



Tactical Casualty Care and Emergency Evacuation for Health Security Personnel-An Updated Review

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Abstract

Background: Tactical Emergency Medical Support (TEMS) has emerged as a critical component of modern law enforcement operations, addressing the limitations of conventional emergency medical services (EMS) in hostile, high-risk environments. Derived from military medical practices such as Tactical Combat Casualty Care (TCCC), TEMS emphasizes rapid assessment, lifesaving intervention, and evacuation under active threat conditions.

Aim: This review aims to provide an updated overview of tactical casualty care and emergency evacuation principles applicable to health security and law enforcement personnel, highlighting operational frameworks, assessment methodologies, and extraction strategies.

Methods: A narrative review approach was employed, synthesizing historical development, operational doctrine, and evidence-informed practices related to TEMS. Key concepts analyzed include zones of care (hot, warm, cool), the Rapid and Remote Assessment Methodology (RRAM), the XABCDE primary survey, and tactical extraction and evacuation techniques.

Results: The review identifies zone-based care prioritization as central to effective TEMS operations, enabling providers to balance clinical intervention with tactical safety. RRAM supports decision-making by integrating threat assessment and medical urgency, while the XABCDE framework ensures structured identification of life-threatening injuries. Evidence supports rapid hemorrhage control, limited airway intervention under threat, and prompt extraction to safer zones to reduce preventable mortality.

Conclusion: Effective TEMS relies on the integration of tactical awareness and medical expertise. Structured assessment, disciplined intervention, and coordinated evacuation are essential to optimizing survival while preserving provider safety in hostile environments.

Keywords: Tactical Emergency Medical Support; Tactical Casualty Care; Law Enforcement Medicine; Emergency Evacuation; TCCC; RRAM.

Introduction

Recent high-profile incidents involving law enforcement officers and civilians have highlighted the critical need for specialized medical support in tactical environments, leading to the establishment of Tactical Emergency Medical Support (TEMS). This approach is derived from military medical practices, which prioritize rapid, adaptive care under high-risk and hostile conditions. During World War I, nonmedical personnel were deployed in battlefield trenches to provide immediate care to wounded service members, laying the foundation for structured

combat medical support. By World War II, these personnel were embedded directly within combat operations, evolving into the formalized combat medic roles recognized in modern military operations. The principles developed in these military contexts—rapid assessment, stabilization, and evacuation under fire—have since been adapted to support civilian law enforcement teams operating in similarly high-threat scenarios [1]. The adaptation of military principles to civilian law enforcement was formalized with the modification of Tactical Combat Casualty Care (TCCC) guidelines for domestic use in 2011. This

modification addresses the unique challenges of civilian tactical operations, which differ from conventional emergency medical services (EMS) in operational risk, environmental conditions, and mission parameters. TEMS personnel must provide care in environments that may remain hostile, such as active shooter incidents, hostage crises, or situations involving explosives. Unlike standard EMS, which focuses on patient stabilization and transport in relatively controlled settings, TEMS providers deliver care and facilitate evacuation under direct threat [1]. Competency in TEMS extends beyond conventional emergency medical skills. Providers require expertise in multiple domains, including wilderness and austere medicine, management of chemical, biological, radiologic, nuclear, and explosive (CBRNE) exposures, hazardous materials response, casualty extraction, and tactical medical evacuation. TEMS practitioners must integrate clinical capability with operational awareness, balancing patient care with team safety, scene security, and mission objectives. This combination of advanced medical proficiency, tactical knowledge, and situational awareness distinguishes TEMS from conventional EMS practices, enabling timely, life-saving interventions in high-risk law enforcement operations [1][2][3][4].

Issues of Concern

Tactical emergency medical support (TEMS) operates in environments characterized by uncertainty, elevated risk, and limited resources, requiring practitioners to make rapid, context-sensitive decisions regarding patient care and evacuation. TEMS providers must constantly assess both environmental and situational threats to determine which interventions will maximize survival while minimizing risk to both the patient and the care team. Unlike conventional emergency medical services (EMS), which generally operate in controlled or semi-controlled environments, TEMS interventions frequently occur under fire, during active threats, or in austere conditions with restricted access to equipment, delayed resupply, and protracted transport times [5][6][7]. In these circumstances, clinical judgment is coupled with tactical awareness, and the prioritization of care may diverge from standard medical protocols to account for operational limitations and imminent danger. A structured framework for threat assessment and care prioritization in TEMS is provided by the delineation of zones of care, which are classified as hot, warm, or cool. The hot zone represents the area of immediate and persistent danger, commonly referred to as the “red zone” or the stage of Care Under Fire. In this zone, the primary objective is rapid self-extrication and minimal life-saving intervention that can be executed without compromising personal safety. The scope of care is deliberately limited; procedures requiring significant time, detailed assessment, or extensive equipment are typically deferred until the patient can be moved to a safer environment. The hot zone emphasizes rapid

