The Egyptian Cardiothoracic Surgeon

Vol. 3, No. 6, 139 - 143

Original Article

Heparin versus No Heparin before Endoscopic Vein Harvesting using Angioscopy

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Abstract

Background: Endoscopic vein harvesting (EVH) became a standard technique with several advantages over open vein harvesting (OVH). Thrombus formation inside the vein lumen is one of the main concerns after EVH. It is not known whether heparin use before EVH could prevent this complication. The study aimed to assess the safety of not giving intravenous heparin before starting the open system EVH procedure using the PeriVu™ Disposable Angioscopy (LeMaitre® VASCULAR- France) as a modality to assess the intraluminal vein clots.

Methods: This research is a randomized study that compared two groups of patients undergoing CABG. One group had 2500 IU heparin before EVH using (Virtusaph plus, Terumo) (n=50) and the other group had EVH without giving heparin (n=50). Intraluminal clots in the vein segments were evaluated using PeriVu Disposable Angioscopy (LeMaitre-VASCULAR).

Results: Preoperative data were comparable between groups with no statistically significant difference. The mean duration of the procedure in the heparin group versus the non-heparin group was 30.6±5.8 and 28.7±5.9, respectively (P= 0.11). Intraluminal clots were detected in two segments out of 103 segments (1.94%) in the No heparin group, while none was detected in the heparin group (P= 0.24).

Conclusion: There was no difference between heparin versus no heparin during endoscopic vein harvest regarding intraluminal thrombus formation. Further studies are recommended to confirm our findings.

KEYWORDS
Endoscopic vein harvesting; Angioscope; Coronary artery bypass grafting

Article History
Submitted: 11 July 2021
Revised: 24 July 2021
Accepted: 3 Sep 2021
Published: 1 Nov 2021

Introduction

Endoscopic vein harvesting (EVH) became the standard technique for many centers because of its significant advantages over open vein harvesting (OVH) in minimizing wound infection, achieving early ambulation, better cosmesis, and lower hospital stay. Thrombus formation inside the vein lumen is one of the main concerns of this technology [1]. Some studies recommended giving a prophylactic dose of heparin to prevent this complication, especially in the CO2 closed systems. In contrast, other research did not recommend heparin in open CO2 systems like (VirtuoSaph plus ® Endoscopic Vessel Harvesting System, Terumo), taking advantage of avoiding the unfavorable bleeding tendency during internal mammary artery harvesting [2].

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Currently, there is no consensus supporting giving heparin before the procedure. This study aimed to assess the safety of not giving intravenous heparin before starting the open system EVH procedure using the PeriVu™ Disposable Angioscopy (LeMaitre® VASCULAR-France) as a modality to assess the intraluminal vein clots.

Patients and methods:

Study Design:

This research is a randomized study carried out in Al-Dabbous Cardiac Center, Kuwait. Two strategies of endoscopic vein harvesting using (Virtusaph plus, Terumo) were compared. We gave heparin 2500 IU at the onset of the procedure in one group, and the second group was without heparin. PeriVu™ Disposable Angioscopy (Figure 1) is a tool that features a unique 10.000 pixel, fused optical fiber bundle that provides a sharp, direct visualization of the vein lumen to evaluate vein quality and the absence of clot in both groups to ensure the safety of using the vein conduit in coronary bypass grafting. The operating two surgeons reported unfavorable bleeding difficulty during internal thoracic artery harvesting as difficult or not without knowing to which group the patient belonged.

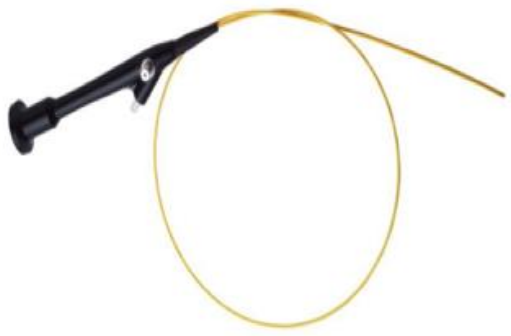

Figure 1: Le Maitre Angioscope

Study population

One hundred consecutive ischemic heart disease patients undergoing coronary bypass grafting (CABG) were included in the study and divided into two groups (Heparin group, n=50 and non-Heparin group, n=50).

Inclusion criteria

We included all IHD patients undergoing CABG with two or more grafts and at least a single venous graft.

Exclusion criteria

Exclusion criteria included any patients on preoperative heparin for any indication or duration and any patient with a preoperative plan for total arterial vascularization.

