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CORONARY BYPASS SURGERY IN DIABETIC PATIENTS: THE PROBLEM OF LEG WOUND HEALING AND ENDOSCOPIC SAPHENOUS VEIN PREPARATION AS A SOLUTION

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Abstract

Objective: In this study, we aimed to compare the short-term wound healing results of the endoscopic vein preparation technique with the classical open vein preparation technique.
Study design: Between January 2020 and January 2024, 628 patients undergone multiple coronary bypass surgery were included the study.
Results: In this study 231 of whom underwent EVH and 399 of whom underwent OVH. In the EVH group M/F was 177/54, mean. Age was 61.06±10.2 years; range was 36-86 years, in OVH group M/F was 291/108, mean. age was: 62.4±9.57 years; range was 30 to 87 years.
DM rate was higher and statistically significant in the EVH group (p=0,040) There was no difference between the two groups in terms of wound infection.(p=0,278) Non
The rate of discharge with infection was 231/8 (3.5%) in the EVH group and 399/74 (18.5%) in the OVH group. (p<0,001). The rate of skin necrosis was 231/0(0%) in EVH and 399/49(12.3%) in OVH (p<0,001). Dehiscence rate was 231/4(1.7%) in EVH and 399/105(26.3%) in OVH (p<0,001). Revision frequency was 231/17(7.4%) in EVH and 399/103(25.8%) in OVH (p<0,001).
Conclusion: We consider EVH is one of the best solutions for the problem of leg wound healing in diabetic patients.

Keywords: endoscopic vein removal, coronary artery bypass graft surgery, classical saphenous vein removal, leg wound infection, wound healing.

1. Introduction

Coronary artery bypass graft (CABG) surgery is the most common type of heart surgery. Over the years, CABG operations have become more complicated for many reasons. One of these reasons is the increase in the number of anastomoses. This has led to the need for longer grafts. Despite the increase in arterial graft bypass surgery, the vena saphena magna (VSM) graft remains one of the most commonly used grafts worldwide due to its easy accessibility and sufficient length for multiple bypasses (1-3). In addition, given that their use began with the advent of coronary artery bypass grafting, vein grafts are among the most familiar grafts in terms of structure, properties, and the wound problems we encounter in the postoperative period(3).

Wound complications and associated prolonged hospitalization, increased treatment cost and increased morbidity rates have been reported between 1% and 44% of cases in open preparations (OVH) using conventional methods(1).This led to the search for alternative methods for VSM preparation. As a result, first minimally invasive methods and then endoscopic saphenous vein preparation (ESVP) were developed. (1,4) Endoscopic saphenous saphenous preparation, which is now widely used worldwide, has been routinely performed in our clinic since January 2020.However, EVH is a high-cost method that requires infrastructure setup and a learning process.

The aim of this study was to compare two different saphenous preparation techniques (EVH vs OVH) in terms of postoperative healing and wound complications in coronary bypass operations performed by the same team in the cardiovascular surgery clinic of Sanko University Faculty of Medicine.

2. Methods or experimental section

This study was designed as a retrospective study to evaluate wound complications in two patient groups. Permission was obtained from SANKO University Faculty of Medicine Ethics Committee for the study protocol. Among 1007 patients who underwent coronary bypass surgery between January 2020 and January 2024, 632 volunteer patients who underwent multiple bypass and were included in the study were evaluated. Of the cases, 231 were EVH and 399 were OVH.

Surgical treatment and GSV preparation of all patients were performed by the same surgical team at SANKO University Hospital. Patients were randomly divided into two groups (OVH and EVH). In the OVH group, preparation was performed with standard open technique through a longitudinal skin incision starting 1 cm above the medial malleolus, in accordance with the saphenous vein tracing, and the side branches were ligated with 3.0 silk or clipped with hemoclip. After hemostasis, the anatomical folds were closed with 1 no and 2.0 no absorbable sutures. The skin was closed intracutaneously with 3.0 absorbable sutures and elastic bandage was applied for 2 days, followed by compression stockings. In the EVH group, after the patient was anaesthetised on the operating table, the VSM calibration and course were routinely evaluated and marked by USG and subcutaneous access was made through a small incision of approximately 2 cm inferior to the medial condyle. The GSV was explored using CO_2 infufflation with the VASOVIEW HEMOPRO 2 (Maquet Holding GmbH & Co.) Endoscopic Vessel Harvesting (EVH) System. A port was placed by tunnelling through the incision. CO_2 insufflation was started with 3 lt/min and 12 mmHg pressure. Dissection cannula was placed into the tunnel. A cautery unit was placed to separate the tributal branches. GSV was dissected up to the groin level using the dissector and cautery. It was ligated and cut at the level of SFJ and the graft was removed by making a 1 cm skin incision from this level. Side branches were ligated using 3.0 silk or clips. After leakage control, if necessary, repair was performed with 7.0 polypropylene. Haemostasis was performed and a vacuum drain was placed. After the incisions were sutured, the leg was closed with elastic bandage. Inclusion criteria: Patients who underwent multiple CABG operations for coronary artery disease were selected.

