**Chapter 27
Blunt trauma considerations**

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**Introduction**

Trauma is a disease whose severity is largely dictated by time and energy kinematics: *time* to definitive care, including operative intervention when required in a minority of cases, and *energy* mechanically transferred to the body to produce injury. Appropriate integration of out-of-hospital and in-hospital management of trauma can have a major effect on overall patient morbidity and mortality. Studies continue to clarify which out-of-hospital interventions truly benefit the patient and which interventions may actually worsen outcomes or delay more effective care options. Specifics on how mechanisms of injury, injury severity, available resources (including air medical services), provider training level, and specialty centers affect management and outcome of traumapatients have become clearer in recent years. Controversy exists as how to best balance the need for expeditious patient transfer from the out-of-hospital environment to in-hospital definitive assessment-based care with the patient’s need for critical or time-sensitive interventions prior to hospital arrival. An ever-enlarging body of experience and scientific study is further defining what management options improve outcomes in specific subpopulations of trauma patients.

In short, trauma is a multifaceted disease that requires a systems-thinking and systems-operating approach, while incorporating new scientific knowledge to provide optimal patient management in the practice of EMS medicine.

**Effect on emergency medical services**

Proper assessment and management of blunt traumatic injuries are among the core goals for EMS physicians, paramedics, and EMTs. The physical demands encountered while managing the trauma patient can be considerable for EMS providers. Extrication from adverse environments and working in inclement weather are common. The ability to adapt the core trauma evaluation and management concepts to any given situation is paramount.

Emergency medical services system structure elements, including ALS versus BLS, staffing level, and use of air evacuation resources, all contribute to a system's ability to care for the trauma patient. Scientific comparison of different operational models is just beginning to demonstrate which can provide the greatest benefit to specific patient populations [1]. Long-held notions of the superiority of ALS interventions in the field (such as IV access for fluid resuscitation and endotracheal airway management) have been called into question [2]. It may be that severely injured patients (at least in an urban setting) are best served by primary application of the basic skills of hemorrhage control, airway support, and rapid transport to the appropriate level trauma center.

**Training for EMS providers**

The central concepts for EMS providers caring for trauma patients include the following.

1. Thorough training on a consistent, organized patient assessment algorithm that can be applied to any trauma patient, regardless of injury severity, is foundational. It should provide hierarchical management that focuses on identification and management of life threats, yet incorporates full, sequenced evaluation and integrated management options for actual and potential injuries. Frequent reassessments and ability to integrate information and recognize trends that require urgent intervention are essential.
2. Efficient, appropriate use of local resources (air transport, hazardous materials, specialized rescue) and knowledge of hospital capabilities and destination policies (e.g. trauma center, pediatric trauma center, specialty burn care center) can improve patient outcomes in patients with significant, time-critical injuries. EMS systems should have policies and procedures to identify such patients and promote primary transport to the most appropriate facility. This concept, pioneered by trauma systems, is now being extended effectively to non-trauma disease processes such as acute myocardial infarction and acute stroke (see Volume 1, [Chapter 13](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c13.xhtml) and [21](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c21.xhtml)). Extrication-related issues that may affect management and timeliness of transport are addressed in Volume 1, [Chapter 28](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c28.xhtml).
3. Proper use of spinal motion restriction, splinting, fluid resuscitation, and pain management to limit additional morbidity. Knowing how and when to properly use infrequent invasive procedures such as cricothyrotomy or needle thoracostomy is essential for patient safety and care (see Volume 1, [Chapter 3](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c03.xhtml)).
4. Universal precautions against blood and body fluid exposure and scene safety training are a vital component of every patient interaction, especially in traumatic injury, where the source of the injury (e.g. a downed power line, broken heavy machinery, or a collapsed building) may pose a serious ongoing threat to rescuers.

Monitoring and reinforcing proper application of these concepts through performance measurement and improvement (see Volume 1, [Chapter 72](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c72.xhtml).), together with adequate practice on infrequently used psychomotor skills, are important parts of medical oversight and can have a demonstrated effect on patient morbidity and mortality. Realistic, relevant, integrated assessment and management scenario-based training, potentially including high-fidelity simulation, has been demonstrated to improve skill consistency and retention and may improve providers’ ability to translate didactics into clinical performance [3]. Nationally and internationally recognized courses that incorporate these elements exist and span the spectrum of care.

