

# Prehospital Trauma Care



**T**he principles of modern prehospital management of severely injured patients were derived from concepts developed in military conflicts. Not all injuries are immediately obvious. Prehospital personnel should be trained to recognize mechanisms of energy transfer that could lead to severe injury. The successful management of patients requires the identification of specific injuries or mechanisms likely to cause severe injury to allow correct triage to an appropriate facility (Figure 1). The process of identifying significant injuries should be defined prospectively by triage protocols to ensure that patients are transported to the appropriate trauma facility.

The goals of the prehospital component of the system are to prevent further injury, initiate resuscitation, and provide safe and rapid transport of injured patients. Patients should be taken directly to the center most appropriately equipped and staffed to handle their injuries as defined by the region's trauma system (see Chapter 1, Trauma Systems). These destinations should be clearly identified and understood by prehospital personnel and should be determined by system guidelines, triage protocols, online medical direction, and the designation of trauma centers. Ambulances should bypass facilities not identified by the region's trauma system as appropriate destinations, even if they are closest to the incident.

## Initial Management

Initial on-scene assessment and management are provided by the prehospital medical team. Medical direction of prehospital trauma care is provided by physician voice-directed communication (online medical direction) or by preexisting protocol (off-line medical direction).

The protocols that guide prehospital trauma patient care should be established by trauma health care providers, including surgeons, emergency physicians, medical directors for emergency medical services (EMS) agencies, and appropriately trained basic and advanced

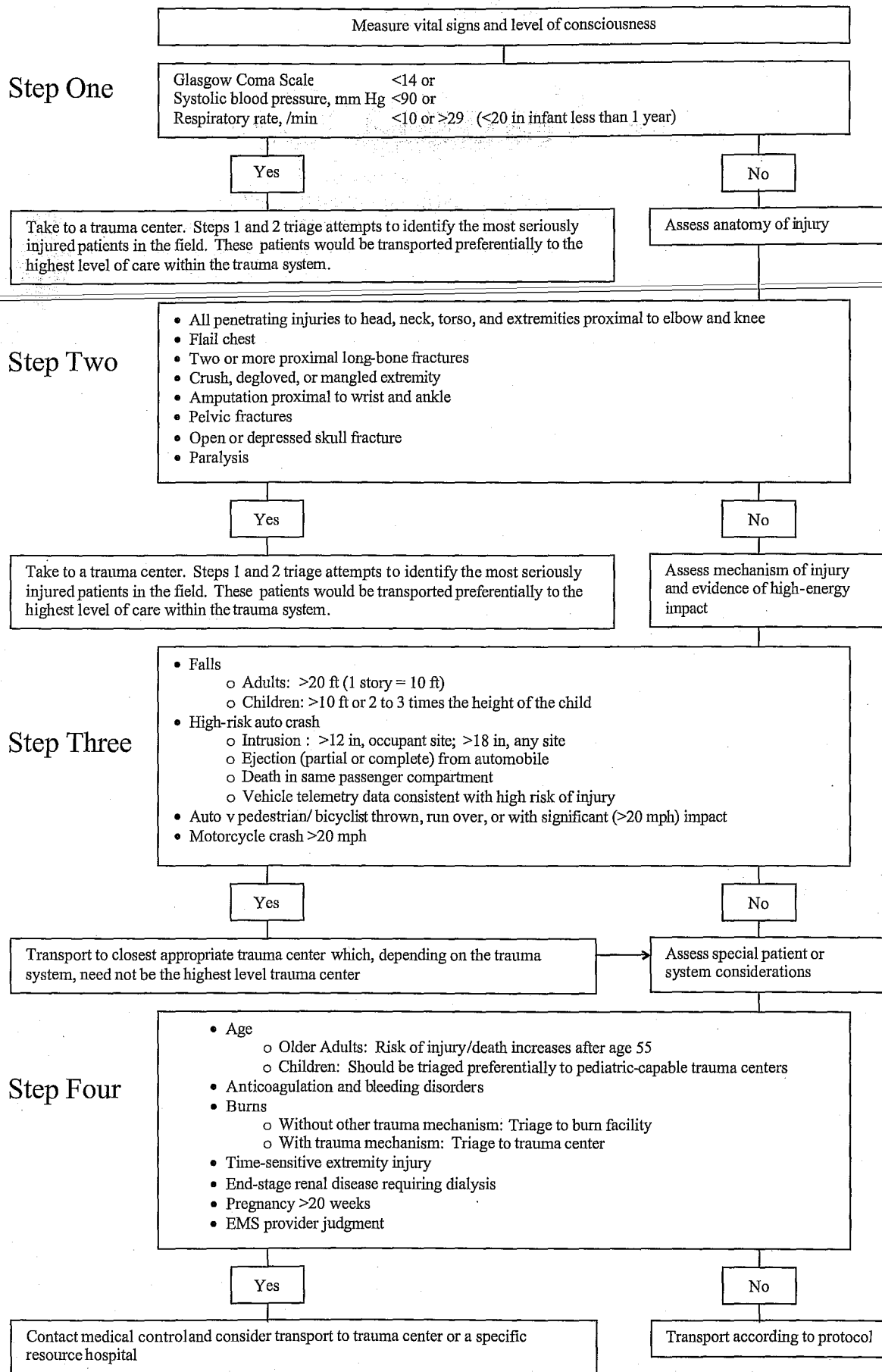
emergency medical personnel. This team approach helps establish continuity of care between prehospital care and hospital protocols. These protocols should be consistent throughout the system.

