



## STATE TRAUMA ADVISORY BOARD MANAGEMENT RECOMMENDATIONS



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### SUBJECT: GERIATRIC TRAUMA PATIENT RESUSCITATION

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*These recommendations represent a suggested treatment method based on a review of the literature and expert opinion reflecting the clinical experience of members of the STAB. The literature review was not performed according to a formal evidence-based medicine process and would therefore be classified as Class III evidence. These recommendations represent a treatment approach without proven superiority over other treatment methods. Their employment is at the discretion of the managing physician.*

**PURPOSE:** To provide recommendations for the optimum monitoring, analysis of data and resuscitation of geriatric trauma patients (>65 years old with a high index of suspicion for significant injury or comorbid conditions) in the very early post injury period.

#### **RATIONALE:**

Elderly patients have constitutional impairments of cardiac, pulmonary, renal and immunologic function. In addition, most also exhibit or are occultly afflicted with diseases which further impair organ function, limit organ functional reserve or reduce the capacity to respond to injury. Elderly trauma patients (>65 years old) have three to five times the mortality rate when compared to younger patients. The leading causes of mortality (following acute death) are severe closed head injury, cardiac complications, pulmonary failure and sepsis. Very little is written on the subject from the perspective of patient management. The guidelines below embody an approach based on experience, applied physiology and published findings. Of great importance is the need to stabilize patients as soon as possible after admission to the emergency department.

These guidelines should not be applied in conflict with patient preference for predetermined treatment directives.

#### **I. IMMEDIATE RESUSCITATION (first 30 minutes)**

- A.** Follow ATLS protocols for primary and secondary surveys. Establish intravenous access, airway control, and consider arterial catheterization for monitoring of arterial blood gases and blood pressure.
- B.** Life-saving procedures should be done as indicated.
- C.** X-rays should be limited to the three-view C-spine, CXR and AP pelvis. All extremity radiographs should be postponed until after monitoring and stabilization has been completed.

- D.** Hemodynamically unstable patients should have a diagnostic peritoneal lavage (DPL) or ultrasound. Patients with an acute abdomen should be taken to the OR for operation. Stable patients with a low likelihood of abdominal injury should have abdominal CT scans postponed.
- E.** A 12-lead EKG should be done and an echocardiogram, if indicated.
- F.** An oximetric pulmonary artery catheter should be considered for seriously injured patients. This may be done in the ED, OR or ICU as determined by the Trauma Surgeon and nursing staff. Ideally, a strip chart recorder should be used to create a permanent record of the SvO<sub>2</sub> measurements.
- G.** CT scan of the brain should be done as part of the immediate resuscitation only for patients with altered level of consciousness, or lateralizing neurologic findings (such as a unilateral dilated pupil and coma). Brain CT scans for other indications and facial CT scans are to be postponed until after optimal hemodynamic monitoring and stabilization by protocol has been completed.
- H.** Following optimization (see below) of cardiodynamics, further diagnostic and non-life-saving procedures should be done.
- I.** Continuous cardiodynamic monitoring should be carried out in the ED, in diagnostic areas and in the operating room.

## **II. GOALS FOR “OPTIMIZATION” OF CARDIODYNAMICS (first 2 hours)**

- A.** The fundamental goal is to improve oxygen consumption (VO<sub>2</sub>) to a level independent of oxygen delivery (DO<sub>2</sub>) or until lactic acidemia is resolved:

$$VO_2 = C.I. \times D(Ca-VO_2) \times 10$$

Where VO<sub>2</sub> is oxygen consumption index (in mL/min/M<sup>2</sup>)

C.I. is cardiac index (cardiac output divided by body surface area (mL/min/M<sup>2</sup>))

D(Ca-VO<sub>2</sub>) is the difference between arterial (a) and mixed venous (v) blood oxygen content.

(ten) is a conversion factor from decaliters to liters.

CaO<sub>2</sub> is the arterial blood oxygen content and is equal to:

$$= (SaO_2 \times hgb \times 1.36) + (PaO_2 \times 0.003)$$

DO<sub>2</sub> is oxygen delivery index and is C.I. (CaO<sub>2</sub>) 10

In short, the variables of concern to the clinician are Cardiac Index, hemoglobin, arterial oxygen saturation of blood, venous oxygen saturation of blood.

## **B. Resuscitation Goals:**

1. C.I.: normally about 2.5 - 3.0 L/min/M<sup>2</sup> in the elderly, the recommended target is an increase to \$ 4 L/min/M<sup>2</sup>.
2. Hemoglobin: normally 12-15 g/dL, the recommended target is 9-12 g/dL. The recommended goal for hematocrit in the elderly trauma patient is 30-35%.
3. SaO<sub>2</sub>: the oxygen saturation of arterial blood should be kept > 95% (PaO<sub>2</sub> of \$ 75 mmHg). Some authorities are satisfied with an SaO<sub>2</sub> > 90%.
4. SvO<sub>2</sub>: monitored by an oximetric PAC, it is normally 75%. The recommended target is >65%. The SvO<sub>2</sub> is a reflection of the oxygen extraction ratio, or (SaO<sub>2</sub> - SvO<sub>2</sub>) ÷ SaO<sub>2</sub>, the amount of oxygen pulled out of arterial blood by the body as a whole.
5. DO<sub>2</sub>: normally greater than 500 mL/min/M<sup>2</sup>, the recommended target is > 600 mL/min/M<sup>2</sup>.
6. VO<sub>2</sub>: normally about 125 mL/min/M<sup>2</sup>, the recommended target is over 170 mL/min/M<sup>2</sup>.

## **C. Administration of Blood:**

1. Packed red blood cells should be undertaken, mindful that many elderly patients have limited ability to cope with rapid changes in intravascular volume.
2. Smaller patients with less circulating blood volume will have proportionately greater increases in hemoglobin level for each unit transfused.
3. Such transfusions will often times be outside current Transfusion Committee guidelines, and an explanation may be requested.

## **D. Cardiac Output: ( is determined by preload, contractility and afterload)**

1. Preload is the venous return to the heart, and is indirectly measured by use of CVP and PCWP (wedged) pressure readings. Although hearts impaired by sepsis, trauma and acute disease do not directly link pressure and volume, most authorities recommend that the PCWP (wedge pressure) be kept at 12-18 mmHg.

2. Afterload is the systemic vascular resistance (SVR), modulated by arteriolar vasomotor tone, which is influenced by autonomic nervous system activity, local tissue/organ bed metabolic characteristics and by cardiac output itself. It is a calculated value, not a directly measured physiologic event.

An elevated SVR reduces the ease of cardiac emptying. The SVR can be reduced by use of nitroprusside, or other vasodilators. (Nitroglycerin lowers preload and afterload).

A very low SVR with systolic BP >90, warm skin and HR <120 does not necessarily require pressor therapy. When mean arterial pressure falls below 65, however, both renal and myocardial perfusion is significantly impaired and pressor support should be considered.

3. Myocardial contractility can be enhanced with inotropic medications, such as Dobutamine.

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