

Referral to a specialist burns unit

• The referral criteria endorsed by the Australian and New Zealand Burn Association (ANZBA) should be considered by primary health care practitioners when assessing whether burns require treatment in a specialist burns unit (see Algorithm 1, Note 4).
• Other reasons for referral to a hospital may include: an ongoing requirement for narcotic analgesia, intravenous (IV) fluids, elevation or frequent or complex dressings; significant comorbidities, social/psychosocial indicators or suspected non-accidental injuries; or a need for other specialist services, eg, physiotherapy.
• The depth of a burn injury should be reassessed, preferably by the same clinician, two to three days after the initial assessment.
• Any burns that are unlikely to heal within 21 days without grafting (deep dermal and/or full thickness burns) should be referred to a burns unit for scar management by day 10–14.
Algorithm 1: Initial assessment and management of burns and scalds

Child or adult with a new burn injury

First aid, emergency examination and treatment (Note 1)

Assess and record cause, non-accidental injury, clinical features, burn size, location and depth (Note 2)

Decide the level of care needed

Is hospital care indicated? (Note 3)

Yes

Is specialist burns unit care indicated? (Note 4)

Yes

Suitable for transfer to a regional burns unit?

Yes

Immediate referral to nearest regional burns unit

No

Immediate referral to nearest hospital

No

Continue managing in primary care. Refer to Algorithm 2: Ongoing assessment and management of burns and scalds in primary care
Notes to Algorithm 1

Note 1: First aid, emergency examination and treatment

First aid
- Ensure your own safety.
- Stop the burning.
- In electrical injuries, disconnect the person from the source of electricity.
- Cool the burn:
  - cool with running tap water (8–15°C) for at least 20 minutes (no ice). Irrigation of chemical burns should continue for one hour.
  - avoid hypothermia: keep the person with the burn as warm as possible; consider turning the temperature of the water up to 15°C (tepid).
- Remove clothing and jewellery.
- Cover the burn:
  - cover with cling film or a clean, dry cloth.
  - avoid topical treatments until the depth of the burn has been assessed.
- Administer analgesia.

Emergency examination and treatment

Primary survey*
- Airway maintenance with cervical spine control
- Breathing
- Circulation with haemorrhage control
- Disability – neurological status
- Exposure + environmental control
- Fluid resuscitation proportional to burn size

Fluid resuscitation
- Burns of >10% body surface area in children and >15% in adults warrant fluid resuscitation.
- Give fluids:
  - 24-hour requirement: 3–4ml crystalloid solution per kg per % burn.
  - plus maintenance fluids for children.
  - give half of the fluids over the first eight hours, the remainder over the next 16 hours.

Prevention of tetanus
There is a risk of tetanus following a burn injury. Refer to the guidelines on the prevention of tetanus following injury, which are available from the Ministry of Health’s Immunisation Handbook 2006.9

### Note 2: Burn assessment

#### Depth assessment

The following table provides guidance in assessing the depth of burn injury.

<table>
<thead>
<tr>
<th>ANZBA 2004 Classification</th>
<th>Former Classification</th>
<th>Example</th>
<th>Appearance</th>
<th>Sensation</th>
<th>Healing Time</th>
<th>Scarring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial dermal</td>
<td>Superficial partial thickness</td>
<td>Scald (spill), flame, oil or grease</td>
<td>Blotchy red, may blister, no capillary refill</td>
<td>No sensation</td>
<td>Over 21 days: grafting probably needed</td>
<td>High risk of hypertrophic scarring</td>
</tr>
<tr>
<td>Mid dermal</td>
<td>Partial thickness</td>
<td>Scald (spill), flame, oil or grease</td>
<td>Dark pink with large blisters</td>
<td>Usually extremely painful</td>
<td>14–21 days</td>
<td>Moderate risk of hypertrophic scarring</td>
</tr>
<tr>
<td>Deep dermal</td>
<td>Deep partial thickness</td>
<td>Scald (spill), flame, oil or grease</td>
<td>Blotchy red, may blister, no capillary refill</td>
<td>In child, may be dark lobster red with mottling</td>
<td>Over 21 days: grafting probably needed</td>
<td>High risk of hypertrophic scarring</td>
</tr>
<tr>
<td>Superficial epidermal</td>
<td>Superficial partial thickness</td>
<td>Scald (immersion), flame, steam, oil, grease, chemical, high-volt electricity</td>
<td>White, waxy or charred, no blisters, no capillary refill</td>
<td>No sensation</td>
<td>Does not heal spontaneously, grafting needed if &gt;1cm</td>
<td>No scarring</td>
</tr>
<tr>
<td>Full thickness</td>
<td>Full thickness</td>
<td>Scald (immersion), flame, steam, oil, grease, chemical, high-volt electricity</td>
<td>White, waxy or charred, no blisters, no capillary refill</td>
<td>No sensation</td>
<td>Does not heal spontaneously, grafting needed if &gt;1cm</td>
<td>Will scar</td>
</tr>
</tbody>
</table>

### Chemical and electrical injuries

**Chemical burns:** Copious irrigation should continue for one hour
- Do not attempt to neutralise chemical burns in primary care
- All chemical burns should be referred to a burns unit

**Chemical eye injuries:** Treat all chemical burns to the eye with copious irrigation of water
- Ensure contact lenses have been removed
- All significant chemical injuries to the eye should be referred acutely to ophthalmology services

**Electrical injuries:** Small entry and exit wounds may be associated with severe deep tissue damage
- An electrocardiogram (ECG) should be carried out to detect arrhythmias
- All electrical injuries should be referred to a burns unit

### Non-accidental injuries

Indicators of possible non-accidental burns or scalds include the following:
- delay in seeking help
- historical accounts of injury differ over time
- history inconsistent with the injury presented or with the developmental capacity of a child
- past abuse or family violence
- inappropriate behaviour/interaction of child or caregivers
- glove and sock pattern scalds
- scalds with clear-cut immersion lines
- symmetrical burns of uniform depth
- restraint injuries on upper limbs
- other signs of physical abuse or neglect.

Refer to a regional burns unit if non-accidental injury is suspected.

*Continued...*
Assessment of burn size: Lund and Browder chart

% Total Body Surface Area Burn

Be clear and accurate, and do not include erythema

<table>
<thead>
<tr>
<th>REGION</th>
<th>% PARTIAL THICKNESS LOSS</th>
<th>% FULL THICKNESS LOSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Neck</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Ant. trunk</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Post. trunk</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Right arm</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Left arm</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Buttocks</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Genitalia</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Right leg</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Left leg</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>TOTAL BURN</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AREA</th>
<th>AGE 0</th>
<th>1</th>
<th>S</th>
<th>10</th>
<th>15</th>
<th>ADULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = ⅛ of head</td>
<td>9 ½</td>
<td>8 ½</td>
<td>6 ½</td>
<td>5 ¾</td>
<td>4 ¼</td>
<td>3 ½</td>
</tr>
<tr>
<td>B = ⅛ of one thigh</td>
<td>2 ⅔</td>
<td>3 ¼</td>
<td>4 ½</td>
<td>3 ½</td>
<td>3 ½</td>
<td>3 ½</td>
</tr>
<tr>
<td>C = ⅛ of one lower leg</td>
<td>2 ⅔</td>
<td>2 ⅔</td>
<td>2 ¼</td>
<td>3 ¼</td>
<td>3 ¾</td>
<td>3 ½</td>
</tr>
</tbody>
</table>

**Note 3: Considerations for referral for hospital care**

Burns of lesser severity than those meeting the criteria for regional burns unit care but with one or more of the following risk factors:

- ongoing requirement for narcotic analgesia or failure to manage dressing-change pain
- IV fluids required
- where oedema may be a problem
- social and/or psychosocial indicators
- suspected non-accidental injury
- frequent or complex dressing issues
- significant comorbidities
- request for other specialist services, eg, physiotherapy.

**Note 4: Referral criteria for regional burns unit care**

The following criteria are endorsed by the ANZBA in assessing whether burns require treatment in a specialised burns unit:

- burns greater than 10% of total body surface area (TBSA)
- burns of special areas – face, hands, feet, genitalia, perineum and major joints
- full thickness burns greater than 5% of TBSA
- electrical burns
- chemical burns
- burns with an associated inhalational injury
- circumferential burns of the limbs or chest
- burns in the very young or very old
- burns in people with pre-existing medical or psychological disorders that could complicate management, prolong recovery or increase mortality
- burns with associated trauma.

NOTE: Referral to the National Burn Centre is made through a regional burns unit. There are regional burns units at Christchurch (03 364 0640), Hutt Valley (04 566 6999), Waikato (07 839 8899) and Middlemore (09 276 0000) Hospitals.
Algorithm 2: Ongoing assessment and management of burns and scalds in primary care

**Child or adult with a burn injury that can be managed in primary care**

**Day 1: Assessment of depth (Note 2)**

- **Epidermal**
  - Moisturising cream
  - Review after 48 hours

- **Superficial/Mid dermal**
  - Reassess burn depth (Note 2). Is it significantly worse (likely to be full thickness)?
  - Antimicrobial dressing (eg, silver sulphadiazine cream)
  - Pain relief (Note 6)
  - Daily review

- **Deep dermal/full thickness**
  - Is the burn area >1cm wide?
    - Yes: Refer acutely as appropriate (Notes 3 and 4)
    - No: Day 3: Reassessment

**Day 3: Reassessment**

- Change to moist wound-healing product or alternatively double-layer paraffin gauze
  - Review within 72 hours
  - Monitor for signs of infection

- **Intact skin?**
  - Yes: Healed, continue moisturiser and sunblock
  - No: Reassess burn depth (Note 2). Is it significantly worse (likely to be full thickness)?
    - Yes: Change to moist wound-healing product or alternatively double-layer paraffin gauze
      - Review within 72 hours
      - Monitor for signs of infection
    - No: Continue with dressings as above
      - Monitor for signs of infection (Note 7)

- **Is healing progressing?**
  - Yes: Continue with dressings as above
  - No: Days 5–7: Change to moist wound-healing product

**Days 5–7:**

- Change to moist wound-healing product

**Days 10–14:**

- Is healing likely within seven days?
  - Yes: Healed. Consider rehabilitation needs (Note 8)
  - No: Continue with dressings
Notes to Algorithm 2

Note 5: Management of blisters and oedema

Management of blisters
- Preferably leave small blisters intact unless likely to burst or interfere with joint movement
- If necessary, drain fluid by snipping a hole in the blister.

Management of oedema
- Where possible, elevate affected area
- Remove jewellery or constricting clothing.

Note 6: Pain management for adults and children

Immediately after the injury
- Cool and cover the burn (with cling film or a clean, dry cloth).

Background pain
- Paracetamol and non-steroidal anti-inflammatory drugs (NSAIDs), alone or in combination with opioids
- Aspirin products should be avoided.

Intermittent or procedural pain
- Consider administering short-acting opioids
- Supplementary anxiolytics if indicated
- Supplement pharmacological therapy with non-pharmacological approaches
- Refer to secondary care if failing to manage dressing-change pain.

Note 7: Signs of infection

Signs of infection
- Surrounding redness, increasing pain, increased exudate/pus, swelling, fever or local wound temperature increase, lymphangitis or increased irritability in a child.

Suggested management
- Swab the wound
- Consider restarting topical silver sulphadiazine
- Consider starting oral antibiotics
- For more serious infection, refer acutely to secondary care.

Note 8: Psychological consequences of burn injury

- Monitor for stress disorders and depression
- Be aware of the risk of sleep disorders
- Consider services that may be able to support families affected by the psychological impact of burn injuries.
Chapter 1
Burn injuries and burns prevention in New Zealand

Evidence statements
- Most burns occur at home.
- Children under five are at the highest risk, with hot liquids being the leading cause of injury in this age group.
- Māori are at increased risk, particularly in the under-five age group.
- Males are at increased risk at all ages.

Evidence
Burns and scalds are a leading cause of injury to children in New Zealand, with children aged five years and under being most at risk, especially toddlers as they become more mobile with little awareness of danger. Every year, about seven or eight New Zealand children aged 15 years and under die as a result of burns or scalds. In most cases, fatalities are the result of house or car fires. Over two-thirds of those who die are aged five years and under and over a third are Māori.

On average about 475 children under 15 years are admitted to hospital every year as a result of burns or scalds, of whom 80% are aged five years and under. In 2002–3, 436 children under five years were admitted to public hospitals with burns and scalds. Most of these injuries involved hot liquids: about 34% were caused by hot drinks, food, fat or cooking oils, 20% by hot tap water, 25% by other hot fluids and 8% by exposure to fire or flames. Over 35% of children aged five years and under admitted to hospital were Māori, and over 60% were boys.

During 2002 and 2003 the total number of adults and children admitted to public hospital with burn injuries was 1311. Thirty-three per cent of these burns were fire, flame or smoke related and 77% were due to scalds and contact with hot objects. Māori comprised 26% of total admissions and Pacific peoples comprised 10.5%. Overall 66% of admissions were male, with higher rates of injury in all age groups. Most burn injuries occur at home (this applies to about 63% of fire or flame burns and 70% of scalds).

Further data from the Injury Prevention Research Unit on age-specific rates of burn injury over the period 2000–2004 is provided in Tables 1.1 and 1.2. This data includes first admissions only (excluding day patients) with a primary diagnosis of injury.

### Table 1.1: Burns from fire or flames: age-specific rates (per 100,000 population) for 2000–2004

<table>
<thead>
<tr>
<th>AGE (YEARS)</th>
<th>RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;15</td>
<td>4.9</td>
</tr>
<tr>
<td>15–24</td>
<td>11.1</td>
</tr>
<tr>
<td>25–44</td>
<td>7.1</td>
</tr>
<tr>
<td>45–64</td>
<td>4.1</td>
</tr>
<tr>
<td>65+</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Table 1.2: Burns due to hot substances and objects, caustic or corrosive material or steam: age-specific rates (per 100,000 population) for 2000–2004

<table>
<thead>
<tr>
<th>AGE (YEARS)</th>
<th>RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>79.8</td>
</tr>
<tr>
<td>5–14</td>
<td>8.5</td>
</tr>
<tr>
<td>15–24</td>
<td>6.5</td>
</tr>
<tr>
<td>25–44</td>
<td>7.4</td>
</tr>
<tr>
<td>45–64</td>
<td>5.7</td>
</tr>
<tr>
<td>65+</td>
<td>7.8</td>
</tr>
</tbody>
</table>


ACC data on burn injuries, which is based on claim numbers for burn injuries covering a three-financial-year period (1 July 2001 to 30 June 2004), shows that there were 65,089 new claimants of burn injury in all age groups, in the three-year period. This number is much higher than other data (locally and internationally), and is probably because ACC covers general practitioner treatments and visits for very minor burn injuries for compensation. For burn injuries, the ratio of males to females is 1.12 to 1.00, and there were 20 fatalities in that period. Children aged under 15 years constituted 33% of burn-related claims.

As in New Zealand, overseas literature reports that children under five years have the highest risk of both burn-related death and burn-related hospitalisations. Epidemiological studies conducted in a number of countries show that children in this age group have the highest burn-incidence rate. In this age group, scalds typically account for 50% of thermal injuries logged in emergency departments, and scalds are also more likely to lead to hospitalisation than any other burn injuries. Up to 80% of all childhood burn injuries in developed countries occur at home, and over 90% occur at home in developing countries.

Opportunities for prevention

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary care providers should provide advice on smoke alarms.</td>
<td>A</td>
</tr>
<tr>
<td>Primary care providers should support local initiatives in primary prevention, where possible.</td>
<td>C</td>
</tr>
</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations – refer to Appendix A for grading details.

Good practice points

Primary care providers should provide advice on the regulation of hot water temperature and appropriate first aid management.

This is the opinion of the Guideline Development Team, or feedback from consultations within New Zealand where no evidence is available.
Evidence statements

• The hot water temperature in the home should be regulated to reach the taps at no more than 50°C.
• There is evidence from the United States (US) that smoke detector legislation can reduce the number of fire-related deaths compared with communities without smoke detector legislation.
• There is evidence that the community-based provision of free smoke alarms (with or without installation) reduces fire-related injuries.
• Simple educational initiatives improve safety in the home.

Evidence

Common preventable causes of serious thermal injury include scalding water and lack of smoke detectors. A 1947 study found that full thickness burns occurred in adult skin in two seconds at 66°C whereas at 54°C this took 30 seconds. In a large US case-control study the absence of a smoke detector increased the risk of death in a residential fire by over 60%.

The primary care setting offers numerous opportunities for promoting safety measures to prevent burns and scalds since young children are the population most at risk and they are usually seen routinely. There is good evidence that advice in this setting promotes good practices with regard to fire safety, although evidence is lacking of a direct impact on injuries.

Similarly, while an educational strategy may improve safety consciousness, there is little evidence about community-based interventions that impact on the rate of injuries. However, individual regulatory measures, such as the installation of temperature controls on hot water cylinders, appear to have had some impact.

A systematic review of individual-level injury prevention strategies delivered in primary and acute care settings showed that such strategies increased smoke alarm ownership and the maintenance of a safe hot water temperature. The most effective interventions used a combination of methods, such as counselling, demonstrations, the provision of free or subsidised safety devices, and reinforcement. None of the relevant trials reported outcomes on fire-related injuries specifically.

A small New Zealand study showed an improvement in the ability of children to recognise fire safety hazards around the home and in families’ self-reported safety practices, such as keeping pot handles turned in. The most problematic recommendation was to reduce the hot water temperature.

