



## Complete Summary

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### GUIDELINE TITLE

Clinical practice guideline: endpoints of resuscitation.

### BIBLIOGRAPHIC SOURCE(S)

Tisherman SA, Barie P, Bokhari F, Bonadies J, Daley B, Diebel L, Eachempati SR, Kurek S, Luchette FA, Puyana JC, Schreiber M, Simon R. Clinical practice guideline: endpoints of resuscitation. Winston-Salem (NC): Eastern Association for the Surgery of Trauma; 2003. 28 p. [93 references]

### GUIDELINE STATUS

This is the current release of the guideline.

## COMPLETE SUMMARY CONTENT

SCOPE  
METHODOLOGY - including Rating Scheme and Cost Analysis  
RECOMMENDATIONS  
EVIDENCE SUPPORTING THE RECOMMENDATIONS  
BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS  
IMPLEMENTATION OF THE GUIDELINE  
INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT  
CATEGORIES  
IDENTIFYING INFORMATION AND AVAILABILITY  
DISCLAIMER

## SCOPE

### DISEASE/CONDITION(S)

- Multiple organ dysfunction syndrome
- Hemorrhagic shock

### GUIDELINE CATEGORY

Risk Assessment

### CLINICAL SPECIALTY

Critical Care  
Emergency Medicine  
Surgery

## **INTENDED USERS**

Advanced Practice Nurses  
Allied Health Personnel  
Emergency Medical Technicians/Paramedics  
Nurses  
Physicians

## **GUIDELINE OBJECTIVE(S)**

- To demonstrate that the proposed endpoint(s) is (are) useful for stratifying the patients' severity of physiologic derangement
- To demonstrate that the proposed endpoint(s) is (are) useful for predicting risk of development of multiple organ dysfunction syndrome (MODS) or death.
- To determine the endpoint(s) for resuscitation that would predict survival without organ system dysfunction if a defined level is achieved within a certain time frame.
- To improve patient survival and morbidity (organ system dysfunction) by use of appropriate resuscitation endpoint(s).

## **TARGET POPULATION**

Severely injured trauma victims

## **INTERVENTIONS AND PRACTICES CONSIDERED**

### **Resuscitation Endpoints**

#### **Global**

1. Oxygen delivery
  - Supranormal oxygen
  - Mixed venous oxygen saturation (SVO<sub>2</sub>)
2. Hemodynamic profiles
  - Central venous pressure (CVP)
  - Pulmonary capillary wedge pressure (PCWP)
  - Right ventricular end diastolic volume index (RVEDVI)
3. Acid-base status
  - Bicarbonate concentrations
  - Arterial lactate
  - End-tidal carbon dioxide levels

#### **Regional**

1. Tissue oxygenation and partial pressure of carbon dioxide (PCO<sub>2</sub>)
  - Tissue oxygen and carbon dioxide electrodes
  - Near infrared spectroscopy (NIRS)
2. Gastric mucosal ischemia
  - Gastric tonometry
  - Sublingual monitoring of the partial pressure of carbon dioxide

- Physical examination

## **MAJOR OUTCOMES CONSIDERED**

- Survival without organ system dysfunction
- Risk for multiple organ dysfunction syndrome or death
- Physiologic derangement

## **METHODOLOGY**

### **METHODS USED TO COLLECT/SELECT EVIDENCE**

Hand-searches of Published Literature (Primary Sources)  
Hand-searches of Published Literature (Secondary Sources)  
Searches of Electronic Databases

### **DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE**

The committee agreed upon the potential endpoints to be considered. Literature for review included human, trauma patients, and some attempted connection between the proposed endpoint and patient outcome (morbidity, survival, etc.), not just process variables. Some nontrauma studies of critically ill patients were also included, particularly if the parameter seemed promising in other surgical patients. Similarly, some non-human studies of promising techniques are discussed; though not part of the main review or recommendations. Medline and EMBASE were searched from 1980 to 2001.

