

Maine EMS Trauma Advisory Committee
Consensus Statement and Clinical Advice for Trauma Management

**TRANSFER OF PATIENTS WITH TRAUMATIC BRAIN
INJURY (TBI)**

PART I: Key Concepts

- A. Correct hypoxemia and hypoperfusion.
- B. Every effort should be made to avoid and prevent hypotension.
- C. At most referring hospitals, the need for brain CT is limited, and more related to triage (disposition) than treatment.
- D. For most significant CNS injuries, treatment equals transfer.
- E. Reversal of therapeutic anticoagulation is an urgent priority of care.

PLEASE REMEMBER:

Transfers or consultations related to **brain injuries** – *regardless of age, comorbidities, or intended destination* – should be directed to the attending **trauma surgeon** at your regional **trauma center**. The trauma surgeon will recommend or facilitate subsequent actions or consultations as needed.

PART II: Annotations and Rationale

A. *Correct hypoxemia and hypoperfusion.*

As in all cases of major injury, emphasis should be placed on aggressive stabilization of the ABC's. Detection and correction of hypoxemia and hypoperfusion are the most important initial interventions in the management of TBI and the prevention of secondary brain injury.¹

B. *Every effort should made to avoid and prevent hypotension.*

The relationship of systemic blood pressure and cerebral perfusion merits special attention.

Severe TBI is an absolute contraindication to any strategy of "permissive hypotension" in the treatment of trauma. The injured brain has lost its ability to regulate its own perfusion. Therefore, when there is brain injury, cerebral perfusion pressure (CPP) is exclusively a function of blood pressure (BP). Mean arterial pressure (MAP) must remain sufficient to compensate for rising intracranial pressure (ICP).

- $CPP = MAP - ICP$
- $MAP \approx \frac{(\text{Systolic BP} - \text{Diastolic BP}) + \text{Diastolic BP}}{3}$

Any single episode of hypotension (MAP less than 60; systolic BP less than 90) in the setting of TBI may more than *double* a patient's chances of dying.²

A TBI patient who arrives hypotensive requires aggressive measures to identify and control hemorrhage and/or to identify and correct other causes of hypotension. This may include fluid boluses and blood products.

If hemorrhage has been excluded as the source of hypotension, consider the use of pressors to maintain a MAP of greater than 60. If the TBI patient requires airway management, the choice of drugs should be carefully considered to minimize hemodynamic changes.

C. *At most referring hospitals, the need for brain CT is limited, and more related to triage (disposition), than treatment.*

In cases of major central nervous system injury, local imaging rarely informs or improves local treatment options.

Brain CT is chiefly indicated, therefore, to investigate the significance of minor clinical symptoms or worrisome mechanism; that is, to direct and protect the disposition of patients with mild to moderate TBI.³ See next.

D. *For most significant CNS injuries, treatment equals transfer.*

Major brain injury, regardless of specific diagnosis, is an independent indication for urgent transfer to a trauma center. Once identified, these injuries recommend emphasis on safe and expedient transfer.

While rare cases of rural burr-hole resuscitation exist, most community hospitals lack the experience, resources, or processes for just-in-time craniotomy. Furthermore, the indications for trephine comprise only a fraction of life-threatening TBI's.

With this in mind, clinicians may consider whether CT in major TBI might be deferred altogether, in favor of shortening the interval to definitive care.

Variables abound (distance, CT capabilities, radiology availability, portability of images, etc.); and should be reflected in local process. Real-time questions or concerns should be addressed to the nearest on-call trauma surgeon.

E. *Reversal of therapeutic anticoagulation is an urgent priority of care.*

Chronic therapeutic anticoagulation becomes a critical comorbidity for injured patients – especially those with CNS injuries. Identifying and controlling anticoagulation is a vital element of stabilization.⁴

Referring hospitals should work closely with trauma centers to prospectively develop processes for reversal, where possible, of anticoagulation. Reversal of anticoagulation for selected patients must be initiated as soon as possible, and ultimately should be managed by a trauma surgeon.

Part III: References

1: Tang ME, Lobel DA. Severe traumatic brain injury: maximizing outcomes. Mt Sinai J Med. 2009 Apr;76(2):119-28.

2: Chestnut, RM et al. Early and late hypotension as a frequent and fundamental source of cerebral ischemia following severe traumatic brain injury in the Traumatic Coma Data Bank. Acta Neurochir Suppl (Wien). 1993; 59:121-5.

3: Stiell IG. The Canadian CT Head rule for patients with minor head injury. Lancet 2001;357(9266):1391-96.

4: Stein DM et al. Recombinant Factor VIIa: Decreasing time to intervention in coagulopathic patients with severe traumatic brain injury. J Trauma. 2008 Mar; 64(3):620-28.