A systematic review found very limited research on the effectiveness of community-based injury-prevention programmes to prevent burns and scalds in children. Only one of the three eligible studies reported a reduction in burn injuries and there were weaknesses in the methodology of this study.

Regulation of hot water temperature to reduce the risk of scalds

• The safest long-term option is to install a tempering valve in the hot water cylinder. This is done by a plumber. It ensures that hot water reaches the taps at the appropriate temperature. Since 1993 the New Zealand Building Code has required that tempering valves be installed in new homes.
• Another option is to turn down the thermostat on the hot water cylinder. If a consumer-adjustable thermostat is not fitted, an electrician can install one. However, the tempering valve option is safer and is also more energy efficient in the long term.
• An adult should be able to hold their wrist under the running water.
• If in doubt, check the hot water temperature with a thermometer.

For more information, see the New Zealand Fire Service website Fire Safety Tips (http://www.fire.org.nz/home_kids/tips/hotwater.htm).
Chapter 2
First aid

Stopping the burning process and cooling

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure your own safety.</td>
<td>C</td>
</tr>
<tr>
<td>If on fire, ‘stop, drop and roll’, smother with blanket or douse with water.</td>
<td>C</td>
</tr>
<tr>
<td>For electrical burns, disconnect the person from the source of electricity.</td>
<td>C</td>
</tr>
<tr>
<td>Remove clothing and jewellery.</td>
<td>C</td>
</tr>
<tr>
<td>Cool burns or scalds by immediate immersion in running tap water (8–15°C) for at least 20 minutes. Irrigation of chemical burns should continue for one hour.</td>
<td>C</td>
</tr>
<tr>
<td>Do not use ice for cooling.</td>
<td>C</td>
</tr>
<tr>
<td>Avoid hypothermia: keep the person with the burn as warm as possible, consider turning the temperature of the water up to 15°C (tepid).</td>
<td>C</td>
</tr>
<tr>
<td>If there has been a delay in starting cooling, this should still be started up to three hours after injury.</td>
<td>C</td>
</tr>
<tr>
<td>Do not attempt to remove tar.</td>
<td>C</td>
</tr>
</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations - refer to Appendix A for grading details.

Evidence statements
- Clothing can retain heat, even in a scald injury.
- Cooling burns reduces the severity of tissue damage.
- Running tap water at 15°C (tepid) is as effective as other forms of cooling.
- Alternative liquids, such as milk or soft drinks, may be used when running tap water is unavailable.
- Be aware of the risk of hypothermia, especially in children and older people.
- Application of ice may deepen the wound and increase the risk of hypothermia.

Evidence
The evidence for stopping the burning process derives largely from expert opinion. Flames should be doused with water or smothered with a blanket or by rolling the person on the ground. Clothing can retain heat and should be removed as soon as possible unless adherent. Jewellery should also be removed and if oedema is present elevate the affected area. Tar burns should be cooled with water, but the tar itself should not be removed. In the case of electrical burns, ensure the power source is turned off and the scene is safe before cooling with water. Expert opinion suggests that if running tap water is unavailable to cool the burn wound, alternative liquids may be used, such as milk or soft drinks.
There is good evidence that immediate cooling of burns reduces the severity of tissue damage. However, the optimum duration and temperature of cooling is largely a matter of expert opinion. The Guideline Development Team extrapolated the low-level evidence from a variety of sources to reach a weakly graded conclusion. Irrigation of chemical burns should continue for one hour. See Chapter 7, Management of chemical injury for the evidence supporting this statement and further information on the management of chemical burns.

Cooling large areas of skin may result in hypothermia, especially in children. Therefore, while it is recommended that the burn wound is cooled by irrigating or immersing in running water, the person with the burn needs to be kept as warm as possible. Ideally the water should be tepid (15°C). Ice or iced water should not be used as intense vasoconstriction can cause burn progression and also increases the risk of hypothermia. In an animal study, the application of ice for 10 minutes resulted in a deeper wound compared with no treatment at all.

A case series study of 695 children with burns in Vietnam found that immediate cooling with cold water significantly reduced the risk of sustaining a deep burn, with an estimated 32% reduction in the need for skin grafting. Similarly, a study of 121 people with burns presenting to Middlemore Hospital found that adequate burns first aid treatment (cooling) was associated with a reduced number of skin-grafting procedures.

Another large case series showed a significantly decreased length of hospital stay in people with less than 30% TBSA burns who received first aid by water cooling. In a randomised single-blinded study of 24 volunteers, no prolonged anti-inflammatory or anti-hyperalgesic effects were observed after 30 minutes’ cooling to 8°C, initiated within 15 minutes after an epidermal burn injury (although the data did not contradict the clinical observation that cooling following a more severe burn or scalding has a pain-relieving effect). An earlier experimental study supported these findings.

Other evidence on cooling derives from animal studies. The methods, duration and temperature of cooling used in these studies varied widely. One experimental study found faster healing at 21 days in deep partial thickness scalds cooled with either tap water (at 15°C, applied on gauze every three minutes) or hydrogel, than in uncooled scalds. Similarly, another experimental study found that scalds treated by ice-water immersion at 10 minutes post-burn for 30 minutes sustained less damage to the epidermis, basement membrane and dermal microvasculature and had less oedema than those untreated. A transient reduction in oedema volume in scalds was also found in another study, which lasted longer with decreasing temperature and increased cooling time. The most pronounced effect was obtained after cooling at 0°C for 120 minutes.

Another study investigated when the cooling strategy should be started. This study began cooling wounds from 10 minutes to 60 minutes post-burn and found markedly better healing when cooling (ice water 0–3°C bath for 30 minutes) was commenced within 30 minutes of burning, compared with 60 minutes after burning.

Gel pads

<table>
<thead>
<tr>
<th>RECOMMENDATION</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gel pads can be used as an alternative to running tap water where water is unavailable or not practical.</td>
<td>C</td>
</tr>
</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations. Refer to Appendix A for grading details.
Evidence statements

- There is insufficient evidence about the effectiveness of burn gels in comparison with running water.

Evidence

There was insufficient evidence to assess adequately whether hydrogel dressings are more effective at cooling or reducing pain than water. Three published studies (two case series in people with burns or wounds and one comparative study in volunteers with non-burned skin) and four studies downloaded from the internet (one in pigs, one with volunteers with non-burned skin and two with people with burns) were identified. One of these studies directly compared the cooling properties of hydrogel dressings with cold water (in people without burns). One comparative study compared hydrogels with other types of dressing for other outcomes, such as healing time and hospital stay. Pain relief was assessed by only one case series.

Findings

An experimental animal study of fair quality found that cooling with a gel dressing at different time periods was more rapid and effective than air cooling and the immediate application of gauze in burned pigs. A poor-quality case series of 131 adults with scalds and burns recorded body temperature rectally and at the skin surface for cold water cooling compared with gel cooling in healthy volunteers without burns. Cold water therapy for 20 to 30 minutes, but not gel cooling, induced hypothermia in participants. The case series also reported that 73% of participants using a gel dressing had a reduction of pain (described as ‘appropriate’, ‘permanent’ or ‘total’) and 16% used no analgesics. The dressing was described as ‘easy’ to administer in 98% of cases.

A controlled trial of fair quality reported that hydrogel dressing with air movement was more effective than hydrogel dressing alone, with a thick bandage or with a bandage plus air movement, in reducing skin temperature in healthy volunteers without burns. Due to the paucity of good-quality randomised evidence, we have been unable to directly compare the effectiveness of burn gels with cold water for cooling and reducing pain. The identified studies did not report any adverse events when burn gels were used.

Initial coverings

Polyvinyl chloride film (cling film)

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Following cooling, polyvinyl chloride (PVC) film may be used as a temporary cover prior to hospital assessment. It should be applied by persons knowledgeable in its use.</td>
<td>C</td>
</tr>
<tr>
<td>PVC film should be layered onto the wound and not applied circumferentially around a limb.</td>
<td>C</td>
</tr>
<tr>
<td>Topical creams should not be applied as they may interfere with subsequent assessment.</td>
<td>C</td>
</tr>
</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations – refer to Appendix A for grading details.

GOOD PRACTICE POINT

PVC film should not be used as a substitute for a dressing product. ✓

This is the opinion of the Guideline Development Team, or feedback from consultations within New Zealand where no evidence is available.
Evidence statements

- The application of PVC film can relieve pain. It is transparent for inspection. It is clean and easy to remove.
- A clean, dry cloth may be used to cover the wound if PVC film is not available.
- The use of PVC film as an alternative to silver sulphadiazine cream makes the subsequent assessment of wound depth easier in people who are transferred within four hours to secondary care.
- There is a risk of constriction if PVC film is wound around a limb that subsequently swells.

Evidence

Insufficient evidence was identified to determine the benefit of PVC film. A non-systematic review, a microbiological study and a case series were identified which assessed water-impermeable PVC film as a dressing for burns.47-49

Findings

Cling film plastic wrap is sold throughout New Zealand, mainly to cover food. It is composed of plasticised PVC film. Based on experience in an English burns unit, Wilson47 concluded in his review that plasticised PVC film was easy to use, safe and cheap and caused no pain. It was found to be particularly useful before surgery and before transfer to the burns unit in the hospital. In a microbiological study of 24 people with partial or full thickness burns who used PVC film as a temporary dressing,48 bacteria were cultured from the initial exudate in only 3 out of 37 burns and subsequent bacterial cultures showed no differences from what was usually found in burn wounds. Laboratory investigations indicated that the wrap had no antibacterial effect on the burn wounds. The other case series49 reported that PVC film as a wound covering enhanced the ability of thermography to assess the damage to the skin blood vessels prior to early surgery. The PVC film did not interfere with the measurement of surface temperature and avoided the cooling effect of evaporation at the site of the wound.

PVC film is often used as a temporary covering of a burn wound. It is pliable, non-adherent and impermeable, acts as a barrier and is transparent for inspection. After the first few centimetres it is essentially sterile. It should be applied in layers and not circumferentially like a bandage, to prevent any tourniquet effect if tissue oedema develops.6

The Guideline Development Team suggests that if cling film is unavailable, a clean, dry cotton sheet (preferably sterile) may be used as a first aid measure at home. In the primary care setting a double-layer paraffin gauze dressing may be used. Hand burns can be covered with a clear plastic bag. Topical creams should not be applied at this stage as they may interfere with the subsequent assessment of the burn.31
Chapter 3
Burn assessment

Emergency management

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>For major burns perform an ABCDEF primary survey and X-rays, as indicated.</td>
<td>C</td>
</tr>
<tr>
<td>Address analgesic requirements.</td>
<td>C</td>
</tr>
<tr>
<td>Establish and record the cause of the burn, the exact mechanism and timing of</td>
<td>C</td>
</tr>
<tr>
<td>injury, other risk factors and what first aid has been given.</td>
<td></td>
</tr>
<tr>
<td>Assess burn size and depth.</td>
<td>C</td>
</tr>
<tr>
<td>Give tetanus prophylaxis if required.</td>
<td>C</td>
</tr>
<tr>
<td>Be alert to the possibility of non-accidental injury.</td>
<td>C</td>
</tr>
</tbody>
</table>

Evidence

Measures recommended for the assessment and initial management of burns derive largely from international expert opinion. The chance of survival following burn injury has increased steadily over the past 60 years, in tandem with the introduction of such measures. Several large case series studying factors predictive of death following burn injury reported a strong correlation between prognosis and two factors: burn area (particularly deep burn area) and age. In addition, studies have found inhalational injuries to be a strong predictor of mortality. There is also evidence that other factors, such as alcohol, contribute significantly to outcome.

ABCDEF primary survey
Airway maintenance with cervical spine control
- Ensure airway is clear and open, keep movement of cervical spine to a minimum.
- Inhalation of hot gases can cause a burn above the vocal cords that may become oedematous over the following hours; a seemingly well person, especially a child, may deteriorate later. See Table 3.1 for signs of inhalational injury.
- If the patency of the airway is at risk, intubate.
Table 3.1 Airway maintenance

<table>
<thead>
<tr>
<th>Signs of Inhalational Injury</th>
<th>Indications for Intubation</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of flame burns or burns in an enclosed space</td>
<td>Erythema or swelling of the oropharynx on direct visualisation</td>
</tr>
<tr>
<td>Full thickness or deep dermal burns to face, neck or upper torso</td>
<td>Change in voice, with hoarseness or harsh cough</td>
</tr>
<tr>
<td>Singed nasal hair</td>
<td>Stridor, tachypnoea or dyspnoea</td>
</tr>
<tr>
<td>Carbonaceous sputum or carbon particles in oropharynx</td>
<td></td>
</tr>
</tbody>
</table>


Breathing
- Expose chest and ensure adequate and equal expansion.
- Provide supplemental oxygen.
- Damage below the vocal cords can be caused by severe chest burns, blast injury or inhalation of smoke or carbon monoxide. The products of combustion can directly irritate the lungs and cause bronchospasm or pulmonary oedema. People with asthma are particularly at risk.

Circulation with haemorrhage control
- Check for bleeding due to other injuries.
- Stop bleeding with direct pressure.
- Check pulse and peripheral circulation.
- Hypotension is not the normal initial response to a burn: check for other causes.
- Normal return from capillary blanch test is two seconds. A deep circumferential extremity burn can act as a tourniquet, causing vascular insufficiency and distal ischaemia which may become apparent some hours after the burn.

Disability: Neurological status
- Establish level of consciousness.
- Poisoning from inhalation of noxious gases can cause confusion, dizziness, headaches and seizures.
- Hypovolaemia and shock can also cause confusion.

Exposure with environmental control
- Remove clothing and jewellery and examine the whole person, including the back, for burn area and co-injuries.
- Keep the person warm: hypothermia develops easily, especially in children.

Fluid resuscitation
- Establish intravenous access with two large peripheral intravenous lines.
- Take blood for full blood count, urea and electrolytes, coagulation screen, amylase and carboxyhaemoglobin.
- The main aim is to maintain tissue perfusion to the wound and prevent the burn deepening and to avoid hypoperfusion or oedema.
- Burns of >10% body surface area in children and >15% in adults warrant resuscitation.
- Give fluids:
  - 24-hour requirement: 3–4ml crystalloid solution per kg per % burn
  - plus maintenance fluids for children
  - give half over the first eight hours, the remainder over the next 16 hours.
- If haemorrhage occurs from other injuries, replace with blood.
• Monitor with urinary catheter, ECG, pulse, blood pressure, respiratory rate, pulse oximetry or blood gases as appropriate.
• Insert nasogastric tube for larger burns or associated injuries.

**X-rays**
• In traumatic injury, order X-rays as indicated.

**Pain relief**
• Give intravenous morphine.
• Use small incremental doses of intravenous morphine until pain is controlled and reassess regularly.

For further information on pain management see Chapter 9, Pain management.

**Burn history**
• Knowledge of the cause of the burn, the exact mechanism and timing of injury and what prior treatment has been given helps to indicate the likely severity of the burn, the likelihood of inhalational or other co-injuries, the presence of contributing underlying causes (e.g., faintness, seizure, alcohol) and the possibility of non-accidental injury. See also Table 3.2 for key points of a burn history.

**Table 3.2: Key points of a burn history**

<table>
<thead>
<tr>
<th>EXACT MECHANISM</th>
<th>EXACT TIMINGS</th>
<th>EXACT INJURY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of burn agent (scald, flame, electrical, chemical)</td>
<td>When did the injury occur?</td>
<td>Scalds</td>
</tr>
<tr>
<td>How did it come into contact with the patient?</td>
<td>How long was the patient exposed to the energy source?</td>
<td>What was the liquid? Was it boiling or recently boiled?</td>
</tr>
<tr>
<td>What first aid was performed?</td>
<td>How long was cooling applied?</td>
<td>If tea or coffee, was milk in it?</td>
</tr>
<tr>
<td>What treatment has been started?</td>
<td>When was fluid resuscitation started?</td>
<td>Was a solute in the liquid? (raises boiling temperature and causes worse injury, such as boiling rice)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is there any suspicion of non-accidental injury?</td>
</tr>
<tr>
<td>Is there a risk of concomitant injuries (such as fall from height, road traffic crash, explosion)?</td>
<td></td>
<td>Electrocautery injuries</td>
</tr>
<tr>
<td>Is there a risk of inhalational injuries (did the burn occur in an enclosed space)?</td>
<td></td>
<td>What was the voltage (domestic or industrial)?</td>
</tr>
</tbody>
</table>

Factors influencing management and prognosis

- The size and depth of burns indicate their likely severity, the need for fluid resuscitation, the potential risk of complications, the rate of healing, the amount of scarring that can be expected, and the need for specialist care. However, a burn is rarely uniform: a mixed pattern of burn is usually found.
- The prognosis for people with major burns is well correlated to the area of the burn (TBSA), the presence of inhalational injury, and age.

Burn size

Assessment and recording of total body surface area burn

<table>
<thead>
<tr>
<th>RECOMMENDATION</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where time allows, use the Lund and Browder chart as the standard assessment tool for estimating the TBSA of the burn.</td>
<td>B</td>
</tr>
</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations – refer to Appendix A for grading details.

Evidence statements

- Lund and Browder charts are more accurate than either the Rule of Nines or palm size in identifying TBSA.
- Lund and Browder charts become less accurate at the extremes of age and body mass index (BMI).
- The Rule of Nines can be faster and more convenient to perform in emergency situations but is not accurate for children and should not be used in those clinical settings.
- A person’s hand size (palm including fingers) approximates to 0.8–1.0% of TBSA. The 1% rule can be cautiously used to estimate the size of small burns (<10%) in primary care.
- Computer assessments of burn size are not sufficiently developed for routine use in primary care.

