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## **The use of Hydrogel Based Burn Dressings in Pre-Hospital First aid: Evidence based practice?**

- A systematic review of the literature and non-traditional data forms exploring the efficacy of HBD practice in the pre-hospital setting.**
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### **Summary**

**This systematic review examines the evidence base used to underpin common treatment recommendations and practice guidelines for the use of Hydrogel Burn Dressings (HBD) in pre-hospital First aid in a sampled cross-section of burns advisory agencies and Emergency Medical Service providers.**

**The review also highlights apparent widespread divergences between recommended approaches to burn 1<sup>st</sup> aid practice using HBD, and their application in the field by Emergency Medical Services and First Aid agencies.**

## Contributors

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## **Abstract**

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### **Introduction**

While traditional use of water based cooling methods and conventional dressing have been the cornerstone of pre-hospital burn first aid, alternative therapies such as hydrogel-based dressings (HBD) have seeped into clinical practice principally because of ease of use in the field. It has also been proposed the technology is a suitable substitute for traditional approaches, being equally effective in the role of cooling the burn, mitigating burn progression, reducing pain and providing an effective covering for the wound.

The aim of this systematic review was therefore to determine the base level of evidence underpinning HBD for use in the pre-hospital setting and current burn first recommendations and practices.

### **Methods**

Three electronic databases (Medline, Embase and Cochrane Database of Systematic Reviews) were searched independently using key terms such as 'pre-hospital setting' 'burn injury' and 'hydrogel', to identify systematic reviews, randomized and non-randomized controlled trials, well designed observational studies and superiority or non-inferiority comparative studies involving humans through to September 2014. We also screened individual journals and conference proceedings (e.g. hand searching), reviewed reference lists of relevant trials, and examined reference sources of clinical practice, first aid and paramedic websites. The search was limited to English language studies. Trials screening and identification was undertaken by two authors (NG and JW) using a pre-defined selection criteria.

### **Results**

Of the 115 studies identified via medical databases and through additional hand searching of internet based data from burn associations, peak resuscitation bodies and paramedic organizations, we found 36 potential studies for inclusion. All were excluded because they were in the wrong clinical setting, explored the wrong patient population, did not examine the intervention or were animal or experimental studies. The examination was therefore considered an empty systematic review.

### **Conclusions**

The current use of HBD in burn first aid appears to be driven by studies and other sources of information that do not reflect the pre-hospital clinical environment. Examination of recommendations from burns advisory bodies, peak resuscitation councils, hospital based burns units and pre-hospital first aid provider guidelines detail variations in their recommendations of use, which suggest not only a re-examination of current evidence, but also the urgent need to improve the intervention and its evidence-base.

## Introduction

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Advances in burn care have seen a dramatic improvement in patient survival, a reduction in complications and important improvements to cosmetic outcome. While much of this care has been driven by hospital-based practices such as surgery, antibiotics and intensive care, the contribution of pre-hospital burn first aid to improved patient outcome remains largely unknown.

Pre-hospital burn first aid has traditionally consisted of cooling the burn with water and covering the wound with an appropriate dressing. Experimental and animal studies have shown water-cooling may provide beneficial effects on wound oedema<sup>[1]</sup>, pain<sup>[2]</sup>, reducing cell injury<sup>[3]</sup> and the inflammatory response<sup>[4]</sup> as well as impacts on healing, recovery, cosmetic outcome and mortality<sup>[5,6]</sup>. More recently, alternative approaches using hydrogel based burn first aid dressings derived from materials first developed in 1955<sup>[7]</sup> have seeped into pre-hospital clinical practice.

This rapid gain in popularity was seen in a number of studies detailing its use as a burns dressing by emergency services in the United Kingdom. Allison (2002)<sup>[8]</sup> showed 39% of UK EMS employed HBD in first aid, whilst in nearly 80% of fire departments, HBD was used as both a dressing and/or cooling agent (Walker 2005)<sup>[9]</sup>. Cuttle (2009)<sup>[10]</sup> also showed 13% of paediatric patients receiving first aid with HBD by local EMS, whilst Hyland (2013)<sup>[11]</sup> found that over 50% of patients in a sample group of 455 were treated by lay first-aiders using hydrogel products.

The rationale for this widespread adoption of HBD into first aid, however, remains unclear. It may have been due to poor clinical understanding, the use of non-evidence based treatment strategies, the absence of defined burn protocols or the emergence of a growing HBD manufacturing base keen to develop market opportunities.

HBD were nonetheless, considered simple to adapt to practice and appeared to solve the dual problems of improvising water cooling in transit (using bottled saline or water) whilst providing a dressing option (from a myriad of choices) at the same time; features aiding the zeal of paramedics to exit the emergency scene with alacrity to definitive management in the ED – a long held (though often clinically misguided) mantra of prehospital care.

HBD are applicable to all areas of the body, come in many sizes and dissipate heat from the wound via convection and evaporation with several products also incorporating additives with anaesthetic, anti-inflammatory or nutrient properties.

Given the widespread use of HBD, there was an urgent need to use a systematic review methodology to determine the base level of clinical evidence supporting the efficacy of HBD in the pre-hospital burn first aid role. The authors also investigated the extent and type of alternative supporting literature and approaches to practice seen in published first aid recommendations and practice guidelines of 37 sampled agencies.

## Materials and Methods

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### Literature search strategy

A structured literature search was last performed in Ovid MEDLINE, EMBASE and The Cochrane Library in June 2014 using a series of keywords such as 'burns', 'thermal injury' 'hydrogel', with 'first aid' and 'pre-hospital setting'. A predefined search strategy was designed for maximal retrieval using medical subject headings and free text search terms. Search terms were also adapted using the thesaurus vocabulary of each database. In addition to the automated search strategies, the internet search engine, Google, was searched for additional relevant studies, along with company/manufacturing websites, expert commentaries on burn first aid in journal articles and burn care agencies. Two authors (JW and NG) conducted the literature search. All searches were limited to articles in English.

### Study selection criteria and procedures

**Study designs:** Systematic reviews, randomized and non-randomized controlled trials, well designed observational studies and superiority or non-inferiority comparative studies were considered for inclusion.

**Clinical outcomes of interest:** Effect on - burn wound temperature, burn progression, analgesic benefit, infection rate, healing and cosmetic outcome, recovery time, mortality.

**Setting:** HBD when used as part of immediate first aid burn care management in the pre-hospital setting.

**Exclusions:** In-vitro experiments or animal studies, non-English language, non-peer reviewed, case series or reports, unpublished manuscripts, narrative reviews, expert testimonials, commentaries and other descriptive articles were excluded.

**Procedure:** Two review authors (N.G, J.W.) excluded irrelevant materials following retrieval in the initial search then independently screened remaining titles, abstracts and full text articles using inclusion criteria. Authors resolved differences of opinion by discussion.

### Assessment of burns advisory agencies and first aid provider organisation guidelines

Authors (NG,JW) identified recommendations and guidelines for practice of burns advisory agencies, Emergency Medical Services and other First aid organisations from institution websites or via electronic (PDF) documents on request from the document holder. References cited in recommendations and guidelines were analyzed using review inclusion criteria and graded based upon Australian National Health and Medical Research Council (NHMRC) hierarchies of evidence [<sup>12</sup> ] and recorded in comparative tables.

### Data extraction

Authors (NG,JW) applied a standardised data extraction form extracting detail on study design demographic and clinical variables as described.