hemorrhage control using tourniquets or hemostatic dressings and expedited evacuation while under threat. The warm zone, or “yellow zone,” corresponds to an area where the immediate threat has diminished but remains possible. This is the operational space for Tactical Field Care, where providers balance the potential benefits of early intervention against the hazards of prolonged exposure in a potentially volatile environment. Care in the warm zone includes more detailed assessment, airway management, intravenous or intraosseous access, analgesia administration, and hemorrhage control beyond simple tourniquets. TEMS practitioners must weigh the risks of delayed evacuation against the clinical benefits of initiating care in place, recognizing that overexposure can compromise both patient survival and provider safety.

The cool zone, alternatively known as the “green zone” or Tactical Evacuation Care (Tac-Evac), is an area free from immediate threat. This zone allows for comprehensive evaluation, advanced resuscitation, and stabilization prior to transport. Interventions can include definitive airway management, blood product administration, and advanced monitoring without the constraints imposed by hostile or unstable conditions. The cool zone represents the environment in which TEMS aligns most closely with conventional EMS practices, enabling completion of interventions that were impossible in higher-risk zones while preparing the patient for transfer to higher-level medical care. Understanding these zones is central to effective TEMS operations. Each zone demands a tailored approach to care that integrates tactical risk assessment with medical priorities. Providers must be trained to rapidly transition between zones, adjust their interventions based on threat levels, and continuously reassess both patient and environmental factors. The zone-based framework enhances decision-making efficiency, reduces preventable mortality, and ensures that care is delivered safely and appropriately across the spectrum of tactical operations. By defining operational boundaries and treatment priorities, the hot, warm, and cool zones establish a systematic approach for TEMS practitioners, allowing them to provide life-saving interventions while preserving team safety in dynamic and high-threat environments [5][6][7].

Rapid and Remote Assessment Methodology (RRAM)

The rapid and remote assessment methodology (RRAM) represents a structured, algorithmic approach to evaluating casualties in tactical environments, aiming to optimize patient outcomes while minimizing exposure risk to Tactical Emergency Medical Support (TEMS) providers. This methodology prioritizes provider safety and situational awareness, reflecting the fundamental principle that intervention should be commensurate with the potential benefit to the patient. By systematically integrating threat assessment with patient evaluation, RRAM guides decision-making

under conditions of uncertainty, constrained resources, and active hazards. The philosophy underpinning RRAM emphasizes that TEMS providers should avoid unnecessary exposure when the clinical advantage of immediate intervention is minimal, thereby preventing additional casualties and preserving operational effectiveness. The initial step of RRAM involves assessing the situation from a secure location, allowing providers to obtain an overview of the scene before committing to direct intervention. Entry into areas where threats remain likely or probable is contingent upon the presence of medical necessity. TEMS personnel are trained to weigh the potential benefits of immediate care against the operational risks of exposure to hostile environments. This evaluation incorporates environmental hazards, the presence of bystanders or assailants, and the potential for escalation, ensuring that provider safety remains a paramount consideration. Only essential interventions should be undertaken when under direct fire, such as rapid hemorrhage control or airway management that can be executed with minimal procedural complexity. Noncritical stabilization procedures and extraction must be deferred until the risk environment becomes more permissive.

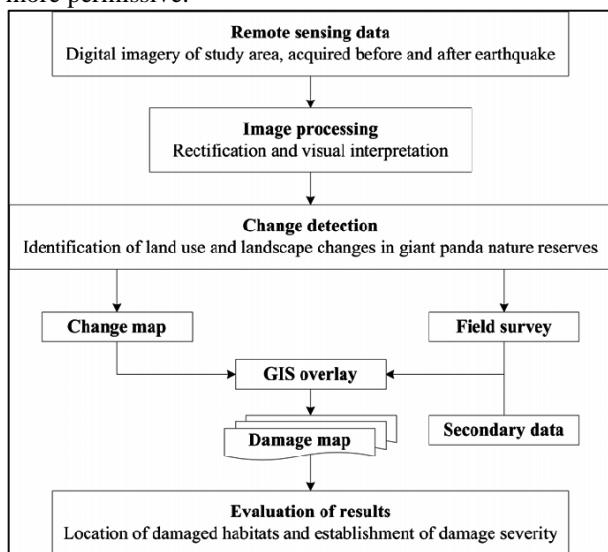


Fig. 1: Rapid and Remote Assessment Methodology (RRAM).

