

The Use of A Mechanical Ankle Dorsiflexor (Phlebopump) with Aspirin in the Prophylaxis of Deep Venous Thrombosis After Hip and Knee Replacement Surgery

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ABSTRACT

Venous stasis as a result of peripheral vascular disease or immobility following trauma, surgery and other disabling conditions has been heralded to be the cause of deep vein thrombosis. No local studies have shown the true incidence of deep vein thrombosis among Filipinos, who undergo elective total joint arthroplasties of the lower extremities. The use of pharmacologic prophylaxis like aspirin, warfarin, low-molecular-weight heparin as well as mechanical means like pneumatic compression devices in previous studies have shown their significance in reducing the incidence of deep vein thrombosis among patients with varying results. The mechanical ankle dorsiflexor (phlebopump) is a new form of mechanical prophylaxis in trying to prevent the occurrence of deep vein thrombosis among patients who will undergo elective total joint arthroplasties of the lower extremities. Seventy-six (76) consecutive patients over a 27 month period were included in the study. All patients were started on the phlebopump, 80 mg of aspirin once daily, early mobilization, physical therapy program and the use of anti-embolic stockings were implemented in all patients on the first postoperative day. None of the patients were given low molecular weight heparin. A Doppler ultrasound of both lower extremities was done on the day prior to discharge from the hospital. Of the 76 patients who underwent surgery, only one patient (1.3%) manifested was readmitted and treated for signs and symptoms of pulmonary embolism, and none of these patients manifested with deep vein thrombosis. There were no deaths that occurred during the study.

INTRODUCTION

Although no local studies will show the true incidence of deep vein thrombosis among Filipinos, practitioners are now more aware of this dreaded

postoperative complication affecting 40% to 80% of the white population who undergo total joint arthroplasties of the lower extremities¹⁻⁵. An increase in the awareness and availability of more sophisticated diagnostic modalities has improved screening measures and accuracy of diagnosing patients with this condition.

The use of pharmacologic prophylaxis like aspirin, warfarin, low-molecular-weight heparin as well as mechanical means like pneumatic compression devices in previous studies have shown their significance in reducing the incidence of deep vein thrombosis among patients with varying results.

The mechanical ankle dorsiflexor is a new form of mechanical prophylaxis in trying to prevent the occurrence of deep vein thrombosis among patients who will undergo elective total joint arthroplasties of the lower extremities.

BACKGROUND

Venous stasis as a result of peripheral vascular disease or immobility following trauma, surgery and other disabling conditions has been heralded to be the cause of deep vein thrombosis (DVT) ever since Virchow in 1856 described this triad⁶. Studies have shown a dramatic fall in venous flow during induction of anaesthesia and during the course of the operation⁶. Browse and Negus in 1970 demonstrated that 80% of postoperative thrombosis occurs in the first three days and the remaining 20% between the fourth and sixth days⁷. Although the foremost prophylaxis for DVT was, and still is, heparin, the clinical importance of physical prophylaxis remains undisputed usually consisting of early immobilization, pressure bandages and physical therapy.

In spite of heparin, deep vein thrombosis postoperatively ranges from 20% to 30% and still higher at 30% to 40% for elective surgeries. Difficult monitoring, poor patient compliance and the prevalence of bleeding complications has led to disappointing experiences for some surgeons and this has led to the concept of the physiological ankle joint pump. The Germans first introduced it as early as the 1880's and another group of German doctors did follow up studies in 1936 and 1956. The most recent study done was in Frieberg in 1995 showing a 2% incidence in 44 patients following surgery of the lower extremity.

OBJECTIVE

The goal of the study was to determine the adequacy of using the mechanical ankle dorsiflexor (phlebopump) as a

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method of postoperative prophylaxis for the occurrence of deep vein thrombosis and pulmonary embolism in patients who underwent primary or revision joint replacement surgery at the Makati Medical Center over a two-year period. Assessment was done by basing it on hospital readmission and mortality rates from thromboembolic complications as well as the presence of thrombus formation on Doppler ultrasound of the lower extremities. Results of the study were then compared to similar studies in the literature.

METHODS

This is a prospective, blinded analytical/case control study of 76 consecutive patients at the Makati Medical Center and Philippine Orthopedic Institute who underwent primary or revision hip and knee replacement surgery by the senior author (RBG) from October 1999 to December 2001. The study included 60 (80%) females and 16 (20%) males with a male to female ratio of 1:4. The average age for females was 57 and males was 67. Patients with a history of pulmonary embolism or deep vein thrombosis were to be excluded but none fell into this criterion. The patients were categorized into four groups: Group 1 – primary hip arthroplasty; Group 2 – revision hip arthroplasty; Group 3 – primary knee arthroplasty and Group 4 – revision knee arthroplasty. Each category was further subdivided as unilateral or bilateral. All patients were started on the phlebopump on the first postoperative day at 30

minutes three times daily. Likewise, 80 mg of aspirin once daily, early mobilization, physical therapy program and the use of anti-embolic stockings were implemented in all patients on the first postoperative day. None of the patients were given low molecular weight heparin. All patients underwent a Doppler ultrasound of both lower extremities done by a single radiologist on the day prior to discharge from the hospital.

RESULTS

Of the 76 patients who underwent surgery, only one (1.3%) female who underwent a primary bilateral total knee arthroplasty was readmitted 2 weeks after because of signs and symptoms of pulmonary embolism. Her Doppler ultrasound taken after surgery prior to discharge was negative. She was admitted to the ICU for two weeks and was discharged improved.

There was one (1.3%) female patient who, after undergoing a bilateral total knee arthroplasty, was positive for a distal clot. However, this patient did not manifest any signs and symptoms of deep vein thrombosis or pulmonary embolism.