## Results

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### Database and Internet Search results

The search strategy identified 115 studies of which 25 potentially relevant articles were retrieved after independent scrutiny of the titles and abstracts. All were excluded because:

- i. They were undertaken in settings other than pre-hospital.  
(Burd 2007<sup>[13]</sup>; Guilbaud 1992<sup>[14]</sup>; Guilbaud 1993<sup>[15]</sup>; Grippaudo 2010<sup>[16]</sup>; Patel 2007<sup>[17]</sup>; Vogt 2006<sup>[18]</sup>; Zhang 2009<sup>[19]</sup>; Edwards 2010<sup>[20]</sup>; Gong 2009<sup>[21]</sup>; Warren 1980<sup>[22]</sup>; Nangia 1988<sup>[23]</sup>; Osti 2006<sup>[24]</sup>; Coats 2002<sup>[25]</sup>.
- ii. They were laboratory designs (Bullock 2010<sup>[26]</sup>; Chen 2007<sup>[27]</sup>; Martineu 2007<sup>[28]</sup>; Ribeiro 2009<sup>[29]</sup>).
- iii. They were animal studies (Homann 2007<sup>[30]</sup>; Dressler 1980<sup>[31]</sup>; Jandera 2000<sup>[32]</sup>; Pei 2008<sup>[33]</sup>; Kiyozumi 2007<sup>[34]</sup>).
- iv. or non-English language articles ((Hauser 2007 (German)<sup>[35]</sup>; Kassain 1991 (Russian)<sup>[36]</sup>; Misterka 1991<sup>[37]</sup> (Russian)).

Manual searching of non-medical database internet sources including company/manufacturing websites identified a further 11 studies. Of these, all were excluded because:

- i. They were in the wrong setting. (Castner 2000<sup>[38]</sup>; Castner 2001<sup>[39]</sup>)
- ii. The intervention was not assessed. (Allison 2002<sup>[40]</sup>; Ashworth 2001<sup>[41]</sup>; Hudspith 2004<sup>[42]</sup>; Lonnecker 2001<sup>[43]</sup>; McCormick 2004<sup>[44]</sup>)
- iii. They were in-vitro experimental studies (Carson<sup>[45]</sup>; Faogoli 1997<sup>[46]</sup>; Torsova 1995<sup>[47]</sup>; Wang 2011<sup>[48]</sup>).

### Review of recommendations and guidelines (non-traditional data forms)

Of 14 peak resuscitation bodies and major burns advisory agencies 4 provided recommendations on HBD as an (alternative) cooling medium whilst 1 advised against its use on paediatric burns patients. None of the 14 bodies advocated for the use of HBD in the primary first aid dressing role. Only 4 agencies provided companion supporting literature for published recommendations. All reference studies were excluded from the review.

Of 23 sampled EMS agencies, none provided supporting HBD literature with published guidelines. (Many EMS agencies utilise in-house consensus medical evaluation or consultative models with local expert institutions to endorse clinical practice guideline development, thus evidence summaries are rarely published in the public domain<sup>[49]</sup>).

Cooling and dressing practices of the sampled agencies appears to be based on studies done in the wrong clinical setting or had no recognized methodological assessment of study quality chosen when including these studies to endorse the practice currently in use. Examination showed no consistent or standardised approach to the use of HBD in burn first aid across regional, national or international boundaries. Due to variations in study design and setting, which precluded these studies from being part of the SR, we could not make any proper inferences.

## Discussion

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### Overview of the evidence

Despite major advances in hospital burn care over the past few decades, minimizing burn wound progression with targeted cooling whilst avoiding hypothermia, effectively managing pain without resorting to excessive use of opioid medication and determining the best approach to wound covering to both protect the injured integument whilst impacting infection rates, remain complex and difficult areas of pre-hospital care. In the absence of a clear evidence based strategy, there has been a gradual shift in clinician behavior with the use of alternative therapies such as HBD.

Following an exhaustive search of medical databases, non-medical websites and first aid agencies using burn and pre-hospital search terms, this systematic review did not identify any studies describing an equivalent or superior effect from HBD in respect of addressing these critical areas in comparison with current recommended therapies. Moreover, we did not find any evidence supporting HBD application strategies for specified durations, at various temperatures or as a delayed treatment comparable or superior to current first aid guidelines.

The safety and effectiveness of HBD and indeed, of all burn first aid in the patient with a large TBSA or deep burn remains an area of both concern and controversy in the absence of adequate research. Nonetheless, HBD remain a widely used alternative burn first aid option in the United States, Asia, Europe, the United Kingdom, Australia, Canada and many other regions where they may be used to treat all sizes and depths of thermal burn injury.

Considering the alarming absence of evidence, a number of sampled agencies involved in providing first aid recommendations and guidelines for practice used a variety of animal, laboratory and observational studies, unpublished materials or manufacturer commissioned reports or testimonials, in various clinical settings other than pre-hospital, to piece together a series of clinically-led, consensus based statements almost exclusively on the water-cooling component of burn first aid.

For example, Singer (2010) compiled an evidence summary for The 2010 American heart Association “International Consensus on First aid Science with Treatment Recommendations”<sup>[50]</sup> providing evidence to demonstrate the benefits of water cooling on healing and reducing pain but included studies in other health care settings and amongst

animal populations (Singer 2010, INFAA – citations listed below). However, the summary describes the HBD burn First aid situation as a “knowledge gap” (1) reflecting the dearth of trial based evidence and the AHA like many recommending bodies, does not provide a recommendation on HBD use in pre-hospital.

With the emphasis on cooling the burn wound (the most widely studied element of first aid and whose efficacy is most widely supported by evidence), has seen investigation of the pre-hospital use of HBD specifically as a first aid dressing largely ignored.

The systematic review by Wasiak et al (2010)<sup>[51]</sup> for example, failed to identify nor included any pre-hospital studies with the literature search limited to superficial and partial thickness thermal injury only. Hospital based HBD dressing studies did not explore the product in the first aid scenario or were unrelated product variants containing a hydrogel component not utilised in pre-hospital.

Furthermore, this review could not identify any studies analyzing the effectiveness of HBD to reduce burn wound pain whilst minimising reliance on pharmacological agents with potential adverse side effects. The studies by Osti (2006)<sup>[24]</sup> and Coats (2002)<sup>[25]</sup> whilst commenting on analgesic effect of HBD in two small patient cohorts (12 and 40) using different study design methodologies, did not quantify the effect with a data analysis from which generalisable conclusions can be drawn.

Current provider first aid guidelines do not advocate any preferred therapy. (HBD, water-cooling, opioid analgesics/other).

## **Recommendations and guidelines for practice**

Despite the limited evidence base informed by clinical trials within this area of pre-hospital practice, with emphasis placed on various settings and animal or laboratory based study designs, there is some level of consensus amongst clinicians to consider “best available” evidence in the early first aid management of patients with burn injury.

Although consensus-based care may have expanded clinical knowledge, there are many areas that remain under-investigated but specific to HBD. These include its contribution to hypothermia complications<sup>[52,53]</sup>, its benefit or otherwise in mitigating burn wound progression and its relative or comparable efficacy to control burn wound temperature and pain and whether the technology inhibits infective complications in the burn wound more effectively than traditional dressing approaches.

Clinical hypothermia issues in particular have seen practice guidelines employing conservative risk mitigation strategies to HBD (and cooling generally) using caveats such as age and TBSA restrictions. However, there does not appear to be any standardisation in these practices. For example, some Australian EMS services employ HBD only where water is inaccessible<sup>[78,54]</sup> or stipulate based upon patient age and/or TBSA<sup>[75]</sup>, whilst one suggests several alternatives all considered appropriate<sup>[55]</sup>. Variations in Australian EMS practice are replicated in overseas jurisdiction. (Tables 3-4: Pages 15-16). Some EMS guidelines advocate



no cooling of the burn with any means (HBD or otherwise) irrespective of the TBSA. Only three of the sampled EMS agencies (Ontario, Florida, New York State) stipulated a burn depth caveat.

Recommendations from International and National first aid agencies<sup>[56,57,58]</sup> reflect the general consensus on early water-cooling of burn injury seen in those from major burns advisory agencies but fail to demonstrate a consensus on other aspects of burn first aid where HBD is utilised. Non-traditional data sources also show similar variations in HBD use as noted in military First aid protocols<sup>[59,60]</sup>.