A critical component of RRAM is the systematic clearance of the patient, particularly in scenarios where the injured party may present a threat. This process, termed CLEAR—Confirm identity, Look for weapons, Evaluate injuries, Acquire intelligence where feasible, and Retain familiarity with weapons—ensures that TEMS providers maintain situational control and are prepared for potential aggression from the patient. Assessing injury severity follows this security evaluation. Stable patients may receive guidance and instructions for self-care from a secure distance, minimizing provider exposure while addressing the patient's needs. Conversely, unstable patients require a more nuanced

risk-benefit analysis, balancing the likelihood of survival gains from intervention against the operational hazards associated with approaching the casualty. When risks to the provider are high, access to the patient is deliberately delayed until a safer extraction can be arranged. In situations where exposure risk is low, the provider may approach to deliver more comprehensive care, including full resuscitation procedures. The methodology also differentiates between on-site critical resuscitation and definitive stabilization; in high-threat contexts, only life-saving measures are initiated until the patient can be relocated to a secure area. Conversely, when the provider's risk is minimal, comprehensive resuscitative efforts may be undertaken immediately, facilitating maximal physiological stabilization prior to extraction. The rapid and remote assessment methodology formalizes a decision-making framework that integrates tactical awareness, threat evaluation, and clinical judgment. By applying RRAM principles, TEMS providers can prioritize patient outcomes, maintain operational safety, and allocate limited resources effectively in high-risk environments. This methodology underscores the interplay between medical urgency and tactical prudence, providing a standardized protocol for managing casualties in complex, unpredictable, and hostile situations. Through the systematic application of RRAM, TEMS teams enhance the likelihood of positive patient outcomes while preserving the safety and operational readiness of both providers and the wider response team [5][6][7].

Environmental Considerations and Primary Survey in Tactical Emergency Medical Support

Environmental conditions play a pivotal role in guiding the actions and decisions of Tactical Emergency Medical Support (TEMS) providers. The operational environment often dictates both the timing and scope of interventions, as exposure of the provider's position can increase the likelihood of targeted attacks. Noise discipline is essential to maintaining concealment; hand signals and controlled, soft speech should be used to communicate without compromising location. Equipment and medical supplies must be carefully secured to prevent accidental noise, such as rattling of packs or instruments, which could draw hostile attention. Upon reaching the casualty, the immediate relocation of both provider and patient to cover is crucial to reduce exposure risk. In low-light or nighttime conditions, the judicious use of low-intensity light sources preserves night vision and limits detection by potential threats. These measures collectively ensure that the TEMS provider can deliver care while maintaining operational safety and reducing the risk of secondary casualties. The primary survey in tactical environments follows the XABCDE framework, which prioritizes life-threatening conditions while adapting to operational constraints. Exsanguinating

hemorrhage is the first and most critical consideration. Rapid identification and control of severe bleeding can be lifesaving. Tourniquets are applied to extremity injuries suitable for such intervention, while hemostatic agents, such as combat gauze, are employed for junctional or non-extremity wounds. Empirical evidence demonstrates that prompt tourniquet application improves hemodynamic parameters and shock indices upon patient arrival at definitive care facilities [8]. These interventions must be executed efficiently, as delays increase mortality risk.

Airway management presents significant challenges in tactical environments due to low-light conditions, limited supplies, and restricted personnel availability. Standard airway techniques remain the foundation of care, but alternative approaches may be required. Supraglottic airways often provide the most practical advanced airway option under these circumstances. In cases of jaw clenching, airway obstruction, cervical spine injury, or severe maxillofacial trauma where airway patency cannot be maintained with upright positioning, a surgical airway may become necessary. These interventions require careful assessment and precise execution to prevent secondary injury and maintain oxygenation. Breathing assessment and support involve the rapid identification and treatment of injuries that compromise ventilation or oxygenation. Large chest wounds require immediate application of occlusive chest seals to prevent “sucking” chest wounds. Needle decompression must be performed swiftly in cases of suspected tension pneumothorax to restore intrathoracic pressure balance. Circulatory support emphasizes permissive hypotension for patients with penetrating torso trauma, balancing oxygen delivery against the risk of exacerbating hemorrhage. Peripheral intravenous access using 18-gauge catheters is acceptable, and intraosseous lines provide an alternative when traditional access is unattainable. Cardiopulmonary resuscitation is generally deferred in unsecured areas due to limited efficacy in traumatic arrest, and its use is rarely indicated even in secured environments.

