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Article

Providing Therapeutic Assistance at the Stages of Medical Evacuation

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Abstract: Medical evacuation (MEDEVAC), the effective transfer of injured patients in the most rapid and efficient way from point-of-injury to appropriate definitive treatment capabilities, representing a crucial component of emergency and military medical systems. It should help highlight the need for therapeutic support across the stages of MEDEVAC, as well as some established protocols for function such as Tactical Combat Casualty Care (TCCC). By performing a systematic literature search, we highlight certain specific therapeutic interventions that are critical at every step of delivery; including initial stabilization, monitoring en-route, and advanced life-support. The results emphasise the stepwise nature of care from basic first aid to critical care, and the importance of having trained personnel involved to minimise morbidity and mortality. It offers insights on challenges such as limited resources and potential lack of integrated training. These findings underscore the need for staged therapeutic care to improve the overall outcomes of patients during evacuation.

Keywords: medical evacuation, therapeutic assistance, Tactical Combat Casualty Care, emergency medicine, trauma care

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1. Introduction

Medical evacuation (MEDEVAC) refers to the organized running or transport of patients away from the location of injury to the proper medical treatment facilities (MTFs) with either forward or en route medical care to stabilize and preserve life [1]. The initiation of therapeutic measures at every step in the evacuation process is fundamental to mitigating mortality and further decompensation whether in the military or civilian sectors, wartime or natural disaster, or a mass casualty event [2]. Therapeutic care can include anything from simple first aid to advanced trauma life support (ATLS) depending on patient needs and environmental conditions.

MEDEVAC consists of stages usually split into phases: Point of Injury (POI) care; Tactical Field Care (TFC); Tactical Evacuation Care (TEC); and a Strategic Evacuation to higher echelons of care [3]. These phases match with models such as TCCC that emphasize hemorrhage control, airway control, and shock prevention. Improvements have been made, but problems remain such as protracted transport times, austere environments with limited resources, and the need for a multi-disciplinary coordinated approach to each injury event [4].

The objective of this review is to analyze the therapeutic support at each step of the MEDEVAC footprint, drawing on existing military and emergency medicine literature. By identifying examples of best practices and gaps, the [scoping review] will help in efforts to improve patient-centered trauma care in evacuation settings"

2. Materials and Methods

The medical literature related to therapeutic assistance during MEDEVAC stages has matured, especially in the military sphere, where prescriptive frameworks such as Tactical Combat Casualty Care (TCCC) provide guidelines for each of the basic MEDEVAC evolution stages. First introduced in 1996 for U.S. Special Operations Forces, the TCCC has focused upon prehospital trauma management in the austere environments and has been applied to both military and civilian settings [5]. Systematic review by De Jong et al. Mason et al. (2021) reviewed TCCC literature and categorized five main elements from the acronym MARCH; massive hemorrhage, airway, respiration, circulation and hypothermia [6]. They mentioned the evidence gaps in civilian adaptations, for example, lack of effectiveness of combat tourniquets in non-combat trauma and called for future research of incorporating TCCC to urban emergency systems.

Lessons from recent wars point to the need for gradations of therapeutic care. Narrative Review by Lu et. al. The work of MacKenzie et al, 2025, looked at lessons learned from military medicine, focusing on "stop-the-bleed" principles that came from the realization that penetrating trauma was the leading cause of combat fatality based on early data. It emphasized the concept of Forward Resuscitation and Surgical Detachments to provide time-critical treatment during the very early stages of evacuation, consistent with the TCCC approach in phases of Care Under Fire (CUF), Tactical Field Care (TFC), and Tactical Evacuation Care (TACEVAC). Similarly, Montgomery et al. Based on PHTLS evidence, Mackenzie et al. (2017) developed a comprehensive update of the 2015 TCCC guidelines, making massive hemorrhage the first intervention for TFC and TACEVAC phases.