There remains no consensus amongst first aid providers sampled for this review on the preferred burn dressing in pre-hospital as seen in prior analysis. (Allison (2002)<sup>[8]</sup> Walker et al (2005))<sup>[9]</sup>. Amongst burns advisory agencies, polyvinyl Clingfilm is the most widely recommended choice principally for its practicality, simplicity and nominal sterility. One agency suggests HBD as an alternative dressing in major burns (RAHBU). Only one of three sampled peak bodies specifies a preferred pre-hospital burn dressing post wound cooling (ERCEFAG -"wet wound dressings"<sup>[61]</sup>).

## **Conclusions**

This systematic review did not identify pre-hospital burn first aid studies of any design and other data sources did not meet inclusion criteria as these were derived from other clinical settings, clinical observational and experimental animal studies or studies that did not assess the intervention (HBD) or clinical outcomes relevant to burn first aid. All thirty-six potential studies identified in the literature search and via non-traditional data forms were therefore excluded from the review.

Study data to establish the bona-fides of HBD as an effective burn First aid intervention thus appears lacking quantitatively and qualitatively making definitive conclusions on the efficacy of the technology in this role unclear.

## **Limitations of the Review**

- Non-English language studies were excluded from the review.
- No studies met inclusion criteria

## **Conflicts of Interest**

The Authors declare no financial, commercial, academic or affiliation conflicts of interest.

**Results: Table 1. HBD evidence summary – Peak Bodies; National Health and Medical Research Council, Australia Level Of Evidence Grading System – (NHMRC)**

Agency		HBD studies	Study Design	HBD Function	Participants
1	<a href="#">British Burns Association</a>	<p>i) Coats TJ, Edwards C, Newton R, Staun E. The effect of gel burns dressings on skin temperature. Emerg.Med J 2002;19:224-5.</p> <p>ii) Jandera V, Hudson DA, de Wet PM, Innes PM, Rode H. Cooling the burn wound: evaluation of different modalities. Burns 2000;26:265-70.</p>	<p>Controlled observational volunteer trial</p> <p>Comparative Porcine Laboratory Experiment</p>	<p>Cooling with HBD in different configurations, Analgesic effect</p> <p>Cooling Effect of HBD vs water compresses</p>	<p>12 Volunteers</p> <p>Porcine Animal Study</p>
2	<a href="#">Australia New Zealand Burn Association</a>	No published evidence brief for recommendations	Consensus statement on HBD	HBD 2 <sup>nd</sup> tier alternative for water cooling only if no water available	N/A
3	<a href="#">New Zealand Guideline Group</a>	<p>i) Castner T Monitoring of Temperature While Cooling Burn Injuries. Rettungsdiennst. 2001; No:1(23): 28-31</p> <p>ii) Mertz PM, Davis SC, Cazzaniga AL, et al. To assess second-degree burn wound treatment with Water-jel. Carlstadt NJ: Trilling Medical Technologies Inc; 1990</p> <p>iii) Torsova V, Chmelarova E. Evaluation of the effects of a new Water Jel System on Specific Bacterial and Yeast Strains in Laboratory Conditions 1995. Burns 21(1):pp47-56.</p> <p>iv) Dolocek R Torsova V. Water Jel in the treatment of Burns: A Bacteriological Study. Journal of Burn Care Rehabilitation. 1990. 11:pp135-141</p> <p>v) Palmhert (1998) Controlled trial 23 patients. Non randomised study Unpublished abstract</p> <p>vi) Coats TJ, Edwards C, Newton R, Staun E. The effect of gel burns dressings on skin temperature. Emerg.Med J 2002;19:224-5.</p> <p>vii) Castner T Cooling out of the bag. Water Jel Burns Dressings. AGAN Product test.Rettungsdiennst.2002;5 (22):32-5</p> <p>viii) Lonnecker S, Schroder V. Hypothermia after burn injury—influence of pre-hospital management. Der Chirurg2001;72:164–7.</p>	<p>Controlled observational volunteer trial</p> <p>Unpublished Porcine Laboratory Study</p> <p>1.In-vitro Bacteriological Laboratory study 2. Case Series</p> <p>Case Series</p> <p>Unpublished Non-randomized controlled trial</p> <p>Controlled observational volunteer trial</p> <p>Cases Series</p> <p>Prospective Interventional Study</p>	<p>Does 1<sup>st</sup> aid cooling cause hypothermia?: HBD vs water</p> <p>Cooling</p> <p>1. HBD anti- bacterial and anti-mycotic effect 2. Signs of infection</p> <p>Preparation for grafting</p> <p>Cooling</p> <p>Cooling with HBD in different configurations, Analgesia</p> <p>Cooling</p> <p>Impact of pre-hospital cooling on incidence of hypothermia</p>	<p>No. not stated “Volunteers aged 27-33”.</p> <p>Porcine Animal Study</p> <p>N/A</p> <p>N/A</p> <p>N/A</p> <p>23 patients</p> <p>12 Volunteers</p> <p>No. Not stated. Volunteers</p> <p>N/A</p>

Agency		HBD studies	Study Design	HBD Function	Participants
4	<a href="#">ACI New South Wales Statewide Burn Injury Service</a>	i) Jandera V, Hudson DA, de Wet PM, Innes PM, Rode H. Cooling the burn wound: evaluation of different modalities. Burns 2000; <b>26</b> :265-70.	Comparative Porcine Laboratory Study	Cooling Effect of HBD vs water soaks	Porcine Animal Study
5	<a href="#">Victorian Adult Burns Service</a>	No HBD studies cited in references	Consensus recommendation on HBD only	HBD as alternative cooling agent Hypothermia risk in major burns Not suitable for paediatrics	N/A
6	<a href="#">Western Australian Burns Service</a>	No published evidence brief for recommendations	No published directive on HBD in First aid recommendations Provider stipulated Guideline on HBD use by first responders	N/A (HBD used as Dressing alternative in EMS Protocol)	N/A
7	<a href="#">Australian Resuscitation Council</a>	i) Jandera V, Hudson DA, de Wet PM, Innes PM, Rode H. Cooling the burn wound: evaluation of different modalities. Burns 2000;26:265-70.  ii) Osti Enzo. Cutaneous Burns Treated With Hydrogel (Burnshield) and a Semipermeable Adhesive Film. Arch Surg. 2006;141:39-42	Comparative Porcine Laboratory Study  Prospective controlled observational Study	Cooling Effect of HBD vs water soaks  Effect on scar formation and time to re-epithelialization; Analgesic benefit and wound maceration	Porcine Animal Study  40
8	<a href="#">European Resuscitation Council European First aid Guidelines</a>	No HBD studies cited in references	Evidence Summary: Three guidelines, one cross-sectional survey, two expert opinion scripts	Dressing ("wet wound dressings can protect the burn")	N/A
9	<a href="#">American Heart Association (American Burn Association)</a>	No HBD studies cited - no references detailed in published burn First aid recommendations	Evidence Summary	N/A	N/A
10	<a href="#">Royal Adelaide Hospital Burns Unit</a>	No HBD studies cited - no references detailed in published guidelines	Consensus recommendation on HBD only	HBD as cooling and dressing agent when no water available	N/A
11	<a href="#">The Children's Hospital West Mead</a>	No HBD studies cited in references	No published directive on HBD in First aid recommendations Local Provider stipulated Guideline	N/A	N/A

Agency		HBD studies	Study Design	HBD Function	Participants
12	<a href="#">Royal Children's Hospital Melbourne</a>	No HBD studies cited - no references detailed in published burn First aid guidelines	No published directive on HBD in First aid recommendations Paediatric advisory to local EMS	N/A	N/A
13	<a href="#">Prince of Wales Hospital Hong Kong</a>	No HBD studies cited in references	No published directive on HBD in First aid recommendations	N/A	N/A
14	<a href="#">Women And Children's Hospital Adelaide</a>	No HBD studies cited in references	Consensus recommendation on HBD only	HBD as alternative cooling agent where no water available	N/A

