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The MMWR

Introduction

Purpose of This Report

Emergency Medical Services (EMS) providers in the United States make decisions about the most appropriate destination hospital for injured patients daily. These decisions are made through a decision process known as •field triage,Ž which involves an assessment not only of the physiology and anatomy of the injury but also of the mechanism of the injury and special patient considerations. The goal of the field triage process is to ensure that injured patients are transported to a trauma center* or hospital that is best equipped to manage their specific injuries, in an appropriate and timely manner, as the circumstances of injury might warrant.

Since 1986, the American College of Surgeons Committee on Trauma (ACS-COT) has published a resource manual that provided guidance for the field triage process through a field triage decision scheme1). This guidance was updated and published with each version of the resources manual during 1986. 219)99n(2009, CDC published guidelines on the field triage process (the Guidelines)6(

FIGURE 1. Field triage decision scheme " United States, 2006



Source: Adapted from American College of Surgeons. Resources for the optimal careof the injured patient. Chicago, IL: American College of Surgeons; 2006. Fotnotes have been added to enhance understanding of field triage by persons outside the acute injury care field.

- * The upper limit of respiratory rate in infants is >29breaths per minute to maintain a higher level of overtriage for infants Trauma centers are designated Level I...IV, in Level I representing the highest level of trauma care available. O48024001689(9994)(99

 - ¶ Age <15 years.
 - ** Intrusion refers to interior compartment intrusion, as opposed to deformation which refers to exterior damage.

** Includes pedestrians or bicyclists thrown or run over by a motor vehicle or those with estimated impact >20 mph with a motor vehicle.

§§ Local or regional protocols should be used to determine the most appropriate level of trauma center; appropriate center need not be Level I.

I Age >55 years.

*** Patients withmeilo Tabler0ts. Wic (roTD 0 T0 Tc - .15f .7.192) Tj /F3 1 Tf .376 c 0 Tw F2 1 Tf .3 0 TD 0 Tc () Tj /F3 (s) Tj [mobted

by EMS providers and represents the Paneles opinions after ticoagulation. Ž Both search strategies excluded case report review of the published medical literature and reports from the editor, editorials, review articles, classic/historic communities that are implementing the Guidelines regardingeprints, continuing medical education, trade journal news their experience. The Panel recognizes that these Guideliadicles, non-English language publications, and articles relate cannot address the specific circumstances of each EMS systedisasters and terrorism. Articles also were excluded if the in the United States or all circumstances that might arise at timeluded the MESH terms emass casualty incidents. Žedisasters scene of injury or while the patient is being transported to blast injuries, Ž or eterrorism; Ž if they were addresses, lecture hospital or trauma center. The Guidelines discuss core elemetetters, case reports, congressional testimony, or editorials; or of any well-managed field triage process; these guidelites were written in a language other than English.

should be adapted to fit the specific needs of local environment total of 2,052 articles (389 on overall field triage and 1,663 within the context of defined state, regional, or local traumanat were step-specific) were identified for further review. Four systems and in accord with an analysis of local data. In areasc injury researchers reviewed abstracts of each article bas of uncertainty, or in those not addressed by the Guidelines and rated local EMS systems should rely on direction from local EMSach article as either •includeŽ or •excludeŽ for further review medical directors, regulations, policies, and protocols. by the Panel. An individual article was selected for inclusion

Methods

if it addressed the field triage of injured patients (i.e., triage methodology, guidelines, or decision schemes) or examined a specific criterion in the Guidelines (e.g., systolic blood

Published peer-reviewed research was the primary basis forsure) in the context of field triage. Articles were included making any revisions to the Guidelines. To identify articles two or more researchers identified them for selection. Data related to the overall field triage process, a structured literature this rating were collected, and an agreement statistic wa search was conducted in Medline. English language peer calculated to assess the reliability of agreement among the for reviewed articles published between January 1, 2006 (the Jears. Statistical programming for calculating Fleiss• Kappa wa of the 2006 revision) and May 1, 2011, were searched. Because in a proceedings of the 30th annual SAS Use no single medical subject heading (MESH) is specific to fiedroup International Congress, and all analyses were conducte triage, multiple search terms were used. The following terms were SAS2(2). Results indicated substantial agreement with searched as MESH vocabulary, keyword, natural language, $k_{\overline{n}}$ 0.73 and standard deviation = 0.009. This process identified truncated terms in order to maximize retrieval of relevant articles. etrauma, Žewound, Žeinjury, Žepre-hospital, Žemergency medical o supplement the structured literature searches, a working services, Ž •ambulance, Ž •transport, Ž and •triage. Ž In addition to review the selected identify articles related to specific steps within the Guidelines identify additional relevant literature that had not that might have been missed by the general field triage search examined, and make initial recommendations regarding strategy described above, researchers used terminology individual components of the Guidelines. This process each criterion of the 1999 and 2006 guidelines as MESHentified an additional 48 articles, which, together with the vocabulary, keyword, natural language, and truncated terms inally identified 241 articles, were provided to the Panel to maximize retrieval of relevant articles. Examples of terms review. Several articles were noted to be relevant to multiple used include •physiology,Ž •flail chest,Ž •accidental falls,Ž and steps in the Guidelines.

