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Great saphenous vein stump: a risk factor for superficial/deep venous thrombosis and an indication for prophylactic anticoagulation? - a retrospective analysis

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ABSTRACT

Background: Great saphenous vein (GSV) grafts are used for coronary artery bypass surgeries, but the remaining stump of the GSV may be the nidus for superficial and deep vein thrombosis. This study aims to determine the risk of thrombosis in the GSV stump in patients who developed lower extremity swelling following coronary artery bypass graft (CABG).

Methods: We conducted a single-center retrospective analysis at Abington Jefferson Hospital of 100 patients who underwent CABG with GSV. Patients were monitored via follow-up for seven days for the development of saphenous vein thrombosis without any prophylactic anticoagulation for venous thrombosis. Risk factors including age, diabetes, hypertension, smoking, familial thrombophilia's, family history of thrombosis, malignancy, and confounding factor-like early mobilization that may potentially alter the results were recorded.

Results: The mean age of included patients was 70 years, and 65% of participants were men, 35% were women. Fourteen percent of the patients developed pain, swelling and edema in a leg where the graft was taken. We included patients aged >50 years with coronary artery disease who underwent CABG with SVG and developed lower extremity symptoms concerning for thrombosis. These patients underwent duplex ultrasound for possible GSV stump thrombosis. Any patients with coronary artery disease but no CABG or no lower extremity edema were excluded from the study. We found no saphenous vein thrombosis in the stump of the GSV in patients with clinical symptoms of thrombosis in their lower extremities based on duplex imaging.

Conclusion: Based on our findings, the postoperative risk of developing thrombosis at the GSV stump and its extension to the deep veins is low and does not warrant prophylactic anticoagulation for venous thromboembolism. However, we recommend that further prospective studies with larger samples for an extended duration are warranted for better assessment of the risk of venous thrombosis in the GSV stump with minimal confounding factors.

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Saphenous; graft; thrombosis; anticoagulation; venous thrombosis

1. Introduction

CABG is one of the more common cardiac surgeries performed. 100,000 to 200,000 patients per year receive CABG in the US [1]. A saphenous vein graft is often used in a CABG. The donor site of the graft can be an inciting event for superficial venous thrombosis (SVT) in legs status post-surgery [2,3]. Injury to a vein act can start the thrombotic process that can progress from SVT to deep venous thrombosis (DVT) [4]. It has been reported that up to 44% of patients with SVT go on to develop a DVT [5]. The concerning part of this is that up to one-third of the patients who develop SVT may go on to develop asymptomatic pulmonary embolism (PE), and up to 13% of these patients also develop symptomatic DVT [5].

The clinical symptoms concerning for thrombosis in the lower extremity, especially at the donor site of saphenous vein uptake for CABG is usually worked up with physical examination and imaging. Previous studies have tried to ascertain the risk of SVT in SVG after harvesting for CABG. However, there is still no convincing evidence linking SVT in the GSV stump following CABG, and data remain limited. This study was undertaken to determine the risk of thrombosis in the GSV stump after harvesting the vein for CABG while limiting the other secondary risk factors of thrombosis.

2. Materials and methods

We performed a single-center study at the Abington Memorial Hospital in Pennsylvania. A total of 100 patients who underwent CABG with GSV harvesting were included in this study. Included patients were monitored for up to seven days after the procedure to assess for the development of SV thrombosis. Patients with clinical symptoms like pain, swelling and edema,

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concerning for GSV thrombosis underwent duplex scanning to rule out thrombosis. We formulated a strict selection criterion and included patients who did not have any other risk factors for thrombosis. We excluded patients having possible other explanation of thrombosis such as pregnancy, acquired thrombophilia's, bone fractures, familial thrombophilia, malignancy, stasis, medications, previous thromboembolism, and immobility. All aspects that may potentially alter the results were taken into consideration. Our patient population did have age>50, diabetes, hypertension, smoking which can contribute to risk of thrombosis. We excluded patients having a previous history of thrombosis and that preoperative ultrasound of these patients in medical record did not show any thrombosis. Patients in our study were not immobile after CABG surgery and were started an aspirin/clopidogrel to prevent coronary artery restenosis.

3. Results

The mean age of the 100 patients included in this study was 70 years, including 65% male, and 35% female. Fourteen percent of study participants developed pain, swelling, and edema of their leg from the side where the graft was taken. These patients further underwent Doppler ultrasound to check for possible GSV stump thrombosis, although none were positive for GSV thrombosis based on duplex imaging. This is demonstrated in Figure 1.