**Results: Table 2. Representative bodies (Refer Evidence Summary Table 1 and Website Links: Appendix 1)**

Key: HBD=Hydrogel Burn dressing CRW=cool running water C=Clingfilm NS=Not specified in guideline DD=Dry Dressing WD=Wet Dressing (undefined) A=Adult P=Paediatric

	Burns Associations						Peak Bodies			Hospital Burns Units				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	BBA [62]	ANZBA [63]	NZGG [64]	NSWACISBIS [65]	VABS [66]	WABS [67]	ARC [68]	ERCEFAG [61]	AHA [69]	RAHBU [70]	CHWM [71]	RCH [72]	POWH [73]	WCHA [74]
<b>Cooling method</b>	"Cool the burn area" (Water)	CRW	"Running tap water" or HBD where water unavailable	CRW	CRW or HBD if no water available	Room temp water"	CRW	CRW	"Cold Water"	CRW or soaked towels for still water/ immersion or HBD if no water available	"Cold tap water"	CRW	"water"	CRW - HBD if no water available
<b>Duration of cooling</b>	20mins	20mins	20mins	20mins	20mins	20-30mins	20mins	15-20mins	"At least until pain is relieved"	20 mins or if no water available "Use HBD for 20mins (high risk) or 10mins (extreme risk) then remove" or 10-20 mins CRW (flame burn)	20-30 mins (Public fact sheet" 20 mins only)	20mins	"up to half an hour"	10-20 mins; 20 mins minor burn 10 to 20 mins major burn HBD removed after 20mins
<b>Cooling Temp</b>	NS	NS	8-15°C	8-25°C "Ideal temp=15°C"	8-20°C	10-15°C	NS	NS	10-25°C	NS	(5-25°C) NS in actual guidelines	NS	NS	NS
<b>Preferred Dressing</b>	C	"Clean dressing"	C	C	C	Clean non-adherent dressing	NS	NS	NS	"Non- adherent dressing" (minor burn)	"A simple non-stick dressing is suitable"	C "useful"	NS	C or "non-adherent dressing"
<b>Alternate dressing</b>	NS	C	"PVC film should not be used as a substitute for a dressing product"	"Wet packs and Soaks"	"Any clean, dry dressing"	NS	NS	NS	NS	C or Clean linen (major burn) or "wrap clean towel around hydrogel"	NS	No HBD on paed. burns. Advisory to local EMS	NS	NS

**Results: Table 3 - Australian, United Kingdom and Canadian EMS (state based Guidelines for Practice. Refer Website Links: Appendix 1)**

	15	16	17	18	19	20	21	22	23	24	25	26
	QAS [75]	ACTAS [76]	SJWA [77]	NSWAS [78]	SAAS [79]	PHECCI [80]	UK AS [81]	Alberta EMS [82]	Nova Scotia EMS [83]	Ontario EMS [84]	Manitoba EMS [85]	Saskatchewan EMS [86]
<b>Cooling method</b>	CRW	Cold water or NaCl	"Cooling with water"	CRW or if still water-wet towels or no water-NaCl or Hartmanns	CRW	"Commence local cooling of area"	Initial irrigation CRW	NS "Cool burn and limit further injury". "If time of injury >30mins do not cool burn"	"Cool the burn with water"	"wet (not soaked) dressings. If shivering or hypotension develops discontinue cooling efforts"	"Irrigation of a burn can cause hypothermia and introduce infection in compromised skin, and is not an appropriate method of pain control"	"Apply a clean dry non-adherent dressing to the burned area"  "Cold compresses should not be used for a burn >20% burn surface area"
<b>Duration of cooling</b>	20mins	NS	At least 10mins	20mins	"Up to 20mins"	Min15mins cooling	"Rare to need more than 10MINS irrigation"	NS	"minimum 10mins"	NS	NS	NS
<b>Cooling Temp</b>	NS	NS	NS	"cool/tepid"	"cold water"	NS	NS	NS	NS	NS	NS	NS
<b>Preferred Dressing</b>	C	Gel burns dressings after cooling or DD	Any of C,H, WD wet sheet	C	C	Burns gel (caution for > 10% TBSA) Cling film Sterile dressing Clean sheet	C	<10% TBSA Cool moist dressings >10% TBSA clean dry sheets	"Sterile Dry dressings"	If burn 1 <sup>st</sup> deg or 2 <sup>nd</sup> deg <10-15% cover with wet sterile dressing "not soaked"	"cover burned area with sterile soaked saline dressing, then cover with dry dressings"	"Place patient between clean dry sheets"
<b>Alternate Dressing</b>	HBD A<20% TBSA P<10% TBSA	"Cover the burnt area with clean dressing/sheets"	Any of C,H,WD	If no water apply HBD (after NaCl/Hartmann's cooling)	HBD no >20mins	HBD no >20mins	HBD if burn <12.5% TBSA due to potential for hypothermia	NS	NS	NS	NS	NS

**Results: Table 4 - US EMS (state based Guidelines for Practice - Refer Website Links: Appendix 1)**

	27	28	29	30	31	32	33	34	35	36	37
	Montana EMS [87]	Alabama EMS [88]	Nth Carolina EMS [89]	Massachusetts [90]	NY State EMS [91]	Pennsylvania [92]	Connecticut EMS [93]	Alaska EMS [94]	Florida EMS [95]	Nebraska EMS [96]	Maine EMS [97]
<b>Cooling method</b>	NS	"Cooling with adequate available sterile water". "Do not induce hypothermia by applying cold or wet dressing to burned area"	"Burn patients are prone to hypothermia - never apply ice or cool the burn, must maintain normal body temperature".	"Stop the burning process with water or saline....."	"Stop the burning process"	"Stop the burning process with water or saline"	Thermal: apply dry sterile dressings "Cool water or saline is of value if applied within 15mins" to no >10% of body	"Cool with water immersion"	"Lavage the burned area with tepid water (sterile, if possible) to cool the skin"	NS "if <10%BSA may cool the burn" "Cool burning material adhering to pt"	<10% Dressing soaked in NaCl or other commercial wet dressing (H) If >10% dry dressing sterile sheet or commercial dry dressing
<b>Duration of cooling</b>	NS	N/A	NS	".....for up to 10 minutes"	NS	NS	NS	"Little benefit after few minutes"	NS	NS	NS
<b>Cooling Temp</b>	N/A	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS
<b>Preferred Dressing</b>	Large burn: "place patient between clean dry sheets", sterile dry dressing for small burns	"Dry Burn Sheet"	"Dry Clean Sheet or Dressings"	"Clean dry dressing"	Partial thickness < 10% TBSA area: moistened sterile dressings or moistened burn sheets	"Cover burned areas with dry sterile burn sheets/ dressings or sterile commercial burn sheets/ dressings."	" Dry Sterile burn dressing"	>10% dry sheet, burn sheet or sterile dressing <10% wet e.g. HBD	>= 20% 2 <sup>nd</sup> deg. or 5% 3 <sup>rd</sup> deg. burns, cover with dry sterile dressings or Water Gel™ wraps. < 20% 2 <sup>nd</sup> deg. burns or 5% 3 <sup>rd</sup> deg. apply wet sterile dressings to burns for 15 mins. to aid in pain control. Alternatively, Burn Free™ gel pads or Water Gel™ wraps may be applied continuously to aid in pain control.	"Cover burned area with Dry bandages or sheets"	"If <10% Dressing soaked in NaCl or other commercially prepped wet dressing If >10% dry dressing, sterile sheet or commercially prepped dry dressing"
<b>Alternate dressing</b>	NS	NS	NS	NS	Full thickness >10%: dry sterile dressings or burn sheets to the burned area(s).	NS	NS	NS	If <20% 2 <sup>nd</sup> deg or <5% 3 <sup>rd</sup> deg burns apply wet sterile dressings or H for 15mins	NS	NS

