

## INITIAL MANAGEMENT OF WAR WOUNDS: Wound Debridement and Irrigation

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<input type="checkbox"/> Minor Changes	(or)	<input checked="" type="checkbox"/> Changes are substantial and require a thorough reading of this CPG	(or)
<input type="checkbox"/> Significant Changes			

**1. Goal.** To review indications for and the procedures associated with battle related wound debridement and irrigation and associated initial wound management strategies for penetrating war wounds.

**2. Background.** Wound debridement and irrigation (D&I) is the most frequently performed surgical procedure in the combat theater.<sup>1</sup> Given the power of today's munitions, prompt removal of nonviable tissue, debris, blood and bacteria is imperative to prevent local and systemic complications associated with such a wound.<sup>2</sup> **While the degree of initial debridement is left to the operating surgeon, care must be given to ensuring all nonviable tissue is removed, while at the same time attempting to preserve as much soft tissue as possible for reconstructive surgery at higher echelons of care. There are now several acceptable methods of adjunctive wound irrigation to include bulb irrigation, gravity irrigation, and pulse lavage. Serial D&I is the mainstay of therapy towards promoting growth of remaining viable tissues. In addition, closed negative pressure wound therapy (i.e. VAC with reticulated open cell foam (ROCF) has been shown to be a useful but not yet a proven clinical adjunct in the management of a wide array of traumatic soft tissue injuries.<sup>3</sup>**

### **3. Evaluation and Treatment.**

- a. Thorough inspection of the wounds with liberal use of surgical wound extension (i.e. wide surgical exposure) is necessary to inspect all levels of tissue, including examination of fascial planes. It is critical that the wartime surgeon have an understanding or appreciation for the phenomenon of wound evolution i.e. an expectation that any given soft tissue wound will evolve with respect to extent and tissue viability over the course of several days following injury.

This being the case, the surgeon should anticipate the need to re-inspect and perform serial D&I on extensive soft tissue wounds. While there is not a strict guideline defining the time sequence of repeat D&I, a general rule is that wounds should be more frequently inspected in the operating room during the acute (<72 hours) phase and less frequently in the sub-acute phase (3-7 days old). D&I in the operating room approximately every 24 hours for 2-3 days has been found necessary in some instances of wounds with extensive contamination and questionably viable soft tissue. Once such wounds have stabilized (as evidenced by the presence of viable tissue within the wound and the absence of additional nonviable tissue), the inspections can be separated in time by 2 days or more until a final

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March 2010

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wound closure strategy is identified (i.e. delayed primary closure with or without closed suction drain, split thickness skin graft with or without preceding tissue transfer).

- b. **Sharp surgical debridement is the mainstay of care for penetrating war wounds; irrigation is an adjunct to surgical debridement and in no way replaces sharp surgical debridement for removal of dirt, debris and non-viable tissue in wounds.** Therefore, a meticulous sharp debridement using a scalpel and/or scissors should be a starting point for nearly all wartime penetrating wounds. Assurance of hemostasis and removal of all nonviable tissue, including skin, fat, fascia, muscle, and bone, are essential to reduce the load of contamination and necrotic tissue in the wound prior to evaluation for dressing or closure.<sup>4</sup>
- c. **Devices:** There are several devices acceptable and available for adjunctive wound irrigation. Simple bulb irrigation and gravity irrigation have been the preferred method of wound irrigation. The bulb and syringe method has been more widely accepted and is significantly less expensive. Large bore gravity-run tubing has been favored for quick irrigations. Pulsatile jet lavage irrigation using a battery powered system is another method of adjunctive irrigation in the overall management of contaminated crushed wounds.<sup>5</sup> It must be emphasized again that all methods of wound irrigation, including pulsatile lavage, are adjuncts to sharp, surgical debridement and not a substitute for surgical debridement.
- d. **Fluids:** Normal saline, sterile water and potable tap water all have documented similar usefulness, efficacy and safety. **Sterile isotonic solutions are readily available and remain the fluid of choice for irrigation.** If unavailable, sterile water or potable tap water can be used.
- e. **Volume:** Bacterial loads drop logarithmically with increasing volumes of 1, 3, 6, and 9 liters of irrigation. The current recommendations are as follows: 1-3 liters for small volume wounds, 4-8 liters for moderate wounds, and 9 or more liters for large wounds or wounds with evidence of heavy contamination.
- f. **Frequency: Depending on the nature of the wound and the degree of contamination, all battle-related wounds should undergo D&I at least once every 48 hours.** Obviously, those wounds with more significant contamination will require more frequent D&I and consideration should be given to performing one final D&I procedure prior to strategic aeromedical evacuation.
- g. **Negative Pressure Wound Therapy with Reticulated Open Cell Foam** (NPWT/ROCF) dressing, commonly referred to as the VAC dressing, is an alternative wound dressing strategy to wet to dry and other temporary wound coverage strategies. VAC dressing can be utilized and left in place for 24 to 48 hours depending upon the extent and acuity of the wound. More extensive and acute soft tissue wounds should have the VAC dressing removed with further debridement and irrigation during the acute (<72 hours) phase and less frequently in the sub-acute phase (wounds 3-7 days old). Recent clinical experience suggests that when used as part of a strict wound management strategy, NPWT with ROCF assists in initiation of delayed primary closure from the ends of the wound. Initiation of delayed primary closure may be started during these repeat irrigations with re-application of smaller VAC dressing sponges as the wound is

