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Incidence and risk factors of early deep venous thrombosis after varicose vein surgery with routine use of a tourniquet

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ABSTRACT

Introduction: The incidence of early deep venous thrombosis (DVT) following varicose vein surgery (traditional open stripping) with routine use of a tourniquet remains unknown.
Materials and methods: A retrospective analysis of all patients who underwent varicose vein surgery with a tourniquet in the authors' unit between 1 January 2012 and 30 November 2013 was undertaken. Cases of postoperative DVT were identified from the unit database, and re-assessments conducted 1, 3 and 6 months after the initial diagnosis were recorded from the outpatient department.
Results: Out of 1461 patients, 113 (7.7%) developed postoperative DVT. Nineteen (1.3%) patients had proximal DVT, and 94 (6.4%) patients had isolated distal DVT. The risk factors for postoperative DVT included old age (≥65 years), female sex and gastrocnemius vein dilation (GVD). GVD was found to be a significant independent risk factor for the occurrence of DVT, with an odds ratio of 2.437 (95% confidence interval 1.644–3.611). Five patients with distal DVT (5.7%) and eight patients with proximal DVT (44.4%) still exhibited a thrombus at 6-month follow-up, but with decreased size and at various stages of resolution.
Conclusions: This study found a higher incidence of postoperative DVT (7.7%) with routine use of a tourniquet during varicose vein surgery than has been reported previously. Among the factors examined, GVD had the highest predictive power for postoperative DVT. Both distal and proximal DVT were associated with acceptable outcomes.

Introduction

Varicose vein surgery is largely considered to be a trivial procedure with few risks, and is often delegated to junior surgeons. However, deep venous thrombosis (DVT) and potentially lethal pulmonary embolism (PE) are potentially significant side effects that can occur following varicose vein surgery. The use of a tourniquet has been advocated during varicose vein surgery as this can reduce blood loss significantly, and improve cosmesis without leading to an overall increase in operative time or changes in patient-reported pain or activity after surgery [1–3]. Many studies have investigated the incidence of DVT after varicose vein surgery with different surgical modalities, including traditional open surgery, radiofrequency ablation, endovenous laser ablation and sclerotherapy, and reported rates have ranged widely from 0.15% to 5.3% [4]. However, to the authors' knowledge, the incidence of postoperative DVT with routine use of a tourniquet during varicose vein surgery has not been reported. In addition, it has not been conclusively established if the use of a tourniquet during varicose vein surgery predisposes patients to a higher risk of postoperative DVT.

The aim of this study was to establish the incidence of postoperative DVT in patients undergoing varicose vein surgery with routine use of a tourniquet, and to determine the specific risk factors for postoperative DVT.

Materials and Methods

Patient Selection

A retrospective study was undertaken by reviewing the records of all patients at a single academic tertiary care centre. Patients who underwent primary unilateral varicose vein surgery with a tourniquet, performed by the same experienced team of consultant vascular surgeons in the authors' unit, between 1 January 2012 and 30 Novmber 2013 were included in this study. All cases were identified from the unit database, in which demographic details (sex and age), obesity status [body mass index (BMI)], CEAP classification, pre-operative haemoglobin level, American Society of Anesthesiologists (ASA) score, surgical records (tourniquet time, operation time and type of

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anaesthesia), and pre- and postoperative duplex ultrasound scanning results (vein condition of the affected limb) were recorded. Obesity was defined as BMI >30 kg/m^2. The severity of varicose veins was classified using the standard CEAP classification system [5]. The normal range of haemoglobin is 120–160 g/l for males and 110–150 g/l for females. The ASA score was used to assess the overall health status of the patients (1, normal healthy patients; 5, patients in very poor condition with little chance of survival) [6]. Inclusion in the present study required all of the abovementioned information, and all patients included were fully ambulant prior to treatment. Exclusion criteria were used to minimize confounders in the analysis, and included: not fully ambulant, alterations of venous anatomy, history of venous thromboembolism, use of oral contraceptive pills or hormone replacement therapy, ASA score >2, and prior varicose vein surgery. Each of these factors could have affected the validity of correlating varicose vein surgery with the likelihood of developing postoperative DVT. All patients gave informed consent before treatment, which was approved by the Institutional Review Board.

