

# The Effect of Deep Vein Thrombosis Prophylaxis on Bleeding in Periorbital Surgery in Trauma Patients

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## Abstract

The aim of this study is to assess if there is an increase in postoperative venous thromboembolism (VTE) or bleeding complications in patients who received perioperative chemical thromboprophylaxis compared with patients in whom chemical thromboprophylaxis was held during periorbital trauma surgery. This is a retrospective chart review of patients undergoing periorbital surgery treated in three different city hospitals, by the Department of Oral and Maxillofacial Surgery, University of Texas, between August 2014 and December 2016. A total of 237 patients were included in this study. None of these patients suffered a postoperative VTE. A total of 102 patients received perioperative pharmacologic thromboprophylaxis in the form of enoxaparin or heparin. In this group, one patient suffered a buccal space hematoma. Chemical thromboprophylaxis was held in 135 patients preoperatively and for at least 24 hours postoperatively. In this group, one patient suffered a retrobulbar hematoma after repair of an orbital floor fracture. The rate of postoperative bleeding complications was compared by the chi-square test and was not statistically significant ( $p = 0.8417$ ).

## Keywords

- trauma
- venous thromboembolism
- anticoagulation
- midface

Venous thromboembolism (VTE), which includes deep vein thrombosis (DVT) and pulmonary embolism (PE), is a serious complication that is preventable.<sup>1</sup> The use of both chemical and mechanical thromboprophylaxis in trauma patients for the prevention of life-threatening VTE has been well established in the literature.<sup>2–4</sup> The most utilized agents for VTE prophylaxis are enoxaparin and heparin. Although this standard is followed for the majority of trauma patients, there is still high variability in the agent used, dose, frequency, and protocol for newly diagnosed VTE across institutions.<sup>5</sup> Additionally, there are certain instances where chemical thromboprophylaxis (CTP) is contraindicated. These are generally bleeding events involving brain and spinal cord, as well as certain major whole organ injuries.<sup>6</sup>

It is generally accepted that patients who require surgical intervention for fractures involving the orbit should have any VTE chemoprophylaxis held for their procedure. This was done to prevent severe bleeding in general and retrobulbar hematoma, in particular, which can lead to significant morbidity including complete loss of vision.

In 2009, Jamal et al presented two case reports of patients who required lateral canthotomy and cantholysis after receiving enoxaparin with periorbital fractures. One patient suffered hemorrhage prior to surgical intervention: it was unclear if the VTE chemoprophylaxis or an increase in blood pressure was the cause of bleeding. The other occurred postoperatively after periorbital surgery in an elderly patient who was placed on 60 mg of enoxaparin every 12 hours, for atrial fibrillation. Her VTE chemoprophylaxis was held for one dose preoperatively, and 5 hours after surgery. Their recommendations were to use 40 mg once daily enoxaparin dose, to stop chemoprophylaxis 12 hours preoperatively, and to hold the medication for 10 to 12 hours postoperatively, in patients requiring periorbital surgery.<sup>7</sup>

Holding or continuing VTE prophylaxis perioperatively in patients undergoing periorbital surgery is inconsistent among different institutions and surgeons. Our institution is not an exception to similar inconsistencies. Providers among different services and even in the same services or

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departments differ in their management of VTE prophylaxis in patients undergoing periorbital surgery. The aim of this study is to assess if there is an increase in postoperative VTE or bleeding complications in patients who received perioperative CTP (anticoagulated [AC]) compared with patients who was held (anticoagulation held [HLD]).

## Materials and Methods

This is a retrospective chart review of patients ( $n = 237$ ) undergoing periorbital surgery treated in three different city hospitals, by the Department of Oral and Maxillofacial Surgery, University of Texas, between August 2014 and December 2016. The inclusion criteria were (1) patients undergoing midface surgery due to trauma, (2) patients undergoing cranium or scalp reconstruction due to traumatic defect. Each patient chart was reviewed to determine (1) if the patient received preoperative or postoperative CTP, (2) if the patient's preoperative or postoperative CTP was held, (3) if the patient had intraoperative or postoperative bleeding complications, and (4) if any patients had a postoperative VTE. This was determined by reviewing each patient's operative report, discharge diagnoses, and hospital course. The patient's records were also reviewed for sex, age, fracture pattern, and isolated facial trauma versus polytrauma. The results were evaluated with chi-square analysis. This chart review was completed with proper institutional review board approval.