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March 2010

## Joint Theater Trauma System Clinical Practice Guideline

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sequentially closed.<sup>4,6,7</sup> In instances where delayed primary closure is not possible, the described wound management strategy using the VAC adjunct has been observed to facilitate wound preparation (i.e. granulation and contraction) for placement of a split thickness skin graft. NOTE: Use of VAC dressings has recently been demonstrated to be safe in patients during strategic aeromedical evacuation (AE). The efficacy and long-term sequelae of NPWT/ROCF is not yet fully established but current clinical experience has been largely favorable. Surgeons who elect to employ this wound coverage method as part of their overall wound management strategy should be thoroughly familiar with the VAC system and its correct use.

- h. **It is critical that the down-range surgeon coordinate dressing changes and necessary repeat D&I with an often aggressive evacuation schedule.** Anticipation of required wound debridements and performance of this down range prior to medical evacuation (MEDEVAC) or AE is necessary to avoid extended periods without wound inspection and/or debridement. Given the propensity for soft tissue wounds sustained in combat to evolve in their acute phase, it is necessary for the surgeon to have a low threshold to perform an additional inspection and D&I before evacuating the casualty. **This compulsive and meticulous approach to wartime soft tissue injuries may decrease the likelihood that a given wound will worsen enroute and lead to adverse patient physiology (i.e. sepsis) discovered upon arrival at the next higher level of care.**
- i. Given the extent of soft tissue injury, many wounds are best managed with repeat debridements and dressing changes (VAC, wet to dry, etc.) performed in the operating room. This strategy affords the patient the comfort of conscious sedation or general anesthesia and the surgeon access to the full array of equipment necessary to perform sufficient debridement, irrigation and initiation of delayed primary closure. Also, reapplication of the VAC dressing may be more complete and effective if performed in the operating room with the support of operating room and anesthesia teams.
- j. **Closure:** With very few exceptions, war wounds should NOT be treated with primary wound closure. Though no hard rules exist for the closure of battle injuries, wartime experience shows three broad categories of wound outcome:
  - (1) Delayed primary closure with or without closed suction (i.e. Jackson Pratt) drain
  - (2) Split thickness skin graft over available local soft tissue
  - (3) Tissue transfer with subsequent split thickness skin graftWhich of these three closure strategies is best suited for any given wartime soft tissue injury is left to the discretion of the surgical team.

