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Review

Time to start putting down the knife: A systematic review of burns excision tools of randomised and non-randomised trials

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Highlights

- Dermal preservation in burn excision is key to obtaining superior scar outcomes.
- Level 1 Evidence comparing excision modalities is sparse, only 3 RCTs. (n = 7148).
- Versajet™ and NexoBrid™, consistently show decreased need for excision.
- All current evidence supports a move away from the knife toward novel techniques.

Abstract

Aims

Dermal preservation during acute burn excision is key to obtaining superior healing/scar outcomes, however, determining the most appropriate excision tool is an ongoing challenge. Novel tool development means the knife is no longer our only option, yet for the majority it remains the gold standard. This systematic review aims to evaluate evidence for burns excision approaches (knife/hydrosurgery/enzymatic).

Methods

CENTRAL, EMBASE, MEDLINE (1946–2017) were searched with MeSH terms: 'debridement', 'burns', 'sharp', 'enzymatic', 'hydrosurgery'. Relevant randomised control trials (RCTs) non-randomised controlled case series/trials were extracted/analysed. In vitro/burn non-specific studies were excluded. Main methodological parameters were intervention/excision efficacy.

Results

Eighteen articles met inclusion criteria (n = 7148): three were RCTs, involving comparator enzymatic (NexoBrid™ (EDNX)) or hydrosurgical (Versajet™) excision to surgical Standard of Care. Both showed statistically significant decreased need for excisional excision and auto-grafting by viable tissue preservation allowing spontaneous healing by epithelialisation.

Conclusion

Level 1 Evidence comparing excision modalities for acute burns is sparse. Although early excision with a knife is still often considered best practice, there is no tool choice consensus or robust comparison with alternate, possibly superior, tools. EDNX or Versajet™ should be considered alternatively. Further RCTs are indicated, with regards final scar outcomes and to allow consensus within current evidence.

Introduction

There are no current gold standards for the choice of tool used in acute burn wound excision. It is generally accepted that the method of burn wound excision and overall approach will vary depending on the receiving burn department's clinical decision preference and available resources. The UK's National Burn Care Standards from 2013 advocate improving patient safety, experience and outcome at all times [1]. With the knowledge that an evidence-based approach will facilitate improved quality and safety, long-standing techniques should continually be re-evaluated and compared to newer strategies [2].

Burns surgeons therefore have a duty to ensure that techniques and tools of burn wound excision have an appropriate evidence basis behind them and to work together to achieve better outcomes, not only in terms of survival but importantly in terms of quality of life, scarring, function, psychology and cosmesis.

For the purposes of this paper, the term 'debridement' covers other similar terms including escharectomy or eschar removal or burn wound excision. Burn excision is the most consistently needed operative intervention in the burn patient pathway. In the majority of burns services across the globe, standard of care (SOC) remains sharp excision with a knife (i.e. Watson;Humby;Goulian), utilising the technique of tangential excision (as per Janzekovic [3]). It has been stated that "every intervention from the point of injury influences the scar even for life" Anna Wood [4]. Also, recent studies have also shown that dermal preservation will positively influence the final scar outcome [5]. With the evolution of burn wound excision techniques and tools, particularly those involving enzymatic debridement (NexoBrid™ (EDNX)) or hydrosurgery (Versajet™), the knife is no longer our only option. In 2006 Granick et al. [6] published an article identifying the need for consensus in wound bed preparation between burns surgeons – a task that we have yet to complete.

We present a full systematic review of the available literature from 1946 to 2017 to establish the evidence behind the full spectrum of burn wound debridement tools, and pose the question 'is it time to start putting down the knife'?

Section snippets

Background: history of the evolution of excision techniques and need for consensus

There is documented evidence from ancient times supporting burn debridement. In Paris, Ambroise Paré, 400 years ahead of his time (1510–1590 AD), was one of the first to describe early burn wound excision [7]. In 1607, the 'father of German surgery' Wilhelm Fabry (1560–1634 AD) revisited the idea stating that for deep burns, blisters should be de-roofed and burn escare should be removed as close to unburnt tissue as possible, early (day 1 or 2) before inflammation sets in. He is credited with ...