Disability assessment focuses on neurologic status. Pupillary responses, mental status, and responsiveness should be evaluated at the earliest safe opportunity. Although the Glasgow Coma Scale (GCS) can be applied, its practicality is limited in tactical conditions; the AVPU scale (Awake, Verbal, Pain, Unresponsive) offers a more feasible alternative. Exposure is performed when operationally possible, allowing a comprehensive evaluation of injuries while implementing measures to prevent hypothermia. Studies indicate that active and passive warming techniques result in comparable outcomes for core body temperature stabilization, suggesting that maintaining patient warmth is critical, but elaborate warming strategies may not be required in resource-limited, tactical settings. The integration of

environmental awareness with the XABCDE primary survey underscores the complexity of TEMS operations. Providers must navigate the dual imperatives of maximizing patient survival and minimizing personal and team exposure. These constraints necessitate adaptive strategies, including prioritization of life-saving interventions, tactical concealment, and efficient use of limited medical resources. By combining operational prudence with clinical expertise, TEMS providers can deliver critical care under high-risk conditions while maintaining the integrity of their mission and safeguarding both themselves and the casualty [5][6][7][8].

Extraction and Evacuation

Extraction and evacuation are integral components of Tactical Emergency Medical Support (TEMS), representing critical phases in the care of injured law enforcement personnel under hostile conditions. Extraction is defined as the removal of a casualty from the immediate site of injury to an area of relative safety where further assessment, stabilization, and medical intervention can occur. The selection of extraction techniques is dictated by the tactical situation, the severity of injuries, environmental hazards, and the availability of trained personnel. The complexity of these procedures underscores the importance of rigorous training, as TEMS providers must perform these actions instinctively under high-stress, dynamic operational conditions. In the case of Special Weapons and Tactics (SWAT) officers sustaining injuries during an operation, initial self-extraction is encouraged if feasible. This involves the injured individual moving to a safe location while performing life-saving self-care measures, such as the application of a tourniquet or the use of hemostatic dressings. Self-care prioritizes the immediate mitigation of life-threatening hemorrhage while delaying manual extraction until the scene is secured, minimizing additional risk to both rescuers and other personnel [9]. When self-extraction is not possible, particularly in scenarios involving penetrating torso trauma or complex polytrauma, manual extraction becomes necessary. Manual extraction involves physically moving the patient using dragging, lifting, or carrying techniques. Ideally, the extraction should follow an initial rapid assessment for injuries; however, operational constraints often necessitate movement prior to complete evaluation. The priority is the reduction of exposure to imminent threats, meaning patients may be moved only as far as necessary to reach hard cover or exit zones of high danger. Manual extraction methods vary according to situational demands, patient size, environmental obstacles, and the number of rescuers available. Rescuers must operate within their physical limitations to avoid personal injury while ensuring the safe transport of the patient. Techniques must be executed systematically and in accordance with pre-established protocols to maintain spinal alignment and prevent secondary trauma.

The long-axis drag is one of the simplest and safest techniques for moving a patient under fire. This method involves dragging the casualty along the body's longitudinal axis, preserving spinal alignment while minimizing the risk of exacerbating existing injuries. When appropriate, the interior portion of the injured officer's vest can be used as a handle, with the rescuer's forearms supporting the neck during the drag. Commercially manufactured drag systems incorporating webbing and ankle loops provide enhanced support and reduce rescuer fatigue. Environmental factors, such as stairs or uneven terrain, require additional caution; gravity can accelerate a casualty's movement during stair descents, making a two-rescuer technique safer and more controlled. Rigid or semi-rigid stretchers are recommended for stair extrication to maintain spinal protection, while soft stretchers are suitable for smooth surfaces with one rescuer or rough terrain with two or more personnel. Alternative extraction methods, including thrown rope drags and manual carries by one or two rescuers, offer versatility depending on operational constraints [9]. Armored SWAT vehicles play a crucial role in providing protective cover during extraction, enabling on-scene medical care to be delivered without subjecting the provider or patient to unnecessary risk. Studies utilizing simulation models have identified devices such as "firefighters worn" and "flexible tarp" systems as highly effective for manual extraction, particularly in scenarios involving high-threat environments [9]. These systems allow multiple rescuers to maneuver casualties efficiently while maintaining tactical awareness and minimizing exposure to hostile fire.