**Resuscitation and initial assessment**

The mechanism of injury, while not entirely predictive of actual injury sustained, often alerts the astute clinician to potential injuries that may be encountered during the assessment and management of the blunt trauma patient in the field. The importance of integration of local EMS and hospital resources, and tailoring guidelines to optimize patient care within these parameters, cannot be overemphasized. Blunt trauma management differs significantly from penetrating trauma, which is addressed in Volume 1, [Chapter 29](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c29.xhtml).

Emergency medical services systems should strive to limit the time from patient contact to departure from the scene to 10 minutes or less in injuries compatible with life threat. Except for control of life-threatening hemorrhage and support of airway and oxygenation/ventilation, all other interventions should take place en route to definitive care.

**The primary survey**

The goal of the primary survey is to identify and address any immediate life threats while the critical patient is promptly packaged for transport. Assessment can begin before arrival on the scene using dispatch information to prepare anticipated care needs based on patient mechanism of injury, potential notification of additional needed resources, and other local considerations.

Once patient contact is safely made, attention to discovering life threats through an organized approach is essential. Attention to arterial hemorrhage control, establishing and/or maintaining airway patency, correcting oxygenation and/or ventilation failure, and improving shock from blunt trauma are key aspects of the primary survey. In the severely injured patient with possible survival, the only survey to be done on-scene is the primary survey.

Scene photography may help convey aspects of mechanism of injury to the receiving physician as long as patient confidentiality is respected [4]. Event data recorders (automotive “black boxes”) will increasingly integrate with EMS to provide objective prearrival information in motor vehicle collisions (MVCs), potentially tailoring data-driven resource allocation based on actual mechanism and patient information. Newer telemedicine applications that allow concurrent assessment by EMS and receiving emergency physicians may facilitate triage and expedite care at the receiving facility for a number of time-sensitive medical complaints, including trauma.

**The secondary survey**

The secondary survey, like the primary survey, is conducted using an organized, consistent approach. It differs substantially from the primary survey in its detail. The secondary survey is a methodical head-to-toe assessment exam designed to identify many non-life threatening injuries that are easily obscured by visually captivating injury or primary survey life threat discovery. While important for all trauma patients, due to management priorities that are identified in the primary survey and require frequent reassessment, the secondary survey may not be performed until after arrival at the destination trauma center for some patients. Omission of the secondary survey for this reason is not incorrect and in fact, may represent a conscious decision by an astute EMS clinician to focus on immediate life threats identified in the primary survey.

**The role of Basic Life Support and Advanced Life Support**

Heated scientific debate continues over the value of out-of-hospital ALS in general, and in trauma care interventions specifically. Selection bias as well as significant variability in system elements and capabilities precludes a definite answer from existing literature at this time. Some evidence-based EMS practice recommendations have been extrapolated from the in-hospital literature, and their ability to translate into patient benefit in the out-of-hospital environment has yet to be demonstrated. A large-scale before-and-after study of ALS has cast significant doubt on the use of ALS in trauma [2]. Initiatives that will provide national data collection and evaluation will foster more evidence-based implementation of patient management in the future. As a result, absent evidence to the contrary, EMS has used what are felt to be time-sensitive interventions that have demonstrated efficacy in the ED and other critical care environments.

**Constellations of blunt traumatic injury**

There are a number of recognized patterns of blunt trauma injury. For example, displaced sternal fractures are associated with a high risk of associated head, spinal, rib, and cardiac injury [5]. The likelihood of intraabdominal injury to motor vehicle occupants increases significantly at speeds greater than 12 mph and exceeds 5% at 20 mph. Extensive abdominal injury evaluation due to mechanism of injury alone appears unwarranted in the absence of associated head, spine, chest, or leg injury [6]. Scapular fractures are commonly associated with rib and lower and upper extremity injury resulting from the high kinetic energy transfer, but not with blunt traumatic aortic injury [7]. Facial fractures due to assault and motor vehicle crashes are associated with intracerebral and pulmonary injuries with a high percentage of these patients requiring intubation during their inpatient course [8]. Obesity (body mass index >30 kg/m [2]) confers a risk for longer hospital and intensive care length of stay, as well as higher mortality in critical blunt trauma patients. Interestingly, head injuries are decreased in this population [9]. Specific recommendations on management of traumatic brain injury and spine injuries are addressed in Volume 1, [Chapters 30](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c30.xhtml) and [36](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c36.xhtml), respectively.

**Issues in specific patient populations**

**Blunt trauma in pregnancy**

Trauma is a leading cause for maternal mortality [10]. Pregnant trauma patients should be managed with the maxim “what’s best for mom is best for baby.” Supporting maternal oxygenation and perfusion is most likely to produce a positive outcome for both patients whenever possible.