Methods and materials

A search was performed combining MeSH terms 'debridement', 'randomised controlled trial (RCT)', 'burns', 'excision', 'sharp', 'enzymatic', 'NexoBrid', 'chemical', 'hydrosurgery', 'Versajet', 'laser' in key databases and search engines including: EMBASE (via OVID 1974–2016), Medline (via Pubmed 1946–2016), CENTRAL (via Cochrane Library), and CINAHL, as well as clinical trial registries (ClinicalTrials.gov; WHO International Clinical Trials Registry Platform; and, UK Clinical Research Network Study ...

Identification of relevant studies

The search strategy yielded a total of 7148 records after de-duplication (11,201 references were initially retrieved). Applying the pre-determined inclusion and exclusion criteria resulted in a total of eighteen articles that met the study inclusion criteria. Studies which used either a combination of dressing and debriding agent or which were not relevant to current practice (e.g. those looking at maggot or larvae therapy) were not included (of note there were no RCTs looking at these compared ...

Discussion

The goal of this systematic review was to evaluate the evidence behind tools available for acute burn wound excision according to the published literature. The broad search filter, enabled retrieval of only eighteen studies suitable for inclusion of which three were properly designed prospective RCTs. Those RCTs that met our inclusion criteria had dissimilar selection criteria, study protocols and compared different modalities with SOC. None, to-date, have looked at the same debridement ...

Summary and conclusion

Despite the lack of evidence basis supporting the generally accepted SOC with the knife as the most effective method of burn excision, this remains the gold standard in the majority of burns facilities worldwide. The lack of scientific and clinical evidence that is available from this review demonstrates, however, that the knife may no longer always offer the optimum outcome, in terms of limb salvage, life preservation, functional outcomes or cosmesis for our patients. Our search strategy had a ...

Conflicts of interest

None. ...

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Acknowledgement

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A novel rapid and selective enzymatic debridement agent for burn wound management: A multi-center RCT
Burns (2014)

E.J. Hyland et al.
Prospective, randomised controlled trial comparing Versajet™ hydrosurgery and conventional debridement of partial thickness paediatric burns
Burns (2015)

T. Annibaletti et al.
The use of Versajet hydrosurgery: 5 years experience
Burns (2011)

A. Schulz et al.
Enzymatic debridement of deeply burned faces: healing and early scarring based on tissue preservation compared to traditional surgical debridement
Burns (2017)

C. Özcan et al.
Enzymatic debridement of burn wound with collagenase in children with partial-thickness burns
Burns (2002)

A. Arno et al.
Extracorporeal shock waves, a new non-surgical method to treat severe burns
Burns (2010)

F. Dutrelle et al.
Management of 2nd-degree facial burns using the Versajet hydrosurgery system and xenograft: a prospective evaluation of 20 cases
Burns (2012)

L. Rosenberg et al.
Safety and efficacy of a proteolytic enzyme for enzymatic burn debridement: a preliminary report
Burns (2004)

H.O. Rennekampff et al.
Debridement of burn wounds with a water jet surgical tool
Burns (2006)

T.C.S. Cubison et al.
Dermal preservation using the Versajet hydrosurgery system for debridement of paediatric burns
Burns (2006)

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Safety of enzymatic debridement in extensive burns larger than 15% total body surface area
2021, Burns
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Italian recommendations on enzymatic debridement in burn surgery
2021, Burns
Citation Excerpt :
...Nonetheless, surgical debridement often results in significant blood and heat loss, and it is hindered by poor selectivity, which means both viable and necrotic tissue may be excised [1–5]. To try and overcome these limitations, several alternative techniques for eschar removal have been developed over the years, including hydro-surgery and enzymatic debridement [2–5]. None has currently become standard of care. ...
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Indeterminate-Depth Burn Injury—Exploring the Uncertainty
2020, Journal of Surgical Research
Citation Excerpt :
...This technique has been used for hundreds of years.50 Acids, enzymes of plant origin, and proteolytic enzymes of bacterial origin have been reported in the literature.50 Here we present two examples of current enzymatic treatments that are in use today. ...
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A systematic review on surgical and nonsurgical debridement techniques of burn wounds
2019, Journal of Plastic, Reconstructive and Aesthetic Surgery
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Bromelain-based enzymatic burn debridement: A systematic review of clinical studies on patient safety, efficacy and long-term outcomes
2023, International Wound Journal

Enzymatic debridement: past, present, and future
2022, Acta Chirurgica Belgica

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