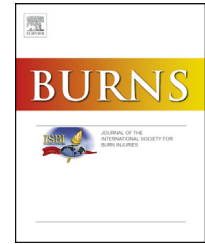


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Long term sensory function after minor partial thickness burn: A pilot study to determine if recovery is complete or incomplete

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ARTICLE INFO

Article history:

Accepted 25 March 2014

Keywords:

Burns

Scar

Sensory function

Outcomes

Semmes Weinstein filaments

von Frey filament

Two-point discrimination

Vancouver scar scale

ABSTRACT

Background: Acute burn damages skin architecture, including nerve endings, altering sensation and influencing recovery of quality of life and participation. It is established that sensation is reduced in scars after deep burn. However, it is unclear if sensory deficits exist in mild scars. The aim of this trial was to determine if sensory deficits persist in mature scars after minor partial thickness burn.

Methods: This observational pilot involved 30 patients with ‘good quality’ scars (defined as VSS ≤ 5 at ≥ 6 months post-burn). Sensory function was compared in scars and site matched uninjured skin using von Frey filaments and two-point discrimination (2-PD). Multivariable regression was used to predict the influence of burn and confounders on sensory outcomes.

Results: Both pressure and 2-PD distance were significantly greater in scar compared to uninjured sites, indicating reduced sensory function. For von Frey filaments, the median was 3.84 (IQR = 1) in scars and 3.22 (IQR = 1) for uninjured ($p = 0.001$). For 2-PD, the median was 3.9 cm (IQR = 1.8) for scars and 2.6 cm (IQR = 1.6) for control sites ($p = 0.001$).

Conclusion: Measureable sensory deficits persist in mature, good quality burn scars. These deficits may influence long-term recovery after minor partial thickness burn.

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1. Background

The majority of burns are considered mild to moderate in terms of their extent and depth. It is understood that rapid epithelialization is essential to minimize long term aggressive scarring

and associated neural end organ disruption. However, despite efforts to diminish the impact of the injury and long-term scarring, sensory disturbances are often reported by the patients and the underlying cause of these deficits is unclear.

Sensory function of the skin has a protective role and is a component of skin function integral to participation,

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<http://dx.doi.org/10.1016/j.burns.2014.03.019>

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interpersonal relationships and quality of life [1]. Post-burn, abnormal and painful cutaneous sensibility is a common long-term sequelae and the severity of the sensory deficit is related theoretically to the depth of burn and consequent surgical interventions used to assist wound closure [2-4].

Current theory suggests that the sensibility deficits from burns are permanent [2]. Holavanahalli et al. revealed that there was a decreased sensitivity to pinprick which persisted more than 3 years post-injury in patients with severe, large area burns [5]. Zocchi et al. compared skin grafted areas and in those that were assessed to have better sensory return, a larger number of 'regenerated nerve endings' were present on biopsy [6].

Recent studies by our group inferred that there may be systemic changes which effect neural regeneration after to burn with nerve ending density post-burn being similar in matched normal skin and scar sites [7-9]. Despite similar nerve densities, the sensory function of burn sites was reduced compared to the uninjured site [8,9]. Animal model studies in this series demonstrated that burn and matched uninjured sites had reduced nerve ending densities compared to pre-burn [10]. The question remains as to whether the quality of the function of nerves between burned and uninjured sites in humans is related to burn depth as sensory function was shown to be significantly different between the sites [8].

Studies to date have not demonstrated clearly if the quality of the scar is related to the sensory outcome. There is a paucity of studies looking at minor, superficial burns and the persistence of sensory deficits. A previous study suggested that sensory deficits were related to severity of burn but this link was not explored further [3]. Our group demonstrated significant long term loss of sensory integrity associated with visible post burn scarring [8]. It is not clear if this is related to the thickness and bulk of the scar 'dampening' or 'baffling' sensory feedback or related to the changes seen in the peripheral nerve field. Thus, the aim of this study was to examine if sensory function is affected in 'good quality' burn

scars or those with minimal or no change to skin pliability in addition to a low scar rating according to the Vancouver Scar Scale (VSS).

2. Methods

2.1. Study design

This research was a pilot study conducted as a prospective observational cohort study (audit).

Patients were recruited, in a sample of convenience, from the Royal Perth Hospital (RPH) Burns Center. They were assessed in the outpatient (ambulatory) review clinics.

Patients were included if they were 6-12 months post-burn; had a burn on one side of the body with available contralateral, unaffected skin as a comparable site; and, the scar was defined as 'good quality' when assessed to have near normal or equivalent to uninjured skin pliability and a score ≤ 5 according to the modified VSS applied as per the RPH protocol (Fig. 1) [11]. Scars registered a score primarily on the pigment sub-scale.

Patients were excluded if they had a known neurological condition that can affect sensation, such as diabetic neuropathy, peripheral vascular disease or spina-bifida; if their scar was assessed to have a mVSS score ≥ 6 or they had burns on the face, in the midline, or pubic/pelvis regions.

The study had been approved by the University of Western Australia and the audit was registered by the RPH Clinical Safety and Quality Unit (CSQU # 080429-1), a sub-committee of the Human Research Ethics Committee.

2.2. Selection and preparation of examination sites

The mVSS assessment was undertaken by the clinical team to identify patients appropriate for recruitment and confirmed by the trained investigators. If multiple scars which fit the inclusion criteria were present, then the most 'convenient' site



Fig. 1 - Example of a 'good quality' scar on the wrist.

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