

## TACTICAL COMBAT CASUALTY CARE: TRANSITIONING BATTLEFIELD LESSONS LEARNED TO OTHER AUSTERE ENVIRONMENTS

# Battlefield Analgesia in Tactical Combat Casualty Care



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At the start of the Afghanistan conflict, battlefield analgesia for US military casualties was achieved primarily through the use of intramuscular (IM) morphine. This is a suboptimal choice, since IM morphine is slow-acting, leading to delays in effective pain relief and the risk of overdose and death when dosing is repeated in order to hasten the onset of analgesia. Advances in battlefield analgesia, pioneered initially by Tactical Combat Casualty Care (TCCC), and the Army's 75th Ranger Regiment, have now been incorporated into the Triple-Option Analgesia approach. This novel strategy has gained wide acceptance in the US military. It calls for battlefield analgesia to be achieved using 1 or more of 3 options depending on the casualty's status: 1) the meloxicam and acetaminophen in the combat wound medication pack (CWMP) for casualties with relatively minor pain that are still able to function effectively as combatants if their sensorium is not altered by analgesic medications; 2) oral transmucosal fentanyl citrate (OTFC) for casualties who have moderate to severe pain, but who are not in hemorrhagic shock or respiratory distress, and are not at significant risk for developing either condition; or 3) ketamine for casualties who have moderate to severe pain, but who are in hemorrhagic shock or respiratory distress or are at significant risk for developing either condition. Ketamine may also be used to increase analgesic effect for casualties who have previously been given opioid medication. The present paper outlines the evolution and evidence base for battlefield analgesia as currently recommended by TCCC. It is not intended to be a comprehensive review of all prehospital analgesic options.

*Keywords:* TCCC, Triple-Option Analgesia, ketamine, fentanyl, OTFC, meloxicam, acetaminophen, pain

### Introduction

In the hospital setting, myriad agents are available to provide analgesia, with each having its own indications, advantages, and disadvantages. In the austere combat setting, having many choices can be, at a minimum, confusing and, at its worst, could harm a casualty through the use of an inappropriate pain control agent.<sup>1</sup> In the hospital, a provider has ready access to monitoring equipment, advanced airway equipment, analgesic reversal agents, fluids, and pressor agents to rectify the use of an improper analgesic. In the austere combat setting, few, if any, of these are available. The purpose

of this review is to discuss the current recommendations for battlefield analgesia made by the Committee on Tactical Combat Casualty Care (CoTCCC). We review the evidence for these recommendations as they have evolved from 1996 until the present. The review is not intended to be a comprehensive discussion of prehospital pain control options, but will focus solely on the analgesic options currently recommended by the CoTCCC.

The original Tactical Combat Casualty Care (TCCC) Guidelines recognized the shortcomings of intramuscular (IM) morphine as a battlefield analgesic, and recommended that morphine be administered intravenously (IV) rather than IM both to speed the onset of analgesia and to reduce the likelihood of overdose.<sup>2</sup>

Oral transmucosal fentanyl citrate (OTFC) and ketamine were subsequently added as additional analgesic options. A 2012 survey of prehospital trauma care in Afghanistan found that combat medics, corpsmen, and Air Force pararescuemen had a positive overall opinion

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of the analgesic options recommended by TCCC, but wanted a more structured approach to determining which analgesic option was most suitable for use in a particular casualty.<sup>3</sup> This request resulted in the development of the TCCC Triple-Option Analgesia plan, which is the current standard for battlefield analgesia in the US military.<sup>4</sup> The Joint Trauma System and the CoTCCC monitor the prehospital literature and update the TCCC recommendations as new evidence becomes available, and additional combat experience is gained. This review presents a brief overview of the evidence for the current TCCC battlefield analgesia recommendations and discusses the applicability of these recommendations to wilderness medicine. A more extensive discussion of the pertinent literature for these recommendations may be found in the 2014 TCCC paper that first presented them.<sup>4</sup>