FIGURE 2. Guidelines for field triage of injured patients " United States, 2011



Abbreviation: EMS =emergency medical services.

- The upper limit of respiratory rate in infants is >29breaths per minute to maintain a higher level of overtriage for infants.
- * Trauma centers are designated Level I-IV. A level I center has the greatest amount of resources and personnel for care of the injured patient and provides regional 1 ineve

BOX 1. Selected examples of CDC s efforts to ensure dissemination, implementation, and evaluation of the 2006 guidelines for field triage*

Dissemination

- t %JTTFNJOBUFE materials
- t & NBJMFE XJUI QFSNJTTJPO G of Emergency Medical Technicians, approximately copies of the field triage continuing education materials
- t.BJMFE USBJOJOH HVJEFT (available at http://www.cdc.gov/FieldTriage/pdf/ EMS Guide-a.pdf) to local, state, and regional emergency medical services, academia, professional organizations, fire departments, ambulance services and trauma centers nationwide

Implementation

http://www.cdc.gov/fieldtriage) that has had 73,636 page views, 8,060 downloads of the 2009 guidelines, and 2,641 downloads of the training materials

providers, physicians, and nurses

Evaluation

t 4VSWFZFE &.4 trauma care providers regarding the guidelines

*CDC. Guidelines for field triage of injured patients: recommendations of the National Expert Panel on Field Triage. MMWR 2009;58(No. RR-1).

In April 2011, the Panel met to discuss the articles, recommendations of the working group, and the experiential base from states and communities implementing the Guidelines GJFME USMBR Severity Score (ISS) >19, Where available, was used as t threshold for identifying severe injury; however, other factors (e.g. Sneed for prompt operative care and intensive care unit [ICU] admission) also were considered. A threshold of 20% positive 150,000 emergency medical services (EMS) providers predictive value (PPV) to predict severe injury was used to place criteria into discussion for inclusion as mechanism-of-injury criteria. A review of NHTSAs National Automotive Sampling System-Crashworthiness Data System (NASS-2303)nd Crash Injury and Research Engineering Network (CIREN) (information also was undertaken to inform the Panel on the high-risk automobile-crash criterion. The final recommendations of the Panel were based on the best available evidence. Whe definitive research evidence was lacking, the Panel based revisions and recommendations on the expert opinion of its t % FWFMPQFE BXFCQBHF GPS Gumen Mode and State recommendations and modifications was not required.

t 1spwjefe dpoujovjoh fevdbujpo2011 Field& Triage Guideline Recommendations

Modifications to the previously published Guidellinea (e FNFSHFODZbeen Summarized (Box 2) The sections that follow discuss the changes made and provide the rationale of the Panel for makin these changes. The 2011 Guidelines have been endorsed I multiple professional organizations and federal government agencies. The national Highway Traffic Safety Administration concurs with these Guidelines. An updated list of endorsing organizations is available at http://www.cdc.gov/fieldtriage.

Name of the Guidelines

Need for Ventilatory Support: Criterion Added

its familiarity among current EMS practitioners, the inclusion The need for ventilatory support (including both bag-mask^f the motor score within the GCand complications because

ventilation and intubation) was added to erespiratory rate of the difficulty of comparative scoring systems, the Panel <10 or >29 breaths per minute (<20 in an infant aged <1 year).

Although it has been assumed that patients requiring ventilatory stolic Blood Pressure in Older Adults and support would meet the respiratory rate criterion, three studie hildren

suggest that this is not necessarily the case and demonstrate The Panel discussed including a systolic blood pressure to respiratory rate, in identifying seriously injured patients, (SBP) threshold of <110 for patients aged >65 years. After Among 6,259 adults meeting Step One criteria across 11 sites in North America, an advanced airway attempt (i.e., intubation of ferences in older adults in Step Four under •Older AdultsŽ; or supraglottic airway placement) was the strongest predictor of death or prolonged hospital stay among all physiologic Panel maintained the decision to retain the SBP<90mmHg threshold in children. Because of the substantial proportion of measure(29). Among 955 injured children meeting Step One criteria from the same sites, little difference was reported voung children with no field measurement of blood pressure in the proportion of children with abnormal respiratory rates (31), the Panel believed this decision would have minimal who were seriously injured compared with those whose injuries on overtriage.