## Appendix 1 First aid Guidelines and recommendations - Website Links

### Peak Bodies, Burns Associations and Burns Hospital Units

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1. British Burns Association: <http://www.nettas.com.tr/burnshield/Pre-hospital%20Approach%20to%20Burns%20Patient%20Management%20Cooling%20British%20Burn%20Association.pdf>
2. Australia New Zealand Burn Association: <http://anzba.org.au> <http://anzba.org.au/assets/Factsheet-First aid2.pdf>
3. New Zealand Guideline Group: <http://www.health.govt.nz/publication/management-burns-and-scalds-primary-care>
4. New South Wales Association for Clinical Innovation Statewide Burn Injury Service Clinical Practice Guidelines: burn Injury Management [http://www.aci.health.nsw.gov.au/resources/clinician-resources/multidisciplinary\\_burn\\_education\\_program](http://www.aci.health.nsw.gov.au/resources/clinician-resources/multidisciplinary_burn_education_program)
5. Victorian Adult Burns Service: <http://www.alfred.org.au/Assets/Files/ManagementofMinorSuperficialBurns.pdf>
6. Western Australia Burns Service: [http://www.healthnetworks.health.wa.gov.au/docs/burns\\_education\\_booklet.pdf](http://www.healthnetworks.health.wa.gov.au/docs/burns_education_booklet.pdf)
7. Australian Resuscitation Council: <http://www.resus.org.au/policy/guidelines/index.asp>
8. European Resuscitation Council European First aid Guidelines: [http://www.researchgate.net/publication/6641654\\_European\\_first\\_aid\\_guidelines](http://www.researchgate.net/publication/6641654_European_first_aid_guidelines)
9. American Heart Association [http://circ.ahajournals.org/content/122/18\\_suppl\\_3/S934.full.pdf+html](http://circ.ahajournals.org/content/122/18_suppl_3/S934.full.pdf+html)
10. Royal Adelaide Hospital: <http://www.rah.sa.gov.au/burns/downloads/2009-Practice-guidelines.pdf>
11. The Children's Hospital West Mead: [http://www.schn.health.nsw.gov.au/\\_policies/pdf/2006-8142.pdf](http://www.schn.health.nsw.gov.au/_policies/pdf/2006-8142.pdf)  
[http://www.chw.edu.au/prof/services/burns\\_unit/05\\_factsheets.htm](http://www.chw.edu.au/prof/services/burns_unit/05_factsheets.htm)
12. Royal Children's Hospital: [http://www.rch.org.au/clinicalguide/guideline\\_index/Burns/](http://www.rch.org.au/clinicalguide/guideline_index/Burns/)
13. Prince of Wales Hospital (Hong Kong) <http://www.fmskhk.org/database/articles/03mb6.pdf>
14. Women and Children's Hospital Adelaide: [http://www.wch.sa.gov.au/services/az/divisions/psurg/burns/documents/burns\\_guidelines.pdf](http://www.wch.sa.gov.au/services/az/divisions/psurg/burns/documents/burns_guidelines.pdf)

### Australian, UK and Canadian EMS Services

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15. Queensland Ambulance Service: <https://ambulance.qld.gov.au/clinical.html>
16. ACT Ambulance Service: <http://esa.act.gov.au/actas/about-us/clinical-management-guidelines/>
17. St Johns Western Australia Ambulance Service: <http://www.fair-go.com/docs/Clinical%20Practice%20Guidelines%20V11%2022.07.11.pdf>
18. NSW Ambulance Service: <http://www.ambulance.nsw.gov.au> (PDF on request)
19. South Australia Ambulance Service: <http://www.saambulance.com.au/ContactUs.aspx> (PDF on request)
20. Pre-Hospital Emergency Care Council of Ireland: <http://www.phcec.it/images/PHECC/Clinical%20Practice%20Guidelines/2012%20Edition%20CPGs/Responder%20CPG%202012%20Version.pdf>
21. UK Ambulance Service: <http://www2.warwick.ac.uk/fac/med/research/hsri/emergencycare/prehospitalcare/jrcalcstakeholderwebsite/guidelines>
22. Alberta EMS <https://www.ahsems.com/public/AHS/protocols/index.html#set/12/browse/2890/view/24626/Algorithm>
23. Nova Scotia EMS: <http://novascotia.ca/dhw/ehs/documents/CPG/EHS6340.02%20Burns.pdf>
24. Ontario EMS: [http://www.health.gov.on.ca/english/public/program/ehs/edu/pdf/bls\\_patient.pdf](http://www.health.gov.on.ca/english/public/program/ehs/edu/pdf/bls_patient.pdf)
25. Manitoba EMS: <http://www.gov.mb.ca/health/ems/guidelines/docs/T10.05.06.pdf>
26. Saskatchewan EMS: <http://www.collegeofparamedics.sk.ca/docs/resources/Protocol%20Manual%20v2.0.pdf>

### US EMS Services

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27. Montana [http://bsd.dli.mt.gov/license/bsd\\_boards/med\\_board/pdf/emt\\_protocols.pdf](http://bsd.dli.mt.gov/license/bsd_boards/med_board/pdf/emt_protocols.pdf)
28. Alabama EMS: <http://www.adph.org/ems/assets/7thEditionProtocols120513.pdf>
29. North Carolina EMS: <http://www.ncems.org/nccestandards/protocols/protocols.pdf>
30. Massachusetts EMS: <http://www.mass.gov/eohhs/docs/dph/emergency-services/treatment-protocols-1101.pdf>
31. New York State EMS: [http://www.health.ny.gov/professionals/ems/pdf/2008-11-19\\_bls\\_protocols](http://www.health.ny.gov/professionals/ems/pdf/2008-11-19_bls_protocols)
32. Pennsylvania EMS: [http://www.portal.state.pa.us/portal/server.pt/community/emergency\\_medical\\_services/14138/ems\\_statewide\\_protocol\\_s/625966](http://www.portal.state.pa.us/portal/server.pt/community/emergency_medical_services/14138/ems_statewide_protocol_s/625966)
33. Connecticut EMS <http://www.ctemscouncils.org/pages/links.html>
34. Alaska EMS: <http://www.ems.alaska.gov/EMS/Assets/Downloads/TraumaEMT.pdf>
35. Florida EMS: <http://www.gbemda.org/florida-regional-common-ems-protocols.pdf>
36. Nebraska EMS: <http://dhhs.ne.gov/publichealth/Licensure/Documents/EMSmodelProtocols2012.pdf>
37. Maine EMS: <http://www.maine.gov/ems/publications/index.html#mdp>



