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Value of Graduated Compression Stockings in Prevention of Venous Thromboembolism after Total Hip and Knee Arthroplasty

Majeed H[1]* and Szypryt EP[2]

[1]Trauma and Orthopaedics, University Hospital of North Staffordshire, Newcastle Road, UK
[2]Consultant Trauma and Orthopaedic Surgeon, Queens Medical Centre, Nottingham NG7 2UH, UK

Abstract

Introduction: Graduated compression stockings (GCS) are used for mechanical prophylaxis for VTE. The aim of our study was to compare the incidence of VTE with and without the use of compression stockings after total hip and knee arthroplasty.

Methods: Data was collected retrospectively over 18 month's duration, and included all consecutive primary total hip and knee replacements. Patients were divided into 2 groups; group I (patients in whom GCS were used) and group II (patients in whom GCS were not used). Data was analyzed by excluding as well as including the patients with previous history of VTE.

Results: 1875 patients underwent total hip and knee replacements, excluding the patients with previous history of VTE. Group I consisted of 982 patients (52.3%) and group II consisted of 893 patients (47.7%). In total, 23 patients (1.22%) had a VTE diagnosed postoperatively (DVT: 8, PE: 15). In group I, 11 patients (1.12%) suffered from VTE (DVT: 4, PE: 7). In group II, 12 patients (1.34%) had VTE (DVT: 4, PE: 8). Including the patients with previous VTE; in total, 2020 patients underwent hip and knee arthroplasty. Group I comprised of 1040 patients with 14 patients (1.34%) diagnosed with VTE (DVT: 5, PE: 9). Group II comprised of 984 patients with15 patients (1.52%) diagnosed with VTE (DVT: 5, PE: 10).

Conclusion: We did not find any obvious benefit of compression stockings in the prevention of VTE after primary total hip and knee arthroplasty in the presence of enoxaparin prophylaxis.

Introduction

Venous Thromboembolism (VTE) remains a clinical threat to orthopaedic surgeons, despite of a large number of clinical trials and research performed on this subject. Various guidelines and recommendations are available in clinical practice but the search continues for an ideal agent or combination of agents for VTE prophylaxis. Rudolf Virchow first described Deep Vein Thrombosis (DVT) and the subsequent risk of pulmonary embolism (PE) over a century-and-a-half ago, and afterward also determined the causal factors [1,2]. After total hip and knee arthroplasty, venous thromboembolism is a potentially serious complication and usually a combination of chemical as well as mechanical prophylaxis is used. The debate continues regarding the best available pharmacological agent, with least possible complications. For mechanical prophylaxis, different methods are in practice including Graduated Compression Stockings (GCS), intermittent pneumatic compression devices, foot pumps, early mobilization and exercises to minimize the risk of postoperative VTE [3]. Some variation exists in clinical practice with regards to the use of graduated compression stockings. According to some studies, 68-73% of lower limb surgeons in the United Kingdom use compression stockings for their patients after total hip and knee arthroplasty (THA, TKA), usually for a duration of four to six weeks after surgery [4]. Compression stockings are presumed to work by increasing the velocity of venous blood flow, and hence preventing venous stagnation in the presence of reduced mobility. A study by Sigel et al. [5] has shown that this effect is best achieved by graded compression of 18 mmHg at the ankle, 14 mmHg at the calf and 8 mmHg at the knee. High levels of compression (>30 mmHg) can impede venous blood flow whereas non-graduated or low levels of compression do not adequately increase it [5,6]. There is little information available on the pressures achieved by the stockings in clinical setting and no study has yet related this performance to the subsequent formation of DVT [7]. The objective of our study was to assess the value of graduated compression stockings in the prevention of venous thromboembolism after primary total hip and knee arthroplasty.

Patients and Methods

This retrospective study was performed in one of the largest university hospital in the UK, over a period of 18 months (Jan 2011 to June 2012). The data were collected from a computerized database, which had been setup in our department for arthroplasty patients to record the information in a prospective manner. All consecutive patients who underwent primary total hip and knee arthroplasty were included. Revision arthroplasties were excluded. These patients were operated on by 13 arthroplasty surgeons (all consultant level) in the department. Seven of these consultants had a regular routine of using compression stockings, while six of them did not use the stockings after surgery for their patients. Based on this finding, we divided our patients into two groups; group I and group II. The patients, in whom GCS were used, were added to group I, and the patients in whom GCS were not used, were added to group II. The information regarding the use of

***Corresponding author:** Majeed H, Specialist Registrar, Trauma and Orthopaedics, University Hospital of North, Staffordshire, Newcastle Road, Stoke-on-Trent ST4 6QB, UK, Tel: 00-44-1782-715444; Bleep: 696, Mobile: 00-44-7973-824-289; E-mail: haroonmajeed@gmail.com

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these stockings was an essential part of the prospectively collected database. The nursing staff measured the size of stockings according to patients' calf diameter.