need for ventilatory assistance was highly discriminating between the two groups (46% and 3%, respectively) and again voor paried at an urban Level L trauma conter determined was determined to be the strongest physiologic predictor of that shock index (heart rate divided by systolic blood pressure serious injury 3(0). Another study involving 3,877 injured is an accurate prehospital predictor of mortality (lowever, being second only to GCS in identifying children in need children had similar findings, with field intubation attempt improves field identification of seriously injured patients of trauma center care1). Therefore, after reviewing the beyond the existing physiologic measures, and noted that literature and considering the evidence, the Panel added need for ventilatory supportŽ to the respiratory rate criterion, recognizing that adults and children requiring advanced airway interventions represent a very high-risk group, whether or not other physiologic abnormalities (including specific respiratory) rate values) are present and to ensure that patients requiring airway support receive the highest level of trauma care within

the defined trauma system.

Additional Physiologic Concerns Discussed by the Expert Panel

The following sections describe additional physiologic criteria topics that were discussed by the Panel and for which no changes were recommended.

Glasgow Coma Scale Motor

Although the Panel considered adding the motor portion of the Glasgow Coma Score (GCSs an alternative to the GCS total (GGS which includes verbal, eye opening, and motor components, no change was made. The motor score has been demonstrated to be associated with the need for lifesaving intervention 32(33). Debate occurred as to whether using only the motor score would be easier for EMS personnel than the GCS owever, because of the lack of confirmatory evidence, the long standing use of the GCS

Step Two: Anatomic Criteria

hemorrhage control methods and thus potentially result in overtriage; and the •crushed, degloved, mangled, or pulseless extremity,Ž •all penetrating injuries to head, neck, torso, and extremities proximal to elbow or knee,Ž and •amputation proximal to wrist or ankleŽ criteria were as likely to identify severely injured patients regardless of tourniquet use. The Panel recommended further study of the use of this intervention.

Pelvic Fractures

Patients with pelvic fractures should receive rapid and specialized care because of the possibility of internal hemorrhage and other associated injuries. The Panel discussed whether the term •pelvic fractureŽ was the most appropriate term for the Guidelines to use to aid EMS professionals in identifying patients in need of trauma center care, recognizing that certain states and communities have changed this terminology to read •unstable pelvic fracture,Ž •suspected pelvic fracture,Ž or •pelvic instability.Ž After extensive discussion, the Panel decided to retain the term •pelvic fracturesŽ as written because no compelling evidence exists that a different name would identify the patients in need of trauma center care more accurately, for the sake of simplicity, and because adding •suspectedŽ or •tendernessŽ to this criterion might increase overtriage unnecessarily.

Step Three: Mechanism of Injury

In Step Three, the intrusion criterion was modified to include roof intrusion. An injured patient who does not meet Step One or Step Two criteria should be evaluated in terms of mechanism of injury (MOI) to determine if the injury might be severe but occult. Evaluation of MOI will help to determine if the patient should be transported to a trauma center. Although different outcomes have been used, recent studies have demonstrated the usefulness of MOI for field triage decisions. A retrospective study of approximately 1 million trauma patients indicated that using physiologic and anatomic criteria alone for triage of patients resulted in undertriage, implying that using MOI for determining trauma center need helped reduce the problem of undertriage46). Another study of approximately one half million patients determined that MOI was an independent predictor of mortality and functional impairment of blunt trauma patients 7). Among 89,441 injured patients evaluated by EMS providers at six sites, physiologic and anatomic criteria

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to access specialized trauma care within this time window by helicopter (79), field triage in nonurban environments needs to be understood better.

Current peer-reviewed triage literature has described multiple outcome measures, including injury severity, clinical outcomes, need for trauma center resources (with or without a measure of timeliness), or a combination of these metrics. The most common clinical outcome measure is ISS >15, although the AIS 3 has also been used. Trauma center need has been

Areas for Specific Research Using the 2011 Field Triage Guidelines

Several new technologies, which emerge from research in the remote noninvasive monitoring of casualties in austere environments, will likely be commercially available in the near future. Of these innovations, the noninvasive monitoring of heart rate complexity and variabi**B**(**y**). (.8)3 respiratory rate (84), tissue oxygenation, and point-of-care lactate testing (85) appear promising for future field triage, but require more research.

The GC $\$ of the GC $\$ is used in state triage guidelines (e.g., Colorado) and has some support in peer-reviewed literature, as noted in the preceding sections. However, additional research is needed to evaluate the use of $\$ field triage and the practical implications of changing this Step One criterion.