The measurement of burn surface area is important during the initial management of people with burns for estimating fluid requirements and determining referral criteria. It is essential that all of the burn is exposed and assessed. During assessment the environment should be kept warm, and small areas of skin exposed sequentially to reduce heat loss. Erythema should not be included.51

Evidence

The practice of using a person’s hand size to approximate 1% body area is commonly taught on emergency medicine courses but has not been well validated.62-67 This practice should be used with caution, particularly in children or for people who are obese (BMI >30) as it does not allow for variations in individual body weight or age. For small areas, up to about 5%, the whole hand (palm plus digits) should be taken to approximate 0.8–1.0% of TBSA.

Five observational studies were found comparing the Rule of Nines burn area chart (see Figure 3.1) with other methods of estimating burn surface area. The Rule of Nines has been found to provide reasonable estimates for burned body surface area for most children and adults.68 For people who are obese or weighing more than 80kg (BMI >30), a Rule of Fives is proposed by one author:69 5% body surface area for each arm, 5x4 or 20% for each leg, 10x5 or 50% for the trunk, and 2% for the head. For infants weighing less than 10kg (BMI <18) a Rule of Eights is proposed: 8% for each arm, 8x2 or 16% for each leg, 8x4 or 32% for the trunk, and 20% for the head.

Computer methods of size estimation have been described for use in various skin disorders. Three studies were reviewed which were considered applicable to burn size assessment. Two observational studies70,71 found a close correlation between the computer methods of size estimation and objective measurement. The participants of one study found a computer program was easy to use and potentially useful in the person’s care.72 No direct quantitative comparisons with manual methods, in people with burns, were found.
Six different types of burn area charts were compared in one observational study. Four of the six were either Lund and Browder (see Figure 3.2) or a modified version of Lund and Browder, and there were two versions of the Rule of Nines represented. Utilising 10 drawings of burns on the six different charts, this study found that the Rule of Nines often overestimated the burn size and was more variable, but could be performed somewhat faster than the Lund and Browder method. The Rule of Nines’ estimates were 3% larger than the Lund and Browder estimates for the same burn representation.

A modification to the Lund and Browder chart has been proposed that adjusts for breast burns in larger-breasted women, as breast burns in these women can be underestimated by as much as 5%.

In the primary care setting it is anticipated by the Guideline Development Team that the use of specific adjustments in estimates of burn area to take account of obesity and large breast size would be precluded by other clinical priorities.

**FIGURE 3.1: ASSESSMENT OF BURN SIZE: RULE OF NINES**

Figure 3.2: Assessment of Burn Size: Lund and Browder Chart

% Total Body Surface Area Burn
Be clear and accurate, and do not include erythema

<table>
<thead>
<tr>
<th>AREA</th>
<th>AGE 0</th>
<th>1</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>ADULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = ⅓ of head</td>
<td>9 ⅔</td>
<td>8 ⅔</td>
<td>8 ⅔</td>
<td>8 ⅔</td>
<td>8 ⅔</td>
<td>8 ⅔</td>
</tr>
<tr>
<td>B = ⅓ of one thigh</td>
<td>2 ⅔</td>
<td>3 ⅓</td>
<td>4</td>
<td>5 ⅔</td>
<td>4 ⅔</td>
<td>4 ⅔</td>
</tr>
<tr>
<td>C = ⅓ of one lower leg</td>
<td>2 ⅔</td>
<td>2 ⅔</td>
<td>2 ⅔</td>
<td>3</td>
<td>3 ⅔</td>
<td>3 ⅔</td>
</tr>
</tbody>
</table>

Burn depth

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The depth of a burn injury should be reassessed two to three days after the initial assessment, preferably by the same clinician.</td>
<td>C</td>
</tr>
<tr>
<td>Testing for pinprick sensation by using a needle should be avoided.</td>
<td>C</td>
</tr>
</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations – refer to Appendix A for grading details.

**Good practice point**
The extent and speed of capillary refill can be used as a clinical method of assessing burn depth.

This is the opinion of the Guideline Development Team, or feedback from consultation within New Zealand where no evidence is available.

**Evidence statements**
- Burns can be difficult to assess accurately in the first few days following injury, particularly in areas of poor circulation or infection.
- Burn depth is easier to assess after the initial oedema and inflammatory reaction have settled.
- The extent and speed of capillary refill is the most useful clinical method to assess burn depth.
- There is insufficient evidence that the newer technologies (laser doppler, thermography, radioisotopes) are practical or useful in assessing burns in the primary care setting.
- Testing for pinprick sensation is painful and can be frightening for children and is not a sensitive test for assessing burn depth.
- An estimate of burn depth is important in planning treatment, but is not required for calculating fluid requirements for acute resuscitation.

**Evidence**
There is little reliable evidence on the assessment of burn depth and the above recommendations derive largely from expert opinion.

Although it is relatively uncomplicated to diagnose very superficial burns and very deep burns, those of intermediate thickness are more problematic as their surface appearance alone is deceptive. The extent and speed of capillary refill is considered the most useful clinical method to assess burn depth. However, the presence of a dermal circulation, as measured by capillary refill at 24 hours post-injury, does not necessarily mean that the burn will remain superficial. Burns can increase in severity and depth over the first few days, particularly in areas of poor circulation or infection. Burn depth is easier to assess after the initial oedema and inflammatory reaction have settled.

Testing for burn depth by using pinprick sensation requires a high degree of compliance and is not appropriate for young children, or for people who are confused or shocked. Moreover, the accuracy of the test is limited.

Biopsy and histology are generally considered to be the gold standards for assessment of burn depth, but are impractical for routine clinical use.

Most studies assess burns after 48 hours or so and therefore there is little evidence assessing the diagnostic accuracy of tools used to assess depth in the acute setting. Laser Doppler, transcutaneous microscopy, reflectance fluoroscopy, radioisotope studies, ultrasound and thermography have all been tried, but are still seen as research tools. The depth of a burn on any individual subject will vary from one location to another.
so all controlled trials of these tools suffer from a difficulty in matching the areas sampled. Despite this, some studies of newer techniques have shown promise in a research setting. The practical problems for the application of these techniques to clinical use include:

- direct contact with the skin surface is sometimes needed
- tests are invasive
- burns in some body areas cannot be tested
- a lack of agreed standardisation of the thresholds
- investigator bias is introduced by the need to choose a sample area.

A small blinded prospective study (of 23 people with 41 wounds) compared clinician assessment with laser doppler imaging to gauge burn depth in adults with acute burns of indeterminate depth. Burns were assessed daily; in most cases the first scan was done one day post-burn (maximum two days). Clinician assessment correctly predicted which of the 41 wounds required excision and grafting (sensitivity 100%), while the laser doppler technique erroneously predicted healing in 8 out of 21 cases when biopsy results confirmed deep partial thickness (mid to deep dermal) or full thickness burns (sensitivity 62%). Conversely, surgeons frequently overestimated burn depth, resulting in unnecessary excision and grafting for seven people (specificity 61.5%), whereas the laser doppler was 100% specific.

Other studies of newer technologies assessed wounds in a non-acute setting, so were not relevant to primary care.

### Non-accidental injury

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>If non-accidental injury is suspected, refer to a regional burns unit.</td>
<td>C</td>
</tr>
<tr>
<td>If non-accidental injury is suspected, examine for other signs of abuse and photograph injuries.</td>
<td>C</td>
</tr>
</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations – refer to Appendix A for grading details.

### Evidence

The high incidence of non-accidental burns and scalds necessitates that primary care staff be alert to this possibility. It is estimated that around 6–8% of paediatric burns are non-accidental, with children aged under three years being at highest risk. A high rate of repetitive injury has been reported among abused children. Older and disabled adults are also at increased risk.

- Indicators of possible non-accidental burns or scalds include the following:
  - delay in seeking help
  - historical accounts of injury differ over time
  - history inconsistent with the injury presented or with the developmental capacity of a child
  - past abuse or family violence
  - glove and sock pattern scalds
  - scalds with clear-cut immersion lines
  - symmetrical burns of uniform depth
  - other signs of physical abuse or neglect.

- Other possible indicators of non-accidental injury may include:
  - inappropriate behaviour/interaction of child or caregivers
  - restraint injuries on upper limbs.

Refer to a regional burns unit if non-accidental injury is suspected.
Tetanus
There is a risk of tetanus following a burn injury. For guidelines on the prevention of tetanus following injury, refer to the Ministry of Health Immunisation Handbook 2006.9

Classification of burns

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid use of the terms first-degree/primary, second-degree/secondary and third-degree burns.</td>
<td>C</td>
</tr>
<tr>
<td>Distinguish between burns that will probably heal without skin grafting and those that will probably require grafting (deep dermal burns and full thickness burns).</td>
<td>C</td>
</tr>
<tr>
<td>Burns that are unlikely to heal within 21 days without grafting should be referred early to secondary care, ideally by day 10–14.</td>
<td>C</td>
</tr>
</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations – refer to Appendix A for grading details.

Evidence statements

- A burn wound that has not healed within three weeks has an increased risk of significant scarring, infection and functional limitation.
- Early excision and grafting reduces mortality and shortens hospital stay.
- Extensive burns that are expected to heal spontaneously may still need to be managed in a hospital setting.

Evidence

Burns are generally classified by depth, as the ability of a bum to regenerate epithelium depends on the number of viable keratinocytes in the wound bed (as well as the wound environment).

International expert opinion notes that superficial dermal wounds should heal within two weeks, but deeper wounds are difficult to assess and may well require grafting, especially if the injuries are extensive or in cosmetically or functionally sensitive areas. The incidence of scarring rises if epithelialisation is delayed beyond three weeks; all wounds that show minimal signs of healing by 10 days should be referred for assessment. Full thickness wounds will most likely require grafting.87

A meta-analysis of six randomised controlled trials (RCTs) of the early excision of burns showed that, in people without inhalational injury, early excision reduced mortality and length of hospital stay. However, there was a greater volume of blood loss in people undergoing surgery.88

The ANZBA33 uses a five-point table. This is recommended for use in preference to the older systems, particularly the first- to third-degree classification, which does not differentiate between burns that are likely to heal spontaneously (superficial dermal) and those that are likely to require grafting (mid dermal and deeper).
<table>
<thead>
<tr>
<th>ANZBA 2004 Classification</th>
<th>Former Classification</th>
<th>Example</th>
<th>Appearance</th>
<th>Sensation</th>
<th>Healing Time</th>
<th>Scarring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Epidermal</strong></td>
<td>Superficial epidermal</td>
<td>UV light, very short flash</td>
<td>Dry and red, blanches with pressure, no blisters</td>
<td>May be painful</td>
<td>Within seven days</td>
<td>No scarring</td>
</tr>
<tr>
<td><strong>Deep dermal</strong></td>
<td>Superficial partial thickness</td>
<td>Scald (spill or splash), short flash</td>
<td>Blotchy red, may blister, blanches with pressure</td>
<td>Usually extremely painful</td>
<td>14–21 days</td>
<td>High risk of hypertrophic scarring</td>
</tr>
<tr>
<td><strong>Mid dermal</strong></td>
<td>Partial thickness</td>
<td>Scald (spill), flame, oil or grease</td>
<td>Dark pink with large blisters Capillary refill sluggish</td>
<td>May be painful</td>
<td>14–21 days</td>
<td>Moderate risk of hypertrophic scarring</td>
</tr>
<tr>
<td><strong>Superficial dermal</strong></td>
<td>Partial thickness</td>
<td>Scald (spill or splash), short flash</td>
<td>Dry and red, blanches with pressure, no blisters</td>
<td>May be painful</td>
<td>Within seven days</td>
<td>Low risk of hypertrophic scarring</td>
</tr>
<tr>
<td><strong>Epidermal</strong></td>
<td>Superficial epidermal</td>
<td>UV light, very short flash</td>
<td>Dry and red, blanches with pressure, no blisters</td>
<td>May be painful</td>
<td>Does not heal spontaneously, grafting needed if &gt;1cm</td>
<td>Will scar</td>
</tr>
</tbody>
</table>

Chapter 4
Referral

Emergency referral

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health care practitioners should follow the ANZBA referral guidance when deciding the level of care that is appropriate for people with a new burn injury.</td>
<td>C</td>
</tr>
<tr>
<td>When seen in primary care, smaller burns that look like they will fail to heal by 14 days should be discussed with a secondary care service for consideration of an acute referral.</td>
<td>C</td>
</tr>
</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations – refer to Appendix A for grading details.

Evidence statements
- ANZBA guidance on referral is universally accepted throughout New Zealand.
- International systems of referral are all consistent with ANZBA guidance.

Evidence
In 2001 the American Burn Association proposed a list of conditions that generally require a referral to a burns unit. In New Zealand there are burns units in Christchurch, Hutt Valley, Waikato and Middlemore Hospitals. The following criteria are endorsed by ANZBA in assessing whether burns require treatment in a specialised burns unit:
- burns greater than 10% of TBSA
- burns of special areas—face, hands, feet, genitalia, perineum and major joints
- full thickness burns greater than 5% of TBSA
- electrical burns
- chemical burns
- burns with an associated inhalation injury
- circumferential burns of the limbs or chest
- burns in the very young or very old
- burns in people with pre-existing medical and/or psychological disorders that could complicate management, prolong recovery or increase mortality
- burns with associated trauma.

Levels of care

Evidence statement
- Evidence from the US experience with trauma systems indicates that a regional approach to providing specialist burn management expertise and a central approach to treating the very severely injured on a national basis can both improve a person’s outcome and be cost-effective.

Evidence
There are four levels of care for burns injuries in New Zealand:
- primary care including accident and medical centre care
• secondary care in a hospital
• regional burns unit care (Christchurch, Hutt Valley, Waikato and Middlemore)
• National Burn Centre level care (Middlemore).

In 2002, the Ministry of Health supported the development of a National Burn Centre based at Middlemore Hospital in Auckland. This Centre will be part of an organised system of care with a network of regional burns units in Christchurch, Hutt Valley and Waikato. Middlemore will continue to act as a regional unit for the northern part of the North Island. People referred to Middlemore from regional units will return for ongoing care and rehabilitation when possible. Adults and children will be treated in the facility.

A review of trauma services and organisation completed by the American Burn Association looked at the evidence for improved personal outcomes from the centralisation of trauma services that occurred in the US through the 1980s and 1990s. It reported improvements in survival, length of stay and costs in centres with higher programme numbers (higher numbers of people treated) and higher surgeon case volumes (higher numbers of people treated by each surgeon) and where people were transferred directly to a trauma centre from the scene of injury. Although we found few high-quality studies of similar system change in burn care, it seems reasonable to expect a similar benefit will extend to all trauma cases.

Australia and the United Kingdom (UK) have reviewed the provision of national burns services and the evaluation and outcomes, when reported, may help inform any restructuring in New Zealand. In the interim the Guideline Development Team found no firm evidence that could support or refute the benefits of the New Zealand model of care.

**Referral between services**

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfer between services is facilitated by prompt assessment, recognised communication channels and locally developed protocols agreed between centres on whom to transfer and when to transfer.</td>
<td>C</td>
</tr>
<tr>
<td>Referrals to National Burn Centre level care should be via the regional burns units.</td>
<td>C</td>
</tr>
</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations – refer to Appendix A for grading details.

**GOOD PRACTICE POINT**

Primary care and accident services will generally develop their own systems for referral depending on the distances involved in travel to secondary services or regional burns units. In general, those people who have less severe injuries than in the ANZBA criteria, but who still require inpatient care, should be referred to local secondary services.

This is the opinion of the Guideline Development Team, or feedback from consultation within New Zealand where no evidence is available.

**Evidence statements**

A lack of data internationally on the relative merits of different service configurations, and the lack of applicability to New Zealand’s unique circumstances and demographics suggest that evaluation of outcomes and referral volumes between services will be needed.
Chapter 5
Management of epidermal burns or scalds

Dressings and creams

**GOOD PRACTICE POINTS**

<table>
<thead>
<tr>
<th>Point</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>A protective dressing or cream product can be used for comfort in epidermal burns and scalds.</td>
</tr>
<tr>
<td>✓</td>
<td>Review epidermal burns or scalds after 48 hours. If the skin is broken, change to a moist wound-healing product (or alternatively double-layer paraffin gauze).</td>
</tr>
</tbody>
</table>

This is the opinion of the Guideline Development Team, or feedback from consultation within New Zealand where no evidence is available.

**Evidence statements**

- There is no compelling evidence to demonstrate an advantage for one wound-care product over another in the management of epidermal burns and scalds.

**Evidence**

There is very little reliable evidence on the management of epidermal burns and scalds. Three small RCTs were found on the management of epidermal burns and scalds, all of fair quality. One very small split-sample RCT (n=12) compared topical steroid cream (clobetasol) and placebo for treating pain and inflammation in volunteers with superficial (epidermal) thermal burns. Another very small split-sample RCT (n=6) assessed erythemal reactions in volunteers with ultra violet (UV) induced skin damage, comparing melatonin, antioxidant creams and Aloe vera in various combinations with no treatment. A larger RCT (n=50) compared healing time and bacterial colonisation rates between hydrocolloid and medicated paraffin gauze with or without silver sulphadiazine.

**Findings**

None of these trials found any statistically significant difference between any of the treatments for any of the outcomes measured, except that povidone-iodine-impregnated gauze was twice as expensive as standard paraffin gauze.