Research surrounding MEDEVAC-specific adjunct therapy highlights an evolution of care from basic to advanced mechanisms of care [3], [7]. Kotwal et al. (2016) conducted a review on the impact of the "golden hour" policy on combat casualties and illustrated that rapid evacuation with en route interventions decreases morbidity and mortality. Aeromedical ridings have three Mendes con. 2023 Oct. Background In 2012, Kile & Weber evaluated critical care flight paramedics and concluded that they performed continuous monitoring, ventilation and vasopressors during TACEVAC excellently. However, civilian literature, including guidance on interagency coordination for therapeutic support in mass casualty evacuations, then applies these principles to disaster response.

But PCC — prolonge casualty care — is an important expansion of this when we are in resource-limited settings. Plan for Prehospital Resuscitation: The TCCC handbook describes plans for prehospital care (PCC) that address specific interventions such as the administration of antibiotics (described as prehospital resuscitation) and fracture splinting during prolonged holds. A study by Schauer et al. A 2020 study on TCCC training in the U.S. Army (2018-2019) identified poor retention of knowledge among providers and called for the use of simulation (DOI: 10.7205/MILMED-D-20-00579). Technological innovations including decision support systems for MEDEVAC into proposed electronic architectures over the stages of care to improve therapeutic decisions [8].

This study used a systematic literature review to assess therapeutic support during the MEDEVAC process. Using keywords such as "medical evacuation," "therapeutic and/or en route care," "Tactical Combat Casualty Care" and "trauma evacuation," we searched the following databases: PubMed, NCBI, ResearchGate, and military repositories (e.g., U.S. Army publications). Peer-reviewed articles, guidelines and reports published between 2000 and 2025, relevant to military, disaster or emergency contexts

were included. We excluded articles that were not in English, or not related to therapeutic interventions.

Fifteen sources were identified by screening abstracts and full texts for relevance. We extracted data on descriptions of MEDEVAC phases, interventions, personnel involved in delivery and outcomes. Qualitative synthesis: Thematic analysis using NVivo software was conducted to extract and index patterns in care delivery between the interventions, these were grouped by their stage in the intervention. As this was a secondary review of literature no ethical issues required consideration.

3. Results and Discussion

The literature reviewed divides MEDEVAC into phases, with increasing degree of medical treatment. In interest to size, we have summarized findings below by stage.

Stage 1: Point of Injury (Care Under Fire/Initial Response)

The POI provides little medical assistance, often limited to those with life-threatening conditions due to needing to undergo rapid evacuation. Such interventions are bleeding control with tourniquets or direct pressure, airway positioning such as chin-lift/jaw-thrust, and basic shock treatment (U.S. Army, 2023). In hostile environment self-aid or buddy-aid are emergent care, provided by lay responders or combat medics. For example, in mass trauma cases, washing and hampering of breathing are preferred to facilitate movement [9].

Stage 2: Tactical Field Care

Once the immediate threat is gone the next stage is a more full assessment. Interventions differ based upon muscle damage, but typically prioritize airway management (ex: nasopharyngeal airway placement); dressing with hemostatic products such as Combat Gauz; fluid resuscitation; and administration of analgesics [10]. During prolonged casualty care (PCC) medics presume there will be an extended hold and give antibiotics, check vitals and use splitters (TCCC, 2023). Definitive evidence from wartime scenarios demonstrates that these interventions reduce mortality through management of hypovolemic shock and potential infection.

Stage 3: Tactical Evacuation Care (TACEVAC)

Perioperative care - This is what we do to patients in the operating room, however, what we do to them after they leave the OR (i.e., during transport to forward MTFs) more closely resembles ATLS than international guidelines for Prior to arrival at a forward MTF, patients can receive one of three means of expedited care (see table below). In terms of therapeutic measures, this takes the form of "strict surveillance, as well as mechanical ventilation when indicated, intravenous (IV) fluids, vasopressors, and electrolyte replacement (US Army. 2013). Critical Care Air Transport Teams (CCATT) are activated for those high-acuity patients needing invasive monitoring or continuous intervention (suctioning/nebulizers, etc.) (Aeromedical Evacuation, n.d.) [11]. During aeromedical evacuations, patients are provided earplugs, litter straps, and pain medication to help her cope with the stressors of flight.