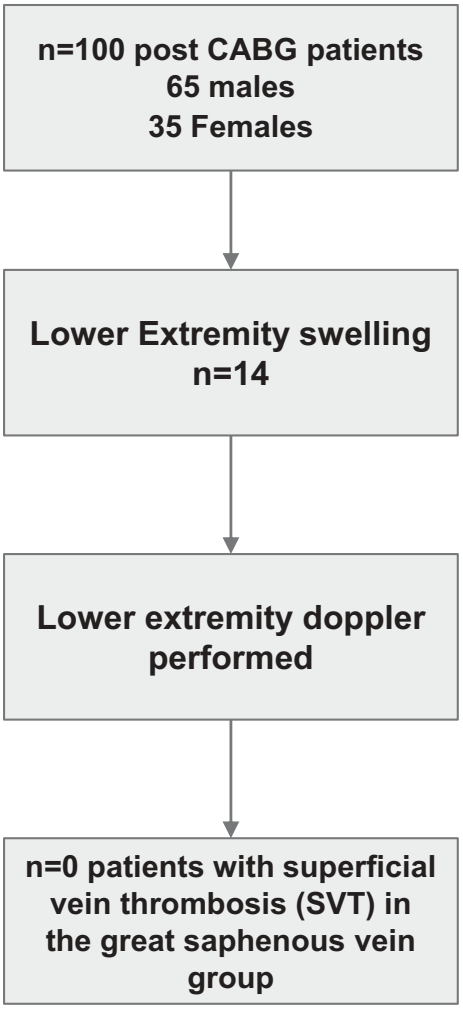

Figure 1. Flowsheet depicting the results of our study.
Abbreviations: CABG, coronary artery bypass graft; SVT, superficial vein thrombosis; GSV great saphenous vein.

4. Discussion

Coronary artery bypass grafting is a standard procedure for multiple vessel coronary artery disease. Conventionally cardiothoracic surgeons use saphenous vein grafts for coronary artery bypass grafting. The surgical technique of taking a graft includes: exposing the great saphenous vein by making an incision 3–5 cm proximal to the medial malleolus, ligating the side branches with dissection of the saphenous vein, cannulating the vessel, and closing the leg wound [6–8].

Postoperative CABG patients are sometimes found to have thrombosis of the leg veins. Thrombosis at the site of the remaining stump of the saphenous vein in the lower extremity can cause SVT that can later progress to DVT and PE [1]. Initial presenting symptoms of thrombosis in the leg after CABG can be pain, swelling and edema in the unilateral leg, although the majority of asymptomatic cases are possible to exist. The exact mechanism of increased thrombosis at the donor site of the vein is not fully understood; it can be due to stasis/immobilization and endothelial damage at the stump of the great saphenous vein. In a study done by Labropoulous et al. 2335 patients were studied after receiving CABG after GSV graft with heparin use perioperatively [2]. Furthermore, out of 2335 patients, 98 were found to have signs and symptoms concerning for venous thromboembolism in the lower extremity during hospitalization or after discharge. Out of 98 patients, 19 patients were found to have thrombosis. Out of these 19, five patients were excluded due to one patient having a protein-C deficiency, and four patients had a thrombosis in contralateral leg/thrombosis, not at the GSV stump. A total of 15 patients had a thrombosis at the site of GSV stump. Of these, two cases had superficial vein thrombosis at a site away from Sapheno-Femoral Junction (SFJ), and the rest had a thrombus in GSV and tributaries. The thrombus at GSV stump ranged 1–4 cm. The sample of cases with thrombus was so small, and statistically insignificant for comparison among subgroups of vein distribution in a study, as mentioned by Labropoulous. In our research, we intended to focus on 100 cases post-CABG, who underwent duplex scan for any concerns/symptoms of vein thrombosis in the leg at the GSV stump site. Among the study

population, 14 patients had a lower extremity swelling within seven days of CABG and underwent doppler study to rule out thrombus. None of the participants were found to have thrombus either at SVG stump site, superficial veins or deep veins. We believe that the previous studies did not clarify the other risk factors for thrombosis and could have confounding factors. Our population size was small due to a more stringent exclusion criteria, we aimed to remove all patients who could have other risk factors for thrombosis (such as family history of thrombophilia's, immobilization, bone fractures etc.). After controlling for other possible causes of thrombosis, we believe that there is a negligible risk of thrombosis in the stump. Our selection criteria best served the objective of the study at the expense of including only a small population but devoid of any other risk factors in a study population. Additionally, we believe that antiplatelet therapy is sufficient in post CABG patients and these patients do not require anticoagulation.