Guidance on dressings and creams from Guideline Development Team opinion includes the use of a protective dressing or cream product for comfort in epidermal burns and scalds, with review after 48 hours. If the skin is broken, the protective dressing or cream product should be changed to a moist wound-healing product or alternatively to double-layer paraffin gauze.
Chapter 6
Management of superficial and mid dermal burns or scalds

Dressings and topical therapy
Dressing products which are unlikely to be found in primary care for use with burns were specifically excluded. The outcomes ‘time to healing’ and ‘infection’ were key questions posed to the literature by the Guideline Development Team. Wasiak and Cleland provided a discussion of other outcomes, such as pain and number of dressing changes. A table describing various wound products and their uses has been compiled using information from manufacturers and Guideline Development Team experience in burn care (see Appendix B).

Preventing infection

**GOOD PRACTICE POINTS**

- Products with antimicrobial action (such as silver sulphadiazine cream) should be used on all burns for the first 72 hours (three days) after burn injury. ✓
- Burn wounds with signs of mild cellulitis can be treated with topical silver sulphadiazine and/or oral antibiotics. ✓
- Acute referral to secondary care is required for people with burns with signs of serious or systemic infection. ✓

**Evidence statements**

- Although there is little evidence supporting the use of silver sulphadiazine for non-infected burns, clinical experience in New Zealand populations supports the routine use of silver sulphadiazine or other antimicrobial creams for the first three days to prevent infection.
- If infection is suspected, longer-term use of silver sulphadiazine may be indicated.
- There is no evidence comparing short-term (three day) use of silver sulphadiazine cream with other wound-dressing practices.

Most burn wounds are initially sterile. Careful aseptic wound-care procedures along with the use of antimicrobial cream for the first three days are generally sufficient to prevent infection. The wound should be regularly monitored, as infection can delay healing, increase scarring and potentially cause systemic infection.

The signs and symptoms of infection include the following:
- warmth and/or redness around the wound
- increasing pain
- increasing exudate, odour or pus from the wound site
- increasing swelling or tenderness
- fever or local wound temperature increase
- lymphangitis
- increased irritability in a child.
The use of silver sulphadiazine is recommended for the first three days following burn injury due to the high incidence of community-acquired Staphylococcus aureus sepsis (SAS) in the New Zealand population. If infection is suspected, expert consensus favours swabbing the wound and considering the use (or re-use) of topical silver sulphadiazine and/or oral antibiotics. It is considered appropriate to extend the use of silver sulphadiazine beyond three days if infection is suspected or present. Acute referral to secondary care is required for people with burns with signs of serious or systemic infection.

If after three days there is no infection, consider changing to a product that encourages moist wound healing.

Evidence
The evidence from published literature on the prevention of burn infection is inconsistent and of limited quality. There were nine fair-quality RCTs comparing silver sulphadiazine with other dressings and topical treatments (n=18 to 104). Two RCTs compared silver sulphadiazine with a silicon mesh dressing, and another RCT compared silver sulphadiazine with a synthetic barrier dressing (n=18). One fair-quality RCT (n=50) compared three types of dressings: a medicated (chlorhexidine) paraffin gauze dressing, a hydrocolloid dressing, and a hydrocolloid dressing with silver sulphadiazine cream. Another fair-quality RCT compared a silver-coated high-density polyethylene mesh dressing with a solution containing 0.5% silver nitrate. A fair-quality RCT compared 1% silver sulphadiazine with a combination of 1% silver sulphadiazine and 0.2% chlorhexidine digluconate.

Five fair-quality RCTs all conducted by the same group compared bacterial colonisation rates in partial thickness (dermal) burns treated with honey, with silver sulphadiazine-impregnated gauze (three studies), polyurethane film, soframycin, paraffin gauze, dry gauze and exposure. These studies were unblinded and of variable size (n=50, 92, 100, 104 and 900). Bacterial colonisation rates were lower with honey in four of the studies. In one study comparing silver sulphadiazine with honey, infection rates were similar for both groups.

No controlled evidence was found on the treatment of infected burns in primary care.

Findings
Although silver sulphadiazine cream is widely used for the prevention of infection of superficial and mid dermal burns, there is currently little evidence supporting its use. The evidence is inconsistent and of limited quality.

One unblinded RCT found that there was a wider variety of bacterial flora and a larger amount of bacterial growth with the use of a silicone mesh dressing compared with silver sulphadiazine. However, this study found no differences in the signs of infection or the amount of wound drainage in both groups. Another study comparing the same products also found no significant difference in the number of infections.

No significant differences in infection rates were found when comparing silver sulphadiazine cream with a synthetic barrier dressing. One of the studies conducted by Subrahmanyam also found similar rates of infection between silver sulphadiazine and honey.

Six studies found a difference in rates of infection/bacterial colonisation.

One study found less wound colonisation and infection using a combination of 1% silver sulphadiazine and 0.2% chlorhexidine digluconate versus 1% silver sulphadiazine alone. The overall incidence of wound bacterial colonisation was significantly less using a combination of 1% silver sulphadiazine and 0.2% chlorhexidine digluconate (65% vs 88%). There was also significantly less wound colonisation by Staphylococcus aureus (41% vs 64%). Clinical wound infection with Staphylococcus aureus developed in one person treated with the combined cream as opposed to five people treated with 1% silver sulphadiazine alone.
However, this result did not reach statistical significance (p=0.16). Another study found that a silver-coated dressing had lower rates of burn wound sepsis (10^6/g) (n=5 vs n=16) and bacteraemia (n=1 vs n=5) in the silver-coated dressing group. However, the results did not reach statistical significance at the 0.05 level.99 Two RCTs carried out by the same group95,97 found that bacterial colonisation rates were significantly lower with the use of honey as a dressing. One study found that medicated (chlorhexidine) paraffin gauze had the least increase in bacteria92 when compared with a hydrocolloid dressing, with or without silver sulphadiazine (p<0.01). However, this study also found that there was no significant difference in the increased incidence of pathogens during treatment in all three groups.

Toxic shock syndrome

Evidence statements
• Deaths from toxic shock syndrome are very rare in New Zealand, but are potentially preventable.
• In rare cases the rapid onset of symptoms of systemic infection with burns may be due to toxic shock syndrome.

Evidence
Toxic shock syndrome is a rare complication of SAS infection. Most of the evidence of toxic shock in people with burns applies to children, but the syndrome has also been reported in adults.107 Reports of toxic shock syndrome in New Zealand are very rare, though anecdotally deaths have been reported in children. There is no definite diagnostic test for toxic shock syndrome and its symptoms are similar to those of other infections, namely fever, rash, diarrhoea, vomiting and hypotension. The diagnosis is generally made using the US Centers for Disease Control and Prevention criteria listed below:108 Diarrhoea, vomiting and oliguria are early signs, which may occur prior to the development of shock and help establish a timely diagnosis. If people with burns undergo a sudden change, especially the rapid onset of fever and gastrointestinal upset, the possibility of toxic shock syndrome should be considered.107

Although early intervention and the administration of effective antimicrobials are essential in the management of toxic shock syndrome, probably the single most important therapeutic measure is the administration of antibodies as human immunoglobulin, fresh frozen plasma or fresh blood, producing a state of passive immunity in the recipient.109

The Centers for Disease Control have identified the following five clinical criteria for toxic shock syndrome:108
1. Temperature ≥38.9°C.
2. Low blood pressure (including fainting or dizziness on standing).
3. Widespread red flat rash.
4. Shedding of skin, especially on palms and soles, one to two weeks after onset of illness.
5. Abnormalities in three or more of the following organ systems:
   − gastrointestinal: vomiting or diarrhoea
   − muscular: severe muscle pain
   − hepatic: decreased liver function
   − renal: raised urea or creatinine levels
   − haematologic: bruising due to low blood platelet count
   − central nervous system: disorientation or confusion.
6. Mucous membranes: red eyes, mouth and vagina due to increased blood flow to these areas.

A survey of children in burns units in the UK found no association between the management of the burn wound and the subsequent development of toxic shock syndrome.109
Wound healing

RECOMMENDATIONS

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use dressings that encourage re-epithelialisation by moist wound healing.</td>
<td>C</td>
</tr>
<tr>
<td>The prolonged use of silver sulphadiazine cream (more than seven days) should be avoided in non-infected burns.</td>
<td>B</td>
</tr>
</tbody>
</table>

*Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations – refer to Appendix A for grading details.

GOOD PRACTICE POINTS

- Following initial silver sulphadiazine cream or antimicrobial dressing, a technique that promotes moist wound healing (such as a hydrocolloid dressing) is recommended.
- The convenience of a reduced number of dressing changes with hydrocolloid products should be considered where this is important to the person.
- Double-layer paraffin gauze can be used where hydrocolloids are unavailable.
- Moisturisers and non-drying, non-perfumed soap should be used to protect the skin after burn injury and may also be helpful for pruritis.
- Burn wounds require extra care when exposed to sun.

*This is the opinion of the Guideline Development Team, or feedback from consultations within New Zealand where no evidence is available.

Evidence statements

- Convenience of use, reduced pain or number of dressing changes makes moist wound-healing products preferable.
- There is insufficient evidence to recommend one moist wound-healing product over another.
- Prolonged use of silver sulphadiazine cream (more than seven days) may delay healing.
- There is a lack of evidence that any dressing product is superior to paraffin gauze in reducing the overall time to healing.
- Hydrocolloid products can be changed every three to five days in wounds that are non-infected or have heavy exudates.

Evidence

Moist wound-healing versus non-moist healing products

Expert opinion strongly favours the use of moist wound-healing products for superficial and mid dermal burns, although the evidence from RCTs is scanty and inconsistent.

Seven small fair-quality RCTs (n=50 to 98) compared moist with non-moist healing products for partial thickness (dermal) burns. 92,104,110-114 None was blinded. The moist healing products included polyurethane film/foam and hydrocolloids and the non-moist products included paraffin gauze and honey. Two of these studies compared hydrocolloids with a non-moist dressing plus silver sulphadiazine. 115,116

As described below, only three of the six RCTs showed a difference in time to healing between moist and non-moist healing products. 106,107,108
One study found hydrocolloids healed wounds significantly faster than gauze and silver sulphadiazine.\textsuperscript{114} Three other studies reported a similar healing time for hydrocolloids and paraffin gauze/tulle gras.\textsuperscript{92,110,113} Comparisons between polyurethane film/foam and paraffin gauze for burns were also inconsistent. One study reported that burns healed significantly faster with polyurethane film\textsuperscript{113} and one study reported no difference between these products in healing rates.\textsuperscript{115} One study found that honey healed significantly faster than polyurethane film.\textsuperscript{104}

There is no convincing evidence from primary RCTs that any other dressing product heals wounds significantly faster than paraffin gauze (which is considered a non-moist dressing). Since paraffin gauze tends to dry out (expert opinion), occlusive moist wound-healing products may be considered for wounds as the volume of wound exudate diminishes.

There is good evidence from a systematic review that moist dressings are superior to non-moist dressings for healing time, comfort and infection rates for burn donor sites.\textsuperscript{115} However, it is uncertain whether this evidence is applicable to the care of superficial and/or mid dermal burns in primary care.

**Dressing changes**

One RCT reported that hydrocolloid required fewer dressing changes than paraffin gauze,\textsuperscript{92} but another reported no difference between them.\textsuperscript{116}

**Silver sulphadiazine cream compared with other dressings and topical treatments**

Twelve RCTs were found comparing silver sulphadiazine cream with other dressings and topical treatments. These studies were rated either fair (10) or good quality (2). The largest study had 111 participants and six of the studies had more than 50 participants. Ten of the 12 studies found that silver sulphadiazine significantly increased time to healing. However, in all of these studies, silver sulphadiazine was applied until complete healing (re-epithelialisation). No studies were found comparing shorter-term use of silver sulphadiazine cream with other dressings or topical treatments.

Four of the 14 studies were fair-quality RCTs comparing silver sulphadiazine with other dressings. Two RCTs comparing hydrocolloid dressings versus silver sulphadiazine found that silver sulphadiazine significantly increased time to healing.\textsuperscript{92,114} One RCT found that silver sulphadiazine increased time to healing when compared with a silicone-coated nylon dressing.\textsuperscript{98} One RCT found no significant difference in time to wound healing comparing a combination of chlorhexidine-impregnated gauze dressing plus silver sulphadiazine cream with hydrocolloid dressing.\textsuperscript{110}

A further seven RCTs were found comparing silver sulphadiazine with various topical treatments. Two of these studies compared silver sulphadiazine cream with a combination of hyaluronic acid and silver sulphadiazine cream.\textsuperscript{115,116} These good-quality studies both reported that time to healing was significantly reduced using the combined hyaluronic acid and silver sulphadiazine cream. One fair-quality RCT compared silver sulphadiazine with a combination of cerium nitrate and silver sulphadiazine.\textsuperscript{119} This study found that the time to healing was reduced by almost eight days when using a combination of cerium nitrate and silver sulphadiazine when compared with silver sulphadiazine alone. However, the results just failed to reach statistical significance at the 0.05 level. Another RCT (n=15) compared silver sulphadiazine cream with collagenase ointment and an antibiotic spray.\textsuperscript{120} This study also found that silver sulphadiazine increased time to healing.

**Silver sulphadiazine compared with alternative therapies for time to healing**

Three fair-quality RCTs\textsuperscript{94,95,96} compared time to healing in partial thickness (dermal) burns treated with honey (non-manuka) versus silver sulphadiazine. In all of these studies, superficial and partial thickness (epidermal and dermal) burns treated with honey healed faster than those dressed with silver sulphadiazine. These studies were fairly small, none was blinded and all the honey studies were conducted by the same researchers.
A large unblinded RCT compared moist exposed burn ointment with silver sulphadiazine and found no difference in time to healing.

**Healing wounds and donor sites are vulnerable to dry skin and sunburn**

Expert opinion favours the use of moisturisers and non-drying, non-perfumed soap to prevent the skin drying out, as this could lead to skin breakdown and secondary infection. Education on sun protection is also important. Extra care needs to be taken at times of sun exposure. Sunscreen and/or protective clothing should be worn if working or playing outside.

Pruritis can also be a problem following burn injury. Persistent pruritis occurs after about 15% of burn injuries, with a further 44% of people reporting occasional pruritis. A systematic review of relevant studies found that a variety of interventions were reported to be beneficial, including medications, massage and transcutaneous electrical nerve stimulation, but none of the studies provided high-quality evidence on which treatment recommendations could be based. The clinical experience of the Guideline Development Team suggests that moisturisers are beneficial.

**When to review**

**GOOD PRACTICE POINT**

- Superficial and mid dermal burns should be reviewed daily for the first three days, then subsequently every three days.

*This is the opinion of the Guideline Development Team, or feedback from consultation within New Zealand where no evidence is available.*

In the absence of randomised data to answer the question “how often should a burn be reviewed?”, the Guideline Development Team discussed three aspects it considered relevant:

- the expected speed of healing for burns of differing depths
- the safety/risk of continued primary care management
- the expected time-lag between the identification of a problem, referral and a definitive specialist opinion.

A good practice point based on the experience of the Guideline Development Team was considered appropriate.

**Management of blisters**

**GOOD PRACTICE POINTS**

- Preferably leave small blisters intact unless likely to burst or interfere with joint movement.
- If necessary, drain fluid by snipping a hole in the blister.

*This is the opinion of the Guideline Development Team, or feedback from consultation within New Zealand where no evidence is available.*

**Evidence statements**

- There is little evidence to guide the management of blisters.
- The bed of a de-roofed blister can be more painful than an intact blister.

Burn blisters occur primarily in superficial dermal and mid dermal burns, but also may overlay deep dermal burns. They are a result of inflammatory changes that occur early in burn injury, whereby increased capillary permeability allows oedema formation between the epidermis and dermis.
Evidence

One controlled trial of 202 people with partial thickness (dermal) burns was identified of relevance. In this study, randomisation was unclear. There were two treatment groups: aspirated and deroofed blisters. The intact blister group was left for 10 days before burn blister fluid was aspirated for analysis. The study assessed infection rates and pain scores.

An RCT of second-degree (dermal) burns in pigs was also found. In this study, 42 burns in two pigs (randomised to debridement or no debridement) were assessed for infection and re-epithelialisation rates.

Findings

In the Swain study, the incidence of infection (bacterial colonisation) in the intact blister group was 14% compared with 76% in the deroofed blister group (p<0.05). Aspiration of fluid (in the intact blister group at 10 days) reduced pain in 34% of participants compared with 0% in the deroofed group. Deroofing worsened pain in 43% compared with 19% in the aspiration group. In the Singer trial, infection rates were higher in deroofed burns (p<0.001).

There is a paucity of evidence to answer the question of whether deroofing is associated with less pain or faster healing compared with leaving blisters intact. A recently published review concluded that it may be worthwhile to consider healing rates associated with different dressing applications because they are an indirect measure of healing in intentionally deroofed versus intact blister management in a partial thickness (dermal) burn. On balance, until there is more evidence, small blisters should be left intact to reduce the risk of infection, but if anatomical position necessitates intervention for functional purposes, aspiration appears to result in less pain than deroofing.

Scarring

<table>
<thead>
<tr>
<th>RECOMMENDATION</th>
<th>GRADE</th>
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<tbody>
<tr>
<td>Any burns that are unlikely to heal within 21 days without grafting should be referred to a burns unit for scar management by day 10–14.</td>
<td>C</td>
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</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations – refer to Appendix A for grading details.

Good Practice Point

A person presenting with scarring some months after a burn should still be referred for specialist opinion.

Evidence statements

- Silicone sheeting may be of benefit in reducing scarring, although the evidence is of poor quality.
- Pressure garments may also be of benefit, but the evidence is inconclusive.
- Burns that do not heal within 21 days are likely to cause scarring, which can result in significant morbidity for the person.