Surgical Procedures and Postoperative Thrombosis Prophylaxis

Patients who had been taking anticoagulation or antiplatelet agents (e.g. aspirin) were asked to stop taking them 1 week before surgery under the premise of safety. The type of anaesthesia was decided by the anaesthetists based on the overall physical status of the patient and the details of surgery. The operative technique was traditional. In brief, under anaesthesia (general anaesthesia, epidural anaesthesia, lumbar anaesthesia, combined spinal epidural anaesthesia or femoral nerve block), a standard operation consisted of flush ligation of the saphenous vein, stripping the great saphenous vein to below the knee. Tourniquets were used routinely in all patients to reduce blood loss and improve cosmesis. Following the groin procedure and stripping, the tourniquet was applied in a circular motion (centripetal) until distal pulses were not palpable and secured at approximately 15 cm above the knee, thus exsanguinating the limb in a centripetal direction and blocking blood flow. Subsequently, multiple phlebotomies of the varicose vein that had been marked on the skin prior to surgery were taken through stab incisions. Once the procedure was completed, cotton cushions and elastic bandages were applied firmly to the treated limb. All procedures went smoothly and no patient had intra-operative complications requiring hospitalization. All patients were vigorously encouraged to ambulate as soon as possible, usually 24 h after surgery. Elastic bandages were worn for 48 h and were replaced with medical compression stockings for at least 1 month. All patients received a single dose of low-molecular-weight heparin prophylaxis (4000 i.u. enoxaparin sodium, Clexane, Sanofi Winthrop Industrie) 8 h after surgery and once daily over the next 3 days. Patients were generally discharged from hospital within 3–5 days.

Duplex Ultrasound and Postoperative Investigation

Duplex ultrasound examinations were performed pre- and postoperatively by experienced examiners of the same team to assess the deep venous system from the inguinal ligaments to the ankle, including insonation of the great saphenous vein, the common femoral vein and the calf muscle veins (gastrocnemius, posterior tibial or popliteal vein). Particular attention was paid to the gastrocnemius vein. Gastrocnemius vein dilation (GVD) was diagnosed when the dilated gastrocnemius vein was more than 5 mm in diameter (or 1.5 times the size of the normal side when dilation was less than 5 mm in diameter), and when it could be compressed completely with a probe and disappear from sight. Pre-operative duplex ultrasound assessment was typically performed 1 or 2 days before surgery, while postoperative duplex ultrasound was conducted 3 days after surgery. A patient was diagnosed with postoperative DVT when the duplex image revealed venous dilatation with an echogenic thrombus, the absence of Doppler signals and narrow, thick-walled veins. The site, size and extent of the thrombus were also identified by duplex imaging. DVT was classified as either proximal (i.e. the thrombus was located at or above the popliteal vein) or distal (i.e. the thrombus was restricted to the infrapopliteal deep veins). A thrombus in both proximal and distal locations was classified as proximal. Symptomatic patients who presented with leg pain, swelling and/or calf tenderness were also recorded from the hospital's postoperative records. Patients with clinical findings that were compatible with PE, such as chest pain, dyspnoea, tachypnoea and oxygen desaturation, were evaluated using multi-slice spiral computed tomography pulmonary angiography. All patients with DVT were given additional anticoagulation medication (warfarin) for 6 months and re-assessed by duplex ultrasound 1, 3 and 6 months after initial diagnosis in the outpatient department. The therapeutic international normalized ratio was adjusted within the range of 2.0–3.0. Patients were thought to have effective anticoagulation when the duplex image revealed disappearance of the thrombus and the presence of Doppler signals. Patients with suspected or confirmed PE remained hospitalized for an extended period following surgery. The outcomes of anticoagulation treatment were reviewed from the outpatient records. Other patients without postoperative DVT were reviewed at a local hospital.

Statistical Analysis

Statistical Package for the Social Sciences Version 17.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analyses. Chi-squared test was used to determine the significance of differences in the occurrence of DVT with respect to age, sex, obesity, affected limb side, CEAP classification, tourniquet time and type of anaesthesia. Multiple logistic regression analysis was performed to confirm the independent predictive factors. $P < 0.05$ was considered to indicate statistical significance.

Results

Patient Characteristics

In total, 1461 patients who underwent unilateral varicose vein surgery with routine use of a tourniquet between 1 January 2012 and 30 November 2013 were enrolled in this study. There were 781 (53.5%) men and 680 (46.5%) women, with an average age of 56.7 years (range 19–88 years). Of all the patients included in this study, 410 patients (28.1%) were diagnosed with GVD. All patients had a good physical status and had an ASA score ≤2. The basic characteristics and pre-operative status of the patients are summarized in Table 1.

Incidence of Postoperative DVT

The incidence of DVT after varicose vein surgery with routine use of a tourniquet was 7.7% (113/1461 patients) within the first 3 postoperative days. There were 19 (1.3%) cases of proximal DVT and 94 (6.4%) cases of isolated distal DVT. Of the 94 patients with distal DVT, 64 (68.1%) patients had a thrombus located in the gastrocnemius or soleus veins, and the remaining 30 (31.9%) patients had a thrombus located in the posterior tibial or peroneal veins. Three of the 19 patients with proximal DVT had a thrombus at the femoral surgical site, three patients had a thrombus in the femoral veins, five patients had a thrombus in the popliteal veins and eight patients had a thrombus both above and below the popliteal veins. Twenty-one (1.4%) patients with DVT were symptomatic, and the remaining 92 (6.3%) patients were asymptomatic. Of the 21 symptomatic patients, 16 (1.1%) had proximal DVT and five (0.3%) had distal DVT (Fig. 1). One patient (0.07%), a 65-year-old man with concomitant symptomatic DVT (proximal DVT), exhibited clinical symptoms consistent with PE; this was confirmed by multi-slice spiral computed tomography pulmonary angiography.