Evacuation refers to the subsequent movement of patients from a secured "cool zone" to a location where definitive transportation can occur, typically involving coordination with civilian emergency medical services (EMS). Evacuation requires careful staging of ambulances outside the outer perimeter, ensuring that personnel and patients are not exposed to residual threats. During this phase, tactical medical providers often continue to deliver advanced interventions, including blood transfusion, vasopressor administration, and mechanical ventilation [10]. In scenarios where conventional EMS transport is unavailable or delayed, tactical teams may utilize SWAT vehicles or patrol cars to transfer critically injured personnel to an appropriate medical facility. Air medical evacuation may be warranted in remote operations or situations where ground transport is compromised, necessitating prior arrangement with aviation units. Coordination with air assets involves establishing GPS coordinates for the nearest landing zones and ensuring that medical teams are prepared to continue care en route. The principles of extraction and evacuation emphasize the prioritization of safety, rapid movement, and preservation of life. Tactical providers must weigh the immediate risk to

themselves and the team against the benefit of medical intervention, balancing the need for speed with adherence to trauma management principles. The integration of self-extraction, manual techniques, armored vehicle protection, and coordinated EMS or air medical evacuation ensures that casualties receive timely, effective care while mitigating the hazards inherent in hostile environments. Mastery of these procedures is fundamental to TEMS operations, requiring ongoing training, simulation exercises, and adherence to evidence-based protocols to optimize patient outcomes and operational safety. By combining structured extraction methodologies with tactical acumen, TEMS providers can maintain mission effectiveness while delivering critical care in environments that are both unpredictable and hazardous. In conclusion, extraction and evacuation within TEMS are multifaceted processes that extend beyond simple patient movement. They encompass the assessment of tactical threats, rapid stabilization, prioritization of interventions, and coordinated transport to definitive care. The success of these operations relies on a rigorous understanding of the principles of tactical medicine, the ability to adapt to dynamic situations, and the integration of specialized equipment and techniques to optimize patient survival while preserving the safety of the provider and team [9][10].

Clinical Significance

Effective communication between Tactical Emergency Medical Support (TEMS) providers and civilian emergency medical services (EMS) during SWAT operations is a critical component of patient care. Timely and accurate information exchange ensures that casualties receive appropriate interventions both on-scene and during transport, ultimately influencing clinical outcomes. Identifying the radio frequency of the standby EMS unit is essential, and, when available, providing the mobile phone contact allows for redundancy in communication channels. Maintaining clarity and brevity in radio transmissions is crucial, as operational environments are often noisy and chaotic. Sensitive information, including patient identifiers, should be omitted to protect confidentiality and operational security. Mobile communication is generally preferred when it can provide more direct and secure coordination. Keeping the EMS crew continuously updated regarding operational events, such as changes in threat level, extraction status, and ongoing patient care, allows for preparation before the patient arrives at a definitive care facility. This communication ensures that personnel, equipment, and resources are appropriately allocated to meet the anticipated needs of the patient. Direct communication with the receiving facility is equally important, as it allows medical staff to anticipate the severity and type of injuries, plan interventions, and allocate necessary resources, including surgical teams or intensive care

beds. The use of a medical card for the injured SWAT officer can further enhance clinical management. Such cards may contain critical information, including allergies, chronic medical conditions, medications, and prior surgical history, which can be pivotal in guiding emergent care decisions. The combination of structured communication, real-time updates, and comprehensive patient information supports seamless coordination between TEMS providers, EMS, and receiving hospitals, improving patient safety and reducing delays in definitive care. Effective communication is therefore not only operationally essential but also clinically significant, as it directly affects patient outcomes in high-risk tactical scenarios.

Conclusion:

Tactical casualty care and emergency evacuation represent critical capabilities for health security and law enforcement personnel operating in high-threat environments. Unlike conventional EMS, TEMS is specifically designed to function under conditions of ongoing danger, limited resources, and dynamic operational constraints. This review highlights the evolution of TEMS from military combat medicine and underscores its relevance to civilian tactical operations. Central to effective TEMS practice is the zone-based model of care, which delineates medical priorities according to threat level and guides appropriate intervention in hot, warm, and cool zones. The Rapid and Remote Assessment Methodology further enhances provider safety by aligning clinical decision-making with tactical risk assessment, ensuring that intervention is justified by measurable patient benefit. The structured application of the XABCDE primary survey allows for rapid identification and management of life-threatening injuries while accommodating environmental and operational limitations. Extraction and evacuation are not merely logistical processes but integral components of patient survival, requiring coordination, discipline, and situational awareness. Techniques such as self-extraction, manual dragging, armored vehicle use, and coordinated EMS or air evacuation reduce exposure while expediting access to definitive care. In conclusion, TEMS effectiveness depends on continuous training, evidence-based protocols, and seamless integration between tactical teams and civilian medical systems. Mastery of these principles is essential to reducing preventable deaths while safeguarding both patients and providers in hostile operational environments.

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