Healing process

Scarring can result in long-term functional disability and changes in appearance, both of which are an indication for specialised care.
The normal process of wound healing by secondary intention involves the processes of epithelialisation and wound contraction. Epithelial cells require a matrix to migrate across. In a superficial wound the dermis is well intact; there are numerous epithelial cells and melanocytes within the dermis, epithelialisation is rapid and wound contraction is not a feature. Hence, there is minimal scarring or alteration in appearance.

In a deeper burn there is less dermis and epithelialisation is prolonged, allowing the formation of granulation tissue. This granulation tissue contains large numbers of fibroblasts and myofibroblasts\(^{127}\) that are believed to produce wound contraction and scarring. Also, the melanocytes which are deep in the dermis may have been injured and/or destroyed, leading to altered pigmentation. Early debridement and skin grafting interrupt this process of granulation formation and so reduce the risk of contraction, which can still occur with grafting, but usually to a lesser extent.

In a healed wound the processes of collagen deposition and angiogenesis have led to the laying down of collagen fibres in a haphazard arrangement with a large influx of blood vessels. Over subsequent months the wound goes through maturation where the metalloproteinases remodel the wound so that it softens and becomes less red. However, if there are continuing adverse factors such as inflammation, infection or tension, the process of scar maturation is hindered or prevented.

When the process of scar maturation is hindered, there is an increased risk of hypertrophic scarring. Hypertrophic scars are thick, raised areas, usually darker than the surrounding skin, which remain within the confines of the original wound and tend to regress over time.\(^{128}\)

Another form of scarring that occurs less frequently is keloid scarring, in which the scar grows beyond the borders of the original wound and does not regress spontaneously. Keloid scarring tends to occur in genetically predisposed individuals and is more common in people of Asian descent and people with darker skin.\(^{129}\)

**Predictors of scarring**
Risk factors for scarring identified in the literature include burn severity and non-white skin. It is unclear whether the risk is higher in children.\(^{123}\) Burn wounds that fail to heal within two to three weeks are at high risk of scarring.\(^{130}\)

**Evidence on interventions for scarring**
One RCT was identified comparing massage together with pressure treatment with pressure treatment alone as treatments for hypertrophic scars in children.\(^{131}\) One Cochrane systematic review\(^{132}\) and one evidence-based report\(^{133}\) were identified on silicone gel sheeting for both the prevention and treatment of hypertrophic and keloid scars. One Cochrane protocol,\(^{134}\) three non-systematic reviews\(^{135,136,137}\) and three RCTs\(^{137-139}\) were identified. One of these RCTs compared pressure garments with no treatment, one RCT compared different types of pressure garments and the other compared different levels of compression on scar erythema and thickness.\(^{139}\)

No controlled trial evidence was found on other interventions such as intralesional steroid injections or laser treatment.

**Findings on interventions for scarring**
There was little evidence on interventions for scarring on which to base recommendations.

**Massage**
No evidence was found that massage is helpful in either the prevention or treatment of scars.

**Silicone gel sheeting**
The Cochrane review (including 13 RCTs) evaluating the effects of silicone gel sheeting for the prevention or treatment of scars reported that silicone gel sheeting significantly reduced the incidence of hypertrophic scarring.
in people prone to scarring (RR 0.46, 95% CI 0.21 to 0.98). A significant improvement in scar elasticity (RR 8.6, 95% CI 2.55 to 29.02) was also reported. However, as the studies were highly susceptible to bias, the authors concluded the evidence of benefit was weak. Similarly, the ACC evidence report concluded that the effectiveness of silicone gel sheeting in scar management could not be confirmed.

**Pressure garments**

The evidence for pressure garments was also inconclusive. Pressure garments have been commonly used for more than three decades, but the optimal pressure and duration has not been confirmed by controlled trials. Pressure garments are usually used in a hospital setting or outpatient clinics.\(^{135}\) They are also associated with significant adverse events, such as overheating, pruritis, wound breakdown and abnormal bone growth.\(^{136,140}\) However, the comparative trial comparing two different levels of pressure (initial pressure of 20mm Hg vs 12mm Hg) reported that there was a significant difference in the thickness of the scar at one month with the higher pressure than with the lower pressure. No differences were found for erythema. A clear association was shown between the persistence of erythema and hypertrophic scar formation. A multicentre comparative trial is currently underway to clarify the role of pressure garments on scar management.\(^{139}\)
Chapter 7
Management of chemical injury

General treatment advice

First aid

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
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<tr>
<td>Irrigation of chemical burns should continue for one hour.</td>
<td>C</td>
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<tr>
<td>All chemical burns should be referred to a burns unit.</td>
<td>C</td>
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</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations – refer to Appendix A for grading details.

Good practice point

Acid burns should not be neutralised with an alkali in primary care.

This is the opinion of the Guideline Development Team, or feedback from consultation within New Zealand where no evidence is available.

Evidence statements

- There is an increased risk of systemic complications following chemical burns.

Evidence

Four retrospective observational studies were considered relevant.\textsuperscript{141-144} No controlled studies or systematic reviews were found. Six non-systematic reviews were also included to ascertain the consensus of expert opinion.\textsuperscript{145-150} Three other retrospective observational studies were selected for their review of the relevant literature.\textsuperscript{151-153}

An 11-year retrospective case series (n=51) compared those people who had immediate irrigation (group A) with those who had delayed irrigation (group B). The size of burn was similar in the two groups (19.7% TBSA in group A vs 17.2% TBSA in group B). In group A, 19% required skin grafting compared with 36% in group B. Mortality was 9.5% (group A) compared with 21% (group B). Length of stay in hospital was 7.2 days (group A) compared with 16.2 days (group B).\textsuperscript{142}

In a four-year retrospective case series (n=35), people who received immediate irrigation to their chemical burn had significantly less incidence of full thickness injury and spent half as long in hospital.\textsuperscript{143}

An eight-year retrospective case series (n=24) found that all people with delayed presentation (n=5) had deep burns that required excision and grafting. All burns in this series were irrigated for 45 minutes to an hour at the burns unit.\textsuperscript{144}

However, a fourth retrospective case series (n=173) found no significant statistical difference in the number of deep burns between those who had immediate irrigation of their wounds and those without immediate irrigation (37.5 vs 46% respectively). Mean hospital stay was 5.8 and 4.8 days respectively (not statistically significant).\textsuperscript{141}
Several non-systematic reviews were considered, all with consistent opinions regarding chemical burns to the skin. They made the following recommendations:

1. Immediate removal of clothing and copious irrigation with water for a period of at least one hour.  
2. No attempt should be made to neutralise an acid burn with an alkali as this may delay irrigation and cause more injury due to heat produced by an exothermic reaction.  
3. There is a risk of systemic complications following chemical burns with hydrofluoric acid, formic acid, phenol, white phosphorus, nitrates and hydrocarbons.  
4. Chemical burns meet the criteria for referral to a specialised burns unit.

Eye injury

<table>
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<th>RECOMMENDATIONS</th>
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<tbody>
<tr>
<td>All significant chemical injuries to the eye should be referred acutely to ophthalmology services.</td>
<td>C</td>
</tr>
<tr>
<td>Treat all chemical burns to the eye with copious irrigation of water.</td>
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Chemical burns to the eyes are associated with residual visual impairment. Physical signs include blepharospasm, tearing, conjunctivitis and uncontrolled forceful rubbing of the eye. Rapid swelling of the corneal epithelium occurs and clouding of the anterior layers of stroma. Cells may be seen floating within the anterior chamber.

Specialist assessment is required for early signs of corneal ulceration or perforation, and the possible late complications of cataract, secondary glaucoma, iridocyclitis and symblepharon.

Specific substances

Hydrofluoric acid

**GOOD PRACTICE POINT**

Anyone exposed to hydrofluoric acid should be promptly referred to a burns unit for definitive treatment after appropriate first aid.

Evidence statements

- Hydrofluoric acid exposure of >2% TBSA can be fatal.  
- Calcium gluconate gel, infiltration or intra-arterial and/or intravenous therapy corrects the hypocalcaemia of hydrofluoric acid burns and reduces pain.

Hydrofluoric acid is a very strong acid. It is used widely, mainly in industrial settings, but it is also found domestically in rust removers and aluminium cleaners.

Features of hydrofluoric acid exposure include severe cutaneous burns, as well as possible systemic and lethal toxicity. Hydrofluoric acid penetrates the skin easily and enters the deeper tissues where it releases the fluoride ion. This ion readily binds with calcium and magnesium and it is this property that makes hydrofluoric acid especially dangerous. Even minor exposure to dilute solutions can cause problems in the deeper tissues, and symptoms and injury may be delayed.
The systemic effects of hydrofluoric acid exposure are due to the fluoride ion binding with serum calcium causing hypocalcaemia which can result in cardiac arrhythmias.154-157,159 Exposure to even small amounts of hydrofluoric acid can result in death, usually due to ventricular arrhythmias.154,157,159,160,162-164

Evidence

Eleven observational studies or case reports154-156,159,161-163,165-168 and four non-systematic reviews157,158,160,164 were reviewed for the guideline. No controlled human studies were located.

A prospective study of 10 people with hydrofluoric acid dermal burns of digits found rapid pain relief with intra-arterial administration of 10% calcium gluconate. All had full functional recovery of their digits with good cosmetic appearance.159

In a 10-year case series of treatments for hydrofluoric acid burns at one facility, 28 of 85 people were treated with local infiltration of 10% calcium gluconate. Only one person (4%) had progression of their injury compared with 14–70% in the other treatment groups. All people treated with calcium gluconate experienced pain relief following the injections.161

Another retrospective case series of the authors’ institutional experience found 42 people with hydrofluoric acid burns for the period 1977–1999. There were 11 recorded cases of hypocalcaemia, which were treated successfully with oral and intravenous calcium supplementation. There were no deaths.165

A case report of one person described the use of calcium gluconate gel topically, cutaneous and subcutaneous injections of 10% calcium gluconate, magnesium chloride and 2% xilocain, and the intravenous use of calcium gluconate which successfully corrects the hypocalcaemia.155

Another case report of one person exposed to a household rust remover described treatment with calcium gluconate gel and intra-arterial calcium gluconate infusion with good outcome.167

In another report, two cases of skin injury and inhalational exposure to hydrofluoric acid were described which were successfully treated with application of 2.5% calcium gluconate jelly and 5% calcium gluconate nebulised solution.168

In a report of three cases of hydrofluoric acid skin injuries (TBSA 5–25%), two people died as a result of cardiac arrest.155 Another reported a case of 15.5% TBSA hydrofluoric acid burn where the person died.154

The last case report was of a man with 44% TBSA burn from hydrofluoric acid who developed recurrent ventricular tachyarrhythmias and subsequently recovered. The authors cite several fatal cases of ventricular fibrillation reported in other studies following 2.5–22% full thickness TBSA burns due to exposure to more than 50% hydrofluoric acid.156

The four non-systematic reviews all have consistent findings. In a comprehensive literature review of hydrofluoric acid burns,157 the authors described several reported cases of death from skin exposure of 2.5–10% TBSA. This is supported by the other reviews.154,155,159

• They all emphasise the importance of immediate, copious and prolonged lavage of the affected area with water.154,159,161,163,165
• For dermal exposure to hydrofluoric acid, the liberal and frequent application of 2.5% calcium gluconate gel is recommended by all authors.
• If pain relief is incomplete or symptoms recur, subcutaneous injections of calcium gluconate are indicated. Both these treatments have been shown to relieve pain.154,157,159,160,164
• Good results have been demonstrated with intra-arterial administration of calcium gluconate.
• Calcium gluconate is also administered intravenously to correct the hypocalcaemia due to hydrofluoric acid exposure.154,157,159,160,165,163
Phosphorus

**GOOD PRACTICE POINT**

Anyone exposed to phosphorus should be promptly referred to a burns unit for definitive treatment after appropriate first aid.

This is the opinion of the Guideline Development Team, or feedback from consultation within New Zealand where no evidence is available.

White phosphorus is commonly used as an incendiary in the manufacture of ammunition and is also used for the manufacture of certain fertilizers, fireworks and distress flares. It readily ignites in the presence of air.

**Evidence statements**

- The person should be transported with the affected area either submerged in water or saline or covered with water- or saline-soaked dressings.

**Evidence**

Four retrospective observational studies, two single case reports and three non-systematic reviews were reviewed. All selected articles had a consensus of opinion:

1. The initial treatment consists of prompt removal of clothing and immediate copious irrigation with water.
2. The person should be transported with the affected area either submerged in water or saline or covered with water- or saline-soaked dressings to prevent the re-ignition of the retained particles of phosphorus.

Absorption of phosphorus can cause systemic complications including hypocalcaemia, hyperphosphataemia, cardiac arrhythmias, renal and hepatic toxicity, and sudden death.
Chapter 8
Management of electrical injury

**Evidence statements**

- High-voltage electrical current damages deep tissues (muscle and nerves). This damage is sometimes not apparent at the initial inspection.
- Cardiac abnormalities can occur following electrical injury. These are frequently transient.

Electrical injuries can be divided into three groups: low-voltage (<1000V), high-voltage (>1000V) and lightning strike.

Low-voltage electrical injuries can cause significant local contact burns and may cause arrhythmias or cardiac arrest. They can cause tetany or muscle spasm that will prevent the person releasing the source of current and may cause fractures.173-175

High-voltage electrical injuries result in severe skin burns and may cause respiratory and cardiac arrest.175 High-voltage electrical current can lead to necrosis of muscle, bone and nervous tissue because of the development of intense heat in bone, which is a poor conductor.176,177 Sometimes there are only localised skin injuries at the entrance and exit sites, and a small skin burn or normal-looking skin can hide deep, massive tissue damage to bone, muscles and nerves. There can be extensive arcing, flash and flame burns as well.178 People who suffer a high-voltage injury are at increased risk of complications including compartment syndrome, cardiac damage and neurological and ophthalmologic problems. Amputation rates above 50% have been reported.145

In lightning strike, a direct strike is usually lethal. In many cases, the majority of the current can pass over the surface of the body (called ‘flashover’). Respiratory and cardiac arrest are common.179 Up to 74% of survivors have significant permanent sequelae.173,180-184

**Cardiac abnormalities**

**Evidence**

Ten observational studies178,185-193 were found to be relevant. No controlled human studies were located.

In a prospective case series of admissions with high-voltage injury (n=15) to a burns unit over a year, 27% had an abnormal ECG on admission, of which all reverted to normal over time. No arrhythmias developed during their hospital stay. None had any clinical evidence of cardiac dysfunction.187

A four-year retrospective case series reported five people with high-voltage electrical injury.181 Two people had ECG abnormalities acutely (one atrial fibrillation and one second-degree atrioventricular heart block). These resolved by the third day post-injury. At both follow-up periods (two and six months), all ECGs were normal and no clinical signs of cardiac damage were found. However, on thallium scintigraphy, there was evidence of myocardial hypoperfusion in all cases.
Another case series study found that 9 out of 10 consecutive people with high-voltage electrical injury had one or more significant cardiac rhythm and/or functional abnormalities during their stay in hospital. At follow-up (4–48 months after discharge) five people showed signs or symptoms of cardiac dysfunction.191

In a retrospective case series of 48 consecutive people with high-voltage injury, eight (16%) had some cardiac event, four (8.3%) had a cardiac arrest at the place of injury, two (4.2%) had a myocardial infarction and two (4.2%) had a cardiac arrhythmia.185

Another observational study found that 13 out of 24 (54%) people being treated for a high-voltage injury had evidence of myocardial injury.189

A 10 year retrospective case series reported cardiac complications (either arrhythmias or ischaemia or myocardial infarction) in 10–46% of those with a high-voltage injury (n=36).188

Another retrospective case series of children (n=185) admitted to a burns unit over a 10-year period found 33% of high-voltage burns (n=58) required amputation and 29% had deep muscle involvement, and 7% had a cardiac arrest.178

One retrospective case series of all admissions (n=179) to a burns unit over five years found a high incidence of compartment syndrome (54%) and amputation (42%) in those with a high-voltage injury (n=55).186

Another observational case series study of all admissions with electrical burns (n=173) found a significant difference between the incidence of amputations between high- and low-voltage injuries (36.6% and 17.9% respectively; p<0.01). ECG changes were seen in 7% of the low-voltage group (n=132) and 12% of the high-voltage group (n=41).192

This is supported by a retrospective case series (n=195) of high-voltage electrical injury admissions over a 19-year period. The authors found 56 (29%) people underwent fasciotomy within 24 hours of injury and 80 (41%) people underwent amputation.193

ECG monitoring

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
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<tbody>
<tr>
<td>Following electrical injuries people should receive a resting 12-lead ECG.</td>
<td>C</td>
</tr>
<tr>
<td>If this initial ECG is normal in people with low-voltage injuries, there is no need for a repeat ECG or for continuous monitoring.</td>
<td>B</td>
</tr>
</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations - refer to Appendix A for grading details.

Evidence statements

- Electrical injury can trigger cardiac arrhythmias.
- The incidence of ECG abnormality or arrhythmia developing after a normal initial 12-lead ECG in people with low-voltage electrical injuries is very low.

Evidence

Ten observational studies were identified as relevant, all with consistent results.196-199 Five studies were of children with mainly low-voltage electrical injuries196,197,199,200,201 and one was of children with mixed voltage electrical injuries.197 Two studies were of all admissions (adults and children) with low-voltage injuries196,199 and the other two were of all admissions with mixed-voltage injuries.196,200
A three-year prospective observational study (n=212) found that asymptomatic people with a normal ECG on presentation after low-voltage injury do not need ECG monitoring. In 196 presentations there were eight episodes with ECG abnormalities that required cardiac monitoring. There were no re-presentations with cardiac arrhythmias after discharge in a four-year follow-up period.