Study conduct

The study started in April 2018 until January 2020. One hundred consecutive patients were included in the study. Two experienced surgeons did all endoscopic procedures with an experience of more than 300 endoscopic procedures for each. Another member of the surgical team was assigned to randomize the patients and to document all demographic data and the depth of the great saphenous vein reported by the Doppler study preoperatively, recording the duration of the harvesting procedure, the number of segments, and the presence or absence of any intraluminal clot detected by the angioscopy (Peri Vu, Le Maitre, France).

The technique of vein harvesting

A standard technique of EVH was followed. Preoperative routine ultrasound was done to assess the veins quality, size, and depth (the distance from the skin's surface to the upper surface of a vein) anteriorly. The patient was positioned in a frog-like position. An incision about 2 cm in the upper leg or lower thigh just above the medial aspect of the knee was done, with careful dissection and identification of the great saphenous vein. This was followed by insertion of a traumatic conical tip of the dissector and starts dissection for the whole length of the vein posteriorly, anteriorly, and laterally. Then insertion of V-keeper gently to protect the vein during harvesting and using V-cutter (bipolar electrosurgical energy) delivers high-frequency electrical current and voltage causing desiccation and vaporization of the target tissue. The device encapsulates the main conduit and simultaneously seals and cuts the branches near the tunnel wall.

After vein harvesting, injection of heparinized saline solution in the vein, covering the angioscopy tip with a small rubber cap to avoid injury to the vein's intima during its advancement inside the vein, examining and video recording of the vein

lumen in a retrograde manner. It was taken into consideration to discard any segment with an intraluminal clot, tear, or any damage to the intima.

Statistical analysis

All data were collected preoperatively in a departmental database (patient analysis and tracking system, Dendrite clinical, UK). Categorical data were presented as percentages and frequency. Mean and standard deviations were provided for continuous variables.

Categorical data were compared using the Chi-square test or Fisher exact test when appropriate and continuous data were compared using the Student t-test. Statistical analysis was performed using SPSS version 27.0 (SPSS, Armonk, NY, USA). A P-value of less than 0.05 was considered statistically significant.

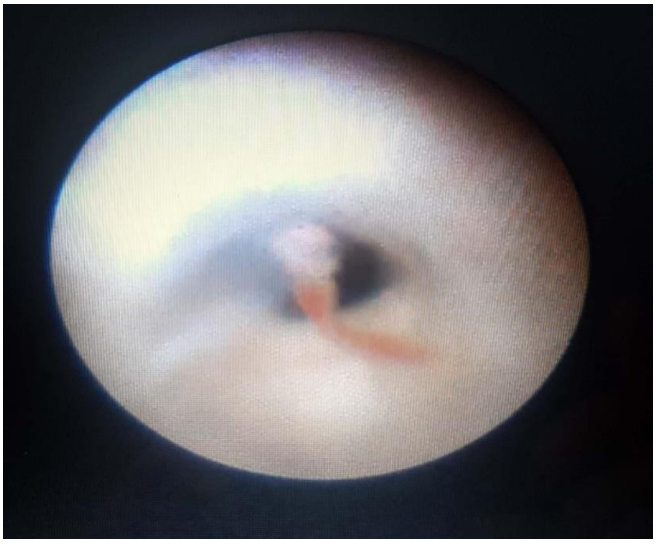

Figure 2: Clot inside the vein lumen as seen by the angioscopy

Results:

Demographic data, including age, sex, body mass index (BMI), diabetes (DM), hypertension, dyslipidemia, smoking, renal insufficiency, and the depth of the veins, are summarized in Table 1. There were no statistically significant differences between both groups. The incidence of peripheral vascular disease (PVD) was 4% in both groups. Veins adherent to the skin were observed by preoperative ultrasound in 5 patients (10%) in the heparin group. In comparison, it was observed in 6 patients in the No heparin group (12%) (P=0.75).

The procedure duration in the heparin group ranged from 20 to 40 min with a mean of 30.6± 5.8. In comparison, it ranged from 18 to 45 min with a mean of 28.7±5.9 in the no heparin group (P= 0.11).

The intraluminal clot was detected in two segments out of 103 segments in the No heparin group (1.94%) (Figure 2). No intraluminal clot was detected in any segment examined in the heparin group (P= 0.24).

Internal Thoracic Artery (ITA) harvesting was reported difficult in 22% (n=11) and 20% (n=10) of patients in the heparin versus the no heparin groups, respectively (P= 0.81).