Exclusion criteria were early post operative death, patients requiring emergency surgery, redo CABG, combined cardiac surgery, C4-C6 chronic venous insufficiency according to CEAP classification, chronic renal failure, previous extremity surgery and critical peripheral arterial disease.After vascular access, cardio-pulmonary bypass, moderate hypothermia and isothermic blood cardioplegia were performed as standard CABG procedure.The two groups were compared in terms of length of hospitalisation, early leg wound healing and complications. Baseline variables of the two groups were compared and differences were statistically evaluated. The covariates included were saphenous vein harvest method, age, gender, diabetes mellitus, left ventricular ejection fraction, total distal anastomoses, and all variables that were significantly different at baseline. The length of hospital stay and incidence of wound complications were evaluated in the two groups. Wound assessment was performed daily by a specialised physician. Patients with complete wound healing were discharged on the sixth postoperative day on average.

Statistical analysis was performed using SPSS version 23 software (SPSS Inc., Chicago, IL, USA). Quantitative data obtained from the study were described by mean and standard deviation or median and interquartile percentages according to the data distribution; qualitative data were described by number and percentage. In the comparison of two groups, independent groups t-test or Mann-Whitney U test was used for quantitative data and chi-square test was used for qualitative data. Odds ratio (also risk measure) was calculated for qualitative data. $P<0.05$ was considered statistically significant.

Results

A total of 628 patients were included in the study. The selected patients were those who underwent isolated, multiple coronary bypass surgery. Patients who underwent concomitant intervention were not included in the study. Baseline variables of the two groups were compared and differences were statistically evaluated. The covariates included were saphenous vein harvest method, age, gender, diabetes mellitus, left ventricular ejection fraction, total distal anastomoses, post operative sixth day haemoglobin and white blood cell values. Among demographic variables, there was no significant difference between age, gender, BMI and LVEF measurements ($p>0.05$). Only DM rate was higher in the EVH group and statistically significant ($p=0.040$) (Table 1).

There was no difference between the two groups in terms of wound infection ($p=0.278$).The rate of non-infective discharge at the wound site was 231/8 (3.5%) in EVH group and 399/74 (18.5%) in OVH group ($p<0.001$). The rate of skin necrosis was 231/0(0%) in EVH and 399/49(12.3%) in OVH ($p<0.001$). Dehiscence rate was 231/4(1.7%) in EVH and 399/105(26.3%) in OVH ($p<0.001$). Revision frequency was 231/17(7.4%) in EVH and 399/103(25.8%) in OVH ($p<0.001$) (Table 2).The frequency of haematoma formation was 231/54(23.4%) in EVH and 399/39(9.8%) in OVH, with a significant difference ($p<0.001$) (Table 2).The mean number of veins was 3.76±0.93 in OVH and 3.42±0.75 in EVH and there was a statistically significant difference ($p<0.001$) (Table 1).

Haemoglobin measurements were 10.14±0.54 in OVH and 10.46±0.70 in EVH on the sixth postoperative day ($p<0.001$) (Table 2).WBC measurements were 11.15±1.57 in OVH and 10.30±1.80 in EVH on the sixth postoperative day ($p<0.001$) (Table 2).30-day mortality was 231/5 (2.2%) in EVH and 399/8 (2.0%) in OVH ($p=1.000$) (Table 2).

The rates of discharge, necrosis, dehiscence, revision and WBC were significantly higher in the OVH group, while the rates of haematoma development and haemoglobin were significantly higher in the EVH group. There was no statistically significant difference in intensive care unit and ward length of stay and 30-day mortality rates (Table 2).

Equations, figures, tables, and others

		Patient Variables		
		EVH group (n=231)	**OVH group (n=399)**	
Variable		**Mean±SD (min-max)**	**Mean±SD (min-max)**	**p**
Age		61,06±10,23 (36-86)	62,43±9,57 (30-87)	0,093[a]
Sex/male n (%)		177 (%76,6)	291(%72,9)	0,307[b]
BMI		28,95±4,34 (21,50-41,10)	29,14±4,68 (16,80-41,10)	0,608[a]
DM T2 n (%)		94 (%40,07)	130(%32,6)	0,040[b]
DAC		3,76±0,93 (1-5)	3,42±0,75 (1-7)	<0,001[a]
EF		55,5±6,66 (30-65)	54,68±7,36 (25-65)	0,163[a]

TABLE 1. THE DEMOGRAPHİC AND CLİNİCAL CHARACTERİSTİCS OF THE GROUPS

BMI:Body Mass Index,DN T2:Diabetes Mellitus Type 2, DAC:Distal Anastomosis Count, EF:Ejection Fraction, SD: Standart Deviation, a: Independent Samples t-test, b: Chi-square