A 10-year retrospective case series (n=38) of all admissions of children with mixed high- and low-voltage injuries found that none of the children had or developed cardiac abnormalities. EEGs were recorded on admission in all cases and all children were monitored for 24 hours or more. The only abnormalities were non-specific temporary ST segment changes in the ECGs of three children.

Six other retrospective case series reviews of electrical injuries were found, four of children and two of adults. One of children (n=44) found no arrhythmias developed over a 5- to 24-hour hour period if the person was asymptomatic and had a normal ECG at presentation. Of the 40 low-voltage injuries, only one had an abnormal ECG, which eventually resolved.

Another (n=151) found no adverse outcomes in those children with normal ECGs. Only one had an abnormal ECG at presentation. One hundred and thirteen people (80%) had cardiac monitoring with no arrhythmias noted. No late arrhythmias developed in the 112 children who were seen for follow-up.

One other study in children (n=35) found an abnormal ECG in one of the 17 children in the low-voltage group in which an ECG was obtained. The abnormality resolved within 24 hours. No serious arrhythmias were detected in any child with a normal ECG on admission.

Another study of 70 children with low-voltage electrical injuries found 2 out of 53 ECGs performed showed what were considered benign arrhythmias. The authors concluded that cardiac monitoring is not required in people who remain asymptomatic for four hours.

Another study (n=20) of children and adults found no need to monitor if the initial ECG was normal and the person was asymptomatic on presentation. One person had an arrhythmia that resolved after treatment and did not recur during the next 24 hours.

In the other study of children and adults (n=70), 11 developed an arrhythmia at the time of injury. Six died in the emergency department and the rest were discharged without cardiac complications. One person had a persistent right bundle branch block on discharge.

One retrospective study (n=224) evaluated practice guidelines for the cardiac monitoring of children who sustain an electrical injury. A total of 164 ECGs were done and 15 were abnormal. Eight of these were determined not to be caused by the electrical injury. Twenty-nine people had cardiac monitoring, of which all were normal except one with benign extrasystoles. One hundred and seventy-two people were seen for follow-up and none had any untoward events. According to coroners' records, none of the 224 people in this study died due to this complication post-discharge from hospital.

In another retrospective case series (n=145) four people had cardiac abnormalities (three had occasional ectopic beats and the other developed atrial fibrillation after a high-voltage injury). All had these abnormalities at the time of admission.
Chapter 9
Pain management

Burn pain management

**RECOMMENDATIONS** | **GRADE**
--- | ---
Immediately after the injury, cooling and covering the burn may provide analgesia. | C
Paracetamol and NSAIDs can be used to manage background pain. | C
Consider administering opioids for intermittent and procedural pain. | C

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations – refer to Appendix A for grading details.

**GOOD PRACTICE POINTS**

- Refer to secondary care if failing to manage dressing-change pain.
- Consider the use of non-pharmacological approaches as a supplement to pharmacological management of pain.

This is the opinion of the Guideline Development Team, or feedback from consultation within New Zealand where no evidence is available.

**Evidence statements**

- Burn pain can be more complex than typical post-operative pain as it includes background, intermittent and procedural pain (due to dressing changes and other interventions).
- It is important to conduct a thorough pain assessment to determine whether background, intermittent or procedural pain is the greatest problem for the individual.
- The pain experienced following burns varies greatly from one individual to another.
- The worst pain score should be less than 5 on a scale of 0–10. Scores of 5 or higher interfere with sleep, activity and mood.

Burn injuries can cause intense and prolonged pain, made worse by the need to change dressings frequently to prevent infection and aid healing. Pain associated with burn injury and treatment is often managed poorly; reasons for this include failure to use and document pain scores from pain-measurement tools, unfamiliarity with suitable analgesic regimes, and concerns about opioid side effects.\(^{204,205}\)

Immediately after the burn injury, simple measures such as cooling and covering the burn can reduce pain.\(^{206}\)

The treatment of severe pain beyond simple measures should include titration in intravenous opioids.

Burn pain is often more complex than typical post-operative pain.\(^{206}\) It can be divided into:
- background pain (associated with the injury)
- intermittent or breakthrough pain (intense pain episodes not relieved by routinely administered analgesics)
- procedural pain (pain related to dressing changes and other interventions).
The aim of zero background pain in burn injuries is achievable and realistic. However, procedural burn pain as a result of dressing changes is difficult to assess and manage and there is little consensus on how best to determine or control this pain.

Evidence
Two guidelines were identified that dealt with pain management, but not specifically burns. A number of RCTs were identified. Most were very small and many were conducted among volunteers using experimentally induced burns. Overall their findings were of limited applicability to primary care. Two studies assessed the effect on pain response of different types of burn ointment compared with placebo and one evaluated local cooling. Three studies addressed the role of opioids in children, five assessed distraction techniques such as massage, music therapy and sensory focusing and two compared ibuprofen with placebo. A further six assessed the role of other medications such as remifentanil and gabapentin, nitazoxanide, lidocaine, dextromethorphan and ketamine.

Findings
There was no consistent finding from the identified RCTs, which were performed in varying settings, with varying severity of burns and in varying groups of people. Most of the recommendations for management of pain are based on best practice in burns units.

Pain management should be integrated into the person’s overall care plan. This plan should provide both pharmacological and non-pharmacological approaches. It has been suggested that background pain and pain resulting from procedures, such as dressing changes and physiotherapy, need to be evaluated and treated separately. It is important to conduct a thorough pain assessment to determine which type of pain is the greatest problem. The pain experienced by people with burns varies greatly from person to person. For this reason, treatment protocols stipulate low starting doses of analgesia and allow for adjustments to be made based on individual pain assessment. Pain measurement scales should be used to assess the degree of pain. A person’s worst pain score should be less than 5 (on a visual analogue scale of 0–10). Scores of 5 or higher interfere with sleep, activity and mood. Therefore, the goal at minimum should be to reduce pain to lower than this level.

Analgesics should be given regularly to control background pain. Paracetamol and NSAIDS (eg, ibuprofen), alone or in combination with opioids, are often appropriate for use in people with small burn wounds. Aspirin products should be avoided because of platelet inhibition and the risk of bleeding.

People with burns may require treatment of procedural pain before dressing changes and during increased physical activity to facilitate cooperation during dressing change and physiotherapy, as well as minimise the risk of developing chronic pain.

Use of opioids
Opioid medications are used in children as well as adults for moderate to severe burn pain. Opioids are useful because they are available in a variety of dose forms that can support a person’s individualised needs. Long-acting opioids can be used for background pain and short-acting opioids can be used for painful procedures such as changing dressings. Opioids may be supplemented with anxiolytics to reduce anxiety, if necessary. There is little evidence to guide the choice of opioid medication. Morphine sulphate is the opioid analgesic standard. The pharmacokinetic properties are largely unchanged in burn-injured patients. Pethidine should be avoided because of side effects associated with the metabolite norpethidine, including dysphoria, agitation and seizures. During dressing changes, conscious sedation with an immediate-acting opioid such as fentanyl may minimise the risk of over-sedation. Other techniques for managing pain and anxiety in children during procedures include using inhaled nitrous oxide, ketamine either enteraly or parenterally, or anxiolysis with a
benzodiazepine such as midazolam. Deep-sedation techniques as provided by an anaesthetist may include dexmedetomidine or propofol infusion up to general anaesthesia.

Non-pharmacological interventions
Non-pharmacological interventions are recommended to supplement, not replace, pharmacological management of pain. These interventions include cognitive behavioural therapy (CBT) (eg, relaxation, imagery), hypnosis and physical therapies such as massage. They can provide people with a sense of control during rehabilitation from their injuries.
Chapter 10
Psychological consequences of burn injury

Adverse psychological responses to trauma

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor people with burn injuries for signs of stress disorders or depression.</td>
<td>C</td>
</tr>
<tr>
<td>Recognise and treat pre-existing disorders and comorbidities (including alcohol and drug dependence) associated with post-traumatic stress disorder (PTSD).</td>
<td>B</td>
</tr>
<tr>
<td>Refer people with acute or chronic PTSD for specialist mental health management.</td>
<td>C</td>
</tr>
</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations – refer to Appendix A for grading details.

GOOD PRACTICE POINTS

- Be aware of services that may be able to support families affected by the psychological impacts of burn injuries.
- Be aware of the increased risk of sleep disorders after burn injuries.

This is the opinion of the Guideline Development Team, or feedback from consultations within New Zealand where no evidence is available.

Burn injuries constitute significant trauma and can cause or exacerbate psychological problems such as acute or persistent stress disorders and depression. Psychological trauma may be compounded by injury-related phenomena such as pain, physical disability and disfigurement. The psychological consequences of burns to a child are likely to involve other family members as well.

Psychological reactions to trauma are categorised by the timeframe since the event (see Table 10.1).
Table 10.1: Diagnosis according to duration of stress symptoms

<table>
<thead>
<tr>
<th>Duration of Symptoms</th>
<th>Diagnosis</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than one month</td>
<td>Acute stress disorder (not PTSD)</td>
<td>These are symptoms that occur in the immediate aftermath of the stressor and may be transient and self-limited. Although not yet diagnosable as PTSD, the presence of severe symptoms during this period is a risk factor for developing PTSD.</td>
</tr>
<tr>
<td>One to three months</td>
<td>Acute PTSD</td>
<td>Active treatment during this acute phase of PTSD may help to reduce the otherwise high risk of developing chronic PTSD.</td>
</tr>
<tr>
<td>Three months or longer</td>
<td>Chronic PTSD</td>
<td>Long-term symptoms may need longer and more aggressive treatment and are likely to be associated with a higher incidence of comorbid disorders.</td>
</tr>
</tbody>
</table>


Acute stress disorder

Evidence statements

- The onset of acute stress disorder in the first month after a burn injury increases the risk of subsequent PTSD.

A diagnosis of acute stress disorder can be made as early as three days following trauma. American Psychiatric Association diagnostic criteria require the presence of at least three of the following dissociative symptoms:

- depersonalisation
- derealisation
- time distortion and/or daze
- numbing and amnesia.

In addition one or more symptoms must be present from each of the three PTSD clusters, namely re-experience of the traumatic event, avoidance and hyperarousal (see Appendix C).

The prevalence of acute stress disorder after burns is unclear, partly due to variability in the assessment tools and diagnostic criteria used. A systematic review of relevant studies reported a range of 11–32% in adults. All the studies were small with a high potential for bias. Another small study, involving 63 children aged one to four years hospitalised with burn injuries, and their parents, reported symptoms of acute stress in nearly 30% (15/51) of the children analysed. The authors identified a pathway whereby pain in the child was strongly associated with acute parental stress, and parental stress led to acute stress in the child.

Predictors of acute stress disorder found in the literature included burn size, poor pre-burn mental health and attribution of blame for the injury to a third party.

People with acute stress disorder are at high risk of subsequent PTSD. In one study of 83 adults hospitalised with burns, 19% (16/83) were diagnosed with acute stress disorder and all but one subsequently developed PTSD.
POST-TRAUMATIC STRESS DISORDER

Evidence statements

- There is evidence of an increased risk of PTSD after burns.
- There is some evidence that the incidence of PTSD is related to the size and location of the burn.
- CBT and selective serotonin reuptake inhibitors (SSRIs) have been shown to relieve the symptoms of PTSD resulting from non-burn events.

A diagnosis of PTSD is made when a person: has experienced a traumatic event with actual or perceived threat of serious injury or death to self or others; has reacted with intense fear, helplessness or horror; and meets symptom criteria in three primary clusters (re-experience of traumatic event, avoidance or numbing, hyperarousal) over a period of more than one month.

The DSM-IV, Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria (see Appendix C) for PTSD are used to diagnose PTSD. The diagnosis requires a combination of symptoms including at least one re-experiencing symptom, three symptoms of avoidance and emotional numbing, and two hyperarousal symptoms.

Evidence on the prevalence of PTSD is inconsistent. Some studies include only inpatients while others include outpatients. Most have relatively small sample sizes and some exclude personal psychiatric history. Moreover, a variety of assessment methods have been used.

Three studies which used validated assessment methods found prevalence rates of 20–45% at a follow-up period of 6–12 months in adults admitted to hospital after burns. These studies were small with a high likelihood of bias.

Evidence on predictors for PTSD is also inconsistent. The only study in the systematic review without a high likelihood of bias found a significant association between chronic PTSD and a history of PTSD symptoms, female sex, size and location of burn. This study did not assess pre-burn mental health or pre-burn history of substance abuse, both of which were identified in other studies as significant predictors of PTSD.

There is very little research relating to the treatment of PTSD in people with burn injuries. One RCT allocated participants to an individual and/or couple psychological debriefing intervention group or a control group that received no intervention. Of the 110 participants who were assessed, 26% in the intervention group had PTSD at 13 months follow-up compared with only 9% in the control group. These findings are consistent with other studies showing that single-session debriefing may be actively harmful.

Esselman et al. found no convincing evidence of interventions to reduce the risk of developing PTSD in people with burns. However, there has been very little research in this area and effective pharmacological and psychological treatments have been reported in the general trauma literature. CBT has been shown to be beneficial, in particular, exposure therapy and stress inoculation training. SSRIs are also effective and are recommended as first-line agents in the pharmacotherapy of PTSD. Treatment techniques need to be researched and validated with people with burns.

Depression

Evidence statement

- There is some evidence of an increased risk of depression after burns.
Evidence
People with burns are also at risk of depression. The relevant evidence is scanty, consisting of six small studies with a very high likelihood of bias.\textsuperscript{123} Estimates of the prevalence of depression in people with burns vary greatly, reflecting disparity in the assessment tools and diagnostic criteria used, the timing of assessment and the populations sampled. Rates of 16–53\% are reported at various follow-up points from 3 days to 32 years, with no consistent trend over time.\textsuperscript{123} Predictors of post-burn depression in the literature include pre-burn mood disorders, burn severity and location and style of problem-solving.\textsuperscript{123} No therapeutic studies for depression in burn survivors were found. However, the general literature supports the use of SSRIs for depression.\textsuperscript{126}

Sleep disorders
Evidence statement
• There is a high risk of sleep disorders after burn injury, which is compounded by pain and by stress disorders.

Evidence
The Esselman et al systematic review\textsuperscript{123} reviewed 16 studies of secondary sleep disorders, including 11 studies of sleep disorders secondary to burn injuries. All these studies had a relatively high risk of bias. Secondary sleep disorders include insomnia, hypersomnia, nightmares, night terrors and sleepwalking.\textsuperscript{230} Difede et al\textsuperscript{232} reported that in their study of 83 adults hospitalised with burns, the most common symptom of stress, reported by 76\% of participants with or without acute stress disorder (ASD), was difficulty falling asleep and staying asleep. A small paediatric inpatient study (n = 25) also found a high prevalence of sleep disorders, such as nightmares (88\% of participants), problems with sleep onset (68\%) and problems with sleep maintenance (88\%).\textsuperscript{240} Similarly, such symptoms were reported in 73\% of 74 participants a week after discharge from hospital.\textsuperscript{241} During the first six months after burns or other trauma, the incidence of insomnia reported in the literature ranged from 37\% to 51\% and at one year was 22–37\%. Although insomnia thus tended to improve over the first year, nightmares were reported in up 30\% of participants at both six months and one year post-burn.\textsuperscript{123} Esselman et al\textsuperscript{123} reported that both early and late post-burn studies indicated the intertwining of sleep disorders and symptoms of ASD, PTSD and depression. Pain is another factor that may compound sleep disorders.\textsuperscript{241,242} There is no reliable evidence on pharmacological or behavioural treatments for sleep disorders after burns. CBT has been found effective for treating sleep disorders in medical patients.\textsuperscript{123}

Post-traumatic stress disorder and parents of children with burns
Evidence statements
• There is evidence of an increased risk of acute stress or PTSD for the parents of children with burns, especially large or painful burns.
• How well a child copes with a burn injury will depend on how well the family is coping with the trauma.
• Resources are available for people who have experienced burn trauma and for their families (see Appendix D).
Evidence

There is some evidence that the parents of children with burns are at increased risk of PTSD, although the relevant studies are all very small with cross-sectional design and a high likelihood of bias.

A study (n=25) of children and adolescents with burns reported that 52% of mothers had past or present PTSD, the most significant predictive factor for maternal PTSD in the mother being the size of the burn. Another study reported a correlation between maternal and child stress syndromes in the families of paediatric burn survivors. Similarly, a recent study (n=52 analysed) in younger children (aged one to four years) reported a vicious cycle whereby pain in the child caused acute stress disorder in the parents, which then increased the likelihood of acute stress in the child.
Chapter 11
 Burn injuries in Māori

GOOD PRACTICE POINTS

Be aware that Māori tamariki (children) are at increased risk of burn-related injuries and deaths. ✓

Consider ways to deliver care that will overcome access barriers, if necessary, such as nurse home visiting for dressing changes. ✓

This is the opinion of the Guideline Development Team, or feedback from consultation within New Zealand where no evidence is available.

Evidence statements

• Tamariki are at increased risk of burn-related injuries and deaths.
• Tamariki have a relatively high level of involvement in home activities that carry a burn or scald risk.