The data was analyzed in two different ways; firstly by excluding the patients who had previous history of DVT and PE, and secondarily by including these patients with previous DVT and PE. For pharmacological prophylaxis, Enoxaparin was used in all our patients, usually at a dose of 20 mg or 40 mg for 2 weeks after knee replacement, and at a dose of 40 mg for 4 weeks after hip replacement. No other mechanical means of thromboembolic prophylaxis were used in any patient. Increased level of calf pain, swelling and tenderness was considered as the criteria for an urgent venous Doppler scan for diagnosis or exclusion of DVT. In patients who developed postoperative shortness of breath, chest pain, unexplained tachycardia or low oxygen saturation, had urgent spiral CT scan for diagnosis or exclusion of PE. This routine was followed as per hospital's usual protocols.

Routine mobilization and physiotherapy regimen was followed in all the patients in order to further reduce the risk of VTE. This included commencement of mobilization from first postoperative day with walking aids and further encouragement with input from physiotherapists as the pain level permitted. Our routine analgesia included Patient Controlled Analgesia (PCA) with opioids and oral paracetamol, followed by addition of oral opioids when PCA was stopped, usually within 24 hours after surgery. The information on those patients, who were diagnosed with DVT or PE subsequent to their discharge from hospital after surgery, was recorded back into our departmental database through the radiology department, anticoagulation clinic and DVT clinic database. Our database was updated regularly after careful validation of this information. We used Chi square test for statistical analysis of our data.

Results

By excluding the patients who had previous history of VTE, in total, 1875 patients underwent primary total hip and knee arthroplasties during our study period in our department (THA: 848, TKA: 1027). Group I consisted of 982 patients (52.3%) in whom compression stockings were used for up to 6 weeks after surgery, and group II consisted of 893 patients (47.7%), in whom stockings were not used (Figure 1). Combined in both groups, 23 patients (1.22%) had an episode of VTE diagnosed postoperatively, including 8 patients with DVT (0.42%) and 15 patients with PE (0.8%).

In group I, 480 patients (48.9%) underwent THA and 502 patients (51.1%) underwent TKA. In this group, 11 patients (1.12%) were diagnosed with VTE after their surgery, including 4 patients with DVT (0.4%) and 7 patients with PE (0.7%). In group II, 368 patients (41.2%) underwent THA and 525 patients (58.8%) underwent TKA. In this group, 12 patients (1.34%) had an episode of VTE diagnosed after their surgery, including 4 patients with DVT (0.44%) and 8 patients with PE (0.89%), (Figures 2 and 3). The comparative analysis of these results in the two groups did not show statistically significant difference (p>0.05) (Table 1).

Among the patients who had total hip arthroplasty performed, group I had 4 patients diagnosed with postoperative VTE (0.47%, DVT=2, PE=2) and group II had 3 patients diagnosed with postoperative VTE (0.81%, DVT=1, PE=2). Among the patients who underwent total knee arthroplasty, 7 patients (1.39%) in group I, were diagnosed with VTE (DVT=2, PE=5), and 9 patients (1.71%) in group II, were diagnosed with VTE postoperatively (DVT=3, PE=6).

There were 149 patients in total who had a previous history of VTE, and were excluded in the first part of our analysis (DVT=95, PE=54). Fifty-eight of these patients belonged to group I, in whom GCS were used (DVT=37, PE=21), and 91 belonged to group II, in whom GCS were not used (DVT=58, PE=33). Including these patients; in total, 2020 patients underwent hip and knee arthroplasty (THA: 904, TKA: 1116). Group I comprised of 1040 patients with 14 patients (1.34%) diagnosed with VTE, including 5 patients with DVT (0.48%) and 9 patients with PE (0.86%). Group II comprised of 984 patients who underwent THA and TKA. This group had 15 patients diagnosed with VTE after their surgery, including 5 patients with DVT (1.52%) and 10

