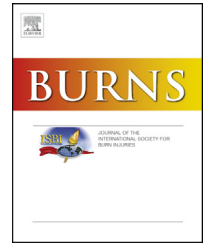


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## Early management in children with burns: Cooling, wound care and pain management<sup>☆</sup>

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### ABSTRACT

**Introduction:** Early management in burns, i.e. prior to admission in a burn center, is essential for an optimal process and outcome of burn care. Several publications have reported suboptimal early management, including low levels of pain medication after trauma, especially in children.

The aim of this study was to evaluate the current practice in the Netherlands and factors related to early management in pediatric burns, i.e. cooling, wound covering and pain management. To study possible change and improvement over time, two study periods were compared.

**Methods:** This study involved two periods; January 2002–March 2004 (period 1) and January 2007–August 2008 (period 2). All children (0–15 years of age) with acute burns admitted within 24 h after burn to one of the three Dutch Burn centers with a formal referral were eligible. Data were obtained from patient records, both retrospectively and prospectively.

**Results:** A total of 323 and 299 children were included in periods 1 and 2, respectively. The vast majority of children in both study periods had been cooled before admission (>90%). Over time, wound covering increased significantly (from 64% to 89%) as well as pain treatment (from 68% to 79%). Predominantly paracetamol and morphine were used. Referral from ambulance services (OR = 41.4, 95%CI = 16.6–103.0) or general practitioners (OR = 59.7, 95%CI = 25.1–141.8) were strong independent predictors for not receiving pre-burn center pain medication. On the other hand, flame burns (OR = 0.2, 95%CI = 0.1–0.5) and more extensive burns (TBSA 5–10%: OR = 0.4, 95%CI = –0.2 to 0.8; TBSA ≥ 10%: OR = 0.2, 95%CI = 0.1–0.4) were independent predictors of receiving pain medication.

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**Conclusion:** Referring physicians of children with burns were overall well informed: they cool the wound after burns and cover it before transport to prevent hypothermia and reduce the pain. Additional studies should be conducted to clarify the duration and temperature for cooling to be effective. Furthermore, there is room and a need for improvement regarding early pain management.

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## 1. Introduction

Each year approximately 240 children with burns are admitted to the three burn centers in the Netherlands which is 40% of all admissions [1]. Even in a relatively small country like the Netherlands, the first critical hours are often spent at the referring hospital, before transport to a specialized burn center. Adequate emergency management is crucial in all (burn) injuries.

Cooling is one of the best known first aid measures in burn [2–4]. It is thought to eliminate heat, to prevent edema and further tissue damage, and to decrease pain [4,5]. After adequate cooling the wound must be covered to protect the wound and prevent hypothermia, especially in children with severe burns. Ointments are advised against to ensure that experts can easily assess the wound at a later stage. Furthermore, pain treatment is important because burns can be very painful. Several types of nociceptors directly stimulate pain during burning, whereas pain following the injury is due to sensitization of the nociceptive pathways in the peripheral and central nervous systems [6]. As lack of adequate early pain management may influence pain perception later on in life [7,8] pain management should be started as soon as possible.

There are continuous programs to educate the general public on the prevention of burns and first aid in several countries. Furthermore, health care professionals are being educated in emergency management of patients with burns, in our country with ATLS, APLS and Emergency Management Severe Burns courses. Despite these efforts, we feel that emergency burn care is still open to improvement. To help identify areas for improvement, in line with our earlier study [9], we evaluated the current national practice on the early management of pediatric burns, i.e. cooling, wound covering and pain management. To study possible improvements over time, two study periods were compared.

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## 2. Methods

This study involved the periods from January 2002 until March 2004 (27 months) and from January 2007 until August 2008 (20 months). All children (0–15 years of age) with acute burns admitted within 24 h of injury, referred to one of three Dutch burn centers were eligible. Data on the first period were obtained from patient records retrospectively. In the second period, data on children aged 0–4 years were collected prospectively; those of children aged 5–15 years were obtained retrospectively. Data included socio-demographic

and burn-related characteristics (Table 1). In addition, data on cooling of the wounds at the accident site and cooling agent were collected. Wound care, i.e. the presence of wound covering before transfer to the burn centers, and the administration of any pharmacological analgesic treatment was documented, including route of administration, dosage, and type of drug. Based on the Pediatric formulary [10] adequate pain management: for paracetamol was considered, an initial rectal dose of 40 mg/kg; for morphine, an initial intravenous dose of 0.05–0.1 mg/kg or an initial rectal dose of 0.2 mg/kg.

The study was approved by the local Medical Ethics Committees.

### 2.1. Statistics

Differences between children and their treatment from both study periods were tested using the Chi-square test and the Mann–Whitney *U* test. Stepwise forward logistic analysis served to analyze factors related to suboptimal management. In the first step ‘study period’ was entered; in the second step possible factors were included: gender, age (0–11, 12–23, ≥24 months), body mass (<10, 10–15, ≥15 kg), total body surface area (TBSA, <5%, 5–10%, ≥10%), etiology (scald, flame, other). Because age and body mass were strongly related, only the factor most strongly related to the outcome was included in logistic analysis: age (cooling) or body mass (wound care, pain management). Analyses were conducted with SPSS PASW 18.0.

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## 3. Results

A total of 355 and 326 children were admitted to Dutch burn centers in study period 1 (2002–2004) and 2 (2007–2008), respectively. Thirty-two children (8.7%) in period 1 and 27 (8.3%) in period 2 were (re)admitted without formal referral, and were therefore excluded from analyses. Characteristics of referred children from both periods were comparable except for etiology (fewer fat burns in period 2;  $p < 0.01$ ) and burn size (smaller in period 2;  $p = 0.01$ ) (Table 1). In both periods, around two-thirds of children were referred by general hospitals.

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## 4. Cooling

The vast majority of patients had been cooled prior to arrival in the burn center (Table 2). There were no significant differences in cooling prevalence between referrers. In addition, there were no differences in the prevalence of cooling over time,

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