

## FROM THE EDITOR

As the Editor I am delighted to have looked after the journal at a time of unprecedented interest in it- the number of submissions has increased approximately four fold since 2005 and the number of articles published has doubled in the same period. This implies that we have been able to be more selective about what we publish and this is reflected in the increasing quality of the Journal's content. I would urge readers to continue to submit their work to the Journal so this can continue. On the back of this renaissance, it allows the Editorial Board to begin to shape how the journal might look in the future and how it might respond better to the needs of its readership. To this end there is a survey available via the journal website which offers the readers a chance to transmit your opinions - good and bad - about the journal and the job it is doing directly to the editorial board. This is your chance to shape the future direction of your journal and I would urge you to complete it.

I would draw all potential authors attention to the new Instructions for Authors which are printed in the back of this edition as well as being available on the website. There is nothing particularly new in them but areas to which special attention must be paid have been highlighted and guidance in some areas has been made clearer. Finally, the website is about to undergo renovation which will include the increased availability of back editions dating back to the inception of Medline in 1966 which will all be freely available and with Free Links from the Medline site. Please be patient whilst the site is out of commission.

Lt Col Jeff Garner  
Editor *J R Army Med Corps*

## EDITORIAL

# Historical Origins and Current Concepts of Wound Debridement

HC Guthrie<sup>1</sup>, JC Clasper<sup>2</sup>

<sup>1</sup>Trauma and Orthopaedic Specialty Training Registrar, South-West Thames Rotation, London Deanery. <sup>2</sup>Defence Professor Trauma and Orthopaedics, Academic Department of Military Surgery and Trauma, Royal Centre for Defence Medicine, Birmingham; Consultant Trauma and Orthopaedic Surgeon, MDHU Frimley Park.

### Abstract

**In the late 18<sup>th</sup> Century wound debridement consisted of incision of skin and deep fascia to release the swelling associated with ballistic injury, however extremity war wounds were more usually managed non-operatively or by amputation. During the First World War debridement was redefined to include excision of all non-viable and foreign material. In the modern era it has been proposed that wounds contain a zone of injured tissue which is not obviously non-viable at the initial debridement. Debridement which preserves this tissue has been described as marginal debridement. Wounds sustained in close proximity to explosions have an extensive zone of injury. Preservation of traumatised tissue may be beneficial in terms of limb salvage and limb reconstruction. Equally the complexity and contamination of these wounds, as well as the physiological frailty of the casualty, may make complete debridement in one sitting an unachievable goal. Where traumatised tissue has been left during debridement it must be reassessed at around 48 hours in order to reduce the risk of infection. Evacuation timelines and logistic infrastructure currently support serial marginal debridement but in future conflicts this may not be the case.**

### Introduction

A set of recommendations for the initial debridement of extremity war wounds have recently been assembled and are published in this edition of the Journal of the Royal Army Medical Corps [1]. The severity and complexity of wounds sustained in close proximity to explosive devices is frequently matched by the overall burden of injury and physiological frailty of those injured

in this way. That many of these casualties are surviving to reach higher echelons of medical care at all is testament to the high quality pre-hospital care casualties receive from their colleagues, team medics, combat medical technicians, paramedics and medical officers. This editorial briefly examines the history of war wound debridement and introduces the contemporary concepts of wound anatomy and debridement that inform the current recommendations.

**Corresponding Author: Colonel JC Clasper L/RAMC, Defence Professor Trauma and Orthopaedics, Frimley Park Hospital, Portsmouth Road, Camberley, Surrey GU16 7UJ. Tel: 01276 526447 Fax: 01276 604457 Email: jonclasper@aol.co.uk**

### History of debridement

In the late 18<sup>th</sup> century the term '*débridement*' was used by French surgeons such as Desault, LeDran, Percy and Dupuytren to

describe the treatment required to prevent the 'étrangement' of swollen soft tissues within their enclosing fascia following injury. Unbridling involved incision of the skin and deep fascia and at this time was not accompanied by excision of devitalised tissue and foreign material. In this context débridement was essentially a treatment for what we now recognise as compartment syndrome and treat by fasciotomy [2].

In fact extremity wounds sustained during the conflicts of that era were either managed non-operatively or by amputation with little middle ground. Both were hazardous for the casualty with mortality rates from amputation of up to 70% [3] balanced against the almost inevitable risk of suppuration associated with non-operative management in the age before antiseptics and antibiotics.

Both approaches had their advocates. During his service as a military surgeon during the Belle Isle campaign in 1761 John Hunter had observed a small number of neglected pistol and musket wounds that healed without any surgical intervention. Based on this very modest sample size he recommended non-operative management as a general principle [4]. In contrast the leading French surgeon of the Napoleonic wars Dominique Larrey used amputation liberally, apparently performing 200 amputations during one 24-hour period at the Battle of Borodino.

Writing after the wars in 1827, Larrey's English counterpart George Guthrie described the 'incalculable difference between the effects of injury caused by cannon and of musket shot in the same part' and considered whether different treatments were necessary. He observed that if amputation was not carried out following cannon injury 'pain, heat and tumefaction of neighbouring parts comes on, which speedily runs into suppuration or gangrene, fever becomes more violent and frequently ends in death'. Like Hunter he was inclined to be less aggressive in the treatment of musket wounds and considered conducting what would now be viewed as a clinical trial but having seen the consequences of suppuration and gangrene commented that he did not 'feel authorised to commit murder for the sake of experiment' [4].