## References

---

- 1 Demling RH, Mazess RB, Wolberg W. The effect of immediate and delayed cold immersion on burn edema formation and resorption. *J Trauma*. 1979 Feb;19(1):56-60.
- 2 Shulman AG. Ice water as primary treatment of burns. Simple method of emergency treatment of burns to alleviate pain, reduce sequelae, and hasten healing. *JAMA*. 1960 Aug 27;173:1916-9.
- 3 Ofeigsson OJ. Observations and experiments on the immediate cold-water treatment for burns and scalds. *Br J Plast Surg*. 1959;12:104-19.
- 4 Boykin JV, Jr., Crute SL. Mechanisms of burn shock protection after severe scald injury by cold-water treatment. *J Trauma*. 1982 Oct;22(10):859-66.
- 5 Yuan J, Wu C, Harvey JG, Holland AJ, Martin HC, La Hei ER, et al. Assessment of cooling on an acute scald burn injury in a porcine model. *JBurn Care Res*. 2007 Apr 10.
- 6 Nguyen NL, Gun RT, Sparnon AL, Ryan P. The importance of immediate cooling—a case series of childhood burns in Vietnam. *Burns*. 2002 Apr;28(2):173-8.
- 7 Kopeček J. Hydrogels: From soft contact Lenses and Implants to self- assembled nanomaterials. *J Polym Sci A Polym Chem*. 2009 Nov 15; 47(22): 5929-46
- 8 Allison K. The UK pre-hospital management of burn patients: current practice and the need for a standard approach. *Burns* 2002; 28:135–42
- 9 A Walker, R Baumber, B Robson. Pre-hospital management of burns by the UK fire service. *Emergency Medicine Journal* 2005; 22: 205–208
- 10 Cuttle L, Kravchuk O, Wallis B, Kimble RM. An audit of First aid treatment of pediatric burns patients and their clinical outcome. *J Burn Care Res*. 2009 Nov-Dec; 30(6): 1028-34.
- 11 Hyland EJ, Harvey JG, Holland AJ. Burn First aid – The weird and Wonderful. Retrospective analysis of the First aid received by 4368 children who presented to the Burns Unit at The Children’s Hospital at Westmead between January 2008 and December 2012. ANZBA Burns Conference 15-18 October 2013: Fremantle, Western Australia. Available at: [http://anzba.org.au/assets/Burn-First aid-the-Weird-and-Wonderful-Dr.-Ela-Hyland.pdf](http://anzba.org.au/assets/Burn-First%20aid-the-Weird-and-Wonderful-Dr.-Ela-Hyland.pdf)
- 12 National Health and Medical Research Council. Australia (2009) NHMRC levels of evidence and grades for recommendations for developers of clinical practice guidelines. Available at: <https://www.nhmrc.gov.au/guidelines/resources-guideline-developers>.
- 13 Burd A. Evaluating the use of hydrogel sheet dressings in comprehensive burn wound care. *Ostomy Wound Manage*. 2007 Mar; 53(3): 52-62.
- 14 Guilbaud J. European comparative clinical study of Inerpan: a new wound dressing in treatment of partial skin thickness burns. *Burns* 1992; 18(5):419–22.
- 15 Guilbaud J, Honde C. Multicentre comparative clinical study of a new wound dressing: PA286 (Inerpan). *European Journal of Plastic Surgery* 1993; 16:73–6.
- 16 Grippaudo FR, Carini L, Baldini R. Procutase versus 1% silver sulphadiazine in the treatment of minor burns. *Burns*; 2010 Sep; 36(6):871-5.
- 17 Patel. HS, Shah. DK. A Comparative Study Of Hydrogel Dressing Versus Conventional Dressing In Burns. *Internet Journal of Surgery*;2007, Vol. 13 Issue 2, p1
- 18 Vogt PM, Hauser J, Robbach O, Bosse B et al. Polyvinyl pyrrolidone-iodine liposome hydrogel improves epithelialization by combining moisture and antisepsis. A new concept in wound therapy. *Wound Repair and Regeneration*, 2001; 9(2):116-119
- 19 Zhang L, Chen J, Han C. A multicenter clinical trial of recombinant human GM-CSF hydrogel for the treatment of deep second-degree burns. *Wound Repair and Regeneration* 2009; 17(5):685-9
- 20 Edwards J. Hydrogels and their potential uses in burn wound management. *British journal of nursing* 2010; 19(11): S12, S14-16.
- 21 Gong Z, Yao J, Ji F, Yang J et al. Effect of ionic silver dressing combined with hydrogel on degree II burn wound healing. *Journal of Clinical Rehabilitative Tissue Engineering Research* 2009; 13(42): 8373-6
- 22 Warren RJ. Snelling CF. Clinical evaluation of the Hydron burn dressing. *Plastic & Reconstructive Surgery* 1980; 66(3): 361-8.
- 23 Nangia A, Hung CT. Laboratory evaluation of a new hydrogel-type skin substitute. *Burns* 1990; 16(5): 368-72.
- 24 Osti E. Cutaneous burns treated with hydrogel (Burnshield) and a semipermeable adhesive film. *Arch Surg*. 2006 Jan; 141(1): 39-42.
- 25 Coats TJ, Edwards C, Newton R, Staun E. The effect of gel burns dressings on skin temperature. *Emerg Med J*. 2002 May; 19(3): 224-5.
- 26 Bullock AJ, Pickavance P, Haddow DB, Rimmer S et al. Development of a calcium-chelating hydrogel for treatment of superficial burns and scalds. *Regen Med*. 2010 Jan; 5(1): 55-64.

- 
- 27 Chen J, Han CM, Su GL, Tang ZI et al. Randomized controlled trial of the absorbency of four dressings and their effects on the evaporation of burn wounds. *Chinese Medical Journal* 2007; 120(20): 1788-91.
- 28 Martineau L. Shek PN. Evaluation of a bi-layer wound dressing for burn care I. Cooling and wound healing properties *Burns* 2006; 32(1):70-6.
- 29 Ribeiro MP, Espiga A, Silva D, Baptista Pet al. Development of a new chitosan hydrogel for wound dressing. *Wound Repair and Regeneration* 2009; 17(6): 817-24.
- 30 Homann HH, Rosbach O, Moll W, Vogt PM et al. A liposome hydrogel with polyvinyl-pyrrolidone iodine in the local treatment of partial-thickness burn wounds. *Ann Plast Surg*. 2007 Oct; 59(4): 423-7.
- 31 Dressler DP. Barbee WK. Sprenger R. The effect of Hydron burn wound dressing on burned rat and rabbit ear wound healing. *Journal of Trauma-Injury Infection & Critical Care* 1980; 20(12): 1024-28.
- 32 Jandera V, Hudson DA, de Wet PM, Innes PM et al. Cooling the burn wound: evaluation of different modalities. *Burns* 2000 May; 26(3): 265-70.
- 33 Pei J, Zhao L, X Jiang J. Curative effect of recombinant human granulocyte/macrophage colony-stimulating factor hydro-gel for topical application on animal model of burn. *Chinese Journal of Biologicals* 2008; 21(5): 414-6.
- 34 Kiyozumi T, Kanatani Y, Ishihara M, Saitoh D et al. The effect of chitosan hydrogel containing DMEM/F12 medium on full-thickness skin defects after deep dermal burn. *Burns* 2007; 33(5): 642-8
- 35 Hauser J, Rossbach O, Langer S et al. Local therapy of grade IIa burns: efficacy and tolerability of a new hydrosome wound gel for the local treatment of grade IIa burns as compared with silver sulfadiazine ointment. (article in German) *Unfallchirurg*. 2007 Nov; 110 (11): 988-94.
- 36 Kassian Vlu. Gerasimova LI. Nikolaev AV et al. Use of Regenkur hydrogel in the local treatment of burns. [Russian]. *Klinicheskaja Khirurgija* 1991; 3: 5-7.
- 37 Misterka S. Clinical evaluation of hydrogel dressing materials after an 8 year period of their application. (Polish) *Polimery w Medycynie* 1991; 21(1-2): 23–30.
- 38 Castner T. Monitoring of temperature while cooling burn injuries. *Rettungsdienst* 2000; 1(23): 28-31
- 39 Castner T Cooling out of the bag. *Water Jel Burns Dressings. AGAN Product test. Rettungsdienst*. 2002; 5 (22): 32-5
- 40 Allison K. The UK pre-hospital management of burn patients: current practice and the need for a standard approach. *Burns* 2002 Mar; 28(2): 135-42.
- 41 Ashworth HL, Cubison TC, Gilbert PM, Sim KM. Treatment before transfer: the patient with burns. *Emerg Med J*. 2001 Sep; 18(5):349-51.
- 42 Hudspeth, J. and S. Rayatt, First aid and treatment of minor burns. *BMJ*, 2004. 328(7454): 1487-9.
- 43 Lönnecker S, Schoder V. Hypothermia in patients with burn injuries: Influence of pre-hospital treatment. *Chirurg* 2001; 72: 164-167
- 44 McCormack, R.A., E.R. La Hei, and H.C. Martin, First aid management of minor burns in children: a prospective study of children presenting to the Children's Hospital at Westmead, Sydney. *Med J Aust*, 2003; 178(1): 31-3.
- 45 Carson CF, Hammer KA, Riley TV. Melaleuca alternifolia (Tea Tree) Oil: A Review of Antimicrobial and Other Medicinal Properties. *Clin Microbiol Rev*. 2006 January; 19(1): 50–62.
- 46 Faoagali J, George N, Leditschke JF. Does tea tree oil have a place in the topical treatment of burns? *Burns*. 1997 Jun; 23(4): 349-51.
- 47 Torsova V, Chmelarova E. Evaluation of the effects of a new Water Jel System on Specific Bacterial and Yeasts Strains in Laboratory Conditions 1995. *Burns* 21(1): 47-56.
- 48 Wang Y, Kim S, Lee A, Maitz P and Li Z. Investigation of Tea Tree Oil hydrogel (BurnAid®) cytotoxic effect on skin cells and anti-inflammatory activity. 2011Burns Research Group, ANZAC Research Institute, Concord Repatriation General Hospital, Sydney, NSW, 2139, Australia.
- <sup>49</sup> Smith G. Kenneally J. Development and implementation of Victorian prehospital Clinical Practice Guidelines: the supraventricular tachycardia example. *Australasian Journal of Paramedicine* 2013: Volume 10; Issue 4. Article 4.

