

COMMENTARY

# Preferences in traumatic intracranial hemorrhage: bleeding vs. clotting

Chee M Chan\*<sup>1</sup> and Marya D Zilberberg<sup>2,3</sup>

See related research by Scales *et al.*, <http://ccforum.com/content/14/2/R72>

## Abstract

Patients with traumatic brain injury and resultant intracranial hemorrhage (ICH) are at high risk for developing venous thromboembolism (VTE). The use of thromboprophylaxis is effective at decreasing the rate of VTE, but at the potential expense of an increased risk of ICH progression. Physicians must carefully consider both the benefits and risks of VTE prophylaxis before prescribing chemical anticoagulants to these patients. To help clarify this difficult choice, Scales and colleagues performed a decision analysis to determine whether the benefits of thromboprophylaxis outweigh the potential risk of worsening ICH. There is increasing evidence that bleeding risks are not as prominent as previously thought. Although the results were largely inconclusive, the present study has identified areas for future research.

Individuals who suffer traumatic intracranial hemorrhages (ICHs), the most common cause of morbidity and mortality in adults younger than 40 years of age, not only incur neurologic deficits but also are at increased risk for complications. Thwarting such complications is paramount to preserving quality of life and improving the likelihood for survival. As such, preventing venous thromboembolism (VTE), the single most preventable cause of morbidity and mortality in neurosurgical patients, is of utmost priority. The decision to initiate VTE prophylaxis in the setting of a traumatic ICH must be carefully considered. Failure to use VTE prophylaxis may result in serious or fatal pulmonary embolism (PE), whereas the use of anticoagulants may potentiate further intracranial bleeding, thereby worsening neurologic

function and possibly precipitating death. The paucity of clinical trials addressing the safety and efficacy of chemical thromboprophylaxis in this patient population leaves clinicians guessing in regard to the appropriate dose, timing, and duration for thromboprophylaxis in the presence of an ICH. Thus, it is left to the physician at the bedside to weigh the risks versus benefits of anticoagulation in the face of the existing potential for a serious PE or the progression of a head bleed. The pivotal question is: how much preventive benefit must be provided in order to outweigh the potential bleeding risk?

In the previous issue of *Critical Care*, Scales and colleagues [1] attempted to address this question and illustrate the difficulty of making this choice in traumatic ICH patients, particularly within 24 hours of the injury. In a decision analysis examining the risks of ICH progression versus the risks of VTE, the authors concluded that there was no clear benefit to providing (expected value = 0.89) or withholding (expected value = 0.90) thromboprophylaxis with low-molecular-weight heparin (LMWH). Although their results were inconclusive, they erred on the side of caution and recommended withholding anticoagulant prophylaxis, particularly early after the initial insult when bleeding progression is perceived to be highest. Because the administration of blood thinners could exacerbate bleeding in an enclosed space and result in the worsening of already poor neurologic function, these recommendations are reasonable.

On the other hand, the consequences of initiating VTE prophylaxis in this population may not be as devastating as one would think. In the general trauma population, thromboprophylaxis is the standard of care because of the astonishingly high incidence of deep venous thrombosis (DVT) development, which consistently exceeds 50% [2,3]. The ability of DVT prophylaxis to achieve a substantial degree of risk reduction (approximately 50%), coupled with an overall low major bleeding rate (less than 2%) [4], clearly demonstrates that the benefits of its use outweigh the risks of bleeding. Except for the difference in location of traumatic injury, those suffering from traumatic ICHs are no different than the general trauma population. To think that their risk of bleeding is

\*Correspondence: [chee262@hotmail.com](mailto:chee262@hotmail.com)

<sup>1</sup>Division of Pulmonary and Critical Care Medicine, Washington Hospital Center, 110 Irving Street NW #2B-39, Washington, DC 20010, USA

Full list of author information is available at the end of the article

increased simply because of the location of bleeding does not seem biologically plausible. Additionally, prospective observational evidence has shown that progression of bleeding after traumatic head injuries is highest during the first 24-hour period, even in the absence of thromboprophylaxis [5]. Despite initiation of DVT prophylaxis at 24 hours, the risk of bleeding does not significantly increase (4%) unless a surgical procedure is required. Thus, in the appropriate patient suffering from an ICH, the advantages of thromboprophylaxis outweigh potential disadvantages.

In the same vein, emerging data suggest that pharmacologic prophylaxis with LMWH does not substantially increase anti-Xa levels when used for DVT prophylaxis, even for patients with severe renal impairment. The DIRECT (Dalteparin's Influence on the Renally Compromised: Anti-Xa) study [6] demonstrated that in 99% of patients with a creatinine clearance of less than 30 mL/minute, trough anti-Xa levels were either undetectable (less than 0.10 IU/mL) or minimal (0.10 to 0.20 IU/mL). Additionally, no association between major bleeding and anti-Xa levels was found. Therefore, if LMWH does not accumulate even in the face of severe renal insufficiency, the likelihood that it will accumulate and precipitate bleeding seems low in a typical patient with traumatic ICH.