Background

Every year, about seven or eight New Zealand children aged 15 years and under die as a result of burns or scalds. In most cases fatalities are the result of house or car fires. Over two-thirds of those who die are under the age of five years\(^2\) and over one-third are Māori.\(^1\)

Analysis of New Zealand Health Information Service hospitalisation data for injury between 1985 and 1994 indicates that Māori children are at high risk of burn-related injuries.\(^2\) Injuries from fire and burns account for 20% of all injuries that require hospital care for children under one year, making this the second most common cause of hospitalisation due to injury in this age group. A further 18% of injuries are caused by contact with hot water or hot substances. During the same period, 5% of injury hospitalisations for kaumātua (elder) aged 65 years or older were for burns or injury as a result of fire.

Prevention

Tamariki form the largest group of the Māori population. If they continue to be over-represented in burns statistics this will impact on the hauora (health and wellbeing) of the individual, the whānau, the hapu and iwi now and in the future. The following studies provide some guidance in the future planning of prevention strategies. There are also further suggestions in Chapter 14, Implementation and evaluation.

Tamariki (aged 7–13 years) have been found to have a higher level of involvement in home activities that carry a burn or scald risk, such as running a bath or using matches.\(^2\) These findings suggest a difference in children’s involvement in household tasks in Māori homes. This may be due to a variety of cultural, social and economic factors. Prevention strategies need to systematically identify and remove barriers to developing safe environments.

Tamariki were found to have a generally good understanding of safety knowledge in this survey,\(^2\) recognising the correct safety action to take in the event of a fire or when they received a burn. In contrast, an Auckland study in 2002 suggested that Māori may be less likely to use cold water therapy on burns compared with people of European descent.\(^1\)
Primary care practitioners can contribute to the prevention of burn injuries by providing information on the prevention of burn injuries and appropriate first aid management and supporting local initiatives in primary prevention.

**Delivery of care**

There are a variety of factors that may influence access to and utilisation of primary care services. Financial, geographical or cultural barriers may be an issue for some Māori. Aside from the cost of services, some Māori may have different attitudes and beliefs concerning illness and doctors, and different cultural patterns of help-seeking. Māori are more likely to forgo general practitioner visits and prescription items (11.4% vs 5.8% for the total population) or prescription items alone (13.0% vs 4.6% for the total population) because of cost. Issues such as lack of transport or access to a telephone will also make access to primary health care more difficult. As a result, some Māori individuals with minor burns may postpone visiting a general practitioner or be reluctant to continue with frequent visits for dressing changes. These are things that may apply to some Māori, but other Māori will have very different social circumstances, values, beliefs and health care practices. Primary care practitioners can assist in removing the barriers to care by considering alternative ways to deliver care, such as nurse home visiting for dressing changes.

There are reports of a number of traditional herbal remedies playing a part in the treatment of burns and scalds among Māori. For further information see Chapter 13, *Complementary and alternative medicines*. 
Chapter 12
Burn injuries in Pacific peoples

**GOOD PRACTICE POINTS**

- Be aware that Pacific children may be at increased risk from hot water scalds.
- Consider ways to deliver care that will overcome access barriers, if necessary (such as nurse home visiting for dressing changes).
- Be aware that language can be a barrier. Encourage a bilingual family member or practice nurse to assist with communication. Ideally, Pacific island population-specific translators should be made available to services that provide for Pacific peoples.

This is the opinion of the Guideline Development Team, or feedback from consultation within New Zealand where no evidence is available.

**Evidence statements**
- Pacific children aged 0 to 4 years appear to be at increased risk from hot water scalds.
- Pacific children have a higher level of involvement in home activities that carry a burn or scald risk.

Pacific children aged 0 to 4 years appear to be at increased risk from hot water scalds. SafeKids New Zealand has reported data gathered by the New Zealand Health Information Service showing that hot water scalds are the second most common cause of hospitalisations for unintentional injury among Pacific children.

**Prevention**
A study in Waitakere City showed that Pacific children (aged 7–13) had a higher level of involvement in home activities that carry a burn or scald risk, such as running a bath or using matches. These levels of involvement in activities with higher burn and scald risk for the child may be due to a variety of cultural, social and economic factors. Prevention strategies need to systematically identify and remove barriers to developing safe environments in order to be effective with Pacific children and their families.

**Pacific concepts of health and illness**
Pacific peoples in New Zealand are a diverse population, coming from 22 different island nations, each with a distinct language and culture. Many Pacific peoples view health in a holistic way, as the total wellbeing of the individual within the context of the family and the community. In addition to physical, mental and social wellbeing (the aspects of health defined by the World Health Organization), many Pacific peoples regard spiritual wellbeing as equally essential to health.

Health care practitioners are regarded as authority figures by many Pacific peoples. As a result, out of respect, individuals may often be hesitant to say what they really think to the doctor or nurse. For example, they may say that they understand an explanation given regarding treatment even when they do not. As it is respectful to respond politely with affirmation to a person of higher status, the individual may agree to follow-up even when they know they may not be able to afford the fee for the follow-up consultation. In addition, the individual may not attend the follow-up appointment if they have not complied with the recommended treatment, conscious that the doctor may be disappointed.
There are reports of a number of traditional herbal remedies playing a part in the treatment of burns and scalds among Pacific peoples. For further information see Chapter 13, Complementary and alternative medicines.

**Delivery of care**

There are a variety of factors that may influence access to and utilisation of primary care services by Pacific peoples. Financial, geographical or cultural barriers may be an issue for some Pacific peoples. Pacific peoples are over-represented in the lower end of the socioeconomic spectrum compared with other New Zealanders. As a result, some Pacific peoples may experience financial barriers to care. Pacific peoples are more likely to forgo general practitioner visits and prescription items (8.0% vs 5.8% for the total population) or prescription items alone (8.4% vs 4.6% for the total population) because of cost.246 Aside from the cost of services, some Pacific peoples may have different attitudes or beliefs concerning illness or doctors. Issues such as lack of transport or access to a telephone will also make access to primary health care more difficult. As a result, some Pacific individuals with minor burns may postpone visiting a general practitioner or be reluctant to continue with frequent visits for dressing changes.

Language is a major barrier to health care for some Pacific peoples. Good primary care practice would include encouraging a bilingual family member or practice nurse to assist with translation. Ideally, Pacific Island population-specific translators should be made available to services that provide for Pacific peoples.

These are things that may apply to some Pacific peoples, but other Pacific peoples will have very different social circumstances, values, beliefs and health care practices.
Chapter 13
Complementary and alternative medicines

Evidence statements
• Systematic reviews of hyperbaric oxygen therapy have found that there is insufficient evidence to support the routine use of hyperbaric oxygen therapy in the treatment of thermal burns.
• There is some evidence that honey helps superficial and partial thickness burns to heal faster compared with conventional dressings, but more research is needed.
• There are no studies on the use of manuka honey as a topical agent in the treatment of burns.
• There is no convincing evidence of any benefit in using Aloe vera for thermal burns.
• There is no convincing evidence to support the use of moist exposed burn ointment for burns in preference to conventional dressings.

Evidence
There is very little reliable evidence on the use of complementary and alternative medicines for burns.

Two systematic reviews of the use of hyperbaric oxygen therapy for the treatment of burns reported that there was insufficient evidence to support its routine use.133,249

A good-quality systematic review of Aloe vera for wound healing250 found no RCTs involving accidental burns. In a small (n=27) non-randomised split-sample study of partial (dermal) and full thickness burns, the distal part of each burn was treated with Aloe vera and the proximal with paraffin gauze.251 Time to healing was significantly faster with Aloe vera, with only minor adverse effects (such as transient discomfort and pain) in both groups.

There were several studies on moist exposed burn ointment but only four were RCTs and none was blinded. One of these studies, reported in three publications,205,252,253 compared time to healing, pain and cost-effectiveness in moist exposed burn ointment and conventional dressings such as paraffin gauze and silver sulphadiazine. Outcomes were similar in both groups.

One large unblinded RCT121 compared moist exposed burn ointment with silver sulphadiazine for time to healing, pain and rate of infection in 508 people of varying age hospitalised with differing types of burn. In the moist exposed burn ointment group, partial thickness (dermal) burns healed significantly faster with less pain (p<0.01) and a significantly lower incidence of infection (p<0.01). However, the quality of this study is uncertain, and as noted elsewhere in this guideline prolonged use of silver sulphadiazine cream is not recommended as it may delay healing. Two other small unblinded RCTs of moist exposed burn ointment,254,255 both by the same author, reported that moist exposed burn ointment may be more cost effective for second-degree (dermal) burns than a range of standard therapies. However, ‘standard therapies’ in these studies included a wide variety of dissimilar comparators.

There were six fair-quality RCTs of honey (non-manuka honey) for partial (dermal) and full thickness burns, all conducted without blinding by the same research group in India.95-97,256,257,258 five95-97,256,258 included 50–100 participants and one95 included 900 participants. In four95-97,256 of these studies, superficial and partial thickness (epidermal and dermal) burns dressed with honey healed significantly faster than those dressed with conventional dressings, with lower bacterial colonisation rates. The majority of these studies compared honey with the prolonged use of silver sulphadiazine cream. The sixth study257 compared honey with tangential excision and grafting for ‘moderate’ burns and reported that outcomes were better with grafting. Other RCTs of
honey conducted by the same group were not considered because they used comparators unlikely to be used in New Zealand, such as amniotic membrane and potato peel.

Small RCTs found no evidence of healing effect for antioxidant ointments or for calendula or bovine fibrinolysin ointment for burns, nor for homoeopathic cantharis for burn pain.

There are reports that harakeke, also known as New Zealand flax, has played a part in the treatment and healing of burns and scalds among Māori. Another Māori remedy in the treatment of burns and scalds is kawakawa leaves and bark. As no RCTs were found to support the use of these remedies, the Guideline Development Team does not recommend their use as a primary or sole method of care.

Some Pacific peoples may use traditional medicine as a first-line treatment for burns/illnesses, or if they feel that Western medicine has not worked. There are reports of numerous medicinal plants being used for burns in the South Pacific region. A few examples include the scraped bark of 'ifiri in Tonga (Inocarpus fagifer, also known as Tahitian chestnut), the grated seed of 'utu (Barringtonia asiatica) and the starch from the root 'pia (Tacca leontopetaloides) in the Cook islands. As no RCTs were found to support the use of these herbal remedies, the Guideline Development Team does not recommend their use as a primary or sole method of care.
Chapter 14
Implementation and evaluation

Overview
The aim of this guideline is to ensure that for individuals with burn injuries there:
• is appropriate initial assessment and care in the primary care setting
• are more appropriate referrals to secondary care and regional burns units
• is more information sharing between providers (common language and tools)
• is more uniformity in burn assessments and outcome measurements
• is improved targeting and use of effective interventions.

Distribution strategies
Publication of the full guideline
The full guideline is available free for download from the ACC website (http://www.acc.co.nz) and the NZGG website (http://www.nzgg.org.nz). The NZGG website also provides supporting documents, including the search strategy and evidence tables for the guideline. Print copies are also available.

It is recommended that efforts are made to create weblinks to the full guideline and summary from medical colleges, professional bodies and other interest groups.

Quick reference clinical format
A summary booklet is being produced with the key messages and algorithms to guide the management of people with burns and scalds in primary care. The availability of a quick reference summary will make the use of the guideline recommendations easier for clinicians.

Dissemination
The full guideline/summary should be distributed to the following groups:
• general practitioners
• primary health care nurses
• iwi/Māori health providers
• Pacific health providers
• ANZBA
• burn support groups
• safety and prevention groups
• armed services, fire services, and ambulance services
• district health boards
• primary health organisations
• independent practitioner associations
• academic lecturers/curriculum planners involved in medical training
• medical colleges/professional bodies
• pharmacists.
Promotion
Guideline launch
The Guideline Development Team suggests that the guideline be launched at an appropriate event or conference to signal the start of the implementation phase. Such an event might be a conference held by the Royal New Zealand College of General Practitioners or other primary health care organisation, or a conference focusing on wound care. Further opportunities for presentations at other relevant local meetings and conferences will be pursued to help primary care practitioners become familiar with the guideline.

Media
The guideline needs to be promoted in the media, including the local medical press. Publicity needs to encompass journals and health professional publications such as: New Zealand Medical Journal, New Zealand Nursing Journal and NZ Doctor. Mainstream media can also be targeted through the use of media releases to newspapers and television programmes. This could include Māori and Pacific magazines, radio and television.

Promoting safety messages
It is recommended that the development of consumer information be funded to inform people about safety measures to prevent burns and scalds.

Additional strategies should be considered to promote burns safety measures through primary care, as young children, the population most at risk, are usually seen routinely.

Consumer information should be offered in Māori and Pacific languages in written and oral forms, eg, CDs and DVDs.

Education
Professional education
Professional education activities could include:
• Organising information and education seminars/workshops (based on the guideline) for practitioners, primary health organisations, independent practitioner associations and district health boards.
• Specific educational initiatives and ongoing updates for particular groups (eg, general practitioners, practice nurses).
• Local continuing medical education activities that include this guideline as part of their programme.
• Developing local strategies to reduce barriers to follow-up care for people with burns, particularly Māori and Pacific peoples.

Community education
Community education activities could include:
• School-based education to teach safe practices to children, which is tailored to meet the needs of children from different communities.
• Education to teach safe practices to children under five years old.
• Encouraging existing home-visit providers to families with young children (particularly with infants 12–18 months of age) to remind them about burn risk and burns first aid.
• Offering training to providers of home-visit services (eg, Plunket, Tamariki Ona), pre-school units and health clinics where pre-schoolers are seen.
• Designing a consumer resource for Māori in consultation with iwi providers.
• Monitoring the educational information that is given out.
Research and evaluation

Research

There is a lack of RCTs relating to burn assessment and treatment. The Guideline Development Team suggests that a Delphi process be used to formally rank the research interest areas in burns. The Delphi process is a structured process that uses a series (or rounds) of questionnaires to gather information and rounds are continued until ‘group’ consensus is reached. This process is popular in health research because it allows the inclusion of a large number of individuals across diverse locations and areas of expertise and avoids the situation where a specific expert might be anticipated to dominate the consensus process.263

The following areas for further research were identified:

• cost-benefit analyses of using dressings. What is cost-effective wound care for burn injuries in primary care?
• a targeted prevention campaign for Maori and Pacific children aged five years and under (visiting mothers who have children 12–18 months to remind them about burn risk and first aid for burns) and a follow-up on its effectiveness
• a study to investigate the effectiveness of traditional remedies (such as kawakawa) on superficial and mid dermal burns
• a study to investigate the effectiveness of various interventions for scarring following burn injuries
• a study to identify the resources and support services needed for people with burn injuries in New Zealand.

Evaluation

An appropriate response to this guideline will be a decrease in the number of late referrals to burn services. Successful implementation of the guideline may result in an increase in overall referrals to secondary care. Another outcome of interest would be the incidence of skin grafting and scarring following burn injuries. Currently, there is no benchmark for this information to measure any change in these areas.

The actual impact of this guideline in practice can be evaluated by the collection of the following information:

• the effect on referrals for hospital-level care or regional burns unit care.
  Making a comparison of baseline referral information before the distribution of the guideline, and referral numbers and patterns after guideline implementation
• referral indications for hospital-level care or regional burns unit care.
  Making a comparison before and after referral indications.
Appendices

A. Evidence and recommendation grading system
B. Wound care options
C. DSM-IV criteria for post-traumatic stress disorder
D. Useful resources
Appendix A: Evidence and recommendation grading system

Studies were graded using a two-tier system that is detailed in the Handbook for the Preparation of Explicit Evidence-Based Clinical Practice Guidelines, published in November 2001 by NZGG. This system has been adapted from other grading systems currently in use, in particular the Scottish Intercollegiate Guideline Network system.

The literature searches for this guideline concentrated on finding high-grade evidence to answer the identified clinical questions, such as systematic reviews, RCTs and, where these were not available, observational studies such as well designed cohort and case control studies. Only these types of study design were graded. Where these types of study were not available, less rigorous study designs such as cross-sectional studies and case studies were considered but were not formally graded.

The two-tier system follows this process:
1. Critical appraisal of individual relevant studies (identified from the searching) and assigning of a level of evidence for the first section of the GATEFRAME checklist that is incorporated into the evidence tables. A random sample of appraisals in the guideline was performed independently by two assessors and the results compared.
2. Joint consensus by the Guideline Development Team on the issues of volume, consistency, clinical relevance and applicability of the body of evidence in the evidence table (filling out the NZGG Considered Judgement form for each clinical question) and the development of graded recommendations that attempt to answer the clinical questions posed.

Developing recommendations
Recommendations were formulated by joint meetings of the multidisciplinary Guideline Development Team. The Team considered the entire body of evidence (summarised in the evidence tables) and filled out Considered judgement forms for each clinical question that was identified as being relevant to the guideline (see http://www.nzgg.org.nz). The following aspects were discussed: volume of evidence, applicability to the New Zealand setting, consistency and clinical impact, with the aim of achieving consensus. Consensus was sought and achieved over the wording of the recommendation and grading. In this guideline, where a recommendation is based on the clinical experience of members of the Guideline Development Team, this is referred to as a good practice point.
Grading of recommendations
The NZGG grades of recommendation are as follows:

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The recommendation is supported by good evidence (where there are a number of studies that are valid, consistent, applicable and clinically relevant).</td>
<td>A</td>
</tr>
<tr>
<td>The recommendation is supported by fair evidence (based on studies that are valid, but there are some concerns about the volume, consistency, applicability and clinical relevance of the evidence that may cause some uncertainty but are not likely to be overturned by other evidence).</td>
<td>B</td>
</tr>
<tr>
<td>The recommendation is supported by international expert opinion.</td>
<td>C</td>
</tr>
</tbody>
</table>

Grades indicate the strength of the supporting evidence, rather than the importance of the recommendations.

