

Thromboembolic disease in Metastatic Femoral Lesions: A Comparison between prophylactic fixation versus fixation after pathological fracture

Background: Prophylactic nailing of pathological lesions prior to fracture in long bones has been associated with improved outcomes compared to intramedullary nailing (IMN) of pathological fractures. Oncology patients who have surgical procedures are estimated to be twice as likely to develop post-operative deep venous thrombosis (DVT) and three times more likely to develop fatal pulmonary embolism (PE) than patients without cancer that undergo the same procedure. Though multiple post-operative variables have been studied in patients with metastatic long bone disease, previous studies have never compared the rate of venous thromboembolic events (VTE) as a primary outcome in patients who underwent IMN before an impending fracture versus those that underwent IMN after a pathologic fracture.

Purpose: The occurrence of a PE is such a rare phenomenon that a very large sample size is required to obtain adequate power to identify statistical differences. Therefore, the purpose of this study was to use a nationally validated database to evaluate the rates of post-operative DVT and PE in patients prophylactically treated for an impending metastatic femur fracture versus patients treated after pathological femur fracture. In addition, other postoperative comorbidities such as: death, pneumonia, myocardial infarction (MI), cerebrovascular accident (CVA), urinary tract infection (UTI), need for blood transfusion, length of hospital stay, and discharge disposition was compared between the prophylactically treated group versus the pathological fracture treated group.

Patients and Methods: A retrospective comparative study was performed using the Nationwide Inpatient Sample database. We identified all patients over 10 consecutive years between 2002-2011 who had undergone femoral stabilization, either for a pathological femur fracture or for prophylactic fixation of femoral metastatic lesion in the United States. The patient population for this study was selected based on combination of diagnosis and procedural codes in accordance with the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). The demographic data, comorbidities, VTE rates, and other common post-operative complications were compared between patients with a fracture diagnosis versus those without a fracture diagnosis. Statistical analysis included two sample independent t-tests to compare linear variables, and Chi-squared tests used to compare categorical data.

Results: There were 2,584 patients in the prophylactically treated group versus 10,420 patients in the pathological fracture followed by treatment group. The pathological fracture group tended to be older (mean age of 72 vs 66 years) with a higher ratio of female patients (70% vs 57%) than the prophylactic treated group ($p < 0.001$). Prophylactically treated patients presented with significantly less pre-existing comorbidities including anemia ($p < 0.001$), congestive heart failure ($p < 0.001$), coagulopathy ($p = 0.001$), hypertension ($p < 0.001$), hypothyroidism ($p < 0.001$), liver disease ($p < 0.001$), neurologic disorder ($p < 0.001$), obesity ($p < 0.001$), and chronic renal failure ($p < 0.001$). Prophylactic treated patients had significantly higher rates of PE ($p < 0.001$) with an odds ratio of 2.0 and a statistical trend towards higher rates of DVT ($p = 0.12$). Patients treated after pathological fracture had significantly higher need for blood transfusion ($p < 0.001$), higher occurrence of postoperative UTI ($p < 0.001$), and less likelihood of being discharged to home versus a rehab facility ($p < 0.001$) than the prophylactic treated group.

Conclusions: Patients that undergo prophylactic nailing of metastatic femoral disease on average tend to be younger and healthier than those treated after occurrence of metastatic pathological fracture. Similar to the literature, patients that are treated after the occurrence of pathological femur fracture tend to have more post-operative complications such as need for blood transfusion, UTI, and less likelihood of being discharged to home. PE and DVT rates are higher in the prophylactic nailing group than the pathological fracture group secondary to multiple theories. Patients that are treated prophylactically may not be anticoagulated as strictly as those that already fractured. In addition, the surveillance protocol for VTE may differ among physicians and hospitals across the nation. Another possible explanation could be that those that fracture have a vent hole that dissipates the intramedullary pressure during the reaming process while the prophylactically treated group has higher intramedullary pressures during reaming and instrumentation. This elevated intramedullary pressure may cause more marrow content/hypercoagulable cancer cells to enter the systemic circulation leading to cascade of thrombotic events resulting in PE. Limitations of this study include limitations inherent to a retrospective database

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including a definitive explanation for the findings observed. Nonetheless, this study suggests that patients prophylactically nailed for metastatic disease should be actively and vigilantly managed to lessen occurrence of postoperative VTE.

Co-authors:

Arun Aneja ¹ MD, PhD	arunaneja13@gmail.com
Jimmy Jiang ¹ MD	jimmy.jiang@uchospitals.edu
Anna Cohen-Rosenblum ¹ MD	anna.cohen-rosenblum@uchospitals.edu
Rex Haydon ¹ MD, PhD	rhaydon@bsd.uchicago.edu
Terrance Peabody ² MD	tpeabody@nmff.org
Hue Luu ¹ MD	hluu@bsd.uchicago.edu

Institution: 1 = University of Chicago, 2 = Northwestern