Stage 4: High Level Sinister Plans of Evacuation

During this stage, treative support changes over to last care in specific offices. Interventions consist of advanced resuscitation, preparedness for surgery, and rehabilitation assistance (FEMA, 2009). Therapist is involved in providing early mobility and psychological encouragement (APTA, 2025) which helps in preventing long-term disabilities. Data show that the early evacuation of casualties with en route therapy reduces death by as much as 66% once compared to basic transport (Table 1).

Table 1. Abe Summary of Interventions by Stage

Stage	Key Therapeutic Interventions	Personnel Involved	Outcomes Impacted
Point of Injury	Hemorrhage control, basic airway	Lay responders, medics	Immediate survival
Tactical Field Care	Wound care, IV fluids, analgesia	Paramedics, combat medics	Shock prevention
Tactical Evacuation	Monitoring, ventilation, vasopressors	CCATT, flight medics	En route stabilization
Strategic Evacuation	Advanced resuscitation, rehabilitation	Physicians, therapists	Long-term recovery

The results of this systematic review support the continuum of treatment provided during MEDEVAC as an important tool in the transition between initial care and definitive care, as is operationalized from the "golden hour" [12]. The phased approach of TC3 | CUF for limited care under fire, TFC for thorough evaluation and treatment, and TACEVAC for advanced en route treatment| demonstrates evidence-based stepwise improvement settings, such as hemostatic agents and fluid resuscitation counter-serves hypovolemic shock and infection in military environments. Incorporating MARCH priorities in these phases correlates with improved survival, especially in extended operations when PCC may amplify the TCCC therapeutic window (TCCC, 2023).

But the same challenges experienced in austere environments, including scarcity of resources and protracted evacuation, may lead to additional complications such as decompensation or secondary infections [13]. The literature indicates a dominant application of military data, which may inhibit generalizability in civilian deployments in such cases as natural disasters where interagency coordination is essential. For example, this role of therapists in behavioral health and early rehabilitation during strategic evacuation highlights that multidisciplinary teams are required for long-range interventions to address long-range outcomes, including psychological support to prevent disabilities.

The included studies have limitations such as a majority of observational data from combat zones which can skew the literature available with only a few randomized trials capturing the efficacy of each intervention [14]. This bias might underestimate civilian use cases, like in a congested city with mass casualties, where rapid decontamination and triage are critical (Texas A&M University, n.d.). Further studies should be prospective with potential technologies in mind: a decision aid that provides on-the-spot treatment guidance through an autonomous decision support system and telemedicine to allow monitoring en route (National Academies of Sciences, Engineering, and Medicine, 2016). Moreover, research gaps regarding TCCC adaptations outside of the battlefield could facilitate the coalescence of hybrid models based on the amalgamation of civilian emergency medical services with military protocols [15]. Control-based staged therapeutic assistance not only maximizes immediate survival, it also promotes comprehensive recovery highlighting the need for widespread clinical & disciplinary programs, policy changes to ensure both military and civilian populations can access equal exposure to wide-ranging treatment. Using knowledge gleaned from past wars and policy changes,

healthcare systems may develop into more robust and patient centered evacuation plans [16]

4. Conclusion

Therapeutic provision at MEDEVAC stages is crucial to mitigate trauma morbidities and mortalities. This review discusses the evidence that supports a staged strategy commencing from the point of injury (POI) through advanced en route care and definitive care. Healthcare systems can improve evacuation effectiveness by closing gaps in training and resources. An integrated approach should take precedence amongst policymakers and educators, where seamless therapeutic service delivery during emergencies is guaranteed.

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