## Results

A total of 237 patients were included in this study. None of these patients suffered a postoperative VTE. There were 186 males (78.4%) and 51 females (21.6%) with an age range from 14 to 88 years. Isolated trauma was seen in 138 patients, while 99 patients had polytrauma. The distribution of frac-

ture type can be seen in ►Table 1 and the distribution of thromboprophylaxis can be seen in ►Table 2. A total of 102 patients received perioperative CTP in the form of enoxaparin or heparin. Of these 102 patients, 14 patients had their preoperative CTP held, but received the next scheduled dose. In this group, one patient suffered a buccal space hematoma after repair of a zygomaticomaxillary complex fracture with an orbital component. This patient's preoperative enoxaparin dose was held, but he received his evening dose postoperatively. The remaining 135 patients' CTP was held preoperatively and for at least 24 hours postoperatively. In this group, one patient suffered a retrobulbar hematoma after repair of an orbital floor fracture. This patient did not receive CTP at any time during the hospital course.

The rates of postoperative bleeding complications were compared by the chi-square test. One patient experienced bleeding while not on prophylaxis and one on prophylaxis experienced bleeding. This difference was not statistically significant ( $p = 0.8417$ ).

## Discussion

Current modalities of thromboprophylaxis utilize both mechanical and pharmacologic agents. Prevention of venous stagnation in the lower limbs by promoting venous outflow proximally is the main objective of the mechanical intermittent compression systems. Attenuating coagulation is done by pharmacological agents that interfere with the coagulation pathway. Intermittent pneumatic compression systems and compression elastic stockings are the primary methods of mechanical prophylaxis. Common pharmacological agents used for thromboprophylaxis are unfractionated heparin (UFH), low-molecular-weight heparin (LMWH), warfarin, and acetylsalicylic acid (aspirin). UFH and LMWH are preferred in a surgical setting due to their early bioactivity and short half-life.<sup>1</sup>

Anticoagulants such as UFH and LMWH work by binding to antithrombin and increasing the rate at which it inhibits clotting factors, particularly activated factor X (factor Xa) and thrombin. LMWH was produced to improve on the pharmacokinetics-associated UFH. LMWH (5,000 Da) is produced by depolymerizing UFH to generate heparin chains with a mean molecular weight one-third that of UFH (15,000 Da). Compared with UFH, the LMWH enoxaparin has less affinity to plasma proteins and therefore has increased bioavailability and duration of action. When coupled with antithrombin III, LMWH has weaker activity against thrombin, but unlike UFH, it has more potent inhibition of factor Xa. Also, due to its smaller molecular size, it may inactivate platelet-bound factor Xa and neutralize platelet factor IX. LMWH is also associated with a lower incidence of heparin-induced thrombocytopenia.<sup>8-10</sup>

The antecedent for this article was a patient involved in a motor vehicle accident with partial ejection resulting in pulmonary contusion and deep neck lacerations. The patient was taken to the operating room for repair of the neck lacerations and his VTE chemoprophylaxis was held until the second day of hospital admission. As a result, this patient

**Table 1** The distribution of fracture type

Type of surgery	n	Bleeding complications	VTE
Orbital Recon	77		
AC	31	0	0
HLD	46	1	0
ZMC/NOE	110		
AC	46	1	0
HLD	64	0	0
LeFort type	39		
AC	19	0	0
HLD	20	0	0
Cranial Recon	11		
AC	5	0	0
HLD	6	0	0

Abbreviations: AC, anticoagulated; HLD, anticoagulation held; n, number of patients; NOE, naso-orbito-ethmoid; VTE, venous thromboembolism; ZMC, zygomaticomaxillary complex.

