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Role of Early Low-Molecular-Weight Heparin Prophylaxis in the Surgical Treatment of Degenerative Spinal Diseases in the Elderly Patients

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Abstract

Study Design: Retrospective review. Summary of Background Data: Deep vein thrombosis (DVT) and pulmonary embolism (PE) are potential complications following major orthopaedic surgical procedures. Venous thromboembolism (VTE) is the disease process underlying DVT and PE. Pharmacological options can be use low-molecular-weight heparin (LMWH). Objective: The purpose of this study is to evaluate the hemorrhage risk when LMWH is started after 24 hours from surgery and to assess venous thromboembolism and pulmonary embolism risk in patients undergoing early prophylaxis after spine surgery. Methods: A consecutive cohort of 100 patients undergoing spinal surgery. Diagnosis was multilevel lumbar spinal stenosis in 46 cases and, degenerative thoracolumbar kypho-scoliosis in 54 cases. Starting on the first postoperative day, patients were routinely administered daily prophylactic enoxaparin at 8 pm (40 mg). Analysis was performed to identify risk factors of VTE among five independent variables (age, sex, obesity defined as body mass index > 30 kg/m^2, smoking, duration of surgery), with statistical significance defined as $P < 0.05$. Results: No deaths in this 100 patient cohort; 2 patients developed symptomatic pulmonary embolism during the first three postoperative days and 1 patient had thromboembolic complications, with acute deep venous thrombosis. Only one statistically significant predictor of acute VTE (duration of surgery, $P < 0.05$). Conclusion: LMWH prophylaxis seems to carry a very low hemorrhage risk and low rate of PE and DVT when started 24 hours after spine surgery. Prophylaxis with LMWH should be considered in all patients underwent major spinal surgery particularly when VTE risk factors are present.

Keywords

Spine Surgery, Heparin, Venous Thromboembolism, Prophylaxis

1. Introduction

Deep vein thrombosis (DVT) and pulmonary embolism (PE) are potential complications following major orthopaedic surgical procedures, predominantly total hip arthroplasty (THA) and total knee arthroplasty (TKA) [1] [2]. Venous thromboembolism (VTE) is the disease process underlying DVT and PE. VTE is associated with advanced age, smoking, obesity, major surgery, hospitalization, immobilization, neurological deficit, blood transfusion, malignancy, trauma, inherited hypercoagulable state, and oral contraceptive use [3] [4]. In the absence of prophylaxis, DVTs occur in as much as 84% of elective hip and knee arthroplasty cases with up to 36% being proximal lesions. The incidence of PE has been reported to range from 9% to 30% with fatal events occurring in 0.1% - 0.7% of the cases [5]. Although lower incidences have been noted, patients undergoing spinal surgery are also at risk of developing thromboembolic complications. VTE risk factors are common in patients with degenerative spine, and without prophylaxis, approximately 15% of patients undergoing posterior spinal surgery develop DVT [6] with PE incidence varying from 0% [7] to 13.1% [8] [9]. Pharmacological options include low-dose unfractionated heparin (UH) and low-molecular-weight heparin (LMWH). LMWH has several advantages compared with UH, including less frequent dosing, fewer bleeding complications, and greater efficacy at VTE prophylaxis [10]-[12] but there is no consensus on its role after degenerative spine surgery [13] [14]. Despite this risk LMWH was routinely used by only 31% of orthopedic spine surgeons recently surveyed [15]. Although there is good evidence that LMWH reduces the incidence of PE and DVT in hip and knee surgery no study has looked into this matter for spinal surgery. Many spinal surgeons are unwilling to use LMWH due to the possibility of epidural haematoma formation in the post operative period. The primary goal of this study is to evaluate the hemorrhage risk when LMWH is started 24 hours after spine surgery. The secondary goal is to assess VTE and PE risk in patients undergoing degenerative spine surgery with early prophylaxis.

