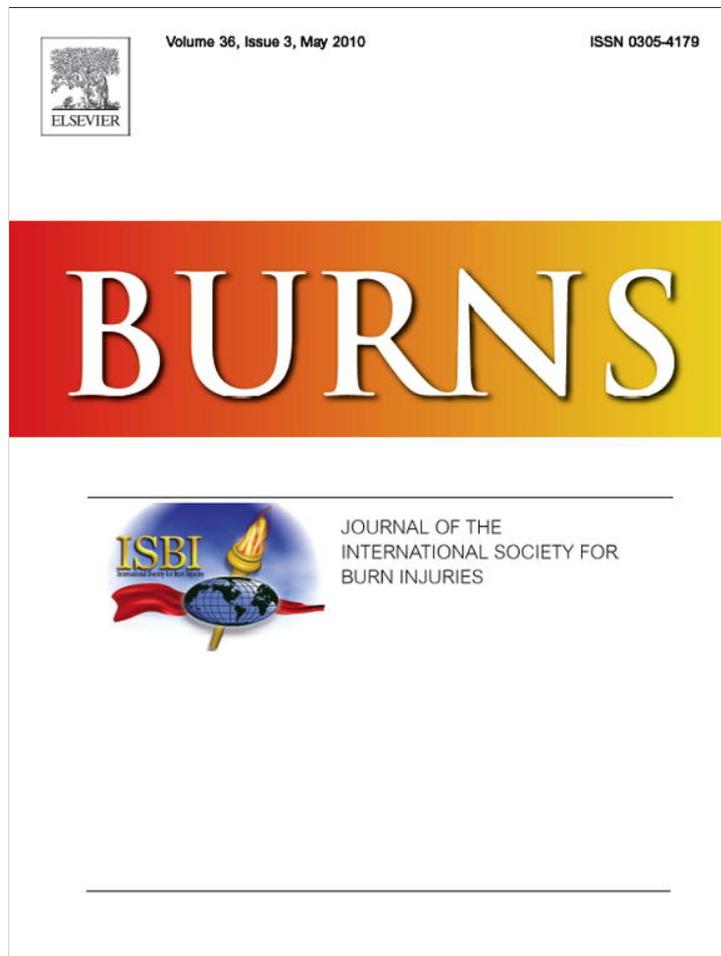


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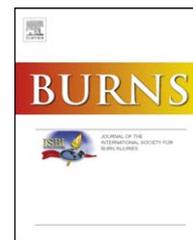


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## Case report

# Water jet for early treatment of chemical burn

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## 1. Introduction

The first necessity in the initial management of burn to remove from the wound the agent of burn and also any contaminants, clothes or foreign bodies. This is particularly important in chemical burns, because the agent may penetrate deeply into the skin and cause ongoing tissue destruction unless it is immediately and completely removed by washing or irrigation using saline or water.

It is well known that irrigation with water is the most effective way both to neutralise and to remove chemical agents; however, some compounds may penetrate the epidermis and may remain after irrigation, so that tissue damage progresses.

Complete removal of necrotic skin and tissue as soon as possible is the next step in burn treatment. This accelerates wound healing with or without dermal substitutes, particularly in superficial injuries. Debridement ideally removes all necrotic tissue in a single procedure, leaving behind viable undamaged tissue. This improves the quality of healing in first- and second-degree burns, and minimises the need for further wound revisions.

The water jet system, based on fluid jet technology, has been advocated as an alternative to standard surgical excisional techniques for burn. The water jet is capable of adequately debriding superficial and partial-thickness wounds [1–4]. In this article we report on the use of water jet hydrosurgery in the early treatment of a hydrochloric acid burn.

## 2. Case report

A 42-year-old man was burned by accidentally spilled hydrochloric acid. He immediately washed the wound with water and, in the emergency clinic, the burned area was irrigated with saline to remove the chemical agent. On examination in our clinic, his left forearm was found to be extensively if superficially injured, causing a burning sensation, pain and swelling (Fig. 1).

Approximately 6 h after the accident, the man underwent an operation using a water jet hydrosurgery system known as Versajet™ (Smith & Nephew, Memphis, TN, USA) to remove all remaining hydrochloric acid from the skin and to debride necrotic tissues. Under aseptic conditions in the operating theatre, after cleansing and sterile draping, debridement of the burned forearm was performed using a standard hand-piece with a 45°-angled tip and a 14 mm working window, at setting 4. The end point of the debridement was bleeding, following removal of devitalised tissue while maintaining the deeper dermis and adnexa. The fatty tissue was not exposed (Fig. 2). The wound was meticulously dressed with conventional vaseline gauze and was examined at the daily dressing change for 2 weeks, to detect any changes that might necessitate additional intervention.

The wound healed uneventfully and was re-epithelialised completely 19 days from injury without further treatment. No complications were observed during follow-up (Fig. 3).

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**Fig. 1 – Left forearm burn due to spilt hydrochloric acid, appearing superficial approximately 4 h after the incident.**



**Fig. 2 – Appearance of the wound immediately after water jet surgery. Debridement is complete, the wound is clean and tissues vital to healing are preserved.**

### 3. Discussion

Recently the water jet system has been advocated as a new surgical tool for burn treatment. On lower settings, the jet can be used to debride necrotic epidermis and dermis while preserving viable tissues [2–5], and very effectively to clean the wound. This allows the surgeon to remove loose epidermal elements, applied creams and slough which may give a false impression of a deeper wound [2,4,6]. Furthermore, the jet can help debride at the edges of a burn and in areas such as the face, groin creases, axillae, hands and feet, where excision of necrosis is very difficult using conventional tangential methods with a hand-held dermatome such as Watson knife. The water jet system on higher settings can also be an adjunct to conventional tangential excision methods for the elevation of hard eschar [2,4,6,7].

This system, in which a high-pressure stream of saline is directed parallel to the working plane, creates a vacuum which evacuates debris, contaminants and tissue from the wound into its receptacle. Thus it is capable of cleansing the wound deeply while also achieving debridement. The adjustable



**Fig. 3 – Appearance of the burn 1 month later, showing uneventful healing without any need for skin graft.**

power settings allow precise and controlled debridement of the surgical planes of skin while preserving dermis, adnexa and tissue vital for re-epithelialisation [2,6–9]. The most important benefits of the system may be tissue preservation with selectivity in removal, particularly in cases of first- and second-degree burn, leading to precise, rapid and clean debridement. In the present case, all of these features of the system helped us clean the agent completely from the wound and debride the whole necrotic area sufficiently 6 h after the accident, resulting in uneventful healing without further surgical intervention.

Chemical burns tend to progress deeper into the skin as long as exposure to or contamination with the agent continues, causing coagulative necrosis. The severity of injury is determined by the composition and concentration of and duration of contact with the agent, which should therefore be removed as totally and as soon as possible. The initial management of all chemical burns, irrespective of the agent involved, consists of removal of all contaminated clothing and thorough irrigation of the wound, which is often best achieved by showering the casualty or by washing copiously with pressured water [10]. However, these procedures may leave in the skin small quantities of the agent which are capable of slowly deepening the burn.

Such progressive necrosis in cases of chemical burn is not rare. Early debridement using the water jet system may preserve healthy tissue while cleansing deeply, eliminating the chemical agent completely and removing all non-viable tissue, thus averting continued destruction.

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