Thromboprophylaxis in Traumatic brain injury

Recommendations

Level I and II

• There was insufficient evidence to support a Level of Evidence 1 or Level of Evidence 2 recommendation for treatment of Deep-Vein Thrombosis (Deep-vein thrombosis) in severe TBI patients.

Level III

• Low-molecular-weight heparin (LMWH) or low-dose unfractionated heparin may be used in combination with mechanical prophylaxis. However, there is an increased risk for expansion of traumatic intracranial hemorrhage [1].

Currently no national standard exists on optimal timing to initiate VTE chemoprophylaxis after traumatic brain injury (TBI). We designed this survey to assess current practice regarding the timing of VTE chemoprophylaxis after TBI.

All the EAST members were surveyed online. Participants reported demographics, and responses to questions regarding VTE chemoprophylaxis in TBI and timing of chemoprophylaxis in 2 hypothetical clinical scenarios of TBI.

Three hundred and ninety-one full responses were collected (response rate 30.9%). Most respondents (75%) reported the decision to initiate VTE chemoprophylaxis with a consensus between the neurosurgery and trauma/critical care services. While 76% of respondents reported experience of seeing pulmonary embolism without chemoprophylaxis, 44% witnessed progression of TBI after VTE chemoprophylaxis. Approximately 50% considered their practice of VTE chemoprophylaxis in TBI patients to be conservative. Almost 50% reported no standardized protocol in their institutions. While 1/3 of the members believed guidelines exist, another 1/3 believed no guidelines available. Responses to two clinical scenarios showed various approaches regarding the timing of VTE chemoprophylaxis.

Currently there is a wide variability in the practice patterns regarding the timing of VTE chemoprophylaxis in TBI patients. This survey reinforces the need for further investigation to guide clinical practice [2].

Low-molecular-weight heparin (LMWH) prophylaxis in pediatric traumatic brain injury appears to be more effective than unfractionated heparin (UH) in preventing venous thromboembolism (VTE). Large, multicenter prospective studies are warranted to confirm the superiority of LMWH over UH in pediatric patients with traumatic brain injury. Moreover, outcomes of VTE prophylaxis in the very young remain understudied; therefore, dedicated studies to evaluate this population are needed [3].

Case series

2014

Venous thromboembolic prophylaxis (VTEp) is often delayed following traumatic brain injury (TBI), yet animal data suggest that it may reduce cerebral inflammation and improve cognitive recovery.

Medical charts of severe TBI patients admitted to a level 1 trauma center in 2009-2010 were queried for admission Glasgow Coma Scale (GCS), head Abbreviated Injury Scale, Injury Severity Score (ISS), osmotherapy use, emergency neurosurgery, and delay to VTEp initiation. Progression (+1 = better, 0 = no change, -1 = worse) of brain injury on head CTs and neurologic exam (by bedside MD, nurse) was collected from patient charts. Marshall computed tomography classification were calculated from the initial head CT results.

A total of 22, 34, and 19 patients received VTEp at early (<3 days), intermediate (3-5 days), and late (>5 days) time intervals, respectively. Clinical and radiologic brain injury characteristics on admission were similar among the three groups ($P > 0.05$), but ISS was greatest in the early group ($P < 0.05$). Initial head CT Marshall computed tomography classification were similar in early and late groups. The slowest progression of brain injury on repeated head CT scans was in the early VTEp group up to 10 days after admission.

Early initiation of prophylactic heparin in severe TBI is not associated with deterioration neurologic exam and may result in less progression of injury on brain imaging. Possible neuroprotective effects of heparin in humans need further investigation [4].

Guidelines

2017

Carney N, Totten AM, O'Reilly C, Ullman JS, Hawryluk GW, Bell MJ, Bratton SL, Chesnut R, Harris OA, Kissoon N, Rubiano AM, Shutter L, Tasker RC, Vavilala MS, Wilberger J, Wright DW, Ghajar J. Guidelines for the Management of Severe Traumatic Brain Injury, Fourth Edition. Neurosurgery. 2017 Jan 1;80(1):6-15. doi: 10.1227/NEU.0000000000001432. PubMed PMID: 27654000. [5].

2007

Brain Trauma Foundation; American Association of Neurological Surgeons; Congress of Neurological Surgeons; Joint Section on Neurotrauma and Critical Care, AANS/CNS, Bratton SL, Chestnut RM, Ghajar J, McConnell Hammond FF, Harris OA, Hartl R, Manley GT, Nemecek A, Newell DW, Rosenthal G, Schouten J, Shutter L, Timmons SD, Ullman JS, Videtta W, Wilberger JE, Wright DW. Guidelines for the management of severe traumatic brain injury. V. Deep-Vein Thrombosis prophylaxis. J Neurotrauma. 2007;24 Suppl 1:S32-6. Erratum in: J Neurotrauma. 2008 Mar;25(3):276-8. multiple author names added. PubMed PMID: 17511543 [6].

[1], [5]

Carney N, Totten AM, O'Reilly C, Ullman JS, Hawryluk GW, Bell MJ, Bratton SL, Chesnut R, Harris OA, Kissoon N, Rubiano AM, Shutter L, Tasker RC, Vavilala MS, Wilberger J, Wright DW, Ghajar J. Guidelines for the Management of Severe Traumatic Brain Injury, Fourth Edition. Neurosurgery. 2017 Jan 1;80(1):6-15. doi: 10.1227/NEU.0000000000001432. PubMed PMID: 27654000.

2)

Strollo BP, Bennett GJ, Chopko MS, Guo WA. Timing of venous thromboembolism chemoprophylaxis after traumatic brain injury. J Crit Care. 2017 Aug 9;43:75-80. doi: 10.1016/j.jcrc.2017.08.012. [Epub ahead of print] PubMed PMID: 28850931.

3)

van Erp IA, Gaitanidis A, El Moheb M, Kaafarani HMA, Saillant N, Duhaime AC, Mendoza AE. Low-molecular-weight heparin versus unfractionated heparin in pediatric traumatic brain injury. J Neurosurg Pediatr. 2021 Feb 12:1-6. doi: 10.3171/2020.9.PEDS20615. Epub ahead of print. PMID: 33578391.

4)

Kim L, Schuster J, Holena DN, Sims CA, Levine J, Pascual JL. Early initiation of prophylactic heparin in severe traumatic brain injury is associated with accelerated improvement on brain imaging. J Emerg Trauma Shock. 2014 Jul;7(3):141-148. PubMed PMID: 25114421.

6)

Brain Trauma Foundation; American Association of Neurological Surgeons; Congress of Neurological Surgeons; Joint Section on Neurotrauma and Critical Care, AANS/CNS, Bratton SL, Chestnut RM, Ghajar J, McConnell Hammond FF, Harris OA, Hartl R, Manley GT, Nemecek A, Newell DW, Rosenthal G, Schouten J, Shutter L, Timmons SD, Ullman JS, Videtta W, Wilberger JE, Wright DW. Guidelines for the management of severe traumatic brain injury. V. Deep-Vein Thrombosis prophylaxis. J Neurotrauma. 2007;24 Suppl 1:S32-6. Erratum in: J Neurotrauma. 2008 Mar;25(3):276-8. multiple author names added. PubMed PMID: 17511543.