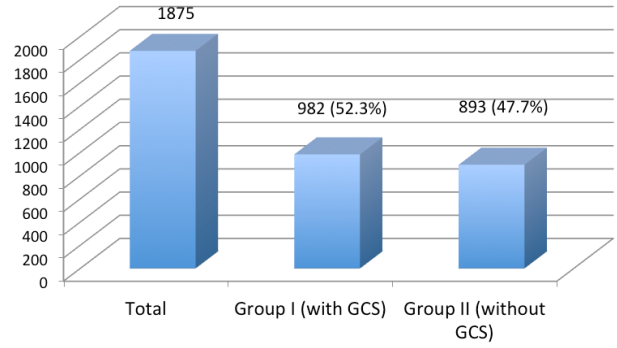

Figure 1: Patients in group I and group II (Excluding previous VTE).

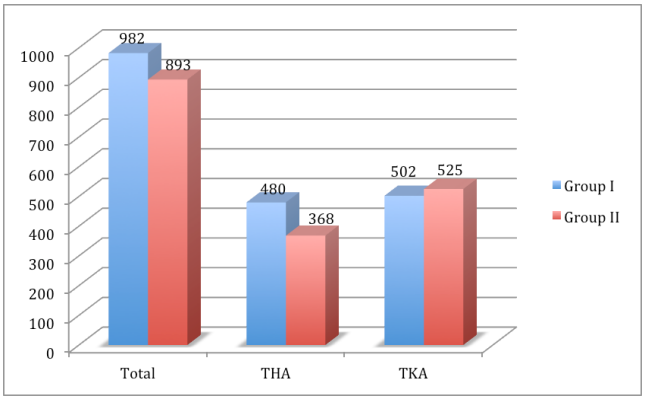

Figure 2: Comparison of patients with THA and TKA in both groups (Excluding previous VTE).

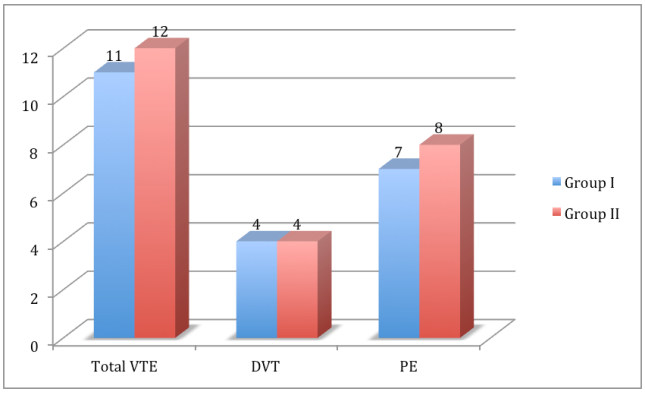

Figure 3: Comparison of patients with VTE in both groups (Excluding previous VTE).

patients with PE (1.01%) (Table 2). The comparative analysis (Figure 4) showed that if the previous history of VTE was taken into account, the combined incidence of postoperative VTE in both groups (i.e. with and without GCS) was found to be higher (relative risk: 1.17, 95% confidence interval: 0.67–0.20).

Enoxaparin was used for chemical prophylaxis in all patients, however 4% patients (84 of 2020) were on Warfarin prior to surgery, which was stopped 5 days before surgery and restarted after surgery, together with Enoxaparin until the INR level was in optimum range. Nineteen patients (0.94%) developed wound haematoma after surgery (8 after THA, 11 after TKA), 5 of which required exploration and washout of the wound within 10 days of surgery. Three patients (0.15%) had gastrointestinal bleeding requiring urgent endoscopy. There was no fatal haemorrhage in any of our patient in either group.

Discussion

Venous thromboembolism after lower limb arthroplasty is a multifactorial disease with both surgical and genetic related risk factors [8]. VTE can potentially lead to significant risk of mortality, as well as morbidity; with both short-term and long-term consequences for the patients and can cause financial burden to the treating hospital and the community. Various clinical trials have been performed in search of an optimal combination of agents for its prevention. The use of graduated compression stockings for VTE prophylaxis is considered to have the benefit of preventing the haemorrhagic complications associated with pharmacological agents used for VTE prophylaxis.

	Group I (with GCS)	Group II (without GCS)
Total number of patients	982	893
Total hip arthroplasty	480	368
Total knee arthroplasty	502	525
Total number of VTE	11 (1.12%)	12 (1.34%)
No of patients with DVT	4 (0.4%)	4 (0.44%)
No of patients with PE	7 (0.7%)	8 (0.89%)

Table 1: Patients without previous history of VTE.