**4. Responsibilities.** It is the trauma team leader's responsibility to ensure compliance with CPG adherence.

### **5. References.**

<sup>1</sup> Emergency War Surgery Handbook, 3<sup>rd</sup> United States Revision 2004. Borden Institute. Walter Reed Army Medical Center, Washington, D.C. Chapter 22: Soft Tissue Injuries. 2004: 22.1-2.14

<sup>2</sup> Haury B, Rodeheaver G, Vensko J, et al. Debridement: an essential component of traumatic wound care. Am J Surg. 1978;135:238-242

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March 2010

## Joint Theater Trauma System Clinical Practice Guideline

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- <sup>3</sup> Powell ET. The Role of Negative Pressure Wound Therapy with Reticulated Open Cell Foam in the Treatment of War Wounds. J Orthop Trauma 2008;22: 138-141
- <sup>4</sup> Leininger BE, Rasmussen TE, Smith DL, Jenkins DH, Coppola C. Experience with wound VAC and delayed primary closure of contaminated soft tissue injuries in Iraq. J Trauma 2006; 61:1207-11
- <sup>5</sup> Gross A, Cutright DE, Bhaskar SN. Effectiveness of pulsating water jet lavage in the treatment of contaminated crush wounds. Am J Surg. 1972;124:373-377
- <sup>6</sup> Pollak AN. Use of Negative Pressure Wound Therapy with Reticulated Open Cell Foam for Lower Extremity Trauma. J Orthop Trauma 2008;22:142-145
- <sup>7</sup> Peck MA, Clouse WD, Cox MW, Jenkins DH, Smith DL, Rasmussen TE. The complete management of traumatic vascular injury in a local population during Operation Iraqi Freedom: A wartime report from the 332<sup>nd</sup> EMDG / Air Force Theater Hospital Balad, Iraq. J Vasc Surg 2007;45:1147-1205.

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Director and CENTCOM SG

Opinions, interpretations, conclusions, and recommendations are those of the authors and are not necessarily endorsed by the Services or DoD.
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March 2010

## APPENDIX A

### ADDITIONAL INFORMATION REGARDING OFF-LABEL USES IN CPGs

#### **A. Purpose.**

The purpose of this Appendix is to ensure an understanding of DoD policy and practice regarding inclusion in CPGs of “off-label” uses of U.S. Food and Drug Administration (FDA)–approved products. This applies to off-label uses with patients who are armed forces members.

#### **B. Background.**

Unapproved (i.e., “off-label”) uses of FDA-approved products are extremely common in American medicine and are usually not subject to any special regulations. However, under Federal law, in some circumstances, unapproved uses of approved drugs are subject to FDA regulations governing “investigational new drugs.” These circumstances include such uses as part of clinical trials, and in the military context, command required, unapproved uses. Some command requested unapproved uses may also be subject to special regulations.

#### **C. Additional Information Regarding Off-Label Uses in CPGs.**

The inclusion in CPGs of off-label uses is not a clinical trial, nor is it a command request or requirement. Further, it does not imply that the Military Health System requires that use by DoD health care practitioners or considers it to be the “standard of care.” Rather, the inclusion in CPGs of off-label uses is to inform the clinical judgment of the responsible health care practitioner by providing information regarding potential risks and benefits of treatment alternatives. The decision is for the clinical judgment of the responsible health care practitioner within the practitioner-patient relationship.

#### **D. Additional Procedures.**

**1. Balanced Discussion.** Consistent with this purpose, CPG discussions of off-label uses specifically state that they are uses not approved by the FDA. Further, such discussions are balanced in the presentation of appropriate clinical study data, including any such data that suggest caution in the use of the product and specifically including any FDA-issued warnings.

**2. Quality Assurance Monitoring.** With respect to such off-label uses, DoD procedure is to maintain a regular system of quality assurance monitoring of outcomes and known potential adverse events. For this reason, the importance of accurate clinical records is underscored.

**3. Information to Patients.** Good clinical practice includes the provision of appropriate information to patients. Each CPG discussing an unusual off-label use will address the issue of information to patients. When practicable, consideration will be given to including in an appendix an appropriate information sheet for distribution to patients, whether before or after use of the product. Information to patients should address in plain language: a) that the use is not approved by the FDA; b) the reasons why a DoD health care practitioner would decide to use the product for this purpose; and c) the potential risks associated with such use.