Advanced automatic collision notification shows promise

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National Expert Panel on Field Triage of Injured Patients Membership as of December 2011

Chair: Gregory J. Jurkovich, MD, Harborview Medical Center, Seattle, Washington.

Members: John H. Armstrong, MD, University of South Florida, Tampa, Florida: Bob Bailey, MA, McKing Consulting, Raleigh, North Claeoli Ra; Bass, MD, Maryland Institute for Emergency Medical Services Systems, Baltimore, Maryland; Eileen Bulger, MD, University, Stelahab Washington; Alasdair Conn, MD, Massachusetts General Hospital, Boston, Massachusetts; Arthur Cooper, MD, Columbia University Matellicat Content of the second sec Hospital, New York, New York; Theodore Delbridge, MD, East Carolina University, Greenville, North Carolina: John FildeershippUNevada, Las Vegas, Nevada; Robert L. Galli, MD, University of Mississippi, Jackson, Mississippi; Catherine Gotschall, ScD, Nationaffic Spaffic And Administration, Washington, District of Columbia; Daniel G. Hankins, MD, Mayo Clinic, Rochester, Minnesota; Mark C. Henry, MD, Stony Brosk, Stony Brook, New York; Teresita Hogan, MD, University of Chicago, Northbrook, Illinois; Richard C. Hunt, MD, Division of Injury Restormate Clater for Injury Prevention and Control, CDC, Atlanta, Georgia; Jorie Klein, Parkland Health and Hospital System, Dallas, Texas; Dsulylas, Gevisipager Health System, Danville, Pennsylvania; D. Randy Kuykendall, Colorado Department of Public Health and Environment, DenverBcoukuederner, PhD, Medical College of Wisconsin, Milwaukee, Wisconsin; Robert C. MacKersie, MD, University of California San Francisco, Catifochtaan, PhD, University of Utah, Salt Lake City; Gregg Margolis, PhD, US Department of Health and Human Services, Bethesda, Malaglagad, CMala, Oregon Health and Science University, Portland; Robert E. O. Connor, MD, University of Virginia, Charlottesville, Virginia; ErridOuserblanversity School of Medicine, Durham, North Carolina; Ritu Sahni, Oregon Emergency Medical Services and Trauma Systems, Lake Oswerger, Drsglom, def. MD, Emory University School of Medicine, Atlanta, Georgia; Nels Sandall, American College of Surgeons, Chicago, Mli Sass ScottD, Emory University School of Medicine and Division of Injury Response, National Center for Injury Prevention and Control, CDGeottantSean Siler, MD, National Disaster Medical System, Washington, District of Columbia; John Sinclair, Kittitas Valley Fire Rescue, Ellengtong Wast Van Gorder, Scripps Health, San Diego, California; Gary Wallace, ATX Group/Cross Country Automotive, Irving, Texas; Stewart C. Vang MS, University of Michigan, Ann Arbor, Michigan; Christopher E. Way, Emergency Services, Parsons, Kansas; Robert Winchell, MD, Mainte Medictairce, Maine; Joseph Wright, MD, Children National Medical Center, Washington, District of Columbia.

Organizations and Federal Agencies Endorsing the Guidelines for Field Triage of Injured Patients List as of December 2011

Air Medical Physician Association, American Academy of Orthopedic Surgeons, American Academy of Pediatrics, American BurmAsisacia@ide and Surgeons, American Association for Respiratory Care, American Association for the Surgery of Trauma, American BurmAsisacia@ide of Emergency Physicians, American College of Osteopathic Surgeons, American College of Surgeons, American Public HeattlerAcate and Society, Association of Air Medical Services, Association of Critical Care Transport, Association of Public-Safety CoOfficialisation ternational, Association of State and Territorial Health Officials, Brain Trauma Foundation, Commission on Accreditation of Medical Services Chiefs, International Health Officials, Brain Trauma Foundation, Commission on Accreditation of Medical Services Chiefs, International Association of Fire Chiefs, International Academies of Emergency Dispatch, International Association of Emergency Medical Services Chiefs, International Association of EMS Educators, National Association of EMS Physicians, National Association of Emergency Medical Technicians, National EMS Management Association, National Volunteer Fire Council, Safe States Allian Academies Security for the Advancement of Violence and Injury Research, Society of Emergency Medicine PhysiciannAs Security Association of America, Western Trauma Association, Federal Interagency Committee on Emergency Medical Services (comprising or physician Association of America, Western Trauma Association, Federal Interagency Committee on Emergency Medical Services (comprising or physician Association of Transportation, the U.S. Department of Homeland Security, the theSoDeptentse, and the U.S. Federal Communications Commission).

The National Highway Traffic Safety Administration concurs with these Guidelines.

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