Treatment of injured patients in the prehospital arena should consist of assessment, extrication, initiation of resuscitation and stabilization, and rapid transport to the closest appropriate facility. The essential components of resuscitation should be limited to the establishment of an airway, provision of ventilation, hemorrhage control, stabilization of fractures, and immobilization of the entire spine. Additional or time-consuming field interventions, in general, should be avoided and not delay definitive care. For example, intravenous access may be established en route to the hospital.

## Overtriage and Undertriage

The prehospital trauma system is driven by the goal of getting the right patient to the right place at the right time. Imprecision results in overtriage (minimally injured patients are transported to higher level trauma centers) and undertriage (severely injured patients are transported to lower level trauma centers). In general, priority has been given to reduction of undertriage because undertriage may result in preventable mortality or morbidity from delays in definitive care. Although overtriage has minimal or no adverse consequences for the patient, it results in excessive costs and burden for higher level trauma centers in the routine care of injured patients. In disaster and mass casualty events, however, overtriage can adversely impact patient care and survival and should be minimized. The medical community needs to be more concerned about undertriage and the medical consequences that result from inadequate use of a trauma system. The system's performance improvement program should evaluate the triage criteria to provide the best quality care to severely injured patients. This care should neither overburden the receiving trauma centers with minimally injured patients nor unnecessarily transport minimally injured patients long distances.

**Figure 1. Field Triage Decision Scheme**



When in doubt, transport to a trauma center

## Note for Figure 1

This field triage decision scheme, originally developed by the American College of Surgeons Committee on Trauma, was revised by an expert panel representing emergency medical services, emergency medicine, trauma surgery, and public health. The panel was convened by the Centers for Disease Control and Prevention (CDC), with support from the National Highway Traffic Safety Administration (NHTSA). Its contents are those of the expert panel and do not necessarily represent the official views of CDC and NHTSA.

## Performance Improvement and Patient Safety

### Medical Direction and Performance Improvement and Patient Safety

High-quality medical direction of prehospital trauma care is provided by 2 methods. Online medical direction is by 2-way voice communication between emergency medical personnel in the field and a physician. The clinical findings are presented, and orders are received for the initial and continuing care of the patient. Off-line medical direction is by protocol and involves development, revision, and monitoring of all operating protocols and procedures by physicians, including reviewing prehospital reports for effectiveness and compliance with preestablished procedures. Surgeons should participate closely with the EMS medical director in the development of trauma components of the EMS system and provide leadership for the development of trauma protocols. The trauma director must be involved in the development of the trauma center's bypass protocol (CD 3-1). The trauma surgeon must be involved in the decision regarding bypass (CD 3-2). Surgeons should be actively involved in prehospital personnel training, the performance improvement process, and the development of trauma components of EMS. High-quality, consistent, emergency care requires that all prehospital personnel in a geographic region understand the triage criteria, treatment protocols, transportation methods, and destination facilities in that geographic region. The state and regional EMS agencies and authorities may consult with the American College of Surgeons Committee on Trauma (ACS-COT) for recommendations of surgeons in the region who are capable of providing leadership.

### Monitoring Overtriage and Undertriage

A trauma system should establish and monitor acceptable rates of undertriage and overtriage. *Undertriage* is defined as a triage decision that classifies patients as not needing trauma center care when, in fact, they do. This classification is false-negative triage. Undertriage is a medical problem. It may result in an adverse patient outcome. The receiving medical facility may not be adequate to diagnose and treat the trauma victim.

Defining acceptable levels of undertriage is dependent on how one defines patients requiring trauma center care (major trauma patients). One method is to identify all of the potentially preventable deaths that occur within a regionalized trauma system. Undertriaged patients would be those who were taken to a non-trauma center hospital and then died of potentially preventable causes. By using this method, a target undertriage rate should be 1% or less.

Another method is to determine how many major trauma patients were transported incorrectly to a non-trauma center. If an Injury Severity Score of 16 or more is used to define major trauma patients, undertriaged patients would be patients with an Injury Severity Score of more than 15 who were taken to a non-trauma center hospital. By using this method, an acceptable undertriage rate can be as high as 5%.

*Overtriage* is a decision that incorrectly classifies a patient as needing trauma center care, although retrospective analysis suggests that such care was not needed. Overtriage has been said to result in overutilization of finite resources (financial and human) and, as such, is also important to monitor. Overtriage commonly is calculated by classifying major trauma patients by using standard registry criteria. One example as originally introduced with the Major Trauma Outcome Study would be patients who died or were admitted to the hospital for more than 48 hours, an intensive care unit, or the operating room. The patients triaged to the trauma center not meeting these criteria become the numerator. The total number of patients triaged to the trauma center would be the denominator. Most agree that an acceptable percentage of overtriage is in the range of 25% to 50%.