Discussion

Coronary artery bypass grafting (CABG) is still the most common cardiac surgery procedure representing annual volumes of approximately 200,000 isolated cases [3] in the US and an average incidence rate of 62 per 100,000 inhabitants in western European countries [4,5]. Despite the increasing use of arterial conduits, the great saphenous vein is still the most commonly used graft because of its ready availability and ease of use [6,7]. The patency rate of these SVGs was attributed to many factors related to the patient as hypercholesterolemia, diabetes mellitus control, hypercoagulable state, calcific or atherosclerotic aorta, bad target with poor distal runoff and discharge therapies. Other factors related to anastomosis or SVG harvesting techniques, either open or endoscopic, could affect the patency [8,9].

Many studies showed no significant difference between open and endoscopic techniques in graft patency [10]. The International Society for Minimally Invasive Cardiothoracic Surgery in 2017 published a consensus statement giving a Level 1B recommendation for endoscopic conduit harvesting [11]. Still, other studies accused clot formation and intimal tears inside the EVH segments of shorter patency, especially for acute graft failure [12].

Some studies comparing the open versus close carbon dioxide insufflation EVH techniques have

Table 1: Comparison of preoperative and operative data between groups

	Heparin Group (n= 50)	No Heparin Group (n= 50)	P-value
Male	34 (68%)	31 (62%)	0.53
Age (years)	58.86± 10.35	59.04± 7.59	0.92
Body mass index (Kg/m2)	27.25± 5.91	27.68± 5.35	0.71
Diabetes mellitus	28 (56%)	25 (50%)	0.55
Smokers	21 (42%)	19 (38%)	0.68
Peripheral vascular disease	2 (4%)	2 (4%)	>0.99
Hypertension	30 (60%)	29 (58%)	0.84
Renal failure	2 (4%)	2 (4%)	>0.99
Dyslipidemia	13 (26%)	16 (32%)	0.47
Veins adherent to skin	5 (10%)	6 (12%)	0.75
Harvest duration (min)	30.6± 5.87	28.7± 5.92	0.11
Number of segments	2.12± 0.59	2.06± 0.68	0.64
Intraluminal Clots	0	2 (1.94%)	0.24
Difficult internal thoracic artery harvest	11 (22%)	10 (20%)	0.81

showed that clot burden is less with the open CO2 insufflation technique even in the absence of heparinization before initiation of the procedure and the recommendation of systemic administration of heparin before occluding flow using a sealed CO2 system led to dramatic reductions in this retained clot. Pre-heparinization before EVH was believed to increase the technical difficulty of internal thoracic artery harvest, owing to increased oozing in the surgical field and may cause an increased incidence of bleeding and hematoma in the tunnel of EVH [2]. Although the difficulty was more in the heparin group, it did not reach a statistically significant difference. Till now, there is no recommendation for systemic heparinization before the open CO2 insufflation EVH technique. The use of open CO2 insufflation to maintain flow within the saphenous vein prevents stagnation of blood within the saphenous vein with subsequent less clot formation.

To our knowledge, this is the first study to compare clot formation with open CO2 insufflation endoscopic system (VirtuoSaph plus ® Endoscopic Vessel Harvesting System, Terumo) if preoperative heparin was given using the PeriVu™ Disposable Angioscopy (LeMaitre® VASCULAR). Both groups showed no statistically significant differences in the risk factors for venous clot formation. There were only two cases with an intraluminal clot in the non-heparin group patients compared to zero clots in the heparin group without a statistically significant difference. Those clots were found in the distal leg segments where the SVG was superficial. The heparin group also had six superficial veins without any clot found. We assume that even with the open CO2 insufflation system, blood stagnation in the superficial saphenous vein is unavoidable and may risk clot formation. This stagnation causing clot formation was evident from our experience using angioscopy before this study when we were using a technique to insert a drain into the endoscopic tunnel by tying a Ticron suture to the proximal end of the vein before cutting it then we were dragging the suture together with the vein through the distal end of the tunnel leaving the proximal end of the stitch to tie it to the drain to pass it back to the tunnel. With this technique, we found three consecutive segments with intraluminal clots near the proximal segments. We stopped this technique since that time. All the segments in the two groups were with no gross intimal tears, healthy intima.

Conclusion

There was no difference between heparin versus no heparin during endoscopic vein harvest regarding intraluminal thrombus formation. Further studies are recommended to confirm our findings.

Acknowledgments:

The authors thank Dr. Ali A Sadek, consultant in public health, University of Alexandria, Sabah Medical Area, Kuwait, for his great help and expert assistance in data management and statistical analysis.

Conflict of interest: Authors declare no conflict of interest.

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