### **NUMBER OF SOURCE DOCUMENTS**

Not stated

### **METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE**

Weighting According to a Rating Scheme (Scheme Given)

### **RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE**

#### **Evidence Classification Scheme**

##### **Class I**

Prospective randomized controlled trials (PRCTs) - the gold standard of clinical trials. Some may be poorly designed, have inadequate numbers, or suffer from other methodological inadequacies.

##### **Class II**

Clinical studies in which the data were collected prospectively, and retrospective analyses which were based on clearly reliable data. These types of studies include

observational studies, cohort studies, prevalence studies, and case control studies.

### **Class III**

Most studies based on retrospectively collected data. Evidence used in this class includes clinical series, databases or registries, case reviews, case reports, and expert opinion.

## **METHODS USED TO ANALYZE THE EVIDENCE**

Systematic Review with Evidence Tables

## **DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE**

Not stated

## **METHODS USED TO FORMULATE THE RECOMMENDATIONS**

Expert Consensus

## **DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS**

Not stated

## **RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS**

### **Level I**

The recommendation is convincingly justifiable based on the available scientific information alone. This recommendation is usually based on Class I data; however, strong Class II evidence may form the basis for a Level I recommendation, especially if the issue does not lend itself to testing in a randomized format. Conversely, low quality or contradictory Class I data may not be able to support a Level I recommendation.

### **Level II**

The recommendation is reasonably justifiable by available scientific evidence and strongly supported by expert opinion. This recommendation is usually supported by Class II data or a preponderance of Class III evidence.

### **Level III**

The recommendation is supported by available data but adequate scientific evidence is lacking. This recommendation is generally supported by Class III data. This type of recommendation is useful for educational purposes and in guiding future clinical research.

## **COST ANALYSIS**

A formal cost analysis was not performed and published cost analyses were not reviewed.

## **METHOD OF GUIDELINE VALIDATION**

Peer Review

## **DESCRIPTION OF METHOD OF GUIDELINE VALIDATION**

The guidelines are forwarded to the chairmen of the Eastern Association for the Surgery of Trauma ad hoc committee for guideline development. Final modifications are made and the document is forwarded back to the individual panel chairpersons.

# **RECOMMENDATIONS**

## **MAJOR RECOMMENDATIONS**

The levels of recommendation (I-III) and classes of evidence (I-III) are defined at the end of the "Major Recommendations" field.

### **Recommendations Regarding Stratifying Physiologic Derangement**

#### Level I

1. Standard hemodynamic parameters do not adequately quantify the degree of physiologic derangement in trauma patients. The initial base deficit, lactate level, or gastric intramucosal pH (pHi) can be used to stratify patients with regard to the need for ongoing fluid resuscitation, including packed red blood cells and other blood products, and the risks of multiple organ dysfunction syndrome (MODS) and death.
2. The ability of a patient to attain supranormal oxygen delivery parameters correlates with an improved chance for survival.

#### Level II

1. The time to normalization of base deficit, lactate, and pHi is predictive of survival.
2. Persistently high base deficit or low pHi (or worsening of these parameters) may be an early indicator of complications (e.g., ongoing hemorrhage or abdominal compartment syndrome).
3. The predictive value of the base deficit may be limited by ethanol intoxication or a hyperchloremic metabolic acidosis, as well as administration of sodium bicarbonate.

#### Level III

1. Right ventricular end diastolic volume index (RVEDVI) measurement may be a better indicator of adequate volume resuscitation (preload) than central venous pressure or pulmonary capillary wedge pressure (PCWP).
2. Measurements of tissue (subcutaneous or muscle) oxygen and/or carbon dioxide levels may identify patients who require additional resuscitation and are at risk for multiple organ dysfunction syndrome and death.
3. Serum bicarbonate levels may be substituted for base deficit levels.

## **Recommendations Regarding Improved Patient Outcomes**

### Level I

1. There is insufficient data to formulate a level 1 recommendation.

### Level II

1. During resuscitation, attempts should be made to increase oxygen delivery to normalize base deficit, lactate, or pHi during the first 24 hours. The optimal algorithms for fluid resuscitation, blood product replacement, and the use of inotropes and/or vasopressors have not been determined.