Table.2 Comparison of the groups in terms of complications and labarotory values

	EVH n=231(%)	OVH n=399(%)	p
Infection	3 (%1,3)	12 (%3)	0,278[a]
Drainage	8 (%3,5)	74 (%18,5)	<0,001[a]
Hematoma	54 (%23,4)	39 (%9,8)	<0,001[a]
Necrosis	0 (%0,0)	49 (%12,3)	<0,001[a]
Dehissence	4 (%1,7)	105 (%26,3)	<0,001[a]
Revision	17 (%7,4)	103 (%25,8)	<0,001[a]
30D Mortality	5 (%2,2)	8 (%2,0)	1,000[a]
	Mean±SD (min-max)	Mean±SD (min-max)	
WBC	10,3±1,8 (1-15)	11,1±1,5 (8-19)	<0.001[b]
HB	10,4±0,7 (9-12)	10,1±0,5 (9-12)	<0,001[b]
ICU (h)	37,3±4,5 (30-50)	37±3,3 (36-48)	0,404[b]

WBC: White Blood Count ,HB: Hemoglobine,ICU: Intensive Care Unit SD: Standard Deviation,a: Chi-square test ,b: Independent Samples t-test

Discussion

Complications related to leg wounds after bypass surgery are common and can be serious enough to require repeated hospitalisation, increased treatment costs, restriction of mobilisation due to pain and additional surgical interventions. While some of the patients have prolonged hospitalisation, others are readmitted to hospital after discharge. While some of these complications resolve with simple dressing methods, others may be complicated enough to require re-hospitalisation and surgical revision, even skin grafting. As a result, the convalescence period of the patients is interrupted and it creates a significant financial burden for both the patients and the healthcare system (Paletta et al. 2000)(Krishnamoorthy et al. 2021)(Chou, Lee, and Wang 2009)(Kroeze et al. 2019). Vein grafts were first used with the beginning of coronary surgery (Sabiston 1963)).Complications of vein preparation with the classical open method are well known. As a result of the search for alternatives to prevent these complications, endoscopic vein preparation (EVP) has been used since the second half of the 1990s. Since its inception, the EVH method has spread rapidly and is now performed in approximately 50-70% of patients undergoing CABG in developed countries (Ouzounian et al. 2010)(Lopes et al. 2009).

Despite its advantages in wound healing, concerns about graft patency rates in patients undergoing EVH have persisted for a long time, but as a result of recent studies, EVH has been accepted to be as safe as OVH(Krishnamoorthy et al. 2021)(Zenati et al. 2019) We have been performing VSM preparation endoscopically in our clinic since the end of 2019.

Demographic variables in the patients included in the study consisted of values specific to our region and two parameters were remarkable. One of them was the rate of Type 2 DM, which was 32.6% in the OVH group and 40.7% in the EVH group. The other was BMI, which was 29.14±4.68 in the OVH group and 28.95±4.33 in the EVH group. Both parameters were above the national average. This situation was considered as a regional health problem that should be studied separately. As a matter of fact, these two parameters were found to be compatible with the data of the Turkish Ministry of Health. No significant differences were found in other demographic parameters.

When the previous studies were analysed, it was found that the infection rates in leg wounds were against OVH in the literature, while the infection rate in our study was 231/3 (1.3%) in EVH and 399/12 (3%) in OVH and there was no significant difference. The possible reason for this result was thought to be related to both the sample size and the exclusion criteria (Athanasiou et al. 2003)(Liliav, Yakoub, and Kasabian 2011)

In our study, wound healing rate, duration of hospitalisation, incidence of non-infective wound complications and re-hospitalisation rate due to leg wound complications in patients were compatible with the literature and resulted in superiority of EVH compared to OVH. In the pain assessment, which we did not include in our study, our clinical observations were consistent with the literature and the need for postoperative analgesia was lower in the EVH group. These results reveal the difference between surgical trauma in EVH and trauma in OVH (Davis et al. 1998).

However, haematoma development was observed to be higher in the EVH group compared to the OVH group, which may be related to haemostasis weakness and preoperative ASA and/or Clopidogrel use. Although revision was needed in 8 of 54 patients with haematoma, palliative methods were sufficient in 46 patients. The incidence of seroma, which is mentioned in similar studies and found at a low rate, was limited to 1 patient in EVH and was not

found in OVH and was not included in the statistical study. There was no difference between the two groups in terms of cardiac complications and 30-day mortality.

3. Conclusion

In this study, discharge, necrosis, dehiscence and the need for surgical revision were lower in the EVH group. However, the most striking part of the study was that although the rate of Type 2 DM was higher in the EVH group, the incidence of non-infective wound complications was clearly lower. While the prevalence of Type 2 DM was 32.6% in the OVH group, this rate was 40.07% in the EVH group. When we look at these results, we consider that endoscopic vein preparation will be one of the valuable methods in CABG operations in diabetic patients who are prone to wound complications.

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CONFLICT OF INTEREST

The authors have no affiliations with or involvement in any organization or entity with any financial interest or nonfinancial in the subject matter or materials discussed in this manuscript.

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