	Group I (with GCS)	Group II (without GCS)
Total number of patients	1040	980
Total hip arthroplasty	503	401
Total knee arthroplasty	537	579
Total number of VTE	14 (1.34%)	15 (1.52%)
No of patients with DVT	5 (0.48%)	5 (0.5%)
No of patients with PE	9 (0.86%)	10 (1.01%)

Table 2: All patients with and without previous history of VTE.

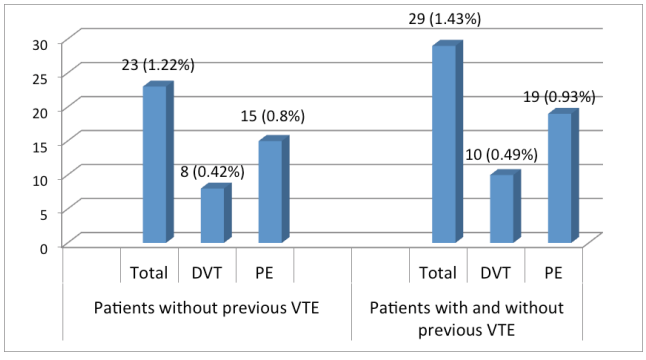

Figure 4: Comparison of VTE occurrence by excluding and including the patients with previous history of VTE.

The evidence still lacks in the efficacy of GCS in providing additional benefit when used in conjunction with chemical prophylaxis for primary prevention of VTE; however, studies have reported that below-knee compression stockings reduce the risk of post-thrombotic syndrome by approximately 50% in patients with proximal DVT [9]. A large clinical trial performed by Cohen et al. compared the use of GCS with Fondaparinux, to Fondaparinux alone and reported that the addition of graduated compression stockings did not improve the effectiveness of prophylactic anticoagulation with Fondaparinux [10]. Another prospective randomized controlled trial showed that with the possible exception of below-knee stockings in knee arthroplasty patients, graded compression stockings were ineffective as prophylaxis for DVT [4]. In a study by Wildin et al. [11], the three commonly used commercially available stockings were compared in healthy volunteers. They compared Anti-Em (Biersdorf Ltd, Milton Keynes, UK), TED (Ken-dall, Basingstoke, UK) and Tx (Brevet, Oldham, UK) and showed that all these stockings failed to produce an ideal gradient in up to 75% of cases [11]. There have been reported complications associated with the use of stockings by some authors, and include venous tourniquet effect when thigh-high elastic stockings roll down, as well as the development of peroneal nerve palsy associated with the chronic increased pressure on the peroneal nerve [12]. In addition, their use is contraindicated in the presence of peripheral vascular disease, skin ulceration and poor skin quality. Compression stockings have been found to be associated with poor patient compliance, especially in the presence of soft tissue swelling after surgery [13]. Their use may also be labour-intense for nursing staff and the carers. It is estimated that the cost associated with the use of these products in the NHS could be as much as over two million pounds each year [7,14].

In our study, there was comparable number of patients diagnosed with VTE after their surgery in both the groups; i.e. with and without the use of GCS. It was interesting to note that the number of patients diagnosed with PE was slightly more after TKA in both the groups compared to THA. However, it was also observed that the overall number of cases with PE was more than DVT in both groups after total hip and knee arthroplasty. It is difficult to comment whether the occurrence of PE was preceded by asymptomatic DVT in these patients. If previous history of VTE was taken into account, the combined number of cases diagnosed with postoperative VTE was higher in both groups (relative risk: 1.17, 95% confidence interval: 0.67–0.20). The strengths of our study include large number of patients in both groups, which were comparable to each other. The data was analysed in different perspectives in order to assess the benefit of GCS. However, we admit the weakness in our study for being a retrospective and non-randomised.

Conclusion

We did not find any obvious benefit of graduated compression stockings in the prevention of VTE after primary total hip and knee arthroplasty in the presence of Enoxaparin prophylaxis. Our results have also shown that the use of GCS does not seem to be associated with an increase in occurrence of postoperative VTE. It was found that there was increased occurrence of postoperative VTE in patients who had previous history of VTE. The patients who underwent knee arthroplasty had slight increased occurrence of VTE as compared to the patients who underwent hip arthroplasty.

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Study conducted at

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