The most frequent traumatic incidents affecting pregnant patients are MVCs. The majority of fetal deaths are due to MVC, with abruptio placentae and abdominal penetrating trauma as other common causes [11]. A study of hospitalized pregnant traumapatients, 80% of whom were involved in MVCs, showed that predictors for fetal loss included higher injury severity score (ISS), maternal death, lower Glasgow Coma Scale score, abdominal abbreviated injury scale (AIS) score greater than 3, vaginal bleeding, and shock with significant base excess. Morbidity, mortality, and hospital length of stay were not significantly different in pregnant versus non-pregnant matched case controls [12].

One small study showed the overall immediate complication rate to be low, most commonly preterm labor and placental abruption [13]. However, an increase in long-term complications was noted as well, with more severe trauma, multiple gestation, vaginal bleeding, and uterine contractions all being independent risk factors.

Destination choice may be affected by potential fetal viability and immediate need for neonatal specialty care. Estimating potential viability at greater than 24–26 weeks gestation by history or palpation of the uterine fundus above the umbilicus can facilitate this decision-making process [12]. Patients at greater than 20 weeks estimated gestational age should be placed with their left side elevated 15°, or up to 30° of reverse Trendelenburg positioning, to relieve pressure on the great vessels, preventing supine hypotension and subsequent significant loss of preload and cardiac output [14]. Although normal pregnancy-related changes in vital signs can imitate early shock, proactive oxygenation, fluid resuscitation, and monitoring are indicated to minimize risk of uterine hypoperfusion and fetal distress.

Emergency caesarean sections are extremely rare and should be reserved for salvageable infants in selected situations, performed by adequate, trained staff including emergency physicians and obstetricians (see Volume 1, [Chapter 45](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c45.xhtml)).

**Geriatric trauma**

With an ever-growing geriatric population, awareness of special considerations is important, particularly in trauma [15]. Geriatric patients are more likely to have intraabdominal injury with concurrent head, leg, or chest injuries, regardless of MVC speed. CDC field triage criteria use age 55 as the break where patient management considerations change to recognize the increased risk of death from trauma after that age (see Volume 1, [Chapter 39](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c39.xhtml) for additional information on field trauma triage).

**Medical oversight issues in trauma**

Among the most important aspects of medical oversight is teaching the ability to effect a prompt and smooth patient transition from scene to hospital. Guidelines for management should be evidence based whenever possible and should take into consideration neighboring regions, hospital practice, and other regional specialty resources. Physician participation in regional and state medical oversight committees helps add clinical practice consistency while taking into consideration specific agency and provider capabilities, which may vary significantly within a locality. Monitoring of current literature and research allows the medical director to modify guidelines in keeping with national trends as tempered by local capabilities. Networking with inpatient physicians (particularly those in critical care, trauma, burns, and pediatrics) helps assure that EMS is focused on similar issues, using complementary technology and practice that will facilitate and expedite optimal patient outcomes both in the hospital and out of the hospital. Such networking will help limit “us versus them” attitudes toward EMS and reinforce that EMS is an equal and essential professional partner in the emergency health care team, dedicated to the same basic principles as the inpatient team.

In the case of trauma care, having specific, agreed-upon regional hospital triage criteria and guidelines on issues such as airway management, fluid resuscitation, medication management, spinal immobilization, and trauma alert categories all facilitate uniformity of in-hospital and out-of-hospital care. Ongoing monitoring of performance on established criteria, such as scene time in high-priority trauma [16], allows for modification of practice and assessment of effect of practice on patient outcomes [17].

**Guidelines for out-of-hospital management**

Guidelines for management of the trauma patient should be focused on providing necessary interventions, together with rapid transport to the closest appropriate facility. Triage guidelines should also address trauma patients who need different types of specialty care by identifying regional facilities with special capabilities such as pediatric trauma, burn care, hyperbaric therapy, and extremity replantation. Scene time should not be delayed while the provider waits for direct medical oversight.

**Air medical transport**

Transport of trauma patients by helicopter has become increasingly common in the United States in recent years. Its positive effect on saving the lives of combat casualties in the Korean and Vietnam conflicts, the Gulf War, and now Iraq and Afghanistan is well documented, though its effect on outcomes in specific civilian patient populations is still being studied, Staffing models vary significantly between the US and European systems. As such, use, patient injury severity, and effects on scene internal and mortality are difficult to compare [18].