GOOD PRACTICE POINT
Where no evidence is available, best practice recommendations are made based on the experience of the Guideline Development Team, or feedback from consultation within New Zealand.

This is the opinion of the Guideline Development Team, or feedback from consultation within New Zealand where no evidence is available.
Appendix B: Wound care options

This table describes various wound products and their uses. It has been compiled using information from manufacturers and Guideline Development Team experience in burn care.

<table>
<thead>
<tr>
<th>NAME</th>
<th>INDICATIONS</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
<th>WEAR TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paraffin or silicone-impregnated fibres</td>
<td>Burns with minimal exudate</td>
<td>Covers and protects</td>
<td>Limited moisture retention</td>
<td>24–48 hours</td>
</tr>
<tr>
<td></td>
<td>Grafts when healing well</td>
<td>Non-sensitising</td>
<td>May cause trauma on removal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-irritant</td>
<td>Requires a secondary dressing to keep it in place and maintain moisture balance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>May cause trauma on removal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Requires a secondary dressing to keep it in place and maintain moisture balance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Requires a secondary dressing to keep it in place and maintain moisture balance</td>
<td></td>
</tr>
<tr>
<td>Hydrocolloids</td>
<td>For burns with light to moderate exudate</td>
<td>Maintains moisture balance</td>
<td>Not recommended for heavily exuding burns, sinuses or tracts</td>
<td>Three to seven days</td>
</tr>
<tr>
<td></td>
<td>Sloughy and necrotic burns</td>
<td>Can help with autolytic debridement</td>
<td>May tear fragile surrounding skin on removal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Self-adhesive and moulds well</td>
<td>Dressing odour can be offensive</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Impermeable to bacteria and contaminants</td>
<td>Gel can be mistaken for pus</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No secondary dressing required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transparent films</td>
<td>Superficial burns</td>
<td>Impermeable to bacteria and contaminants</td>
<td>Not recommended for exuding burns or new burns</td>
<td>One to three days</td>
</tr>
<tr>
<td></td>
<td>Burns with little or no exudate</td>
<td>Supports autolytic debridement</td>
<td>Requires dry border to adhere</td>
<td></td>
</tr>
<tr>
<td></td>
<td>As protection for fragile compromised areas of unbroken skin</td>
<td>Allows visualisation of the wound</td>
<td>Can be difficult to handle</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No secondary dressing required</td>
<td>May not stay in place in areas of moisture</td>
<td></td>
</tr>
</tbody>
</table>

Continued ...
<table>
<thead>
<tr>
<th><strong>NAME</strong></th>
<th><strong>INDICATIONS</strong></th>
<th><strong>ADVANTAGES</strong></th>
<th><strong>DISADVANTAGES</strong></th>
<th><strong>WEAR TIME</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hydrogels</strong></td>
<td>For necrotic and sloughy burns, Deep-cavity burns with necrosis and slough and light exudate</td>
<td>Rehydrates the wound bed, Aids autolytic debridement, Fills dead space in cavity burns, Small amount of absorptive action, Can be soothing and reduce pain</td>
<td>Not recommended for moderate or heavily exudating burns, Requires secondary dressing, Can macerate wound edges if not carefully applied, Can soak into some secondary dressings</td>
<td>One to two days</td>
</tr>
<tr>
<td><strong>Alginates</strong></td>
<td>For partial and full thickness burns with moderate to heavy exudate, Wounds with undermining or sinus tracts, Wounds with necrotic tissue with exudate, Infected wounds</td>
<td>Absorbs 20 times its own weight, Forms a gel over wound, Supports debridement, Fills dead space (comes in wicks as well as sheets), Easy to remove if gelled, Easy to use and cut to fit</td>
<td>Not recommended for lightly exudating wounds or wounds with eschar (a dry scab or slough), If dries out can be difficult to remove, Requires a secondary dressing</td>
<td>One to four days</td>
</tr>
<tr>
<td><strong>Hydrofibres</strong></td>
<td>Partial thickness burns, Moderate to heavily exuding burns</td>
<td>Absorbs 25 times its own weight, Vertically wicks fluid therefore controls lateral spread of exudate, Can fill dead space (comes in wicks as well as sheets), Tensile strength comparable to gauze, Forms a gel over wound, Reduces maceration of surrounding skin, Easy to use and cut to fit, Easy to remove if gelled</td>
<td>Not recommended for dry burns – will adhere to a dry wound, Not recommended for burns with eschar, Requires a secondary dressing to secure it</td>
<td>1–14 days</td>
</tr>
<tr>
<td>NAME</td>
<td>INDICATIONS</td>
<td>ADVANTAGES</td>
<td>DISADVANTAGES</td>
<td>WEAR TIME</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Foams</td>
<td>Partial and full thickness burns with minimal to moderate exudate. Secondary dressing to provide additional absorption.</td>
<td>Non-adherent. Does not cause trauma on removal. Easy to use and apply. May be used under compression.</td>
<td>Not recommended for burns with little or no exudate. May macerate surrounding skin if it is not protected. Needs to be taped if it is in non-adhesive form.</td>
<td>One to five days</td>
</tr>
<tr>
<td>Silver</td>
<td>Different products act differently at the wound bed as per dressing type, eg, hydrofibre or wound contact dressing.</td>
<td>Partial and full thickness burns. Burns that appear to be infected.</td>
<td>Generally absorbs exudate. Delivers antibacterial/antimicrobial component to wound bed – effective against gram-positive and gram-negative bacteria, fungal infections.</td>
<td>1–14 days depending upon product chosen</td>
</tr>
</tbody>
</table>

**Notes:**
- Foams: Partial and full thickness burns with minimal to moderate exudate. Secondary dressing to provide additional absorption.
- Silver dressings: Different products act differently at the wound bed as per dressing type, eg, hydrofibre or wound contact dressing.
- Silver creams: Partial and full thickness burns. Dry eschars. Infected burns.
Appendix C: DSM-IV criteria for post-traumatic stress disorder

The following table has been reproduced from the DSM-IV criteria. The diagnosis of PTSD requires a combination of symptoms including at least one re-experiencing symptom, three symptoms of avoidance and emotional numbing, and two hyperarousal symptoms.

A. The person has been exposed to a traumatic event in which both of the following have been present:
   1. The person experienced, witnessed or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others.
   2. The person’s response involved intense fear, helplessness, or horror. Note: In children, this may be expressed instead by disorganised or agitated behaviour.

B. The traumatic event is persistently re-experienced in one (or more) of the following ways:
   - recurrent and intrusive distressing recollections of the event, including images, thoughts or perceptions. Note: In young children, repetitive play may occur in which themes or aspects of the trauma are expressed
   - recurrent distressing dreams of the event. Note: In children, there may be frightening dreams without recognisable content
   - acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions, hallucinations and dissociative flashback episodes, including those that occur upon awakening or when intoxicated). Note: In young children, trauma-specific re-enactment may occur
   - intense psychological distress at exposure to internal or external cues that symbolise or resemble an aspect of the traumatic event
   - physiological reactivity on exposure to internal or external cues that symbolise or resemble an aspect of the traumatic event.

C. Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated by three (or more) of the following:
   - efforts to avoid thoughts, feelings or conversations associated with the trauma
   - efforts to avoid activities, places or people that arouse recollections of the trauma
   - inability to recall an important aspect of the trauma
   - markedly diminished interest or participation in significant activities
   - feeling of detachment or estrangement from others
   - restricted range of affect (eg, unable to have loving feelings)
   - sense of a foreshortened future (eg, does not expect to have a career, marriage, children or a normal life span).

Continued ...
D. Persistent symptoms of increased arousal (not present before the trauma), as indicated by two (or more) of the following:
  • difficulty falling or staying asleep
  • irritability or outbursts of anger
  • difficulty concentrating
  • hypervigilance
  • exaggerated startle response.

E. Duration of the disturbance (symptoms in Criteria B, C and D) is more than one month.

F. The disturbance causes clinically significant distress or impairment in social, occupational or other important areas of functioning.

Specify if:
Acute – if duration of symptoms is less than three months
Chronic – if duration of symptoms is three months or more.

Specify if:
Delayed onset – if onset of symptoms is at least six months after the stressor.
Appendix D: Useful resources

**Burn associations**
- Australian and New Zealand Burn Association – http://www.anzba.org.au
- American Burn Association – http://www.ameriburn.org
- International Society for Burn Injury – http://www.worldburn.org

**Support Groups**

**Burn Support – Waikato**
Burn support organisation in Waikato.
http://www.burnsupport.org.nz

**Burn Support Foundation Inc**
A non-profit, self-help organisation helping burn survivors and their families return to productive lifestyles following injury. This organisation provides a free newsletter and organises two weekend camps per year.
P.O Box 476, Paddington, 2021
New South Wales, Australia

**Burn Support Group Charitable Trust Inc**
Produces a regular newsletter, runs workshops, education evenings and an annual camp for children. It also provides education/prevention work and visits inpatients.
http://www.burns.org.nz

**Burn Support Groups Database**
A register of burn support groups world-wide. Non-burn support groups also are invited to register.
http://www.burnsupportgroupsdatabase.com

**Burn Survivors On Line**
Provides information and support for burn survivors and their families throughout the world.
http://www.burnsurvivoronline.com/

**Changing Faces**
Provides free and confidential help, support and information for children (and their parents) and adults who have facial disfigurations.
http://www.changingfaces.co.uk

**Phoenix Society for Burn Survivors**
International, non-profit, self-help organisation helping burn survivors and their families return to happy and productive lives following injury.
http://www.phoenix-society.org
Skylight
Skylight provides a national support service for New Zealand children and young people who are experiencing change, loss and grief – whatever its cause.
http://www.skylight.org.nz

Survivors of Burn Injury
Burn resource centre for survivors of burn injury.
http://www.burnsurvivor.com
**Abbreviations and acronyms**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC</td>
<td>Accident Compensation Corporation</td>
</tr>
<tr>
<td>ANZBA</td>
<td>Australian and New Zealand Burn Association</td>
</tr>
<tr>
<td>BMI</td>
<td>Body mass index</td>
</tr>
<tr>
<td>CBT</td>
<td>Cognitive behavioural therapy</td>
</tr>
<tr>
<td>CMDHB</td>
<td>Counties Manukau District Health Board</td>
</tr>
<tr>
<td>ECG</td>
<td>Electrocardiogram</td>
</tr>
<tr>
<td>NZGG</td>
<td>New Zealand Guidelines Group</td>
</tr>
<tr>
<td>PTSD</td>
<td>Post-traumatic stress disorder</td>
</tr>
<tr>
<td>PVC</td>
<td>Polyvinyl chloride</td>
</tr>
<tr>
<td>RCT</td>
<td>Randomised controlled trial</td>
</tr>
<tr>
<td>RR</td>
<td>Relative risk</td>
</tr>
<tr>
<td>SAS</td>
<td>Staphylococcus aureus sepsis</td>
</tr>
<tr>
<td>SSRIS</td>
<td>Selective serotonin reuptake inhibitors</td>
</tr>
<tr>
<td>TBSA</td>
<td>Total body surface area</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>US</td>
<td>United States of America</td>
</tr>
<tr>
<td>UV</td>
<td>Ultraviolet</td>
</tr>
</tbody>
</table>
Glossary

Angiogenesis The formation of new blood vessels.
Arrhythmia Any deviation from the normal rhythm, eg, of the heart.
Atrial fibrillation Very rapid, uncoordinated contractions of the atria of the heart.
Blepharospasm A spasm of the eyelid.
Body mass index (BMI) An indicator of body fatness. Calculated from the formula weight/height squared, where weight is in kilograms and height is in metres.
Case control studies Sometimes described as retrospective, these studies look back in time at a group of individuals with a particular disease or outcome and compare it with a suitable control group of individuals without the disease or outcome.
Compartiment syndrome A potentially limb- and life-threatening complication pressure leads to vascular occlusion, which in turn causes hypoxia, necrosis and a further increase in pressure.
Debridement Thorough cleansing of a wound, with removal of all foreign matter and injured or infected tissue.
Depersonalisation A subjective feeling of having lost one’s personality.
Dysphoria A state of feeling unwell or unhappy.
Dyspnoea Difficult or laboured breathing.
Ectopy Pertaining to a beat or rhythm occurring outside its normal location or at the wrong time.
Erythema Reddening of the skin.
Exudate The material composed of serum, fibrin and white blood cells that escapes from blood vessels into a superficial lesion or area of inflammation.
Fasciotomy Incision of a fascia, a connective tissue sheath which unites the skin to the underlying tissues and also surrounds many muscles.
Hapū Groups of whānau with common ancestral links; sub-tribe.
Hydrocolloid Any of several substances that yield gels with water.
Hyperalgesia Increased sensitivity to pain or enhanced intensity of the pain experience.
Hyperphosphataemia Excessive phosphates in the blood.
Hypertrophic scarring Thick raised areas, usually darker than the surrounding skin, which remain within the confines of the original wound and tend to reduce over time.
Hypocalcaemia A deficiency of calcium in the blood.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoperfusion</td>
<td>Decreased blood flow through an organ.</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>Below normal body temperature.</td>
</tr>
<tr>
<td>Hypovolaemia</td>
<td>An abnormally low volume of blood circulating through the body.</td>
</tr>
<tr>
<td>Insomnia</td>
<td>Sleeplessness.</td>
</tr>
<tr>
<td>Iridocyclitis</td>
<td>Inflammation of the iris and ciliary body of the eye.</td>
</tr>
<tr>
<td>Ischaemia</td>
<td>Deficient blood supply.</td>
</tr>
<tr>
<td>Iwi</td>
<td>A social and political unit made up of several hapū sharing common descent; Māori tribe or nation.</td>
</tr>
<tr>
<td>Kaumātua</td>
<td>Wise and experienced older members of a whānau, usually aged over 55 years.</td>
</tr>
<tr>
<td>Keloid scarring</td>
<td>A scar that grows beyond the borders of the original wound and does not reduce spontaneously.</td>
</tr>
<tr>
<td>Lavage</td>
<td>Irrigation of or washing out of a body cavity.</td>
</tr>
<tr>
<td>Lymphangitis</td>
<td>Inflammation of a lymph vessel.</td>
</tr>
<tr>
<td>Metalloproteinases</td>
<td>Enzymes that are involved in the degradation of the extracellular matrix.</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>Damage to heart muscle that results typically from the partial or complete blocking of a coronary artery.</td>
</tr>
<tr>
<td>Necrosis</td>
<td>Localised death of tissue.</td>
</tr>
<tr>
<td>Occlusive dressing</td>
<td>A dressing that prevents air reaching a wound and that retains moisture, heat, body fluids and medication.</td>
</tr>
<tr>
<td>Oedema</td>
<td>Swelling.</td>
</tr>
<tr>
<td>Oliguria</td>
<td>Reduced urine output.</td>
</tr>
<tr>
<td>Pruritis</td>
<td>Itching.</td>
</tr>
<tr>
<td>Randomised controlled trials (RCTs)</td>
<td>Trials in which individuals in a population are randomly allocated into two groups. The two groups are usually called the study or experimental group, and the control group, which does not receive the intervention. The results are compared by comparing rates of one or more outcomes (endpoints) between the two groups. Randomised controlled trials are generally regarded as the most scientifically rigorous method of assessing the effectiveness of treatments and other interventions (eg, screening procedures).</td>
</tr>
<tr>
<td>Secondary care</td>
<td>Public hospitals, hospital-based services and specialist services.</td>
</tr>
<tr>
<td>Symblepharon</td>
<td>Adhesion between an eyelid and the eyeball.</td>
</tr>
<tr>
<td>Tamariki</td>
<td>Children.</td>
</tr>
<tr>
<td>Tetany</td>
<td>A condition of muscular hyperexcitability leading to cramps and spasms.</td>
</tr>
<tr>
<td>Whānau</td>
<td>The extended family. Relationships that have blood links to a common ancestor; extended family.</td>
</tr>
</tbody>
</table>
References


10. Injury Prevention Research Unit, University of Otago. Injury to children in NZ resulting in death or hospitalisation. Fact Sheet No. 22. Dunedin: Injury Prevention Research Unit, University of Otago; 2001.


245. Broughton J. Injury to Maori: Does it really have to be like this? Dunedin: The Ngai Tahu Maori Health Research Unit and the Injury Prevention Research Unit, Department of Preventative and Social Medicine, University of Otago; 1999.


STATEMENT OF INTENT

Evidence-based best practice guidelines are produced to help health practitioners and consumers make decisions about health-care in specific clinical circumstances. Research has shown that, if properly developed, disseminated and implemented, guidelines can improve clinical care. This guideline is based on clinical and methodological studies and other research on the management of spinal fractures. The recommendations are derived through a systematic consensus process based on the experience of the Guideline Development Team.

While guidelines represent a statement of best practice based on the latest available evidence (at the time of publishing), they are not intended to replace the health professional’s judgment in each case.

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Where guidelines are modified for local circumstances, significant departures from the national guidelines should be fully documented and be made to the decision-makers regularly reviewed.

An electronic copy of the full guideline and guideline summary are available for download from http://www.acc.co.nz or http://www.angp.org.nz (Search “Publications” then “Guidelines and Reports” then “Weaks in Brace”); or to get a printed copy, please contact the ACC Customer Group on office 0800 929 930.

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ACC Patient Helplines: 0800 322 929

ACC Patient Claims Helpline: 0800 333 995
Management of Burns and Scalds in Primary Care

JUNE 2007

Evidence-based Best Practice Guideline