## **Definitions:**

## **Strength of the Recommendation Scheme**

### **Level I**

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## **Evidence Classification Scheme**

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### **CLINICAL ALGORITHM(S)**

None provided

## **EVIDENCE SUPPORTING THE RECOMMENDATIONS**

### **TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS**

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

## **BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS**

### **POTENTIAL BENEFITS**

Appropriate definition of endpoints useful for:

- Stratifying the patients' severity of physiologic derangement
- Predicting risk of development of multiple organ dysfunction syndrome or death
- Prediction of survival without organ system dysfunction
- Improvement of patient survival and morbidity (organ system dysfunction) by use of appropriate resuscitation endpoints.

### **POTENTIAL HARMS**

Not stated

## **IMPLEMENTATION OF THE GUIDELINE**

### **DESCRIPTION OF IMPLEMENTATION STRATEGY**

An implementation strategy was not provided.

## INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

### IOM CARE NEED

Getting Better

### IOM DOMAIN

Effectiveness  
Timeliness

## IDENTIFYING INFORMATION AND AVAILABILITY

### BIBLIOGRAPHIC SOURCE(S)

Tisherman SA, Barie P, Bokhari F, Bonadies J, Daley B, Diebel L, Eachempati SR, Kurek S, Luchette FA, Puyana JC, Schreiber M, Simon R. Clinical practice guideline: endpoints of resuscitation. Winston-Salem (NC): Eastern Association for the Surgery of Trauma; 2003. 28 p. [93 references]

### ADAPTATION

Not applicable: The guideline was not adapted from another source.

### DATE RELEASED

2003

### GUIDELINE DEVELOPER(S)

Eastern Association for the Surgery of Trauma - Professional Association

### SOURCE(S) OF FUNDING

Eastern Association for the Surgery of Trauma (EAST)

### GUIDELINE COMMITTEE

EAST Practice Management Guidelines Workgroup

### COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

*Work Group Members:* Samuel A. Tisherman, MD, FACS; Philip Barie, MD, FACS; Faran Bokhari, MD, FACS; John Bonadies, MD, FACS; Brian Daley, MD, FACS; Lawrence Diebel, MD, FACS; Soumitra R. Eachempati, MD, FACS; Stanley Kurek,

DO; Fred A. Luchette, MD, FACS; Juan Carlos Puyana, MD, FACS; Martin Schreiber, MD, FACS; Ronald Simon, MD, FACS

## **FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST**

Not stated

## **GUIDELINE STATUS**

This is the current release of the guideline.

## **GUIDELINE AVAILABILITY**

Electronic copies: Available in Portable Document Format (PDF) from the [Eastern Association for the Surgery of Trauma \(EAST\) Web site](#).

Print copies: Available from the Eastern Association for the Surgery of Trauma Guidelines, c/o Fred Luchette, MD, Loyola University Medical Center, Department of Surgery Bldg. 110-3276, 2160 S. First Avenue, Maywood, IL 60153; Phone: (708) 327-2680; E-mail: [fluchet@lumc.edu](mailto:fluchet@lumc.edu).

## **AVAILABILITY OF COMPANION DOCUMENTS**

The following is available:

- Utilizing evidence based outcome measures to develop practice management guidelines: a primer. Allentown (PA): Eastern Association for the Surgery of Trauma; 2000. 18 p. Electronic copies: Available from the [Eastern Association for the Surgery of Trauma \(EAST\) Web site](#).

An excerpt is also available:

- Pasquale M, Fabian TC. Practice management guidelines for trauma from the Eastern Association for the Surgery of Trauma. J Trauma 1998 Jun;44(6):941-56; discussion 956-7.

Print copies: Available from EAST Guidelines, c/o Fred Luchette, MD, Loyola University Medical Center, Department of Surgery Bldg. 110-3276, 2160 S. First Avenue, Maywood, IL 60153; Phone: (708) 327-2680; E-mail: [fluchet@lumc.edu](mailto:fluchet@lumc.edu).

## **PATIENT RESOURCES**

None available

## **NGC STATUS**

This NGC summary was completed by ECRI on April 21, 2004. The information was verified by the guideline developer on August 5, 2004.

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