- 
- 50 Markenson D, Ferguson J, Chameides L, Cassan P et al. Part 13: First aid: 2010 American Heart Association and American Red Cross International Consensus on First aid Science With Treatment Recommendations.. Thermal Cutaneous Burns: Circulation 2010;122:S586 Available at:  
[http://circ.ahajournals.org/content/122/16\\_suppl\\_2/S582.full.pdf+html](http://circ.ahajournals.org/content/122/16_suppl_2/S582.full.pdf+html)
- 51 Wasiak J, Cleland H, Campbell F. Dressings for superficial and partial thickness burns. Cochrane Database of Systematic Reviews 2008, Issue 4. Art. No.: CD002106.
- 52 Lonnecker S, Schroder V. Hypothermia after burn injury—influence of pre-hospital management. Der Chirurg 2001;72:164–7.
- 53 Adam J. Singer, MD, Breena R. Taira, MD, Henry C. Thode Jr., PhD, Jane E. McCormack, RN, Mark Shapiro, MD, Ani Aydin, MD, and Christopher Lee, MD The Association Between Hypothermia, Pre-hospital Cooling and Mortality in Burn Victims. Academic Emergency Medicine. 2010; 17:456–459
- 54 Ambulance Victoria. Doncaster 2012 Clinical Practice Guidelines CPG A805: Adult Burns. Revised 2012. Available at:  
<http://www.ambulance.vic.gov.au/Paramedics/Qualified-Paramedic-Training/Clinical-Practice-Guidelines.html>
- 55 Saint Johns Ambulance Service (Western Australia) Inc. Perth (2008). Clinical Practice Guidelines for Ambulance Care in Western Australia Guideline 5.15: Burns 2008 August.  
 Available at: <http://www.fair-go.com/docs/Clinical%20Practice%20Guidelines%20V11%2022.07.11.pdf>
- 56 International Federation of Red Cross and Red Crescent Societies. International First aid and resuscitation guidelines 2011. 2 Screens. Accessed Oct 2014. Available from: <http://www.ifrc.org/what-we-do/health/first-aid-saves-lives/>
- 57 St John Ambulance Australia. Home page: <http://stjohn.org.au/>. First aid Facts. English. Burns and Scalds. 3 screens. Accessed Nov 3 2014. Available from:  
[http://stjohn.org.au/assets/uploads/fact%20sheets/english/FS\\_burns.pdf](http://stjohn.org.au/assets/uploads/fact%20sheets/english/FS_burns.pdf)
- 58 British Red Cross. Home page: <http://www.redcross.org.uk/>. What we do. First aid. Everyday First aid. Burns. 3 Screens. Accessed Nov 3 2014. Available from :  
<http://www.redcross.org.uk/What-we-do/First-aid/Everyday-First-aid/Burns>
- 59 US Government Combat Trauma Treatment and Management Handbook Department of the Army Academy of Health Sciences Fort Sam Houston, Texas 91W10 Advanced Individual Training Course 78234. Available from:  
[http://www.medtrng.com/handbook1/Handbook\\_Combat%20Trauma%20Treatment%20and%20Management.pdf](http://www.medtrng.com/handbook1/Handbook_Combat%20Trauma%20Treatment%20and%20Management.pdf)
- 60 UNITED STATES MARINE CORPS Field Medical Training Battalion Camp Lejeune FMST 1402 Manage Burn Casualties FMST Student Manual - 2008 Web Edition  
 Available at:[http://www.operationalmedicine.org/TextbookFiles/FMST\\_20008/FMST\\_1402.htm](http://www.operationalmedicine.org/TextbookFiles/FMST_20008/FMST_1402.htm)
- 61 Van de Velde S, Broos P, Van Bouwelen et al on behalf of the European First aid Manual project by the Belgian Red Cross-Flanders. European Resuscitation Council (2007) European First aid guidelines. Available at: [http://www.researchgate.net/publication/6641654\\_European\\_first\\_aid\\_guidelines](http://www.researchgate.net/publication/6641654_European_first_aid_guidelines)
- 62 British Burn Association. England. (2011). Pre-hospital Approach to burns patient management. Available at: <http://www.nettas.com.tr/burnshield/Pre-hospital%20Approach%20to%20Burns%20Patient%20Management%20Cooling%20British%20Burn%20Association.pdf>
- 63 Australia and New Zealand Burn Association. (2012) Allied Health Care Professionals, Health Care Guidelines Edition 2. Available at: <http://anzba.org.au/care/first-aid/>
- 64 New Zealand Guideline Group (2007). NZGG: Evidence based Guidelines 2007 Management of burns and scalds in primary care. June Available from:  
[http://www.nzgg.org.nz/library\\_resources/63](http://www.nzgg.org.nz/library_resources/63)
- 65 NSW Government Department of Health. NSW State-wide Burn Injury Service (2011). Clinical Practice Guidelines Burn Wound Management. Revised 28/10/2009.  
 Available at: [http://www.health.nsw.gov.au/resources/gmct/burninjury/pdf/Clinical\\_Practice\\_Guidelines\\_281009.pdf](http://www.health.nsw.gov.au/resources/gmct/burninjury/pdf/Clinical_Practice_Guidelines_281009.pdf)
- 66 Victorian Adult Burns Service, Alfred Hospital, Royal Childrens Hospital. Melbourne, Australia. Burns Management Guidelines. 2011 First aid. Available at:  
<http://www.vicburns.org.au/First-aid.html>
- 67 Government of Western Australia. Department of Health. Burns Service of Western Australia (2011) Guidelines for the initial Management of Adult (and Paediatric) Burns. Available at: [http://www.healthnetworks.health.wa.gov.au/docs/burns\\_education\\_booklet.pdf](http://www.healthnetworks.health.wa.gov.au/docs/burns_education_booklet.pdf)
- 68 Australian Resus. Council. (2008) Burns. Available at: [http://www.resus.org.au/policy/guidelines/section\\_9/burns.htm](http://www.resus.org.au/policy/guidelines/section_9/burns.htm)

