Chapter 2
First aid

Stopping the burning process and cooling

RECOMMENDATIONS	GRADE
Ensure your own safety.	C
If on fire, 'stop, drop and roll', smother with blanket or douse with water.	C
For electrical burns, disconnect the person from the source of electricity.	C
Remove clothing and jewellery.	C
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.	C
Do not use ice for cooling.	C
Avoid hypothermia: keep the person with the burn as warm as possible, consider turning the temperature of the water up to 15°C (tepid).	C
If there has been a delay in starting cooling, this should still be started up to three hours after injury.	C
Do not attempt to remove tar.	C

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.[31,32] 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.[31] 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[31] and also increases the risk of hypothermia.[33] In an animal study, the application of ice for 10 minutes resulted in a deeper wound compared with no treatment at all.[34]

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.[35] 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.[1]

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.[36]

In a randomised single-blinded study[37] of 24 volunteers, no *prolonged* anti-inflammatory or anti-hyperanalgesic 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.[38]

Other evidence on cooling derives from animal studies. The methods, duration and temperature of cooling used in these studies varied widely.

One experimental study[39] 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[40] 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,[41] which lasted longer with decreasing temperature and increased cooling time. The most pronounced effect was obtained after cooling at 0°C for 120 minutes.

One study investigated the optimum period of cooling.[42] This involved cooling burns at 8°C for time periods from 15 to 120 minutes. The results suggested that 30 minutes was the optimal duration of cooling.

Another study investigated when the cooling strategy should be started.[43] 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

RECOMMENDATION	GRADE
Gel pads can be used as an alternative to running tap water where water is unavailable or not practical.	C

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[44] 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[45] 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 36% used no analgesics. The dressing was described as 'easy' to administer in 98% of cases.

A controlled trial of fair quality[46] 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)

RECOMMENDATIONS	GRADE
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.	C
PVC film should be layered onto the wound and not applied circumferentially around a limb.	C
Topical creams should not be applied as they may interfere with subsequent assessment.	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 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 consultation 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, Wilson[47] 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 series[49] 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]