Improving the final outcome of injured patients is directly dependent on effectively monitoring, integrating, and evaluating all components of patient care. Prehospital personnel should be involved in the review process and be accountable to the medical direction system that is in place at the hospital and in the geographic region (see Chapter 16, Performance Improvement and Patient Safety). The trauma program must participate in the development and improvement of prehospital care protocols and patient safety programs (CD 3-3).

### **EMS Patient Records**

The prehospital record of the incident should include the type and mechanism of injury, the anatomic and physiologic derangement of the patient, relevant times of the incident, extrication, on-scene care, and the timing of interventions. Documentation of these events allows personnel in the trauma center to have an understanding of the event and the potential for injuries. Some programs have found photographs to be useful, but they should not delay the process of care. The degree of damage to a motor vehicle should be reported, especially if the patient seems to have minimal injuries. This information prompts hospital personnel to evaluate the patient for occult injuries. Trauma scores, when requested, should be documented. Accurate, promptly available, EMS patient care records are important for building trauma registries.

### **Air Transportation**

Air medical transportation has become an important method of rapidly transporting injured patients from the scene or the transferring facility to a trauma center. A structured air medical safety program should be in place to guide prehospital personnel in establishing a safe landing site, proper loading procedures, communications with pilots and medical personnel, and safe procedures in proximity to an operating helicopter. Criteria and procedures for requesting air medical transport should be developed before the implementation of an air medical program. Air medical dispatch guidelines have been developed by the National Association of EMS Physicians. Online and off-line medical direction are invaluable in the provision of appropriate air medical care. The medical flight crew should have a structured air medical educational curriculum and an ongoing performance improvement program integrated with the trauma system performance improvement program.

### **Additional Issues**

The decision to withhold or terminate resuscitation efforts in the field is difficult. To assist in developing protocols

for online and off-line medical direction after traumatic cardiopulmonary arrest, the ACS-COT and the National Association of EMS Physicians developed evidence-based guidelines that define when termination of resuscitation is appropriate (see Appendix A, Guidelines for Withholding or Termination of Resuscitation in Prehospital Traumatic Cardiopulmonary Arrest). Victims of decapitation or bodies exhibiting decomposition or rigor mortis and other conditions defined by the EMS system as dead should be transported as directed by the medical examiner or coroner. Prehospital trauma care should emphasize the safety of patients and EMS personnel at the scene and in transport.

Communicable diseases, such as hepatitis and AIDS, are a significant potential problem for prehospital personnel. Compliance with Occupational Safety and Health Administration standards is mandatory, and training should emphasize these standards.

All prehospital responders should have available appropriate protective equipment and should be trained in its use.

### **Supplemental Readings**

Esposito TJ, Offner PJ, et al: Do prehospital trauma center triage criteria identify major trauma victims? *Arch Surg* 130:171-176, 1995

Fries GR, McCalla G, et al: A prospective comparison of paramedic judgment and the trauma triage rule in the prehospital setting. *Ann Emerg Med* 24:885-889, 1994

General Accounting Office: Emergency Medical Services: Reported Needs Are Wide-ranging, With a Growing Focus on Lack of Data. Washington, DC, General Accounting Office, 2001. Report No. GAO-02-28

Health Resources and Services Administration, US Department of Health and Human Services: Emergency Medical Services for Children Five-year Plan 2001-2005 Midcourse Review. Available at <http://www.mchb.hrsa.gov/programs/emsc/midcourserewiew.htm>. Accessed March 3, 2006

Hopson L, Hirsh E, Delgado J, et al: Guidelines for withholding or termination of resuscitation in prehospital traumatic cardiopulmonary arrest: joint position statement of the National Association of EMS Physicians and the American College of Surgeons Committee on Trauma. *J Am Coll Surg* 196:106-112, 2003

Hoyt DB, Coimbra R, Potenza BM: Trauma systems, triage, and transport, in Moore EE, Feliciano DV, Mattox KL (eds): *Trauma*, 5th ed. New York, McGraw-Hill, 2004

Kotch J, Burgess BE: Helicopter transport of pediatric versus adult trauma patients. *Prehosp Emerg Care* 6:306-308, 2002

Kuehl A: Prehospital systems and medical oversight. Dubuque IA: Kendall/Hunt Publishing, 2001

Mulligan-Smith D, O'Connor RE, Markenson D: EMSC partnership for children: National Association of EMS Physicians model pediatric protocols. *Prehosp Emerg Care* 4:111-130, 2000

National Highway Traffic Safety Administration: National EMS Research Agenda. Washington, DC, US Department of Transportation, 2001

Prehospital Trauma Life Support Committee, National Association of Emergency Medical Technicians, in cooperation with the Committee on Trauma, American College of Surgeons, McSwain NE, Frame S, Salomone JP, eds: *PHTLS: Basic and Advanced Prehospital Trauma Life Support*, 5th ed. St Louis, MO, Mosby, 2003

Wood D, Kalinowski EJ, Miller DR, et al: Pediatric continuing education for emergency medical technicians. *Pediatr Emerg Care* 20:261-268, 2004