- 
- 69 Markenson D, Ferguson JD, Chameides L, Cassan P et al. American Heart Association and American Red Cross Guidelines for First aid. International Consensus on First aid Science with Treatment Recommendations Part 13: First aid. Circulation. 2010; 122:S934-46 Available from:  
[http://circ.ahajournals.org/content/122/16\\_suppl\\_2/S582.full.pdf+html](http://circ.ahajournals.org/content/122/16_suppl_2/S582.full.pdf+html)
- 70 Royal Adelaide Hospital Burns Service. Adelaide (2010). Practice guidelines/ Burns. First aid/Appendix K  
 Available at: <http://www.rah.sa.gov.au/burns/downloads/2009-Practice-guidelines.pdf>
- 71 Westmead Childrens Hospital Sydney (2012). Fact Sheets. First aid. Available at: <http://kidshealth.chw.edu.au/fact-sheets/burns-and-scalds-burn-care-advice>
- 72 Royal Children's Hospital. Melbourne (2012) Clinical Practice Guidelines Burns First aid and Pain Relief.  
 Available at: [http://www.rch.org.au/clinicalguide/cpg.cfm?doc\\_id=5158#first\\_aid](http://www.rch.org.au/clinicalguide/cpg.cfm?doc_id=5158#first_aid)
- 73 Prince of Wales Hospital Hong Kong (2009) Acute Burns Unit Protocol. The Hong Kong Medical Diary 2007 Dec;12(12):  
 21-5. Available at: <http://www.fmsk.org/database/articles/03mb6.pdf>
- 74 Womens and Childrens Hospital Adelaide (2010) Burns Unit. Guidelines for the Management of Paediatric Burns. Available at:  
[http://www.wch.sa.gov.au/services/az/divisions/psurg/burns/documents/burns\\_guidelines.pdf](http://www.wch.sa.gov.au/services/az/divisions/psurg/burns/documents/burns_guidelines.pdf)
- 75 Queensland Ambulance Service Brisbane (2011) QAS Clinical Practice Guidelines. Trauma Emergencies. CPG 2.10.04: Burns. Version 1 Updated 07-04-11. Available at:  
<https://ambulance.qld.gov.au/clinical.html>
- 76 ACT Ambulance Service. (2010) Clinical Management Manual - Pocket Edition. Clinical Management Guideline CMG 21 (Accessed Jan 2010) Version 4.2 Revised.  
 Available at: <http://esa.act.gov.au/actas/about-us/clinical-management-guidelines/>
- 77 Saint Johns Ambulance Service (Western Australia) Inc. Perth (2008). Clinical Practice Guidelines for Ambulance Care in Western Australia Guideline 5.15: Burns 2008  
 August. Available at: <http://www.fair-go.com/docs/Clinical%20Practice%20Guidelines%20V11%202022.07.11.pdf>
- 78 Ambulance Service of NSW. (2011) Clinical Practice Guidelines. 2011 protocol T12: Burns. 2009 July 29, Revised Jan 2011. (Unpublished Document. PDF Copy available  
 from the author)
- 79 South Australian Ambulance Service (2010). Clinical Practice Protocols Burns. CPP CPP-CS-008 30-06-10. (Unpublished Document. PDF Copy available from the author)
- 80 Pre-hospital Emergency Care Council. Ireland. (2012) Clinical Practice Guidelines for Pre-Hospital emergency Care. Section 6: Trauma/Burns. 2/3.6.4 Version 2, 10/2011  
 Available at: <http://www.phccit.ie/Images/PHECC/Clinical%20Practice%20Guidelines/2012%20Edition%20CPGs/Responder%20CPG%202012%20Version.pdf>
- 81 Joint Royal College Ambulance Liaison Committee. London (2006) Guidelines. JRCALC Guidelines 2006. Available at:  
<http://www2.warwick.ac.uk/fac/med/research/hsri/emergencycare/prehospitalcare/jrcalcstakeholderwebsite/guidelines>
- 82 Alberta Health Services. Provincial Medical Control Protocols Adult and Pediatric Last Updated: 2001 June 21  
 Available at: <https://www.ahsems.com/public/AHS/protocols/index.html#set/12/browse/2890/view/24626/Algorithm>
- 83 Nova Scotia. Department of Health and Wellness EHS/ Paramedics/ Evidence Based Protocols Last Updated 2006 Nov 3 Available at:  
<http://novascotia.ca/dhw/ehs/documents/CPG/EHS6340.02%20Burns.pdf>  
 Evidence Summary available from: [https://emspep.cdha.nshealth.ca/LOE.aspx?VProtStr=Burns \(fire/flare\) &VProtID=127](https://emspep.cdha.nshealth.ca/LOE.aspx?VProtStr=Burns (fire/flare) &VProtID=127)
- 84 Ontario. Ministry of Health and Long Term care. (2007) Basic Life Support Patient Care Standards. Environmental Related Disorders. Burns 4-4. Last Updated 2011 Jan  
 20 Available at: [http://www.health.gov.on.ca/english/public/program/ehs/edu/pdf/bls\\_patient.pdf](http://www.health.gov.on.ca/english/public/program/ehs/edu/pdf/bls_patient.pdf)
- 85 Manitoba. Department of Health. EMS Emergency Treatment Guidelines and Protocols; Trauma: T10 Burns 2006 May20] Available at:  
<http://www.gov.mb.ca/health/ems/guidelines/docs/T10.05.06.pdf>
- 86 Saskatchewan College of Paramedics Member resources.(2014) Paramedic Clinical Practice Protocols. Manual V 2.0. Sep 13, 2014. Available at:.  
<http://www.collegeofparamedics.sk.ca/docs/resources/Protocol%20Manual%20v2.0.pdf>

---

87 Montana Department of Labor and Industry. (2014) ECP Statewide Protocols Available at:

[http://bsd.dli.mt.gov/license/bsd\\_boards/med\\_board/pdf/emt\\_protocols.pdf](http://bsd.dli.mt.gov/license/bsd_boards/med_board/pdf/emt_protocols.pdf)

88 Alabama. Department of Public Health (2013) Alabama EMS Patient Care protocols. Seventh Edition. (Accessed Oct 2013) Available at:

<http://www.adph.org/ems/assets/7thEditionProtocols120513.pdf>

89 North Carolina. Division of Health Service Regulation. Office of Emergency Medical Services (2009) Treatment protocols Available at: [http://www.ncems.org/pdf/Pro50-](http://www.ncems.org/pdf/Pro50-Burns-Thermal.pdf)

Burns-Thermal.pdf

90 Massachusetts. Executive Office of Health and Human Services (2011) Emergency Medical Services Pre-hospital Treatment Protocols Ninth Edition 9.0.2 Updated 2011

Jan 4 Protocol 50. Available at: <http://www.mass.gov/eohhs/docs/dph/emergency-services/treatment-protocols-902.pdf>

91 New York State. Department of Health.(2008) New York State EMT/AEMT BLS Protocols T4 Burns

Available at: [http://www.health.ny.gov/professionals/ems/pdf/2008-11-19\\_bls\\_protocols](http://www.health.ny.gov/professionals/ems/pdf/2008-11-19_bls_protocols)

92 Pennsylvania. Department of Health. (2013) EMS State-wide Protocols July 1, 2013 671. Burns. Available at:

[http://www.portal.health.state.pa.us/portal/server.pt/community/emergency\\_medical\\_services/14138/ems\\_statewide\\_protocols/625966](http://www.portal.health.state.pa.us/portal/server.pt/community/emergency_medical_services/14138/ems_statewide_protocols/625966)

93 Connecticut. Department of Public Health (2011) Connecticut State BLS Guidelines Available at: <http://www.ctemscouncils.org/downloads/bls%20procedures.pdf>

94 State of Alaska. Alaska Department of Health and Social Services <http://www.alaska.gov/> Division of Public Health. Emergency Medical Services. Emergency Medical

Services Unit Downloads Trauma Guidelines Updated 2007 Jan 4 screens [Cited: 2011 October ] Available from:

<http://www.ems.alaska.gov/EMS/downloads/treatment.htm>

95 Greater Broward EMS Medical Directors Association. (2014) Florida Regional Common EMS Protocols 4th Edition, Version 1, May 19, 2014 Available at:

<http://www.gbemda.org/florida-regional-common-ems-protocols.pdf>

96 Nebraska Department of Health and Human Services. Emergency Medical Services. Model Protocols Available at:

<http://www.hhs.state.ne.us/crl/rcs/ems/protocols.pdf>

97 Maine Government. Department of Public Safety (2008) Emergency Medical Services Laws Rules and Protocols 2008 Maine EMS Treatment Protocols. Updated 2008

July 1 Available at: <http://www.maine.gov/dps/ems/legal.html>