**Table 2** The distribution of thromboprophylaxis

Patient group	Number of patients	Isolated trauma	Polytrauma	Bleeding complication	VTE
AC	102	44	58	1	0
HLD	135	94	41	1	0

Abbreviations: AC, anticoagulated; HLD, anticoagulation held; VTE, venous thromboembolism.

eventually suffered a PE on hospital day 4. VTE being one of the most common preventable causes of hospital death, it is imperative to only halt CTP when absolutely necessary. Trauma patients who do not receive thromboprophylaxis are at an increased risk of VTE. This is consistent with our current knowledge of thrombus physiology as describe by Virchow's triad, stasis, vascular injury, and hypercoagulability. Trauma patients have all aspects of Virchow's model working against them, and as a result, they are at a 13-fold higher risk of developing DVT.<sup>11</sup> Furthermore, the incidence of DVT in patients who *have* received thromboprophylaxis ranges from 12 to 65%.<sup>12</sup> The combination of both mechanical and chemical prophylaxis has been shown to be most effective in decreasing DVT complications.<sup>13</sup>

The results of this study are interesting. Although not statistically significant, only one patient who was continued on CTP throughout the perioperative period suffered a buccal space hematoma and one patient not continued on CTP suffered a significant periorbital bleeding event. As surgeons continue to repair periorbital trauma on immobilized polytrauma patients, the need to continue CTP throughout the perioperative period will continue. Although these results support the continuation of the CTP in the preoperative period for periorbital surgery, a randomized prospective study of this subject will allow this practice to be more grounded in science.

#### Conflicts of Interest

No disclosures or conflicts of interest to report.

#### References

- O'Donnell M, Weitz JI. Thromboprophylaxis in surgical patients. *Can J Surg* 2003;46(02):129–135
- Norwood SH, McAuley CE, Berne JD, et al. A potentially expanded role for enoxaparin in preventing venous thromboembolism in high risk blunt trauma patients. *J Am Coll Surg* 2001;192(02):161–167
- Geerts WH, Jay RM, Code KI, et al. 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(10):701–707
- Louis SG, Sato M, Geraci T, et al. Correlation of missed doses of enoxaparin with increased incidence of deep vein thrombosis in trauma and general surgery patients. *JAMA Surg* 2014;149(04):365–370
- Bandle J, Shackford SR, Sise CB, Knudson MM; CLOTT Study Group. Variability is the standard: the management of venous thromboembolic disease following trauma. *J Trauma Acute Care Surg* 2014;76(01):213–216
- Gould MK, David G, Sherry W, et al. Prevention of VTE in nonorthopedic surgical patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest* 2012;141(2, Suppl):e227S–e277S
- Jamal BT, Diecidue RJ, Taub D, Champion A, Bilyk JR. Orbital hemorrhage and compressive optic neuropathy in patients with midfacial fractures receiving low-molecular weight heparin therapy. *J Oral Maxillofac Surg* 2009;67(07):1416–1419
- Weitz JI. Low-molecular-weight heparins. *N Engl J Med* 1997;337(10):688–698
- Levine MN, Hirsh J, Gent M, et al. Prevention of deep vein thrombosis after elective hip surgery. A randomized trial comparing low molecular weight heparin with standard unfractionated heparin. *Ann Intern Med* 1991;114(07):545–551
- Dolovich LR, Ginsberg JS, Douketis JD, Holbrook AM, Cheah G. A meta-analysis comparing low-molecular-weight heparins with unfractionated heparin in the treatment of venous thromboembolism: examining some unanswered questions regarding location of treatment, product type, and dosing frequency. *Arch Intern Med* 2000;160(02):181–188
- Heit JA, Silverstein MD, Mohr DN, Petterson TM, O'Fallon WM, Melton LJ III. Risk factors for deep vein thrombosis and pulmonary embolism: a population-based case-control study. *Arch Intern Med* 2000;160(06):809–815
- Ho KM, Burrell M, Rao S, Baker R. Incidence and risk factors for fatal pulmonary embolism after major trauma: a nested cohort study. *Br J Anaesth* 2010;105(05):596–602
- Barrera LM, Perel P, Ker K, Cirocchi R, Farinella E, Morales Uribe CH. Thromboprophylaxis for trauma patients. *Cochrane Database Syst Rev* 2013;(03):CD008303