The introduction of modern antiseptics by Joseph Lister also encouraged a non-operative approach to extremity wound management despite advances in anaesthetic care making surgery less hazardous. Lister's use of 5% carbolic acid solution to disinfect surgical instruments, hands and wounds resulted in a striking reduction in infection and amputation mortality rates in civilian injuries [5]. By the outbreak of the First World War antiseptics were viewed as the most important element of wound treatment and were described as 'a less brutal and more gentlemanly plan' by Watson Cheyne [6].

Unfortunately the carnage of the aftermath of the Battle of the Marne revealed that applying antiseptics alone was a completely inadequate management strategy for the high-energy wounds sustained in the contaminated battlefields of Northern France. The Belgian surgeon Antoine Depage recommended that to 'avoid grave complications it is necessary to open the wounds widely as quickly as possible, to remove foreign bodies and to drain the wounds'. He used the term 'épluchage' to describe combing the wound for dead and foreign material [7]. Writing in the British Medical Journal in 1915 a Lieutenant ETC Milligan used the term 'wound excision' to describe a similar process [8]. At the Inter-allied Surgical Conference for the Study of War Wounds held in Paris in 1917 the historic term débridement was reintroduced; whether this was deliberate or due to a problem with language has been the subject of some debate [2]. Debridement at this stage

encompassed extension of the original traumatic wound to allow exploration of all layers of the wound and excision of all nonviable and foreign material within it.

## Contemporary concepts of wound anatomy and débridement

Based on Jackson's original model of a burn wound [9] it has been proposed that all war wounds contains a central area of necrotic tissue and a peripheral zone of injury, surrounded by healthy tissue [10]. The zone of injury has been defined as the area surrounding a wound that, though traumatised, may not appear nonviable at initial débridement [11]. Delineating between traumatised viable and nonviable tissue is often challenging for even the most experienced surgeons. A traditional ballistic injury caused by a penetrating projectile may have a relatively modest zone of injury but the wounds sustained by casualties in close proximity to explosions are characterised by an extensive zone of injury which is both grossly contaminated and frequently involves many different tissue types and anatomical regions. The zone of injury in these wounds has also been referred to as the blast trauma zone [12].

That this group of casualties are also the most severely injured and consequently less physiologically stable makes this challenge even greater. Firstly, they are less able to tolerate lengthy surgery although advances in the treatment and prevention of acidosis, coagulopathy and hypothermia have improved this. Secondly, the tissue within the zone of injury may not survive as tissue hypoxia may be prolonged due to hypovolaemia, arterial injury, tourniquet usage, local vasoconstriction due to ballistic trauma or the deliberate use of vasopressors to support the central circulation. The fact that wounds have a life history and that the tissue within them evolves is not such a new observation [13] but perhaps the size of the tissue injury in a group of casualties who in earlier conflicts would not have survived to reach hospital care is a feature of our times.

In recognition of these different wound zones débridement has now been classified as incomplete, marginal, complete or radical [14]. Incomplete débridement describes a wound from which not all necrotic material has been removed. This will provide a source of nutrients for bacterial growth, increase the likelihood of infection and should be avoided. Marginal débridement implies that although all necrotic tissue has been removed some injured but potentially viable tissue remains for later re-evaluation. Complete débridement involves the removal of both necrotic and injured tissue, leaving all healthy uninjured tissue. Radical débridement includes the excision of healthy tissue, which may result in increased morbidity and worse functional outcome.

At present marginal and complete débridement both have a place in modern extremity war surgery. A traditional ballistic wound may be completely debrided at the initial surgery and undergo delayed primary closure as a planned procedure a few days later. In this situation preservation of tissue in order to achieve limb salvage and aid limb reconstruction is not relevant and although some injured tissue has been debrided along with necrotic and foreign material the outcome is no different. In a resource limited environment complete débridement may also be performed in order to avoid the need for serial débridements.

However, in many circumstances such as the complex wounds sustained in close proximity to explosive devices it is necessary to perform serial marginal débridements [10]. The staged removal of only nonviable tissue minimises the loss of traumatised viable

tissue potentially making limb salvage possible, facilitating subsequent limb reconstruction and improving eventual functional outcome. It may also be the case that the complexity of the wound, its degree of contamination and the evolving nature of tissue viability within the wound make complete debridement in one sitting an unachievable goal thereby necessitating a serial debridement approach. One study of 46 lower extremity flap reconstructions describes how a mean of five debridements (range 2 to 13) over a mean of 21 days (range 7 to 82) was required prior to undertaking subacute tissue reconstruction using either pedicled or free flaps [15].

### Conclusion

The meaning of the term debridement has changed, as have wounds and warfare. They continue to evolve. The most severe wounds sustained in Iraq and Afghanistan are unlike those of previous conflicts and are frequently seen in casualties whose multiple injuries would not previously have been considered compatible with survival. Perhaps there is now an 'incalculable difference' between these wounds and those due to ballistic penetrating trauma that demands different approaches. Tissue preserving marginal debridement may promote limb salvage and facilitate limb reconstruction. It may also be necessitated by the complexity and contamination of the wound or the physiological status of the casualty. If planning or anticipating serial marginal debridements the surgeon must be confident in the robustness and timeliness of the casualty evacuation system in order to risk leaving traumatised but potentially viable tissue within the wound at the initial debridement. The current operational deployment in Afghanistan supports this approach but in subsequent conflicts it may not be practical and a further change in practice may be required.

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