2. Material and Methods

After institutional review board approval, a consecutive cohort of 100 patients undergoing spinal surgery by a single surgeon at an academic spinal unit over a 24-month period was prospectively followed. The average patient age was 71.9 years (66.7 - 81.3) and the minimum follow up time was 12 months. From the 100 patients, 46 underwent a lumbar procedure, and the remaining 54 had either a thoracic or thoracolumbar junction procedure. Inclusion reasons within the work was a definite diagnosis compatible with those listed below. Reasons for exclusion were oncological pathologies, metastases, and infection. Diagnosis was multilevel lumbar spinal stenosis in 46 cases and, dege-

nerative thoracolumbar kypho-scoliosis in 54 cases. The average duration of surgery was 210 minutes. Starting on the first postoperative day, patients were routinely administered daily prophylactic enoxaparin at 8 pm (40 mg); anticoagulation was resumed on 15 postoperative day. All patients were mobilized by third postoperative day. Lower extremity ultrasonography was performed on patients with a sign or symptom of DVT; patients with dyspnea, chest pain, desaturation, tachypnea, or tachycardia underwent chest computed tomography (CT) with contrast to exclude PE. Serial neurological examinations were performed as part of routine postoperative care to achieve immediate CT scan for any new or worsened neurological deficit and to return the patient to the operating room for any hemorrhagic complication. Statistical analyses were conducted with SPSS Statistics (version 20, IBM Corp., Armonk, NY). Rates of hemorrhage, acute DVT and PE were calculated. Logistic regression analysis was performed to identify risk factors of VTE among five independent variables (age, sex, obesity defined as body mass index > 30 kg/m^2, smoking, duration of surgery), with statistical significance defined as $P < 0.05$. The waist-hip ratio has been lingering on average to 0.84 for women and 0.94 for men (Table 1).

3. Results

None of the patients suffered any bleeding complication as a result of the introduction of anticoagulation prophylaxis; no patients developed epidural hematoma, superficial hematoma, or persistent wound drainage. No deaths occurred in this 100 patient cohort; 2 patients developed symptomatic PE during the first three postoperative days following thoracolumbar procedures with shortness of breath being the main symptom. In one out of the two PE cases, the duration of surgery exceeded the average time. Clinical suspicion of PE was confirmed using chest CT with contrast. After one week post-op 1 patient had thromboembolic complications, with acute DVT diagnosed by lower extremity ultrasonography. Immediate anticoagulation (heparin drip or therapeutic enoxaparin bridge to warfarin) was begun for PE and acute DVT diagnosed on third postoperative day or later. Logistic regression analysis demonstrated only one statistically significant predictor of acute VTE (duration of surgery, $P < 0.05$). A follow-up of 12 months the patients did not have cardio vascular events and showed an improvement in quality of life. Improving the quality of life would be attributable to the resolution of symptoms, after the spinal surgery.

Table 1. Average of the scanned values.

Patient groups	(41)	(59)
Age	66 - 77	68 - 81
Sex	Male	Female
BMI (obesity)	28.2	28.9
Smoking (average)	(yes) 12; (no) 29;	(yes) 15; (no) 44;
Duration of surgery	210 min	210 min

4. Discussion

A great variation in the incidence of acute VTE exists in the literature for spinal surgery. Ferree reported a 5% DVT incidence [16] using ultrasonography in a group consisting of 60 patients undergoing laminectomy using compressive stockings for prophylaxis. All of the reported thrombi were distal to the knee, which is known to have a lessened risk for PE [17]. No PE was recorded in that study group. In a randomized study looking at the efficacy of different compression devices, including a subgroup of cases receiving coumarine anticoagulation, Rokito *et al.* [7] found a very low DVT rate (0.3%) and no symptomatic PE. In contrast, Rosner *et al.* [8], using a retrospective cohort of high-risk patients as a control group to study the routine use of IVCF as a form of thromboembolic prophylaxis, found a much higher rate of PE (13.1%). Only one study, by Dearborn *et al.* [18], looked prospectively at the incidence of both asymptomatic DVT and asymptomatic PE during spinal surgery. Pharmacological prophylaxis is widely used in the setting of spinal cord injury, but there is no consensus on its role after degenerative spine surgery [12]-[15]. Although there is good evidence that LMWH reduces the incidence of PE and DVT in hip and knee surgery [19] no study has looked into this matter for spinal surgery. Many spinal surgeons are unwilling to use LMWH due to the possibility of epidural haematoma formation in the post operative period. Only one study so far has shown the relative safety of this approach, reporting a very low (0.7%) incidence of postoperative haematomas [20]. This low incidence is also confirmed in our study.

5. Conclusion

LMWH prophylaxis seems to carry a very low hemorrhage risk and low rate of PE and DVT when started 24 hours after spine surgery. Pharmacological prophylaxis with LMWH should be considered in all patients underwent major spinal surgery particularly when VTE risk factors are present. Vigilance against DVT and PE is warranted, and surveillance lower extremity ultrasonography should be considered specially in patients with delayed mobilization.

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