In 2014, subsequent to the TCCC Guideline updates, wilderness pain control guidelines were developed and released by the Wilderness Medical Society (WMS). These excellent guidelines do not, however, provide the specificity requested and required by the combat medic and subsequently were not adopted by the military.<sup>5</sup>

## Discussion

The provision of care in TCCC is divided into phases of care with particular procedures, or medications given in specific care phases.<sup>2</sup> For the provision of analgesia, the separation of care is minimal. In the Care Under Fire phase, no analgesia is provided. The choices for analgesic agents and the rationale for their use is the same for both the Tactical Field Care (TFC) and the Tactical Evacuation Care (TACEVAC) phases of care in TCCC, thereby simplifying the decision process for combat medical personnel. When utilizing this approach in the wilderness setting, this simplicity would remain. Pain control would not be utilized during a setting of immediate danger (ongoing rock fall or imminent avalanche risk), but would be given once the injured patient is out of immediate danger. All wilderness medicine care, outside of a setting of immediate danger, theoretically falls under the TFC phase of TCCC.

The choice of pain medication recommended for use in TCCC is based on the pain level and hemodynamic stability of a casualty. The degree of pain a casualty is suffering is based on the assessment by the provider. Pain is defined as mild-to-moderate versus moderate-to-severe. The Triple-Option Analgesia approach thus separates analgesia choices for casualties into 1 of 3 categories: 1) casualties with mild to moderate pain; 2) casualties with moderate to severe pain and without actual or impending pulmonary or hemodynamic compromise; or 3) casualties with moderate to

severe pain with actual or impending pulmonary or hemodynamic compromise.<sup>4</sup>

## CASUALTY IN MILD-TO-MODERATE PAIN

The goal in a casualty with mild-to-moderate pain is to provide pain relief that does not affect their sensorium. This allows them to either continue to facilitate their mission set or to help facilitate their own medical care and evacuation, depending on circumstances. In the wilderness setting, this would, in particular, apply to the casualties being able to facilitate their own evacuation. In TCCC, a casualty that has mild-to-moderate pain is given a combat wound medication pack (CWMP). This is a prepackaged oral medication combination that is designed to provide the highest level of pain control available that does not affect the mental status of the casualty, impair platelet function, or potentially worsen hypotension or pulmonary compromise. The CWMP was previously called a Combat Pill Pack, but has been redesignated the CWMP in the most recent TCCC update.<sup>6</sup> A CWMP contains meloxicam, acetaminophen, and moxifloxacin.

## COMBAT WOUND MEDICATION PACK MEDICATIONS

Meloxicam 15 mg tablet is a drug of the enolic acid nonsteroidal anti-inflammatory drug (NSAID) class. Its primary advantage over other NSAIDs is its lack of inhibition of platelet function.<sup>4</sup> Meloxicam is a 90% cyclooxygenase-2 (COX-2) inhibitor, and therefore has minimal effect on platelet function, whereas most NSAIDs have a significant cyclooxygenase-1 (COX-1) effect, which inhibits platelet function. Although some studies on elective surgery patients have shown no effect of acute doses of NSAIDs on bleeding,<sup>7,8</sup> impaired platelet function can potentiate trauma-induced coagulopathy, which causes increased mortality in combat casualties.<sup>3,4</sup> Analgesics intended for use on the battlefield should not impair coagulation. The 2 oral pain medications in the TCCC-recommended CWMP (acetaminophen and meloxicam) do not cause either decreased sensorium or decrements in platelet function. The choice of the selective NSAID meloxicam is no more expensive under government pharmaceutical pricing than nonselective NSAIDs.<sup>9</sup> The first generation of the CWMP contained rofecoxib, a 100% COX-2 NSAID with minimal effect on platelet function. In 2006, after this medication had been found to increase the risk of heart attacks and strokes in patients who were taking it for long periods of time, rofecoxib was removed from the TCCC Guidelines. It was replaced with meloxicam, another selective COX-2 inhibitor.<sup>10</sup> Celecoxib was also considered as a replacement for rofecoxib, but was not

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