Many surgeons prefer to put patients on DVT prophylaxis throughout hospitalization duration following CABG due to immobility after major surgery [9]. Patients who develop thrombosis can have underlying inherited or acquired thrombotic risk due to low anticlotting or increase clotting factors. This is also in fact mentioned as a case of protein-C deficiency, who developed SVT status post CABG in a study done by Labropoulous [2]. In another study done by Hanson et al. up to 35% of the patients with SVT have an underlying hypercoagulability [10]. Controversial literature exists for the prevention of thrombosis in leg veins after CABG and depends on the surgeon's practice. Most patients receive heparin anticoagulation pre, peri, and post procedure, and it can/cannot prevent the DVT occurrence. However, interestingly, up to 13% of the patients after CABG can develop thrombosis in the leg vein despite a maximum dose of heparin [1]. In the study by Labropoulous 15 patients developed GSV stump thrombosis despite heparin use perioperatively.

In our study, we excluded patients with secondary risk factors for thrombosis such as pregnancy, acquired thrombophilia's, bone fractures, familial thrombophilia, malignancy, stasis, medications, previous thromboembolism, and immobility. Our population had no other risk factors for thrombosis other than post-operative risks due to immobilization and CABG surgery related stump thrombosis. The former was reduced by selecting patients who had early ambulation after the surgery and the later was the subject of assessment in this study. We hypothesized that patients who are status post CABG are at high risk of thrombosis as suggested by previous studies, the results in our study were different as we controlled the confounding factors. Our study participants didn't develop any thrombus in the GSV stump without heparin prophylaxis after CABG, as patients were started an aspirin/clopidogrel and had an early ambulation. The literature review also mentioned early postoperative swelling of the vein donor leg could be expected, is usually benign, self-resolving and doesn't always have underlying thrombus in most of the cases [11].

In patients with diagnosed cases of thrombus in the leg veins after GSV stump, the site of involvement is important in management. Thrombus below the knee is usually benign unless it progresses to the proximal veins/pulmonary embolism. In a study by Labropoulous et al., 5 out of 15 patients who had venous thrombus, developed PE symptoms, and underwent imaging for PE. Two patients had a high probability PE finding on a ventilation-perfusion scan [2].

As discussed by Lohr et al. symptoms, risk factors, and physical examinations are not a correct predictor of the common femoral vein extension as the majority of cases lacks positive signs and symptoms [12]. Another study by Murgia et al. resulted in that thrombus presence, and extent can be diagnosed by Duplex scanning with a 100% accuracy [13,14]. In our study, we also performed a Duplex scanning on patients with symptoms/signs of thrombosis at GSV stump site.

After the diagnosis of confirmed thrombosis of the lower extremity, the primary methods of treatment of SVT/DVT graft site include anticoagulation and surgical intervention. The anticoagulation regimen includes heparin and warfarin. In a study by Labropoulous et al. 13 out of 15 patients with venous thrombus in the leg were treated with heparin and warfarin with INR monitoring [2]. Despite treatment with anticoagulation, two patients still had an extension of thrombus [2]. Surgical clipping/ligation can treat patients with limited response to anticoagulation and also prevent the extension of thrombosis from superficial to deep veins [10]. Surgical removal of SFJ also prevents DVT progression and PE. Another study by Lohr et al. reported surgical intervention is effective if the venous thrombus is within 3 cm of SFJ [12]. Studies by Lofgren et al., and Pulliam et al., reported that surgical intervention is effective in the prevention of progression of thrombus [15,16].

Thrombosis in the GSV stump after CABG is not well linked to GSV site. The thrombotic risk of these patients is not high at GSV site status post CABG. The use of pre, peri, and postoperative use of heparin is controversial. In our study, we didn't use prophylactic anticoagulation for venous thromboembolism, and we didn't find to have any thrombus in cases presented with lower extremity edema status post CABG. The lower extremity edema in the leg of the GSV stump can be a normal finding, but imaging should be done to rule out thrombus. The main strength of this study is that it is the second study that discusses these associations.

5. Conclusion

The association of SVT in the SVG stump following CABG is theoretical. Our study failed to show any thrombus in the lower extremity in patients off anticoagulation with clinical symptoms of thrombus seven days after CABG. To date, there is insufficient evidence to recommend for or against routine DVT prophylaxis after CABG to prevent SVT in the SVG stump and its extension to DVTs. In the future, large randomized clinical trials would be helpful to develop causation of diagnosed stump thrombosis and to develop guidelines of venous thromboembolism prophylaxis after CABG.

Authors contributions

Yasir Khan, develop the research strategy and did data collection

Muhammad Arslan Cheema coordinated the data collection

Ammar Abdullah did the statistical analysis and helped in manuscript

Yasar Sattar re-wrote the revised manuscript, edited images and proof reading.

Shujaul Haq helped in reference arrangement and data mining.

Asoka Balaratna did the critical review

Waqas Ullah wrote the initial manuscript

Disclosure statement

No potential conflict of interest was reported by the authors.

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