In the entire series, only one patient (1.3%) manifested was readmitted and treated for signs and symptoms of pulmonary embolism, and none of these patients manifested with deep vein thrombosis. There were no deaths that occurred during the study.

Table 1. Incidence of clinical and ultrasonographic DVT among patients who underwent surgery

	Females	Males	Positive Doppler Ultrasound	Percentage (+) No of Patients	Positive for Symptoms	Percentage (+) No of Patients
Primary hip	18	3	0	0	0	0
Bilateral	5	2				
Revision hip	9	1	0	0	0	0
Bilateral	0	0				
Primary knee	11	3	0	0		
Bilateral	11	4	1	1.3%	0	1.3%
Revision knee	5	3	0	0	0	0
Bilateral	1	0	0	0	0	0
Total	60	16	1	1.3%	1	1.3%

DISCUSSION

Venography remains the gold standard in the diagnosis of deep vein thrombosis. However, aside from this being a very expensive procedure in our setting, it is also technically demanding and carries the risk of patient reaction to the contrast medium⁸. The use of the ultrasound in the detection of deep vein thrombosis started in the early 1990's because of the advantages of it being non-invasive and less costly. Doppler ultrasound that combines Doppler analysis with high-resolution tissue imaging provides flow information of both arteries and veins. Westrich reported a sensitivity of 85%, a specificity of 97% and an accuracy of 95% for detecting deep vein thrombosis when he compared this to venography. All our patients were subjected to Doppler ultrasound postoperatively. Out of the 76 patients, only one (1.3%) female patient who had a simultaneous bilateral total knee arthroplasty done showed significant

ultrasonographic findings of deep vein thrombosis on one side but did not manifest any sign or symptoms. However, another female patient (1.3%) who also underwent a simultaneous bilateral total knee arthroplasty was readmitted after two weeks because of pulmonary embolism. She was admitted to the ICU for one and a half weeks and was discharged improved. A lung scintigraphy failed to conclude the presence of an embolus. Again, it would be unsafe to infer that the other patients had no thromboembolism post surgery since a negative ultrasound does not guarantee its absence.

The issue of giving prophylaxis for deep vein thrombosis for patients undergoing joint arthroplasty has been met with controversy. Westrich documented pulmonary embolism in 2% to 5% of patients without any form of prophylaxis with a mortality rate of 1% to 2%. Hodge reported the incidence of deep vein thrombosis after

knee arthroplasty alone, without prophylaxis, to be as high as 84%¹⁰.

Studies on the use of chemical prophylaxis in the form of heparin, oral coumadin unfractionated heparin and low molecular weight heparin have significantly lowered the rates of thromboembolic complications but the issue of monitoring blood parameters as well as clinically significant bleeding has always been a concern. Eriksson et al compared unfractionated heparin to low molecular weight heparin as prophylaxis for 122 total hip replacement patients and found LMWH to be significantly better in terms of complications but still with a 12.3% rate of patients detected to have pulmonary embolism for the LMWH group¹¹. Blanchard study noted a 1% to 5% rate of postoperative bleeding for patients on LMWH¹².

Aspirin when used alone as prophylaxis on total knee arthroplasty patients has a prevalence rate for deep venous thrombosis of 59% to 68% in two studies done at the Hospital for Special Surgery (Westrich et al, Haas et al). However, when combined with a mechanical form of prophylaxis (pneumatic sequential compression boots), the rate goes down to 22% for unilateral and up to 28% for bilateral procedures^{9,13}.

The major advantages of prophylaxis with mechanical dorsiflexion device as well as other forms of mechanical prophylaxis are the presumed decrease in the incidence of bleeding complications and the necessity for monitoring blood parameters for patients on oral anticoagulants. All patients in this study were started on aspirin on the first postoperative day together with the use of the mechanical ankle dorsiflexor (phlebopump), early mobilization and compression stockings (TEDS).

It is a fact that blood is moved throughout the body by the pumping action of the heart. It is also affected by the stretching of muscles surrounding the veins by squeezing and propelling blood in the venous lines. The current forms

of mechanical prophylaxis compresses the leg in order to propel blood in the veins. However, this technology, which is widely used, is unable to duplicate innate physiological action and the incidence of DVT remains high.

Roberts in 1971 demonstrated that with rhythmic ankle dorsiflexion, peak femoral vein flow is increased by twice its normal value and that its pulsatility by almost elevenfold with its effect sustained 30 minutes after the modality⁶. Staubesand et al (1995) measured venous flow using a duplex sonography and found a 100% increase in flow rate over their resting values¹⁴. Chylarecki et al in 1994 in a controlled study of 95 trauma patients demonstrated a decrease in the incidence of DVT by 90% when heparin was combined with the dorsiflexor device compared to heparin alone¹⁵.

Our study appears to demonstrate similar results in the literature that deep vein thrombosis was more commonly seen after knee replacement, compared to hip replacement. One patient who was positive for thrombosis on Doppler ultrasound and one who was readmitted for signs and symptoms of pulmonary embolism had a simultaneous bilateral total knee replacement.

CONCLUSION

There were 76 patients in this study who underwent total joint replacement surgery at the Makati Medical Center from October 1999 to December 2001. Seventy-nine percent were females and 33% were males with an average age of 57 for males and 67 for females.

The incidence of deep vein thrombosis by Doppler ultrasonography was 1.3% and clinical pulmonary embolism was 1.3%. There was no death in the study.

The use of the mechanical ankle dorsiflexor (phlebopump) coupled with aspirin, early mobilization, physical therapy and anti-embolic stockings seems to be an effective form of prophylaxis for this population.

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