Growing evidence suggests that our current thromboprophylaxis regimens are relatively safe and possibly even suboptimal [7,8]. Taking the risk-benefit equation one step further, it is likely that the early administration of DVT prophylaxis in this patient population may be less hazardous than the alternative of full-dose anticoagulation or an inferior vena cava (IVC) filter when VTE actually develops. The potential long-term complications associated with an IVC filter, namely IVC thrombosis, migration of the filter [9], and increased risk for DVT [10], must be contemplated before its placement. Despite these considerations, the lack of concrete evidence from a randomized controlled trial leaves physicians skeptical about the safety of thromboprophylaxis in the setting of a traumatic ICH. This uncertainty is mirrored in the decision analysis by Scales and colleagues [1], in which the estimated risk of ICH progression, even without exposure to anticoagulants, ranged widely from 0.001 to 0.990. Hence, at the very least, the findings of this study illustrate that much research is still needed to clarify the appropriate timing, dose, and patient characteristics to safely administer VTE prophylaxis in this population. Furthermore, this study has identified the need for a risk stratification tool to select those patients who are at low risk for ICH progression and would be ideal candidates for DVT prophylaxis at 24 hours. In the meantime, while

we await more information, it seems that the decision to administer thromboprophylaxis should be cautiously considered on an individual basis.

#### Abbreviations

DVT, deep venous thrombosis; ICH, intracranial hemorrhage; IVC, inferior vena cava; LMWH, low-molecular-weight heparin; PE, pulmonary embolism; VTE, venous thromboembolism.

#### Competing interests

The authors declare that they have no competing interests.

#### Author details

<sup>1</sup>Division of Pulmonary and Critical Care Medicine, Washington Hospital Center, 110 Irving Street NW #2B-39, Washington, DC 20010, USA. <sup>2</sup>School of Public Health and Health Sciences, University of Massachusetts, Arnold House, 715 North Pleasant Street, Amherst, MA 01003, USA. <sup>3</sup>EviMed Research Group, LLC, Po Box 303, Goshen, MA 01032, USA.

Published: 14 May 2010

#### References

1. Scales D, Riva-Cambrin J, Wells D, Athaide V, Granton J, Detsky A: **Prophylactic anticoagulation to prevent venous thromboembolism in traumatic intracranial hemorrhage: a decision analysis.** *Crit Care* 2010 **14**:R72.
2. Geerts WH, Code KI, Jay RM, Chen E, Szalai JP: **A prospective study of venous thromboembolism after major trauma.** *N Engl J Med* 1994, **331**:1601-1606.
3. Kudsk KA, Fabian TC, Baum S, Gold RE, Mangiante E, Voeller G: **Silent deep vein thrombosis in immobilized multiple trauma patients.** *Am J Surg* 1989, **158**:515-519.
4. Geerts WH, Jay RM, Code KI, Chen E, Szalai JP, Saibil EA, Hamilton PA: **A comparison of low-dose heparin with low-molecular-weight heparin as prophylaxis against venous thromboembolism after major trauma.** *N Engl J Med* 1996, **335**:701-707.
5. Norwood SH, McAuley CE, Berne JD, Vallina VL, Kerns DB, Graham TW, Short K, McLarty JW: **Prospective evaluation of the safety of enoxaparin prophylaxis for venous thromboembolism in patients with intracranial hemorrhagic injuries.** *Arch Surg* 2002, **137**:696-701; discussion 701-692.
6. Douketis J, Cook D, Meade M, Guyatt G, Geerts W, Skrobik Y, Albert M, Granton J, Hébert P, Pagliarello G, Marshall J, Fowler R, Freitag A, Rabbat C, Anderson D, Zytaruk N, Heels-Ansdell D, Crowther M; Canadian Critical Care Trials Group: **Prophylaxis against deep vein thrombosis in critically ill patients with severe renal insufficiency with the low-molecular-weight heparin dalteparin: an assessment of safety and pharmacodynamics: the DIRECT study.** *Arch Intern Med* 2008, **168**:1805-1812.
7. Geerts WH, Bergqvist D, Pineo GF, Heit JA, Samama CM, Lassen MR, Colwell CW: **Prevention of venous thromboembolism: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th Edition).** *Chest* 2008, **133** (6 Suppl):381S-453S.
8. Weitz JJ, Hirsh J, Samama MM: **New antithrombotic drugs: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th Edition).** *Chest* 2008, **133** (6 Suppl):234S-256S.
9. Tardy B, Page Y, Zeni F, Lafond P, Decousus H, Bertrand JC: **Acute thrombosis of a vena cava filter with a clot above the filter. Successful treatment with low-dose urokinase.** *Chest* 1994, **106**:1607-1609.
10. Decousus H, Leizorovicz A, Parent F, Page Y, Tardy B, Girard P, Laporte S, Faivre R, Charbonnier B, Barral FG, Huet Y, Simonneau G: **A clinical trial of vena caval filters in the prevention of pulmonary embolism in patients with proximal deep-vein thrombosis. Prevention du Risque d'Embolie Pulmonaire par Interruption Cave Study Group.** *N Engl J Med* 1998, **338**:409-415.

doi:10.1186/cc8996

Cite this article as: Chan CM, Zilberberg MD: Preferences in traumatic intracranial hemorrhage: bleeding vs. clotting. *Critical Care* 2010, **14**:153.