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Time is now: venous thromboembolism prophylaxis in blunt splenic injury

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Abstract

BACKGROUND: The safety and timing of venous thromboembolism (VTE) prophylaxis in patients with blunt splenic injuries is not well known. We hypothesized that early initiation of VTE prophylaxis does not increase failure of nonoperative management or transfusion requirements in these patients.

METHODS: A retrospective review of trauma patients with blunt splenic injury was performed. Patients were compared based on initiation and timing of VTE prophylaxis (<24 hours, 24 to 48 hours, 48 to 72 hours, and >72 hours). Patients who received VTE prophylaxis were matched with those who did not. Primary outcomes included were operation or angioembolization.

RESULTS: A total of 497 patients (256 received VTE prophylaxis and 241 did not) were included. There was no difference in the number of interventions based on presence of or time to VTE prophylaxis initiation.

CONCLUSIONS: Early initiation (<48 hours) of VTE prophylaxis is safe in patients with blunt splenic injuries treated nonoperatively, and may be safe as early as 24 hours.

Nonoperative management (NOM) has become the standard of care for treatment of hemodynamically stable patients with blunt splenic injuries.[1–4] However, these trauma patients have an increased risk for developing venous thromboembolism (VTE), including the development of pulmonary embolism (PE), which carries an associated mortality rate approaching 20%.[5–7] The rate of VTE also appears to be increasing.[5] Thus the care of NOM patients presents the challenge of balancing the risk for developing VTE with the increased risk of bleeding and failure of NOM from the splenic injury.

The safety and timing of pharmacologic VTE prophylaxis in this population has not been well established. Guidelines from the American College of Chest Physicians and Eastern Association for the Surgery of Trauma recommended early VTE prophylaxis administration in patients with NOM for blunt solid organ injury but did not reach consensus in addressing the time for initiation.[8,9]

We hypothesized that early initiation (within 48 hours of admission) of VTE prophylaxis does not increase failure of NOM in patients with blunt splenic injuries, including bleeding complications, transfusion requirements, or the need for operative or radiologic interventions.

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Methods

A retrospective study was performed at Community Regional Medical Center in Fresno, California, an ACS-verified level I trauma center. Patients with blunt splenic injury were identified from the trauma registry from July 2007 to December 2015. Exclusion criteria included patients with brain injuries, those less than 13 years of age, undergoing immediate operative intervention, discharged less than 24 hours from arrival, died, or were transferred to another facility within 48 hours of arrival. The trauma registry and medical records were reviewed for demographic data, injury severity score (ISS), grade of splenic injury, ICU, and hospital lengths of stay, splenic interventions (angioembolization, splenectomy, and splenorrhaphy), units of blood transfused, and details of VTE prophylaxis (chemical/mechanical, type/dosage of chemical propylaxis, time initiated and discontinued, and reason for discontinuation). All patients that had angiography underwent embolization of the spleen (with gelfoam, coils or both). The American Association for the Surgery of Trauma organ injury scale was used to classify splenic injury grade. Grades I and II injuries were defined as low grade, grade III as intermediate, and grades IV and V as high-grade splenic injuries.[10] Our trauma service guidelines for management of splenic injuries include immediate operative intervention for patients with hemodynamic instability, angioembolization for extravasation/contrast blush seen on computer tomography scan, and nonoperative management followed with serial hemoglobins for the remaining patients. Decisions regarding immediate intervention vs nonoperative management were made at the discretion of the trauma attending at the time of admission.

Patients were categorized into 2 groups, patients that received VTE prophylaxis and patients that did not. Patients initially managed nonoperatively, and then underwent any intervention including operative or angioembolization, before initiation of VTE prophylaxis, were included in the no VTE prophylaxis group. For sub-analysis of the group receiving VTE prophylaxis, patients were separated into 4 groups by time of initiation of VTE prophylaxis: immediate ($<$24 hours of hospital arrival), early (24 to 28 hours), intermediate (48 to 72 hours), and late ($\geq$72 hours). Enoxaparin 30 mg subcutaneously every 12 hours is used at our institution for VTE prophylaxis in trauma patients and 40 mg subcutaneously daily in general surgery patients. For patients with renal insufficiency, heparin 5000 units subcutaneously every 8 hours was given. The timing of initiation of VTE prophylaxis was left to the attending trauma surgeon's discretion. VTE complications, including PE and deep venous thrombosis (DVT), were identified by computer tomography pulmonary angiography or ultrasound of the extremities. These studies were ordered at the discretion of the attending trauma surgeon in patients with high clinical suspicion for PE and/or DVT.

For those patients who did not receive VTE prophylaxis, failure was defined as the need for splenic angioembolization or any splenic operation, including partial or total splenectomy. Indications for intervention were dropping hemoglobin or hemodynamic instability. In patients receiving VTE prophylaxis, failure of splenic management was broadened to include discontinuation of VTE prophylaxis for dropping hemoglobin, the use of splenic angioembolization, or any splenic operation, including partial or total splenectomy and splenorrhaphy. Patients on VTE prophylaxis after angioembolizaion failed if a splenectomy/splenorrhaphy was subsequently performed for dropping hemoglobin or hemodynamic instability.

Propensity score matching was used to examine treatment failure between patients receiving VTE prophylaxis and those who did not. Age, ISS, and grade of splenic injury were used to match patients 1:1, without replacement, using the nearest neighbor algorithm. Eberley et al[11] reported an NOM failure of 7% in patients with splenic injuries who did not receive VTE prophylaxis. Using this, we conducted a sample size calculation and found that approximately 250 patients in each group would allow us the identification of an 8% difference in failure rates between the 2 groups and 165 patients in each group would allow identification of a 10% difference in failure rates with 80% power.

Continuous variables are reported as mean $\pm$ standard deviation, ordinal data are presented as mean (interquartile range), and categorical data are reported as percentages. Overall continuous data were analyzed using Mann Whitney U and Kruskall-Wallis tests. Matched continuous data were analyzed with Wilcoxon signed-rank tests. Chi-square tests were used to examine categorical data. Significance was attributed to a P value less than .05. Statistics were performed using the Statistical Package for Social Sciences (SPSS version 23.0; IBM Corporation, Armonk, NY). This study was approved by the Institutional Review Board of the University of California San Francisco, Fresno and Community Medical Centers.

Results

During the study period, 21,979 trauma patients were admitted to Community Regional Medical Center, including 18,758 as a result of blunt trauma. Nine hundred thirty-five patients had a splenic injury. Patients were excluded due to brain injury (180), immediate operative intervention (134), death/discharge less than 24 hours (78), transfer in less than 48 hours (7), and age less than 13 (39). Of the remaining 497 patients constituting the study population, 256 received VTE prophylaxis, whereas 241 did not (Fig. 1).

Patients receiving VTE prophylaxis were compared with those who did not. The two groups differed by age, ISS, and spleen grade (Table 1). Reflecting the higher median ISS