There is recent concern that air medical transport may not uniformly provide added patient benefit for a number of reasons, including poor triage by field providers [19]. Systems should implement guidelines to appropriately integrate valuable air medical assets into their trauma system, particularly given the cost and potential additional risks to both crew and patient [20,21].

**Hospital destination**

Patient outcomes are significantly better at trauma centers than at non-trauma centers. Both in-hospital and 1-year adjusted case fatality and relative death risk rates for moderately to severely injured patients are significantly better, typically with a 25% reduction in fatality risk [22]. Studies support the importance of rapid transport to a regional trauma center where definitive care can be rendered [23]. With the exception of safety issues, securing an unstable airway, and absent extrication issues, there is generally no indication for prolonging scene times, particularly in the severely traumatized patient.

It is crucial that the out-of-hospital provider rapidly and accurately identify the subset of trauma patients who may most benefit from trauma center management. The field triage decision scheme is fully described in Volume 1, [Chapter 39](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c39.xhtml). The most current version has shown efficacy and de-emphasizes trauma scoring, relying instead on progressive assessment of patient physiology, injury anatomy, mechanism, and special circumstances to provide trauma center destination guidance.

Provider judgment has been introduced as a factor in decision making for transport to a regional trauma center in the field triage decision scheme. Trauma scores and mechanism of injury should not override provider judgment and divert a patient away from a trauma center [24].

Intriguing new research raises questions on structure of hospital trauma systems. Inclusive systems, in which every facility in a region or state participates to the extent of their capabilities, are compared with exclusive systems, in which a limited number of high-level centers receive the majority of patients. In one study, the odds of triage to a regional trauma center and inpatient mortality were similar in both groups; however, the most inclusive systems were associated with the lowest odds of death [25].

**Trauma scoring**

Trauma scoring systems were first developed to attempt to quantify severity of injury and guide appropriate triage of patients to trauma centers. A variety of scoring systems exist, but their use is likely greater for research purposes than for patient care in the field [26].

Multiple different scoring systems and permutations have been developed and continue to evolve to assist in predicting injury, need for emergency surgery, and outcomes [27,28]. The Revised Trauma Score (RTS) is one of the more common trauma scoring systems ([Table 27.1](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c27.xhtml#c27-tbl-0001)). It combines the Glasgow Coma Scale score with respiratory rate and systolic blood pressure. Some systems, including the RTS and the ISS as well as derivations such as the survival risk ratio (SRR), have been used to predict patient outcome [29–32]. Each trauma system must determine acceptable levels of overtriage and undertriage and how to best achieve these goals through ongoing quality improvement and surveillance.

[**Table 27.1**](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c27.xhtml#R_c27-tbl-0001) Revised Trauma Score

| **RR/min** | **SBP (mmHg)** | **GCS** | **RTS points** |
| --- | --- | --- | --- |
| 10–29 | >89 | 13–15 | 4 |
| >29 | 76–89 | 9–12 | 3 |
| 6–9 | 50–75 | 6–8 | 2 |
| 1–5 | 1–40 | 4–5 | 1 |
| 0 | 0 | 3 | 0 |

Adapted from Champion [32], with permission from Lippincott, Williams and Wilkins.

GCS, Glasgow Coma Scale; RR, respiratory rate; SBP, systolic blood pressure.

**Prevention and other public health issues**

Trauma is largely a preventable disease with a tremendous cost to society. Although it affects all age groups, it is particularly devastating to the young and remains the major killer of North Americans under 40 years of age. As part of their role as advocates for their entire community’s health status, EMS physicians and systems must play an active role in injury prevention.

Participation in community-based programs to encourage safer behaviors and risk reduction can reduce the number of injured persons. Programs such as helmet use [33], cycle and pool safety, proper use of car seats, and use of seat belts have all helped to reduce the number and severity of injuries. Programs targeting safe storage of firearms, reduction in drunk driving, and home safety assessments for elders can have positive effects on the community and may be led at the local, state, or national level. Local systems are able to tie into these resources without having to commit large amounts of financial and/or personnel support. This also represents an opportunity to put forward a proactive, positive “public face” for the EMS agency involved. The leadership for this effort must involve physician medical oversight. The CDC's Injury and Violence Prevention and Control page ([www.cdc.gov/injury](http://www.cdc.gov/injury)) is an excellent resource. See also Volume 2, [Chapter 13](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/Vol2/c13.xhtml), for additional information.

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