

Comparative study of traditional long incision vein harvesting and multiple incisions with small skin bridges in patients with coronary artery bypass grafting at King Abdullah University Hospital - Jordan

Estudo comparativo entre a exérese da veia safena tradicional por incisão contínua e incisões múltiplas com pequenos "patches" de pele em pacientes submetidos à revascularização do miocárdio no Hospital Universitário King Abdullah - Jordânia

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Abstract

Objective: Saphenous vein harvesting can be associated with wound complications, incision pain, infection, and poor cosmetic outcome. The objective of our study is to determine the difference in wound complication and infection rates between two saphenous vein harvesting techniques, long incision versus multiple short interrupted incisions (tunneling) for coronary artery bypass grafting at the King Abdullah University Hospital - Jordan.

Methods: Retrospectively we analyzed data from 1,050 consecutive elective coronary artery bypass procedures performed from May 5, 2003, to December 31, 2007, in our institution. Saphenectomy using traditional Long incision vein harvesting (Group 1) performed in six hundred and fifty patients (n=650), while saphenectomy using multiple incisions with small skin bridges - tunneling (Group 2) performed in four hundred patients (n=400). Saphenectomy performed by the cardiac surgery assistant or main cardiac surgeon. Inflammation, dehiscence, cellulites, lymphangitis, drainage, necrosis, or abscess necessitating dressing, antibiotics or debridement before complete healing without eschar were defined as wound complications. There was no

statistical difference in preoperative risk factors in both groups. Test results were considered significant when $P < 0.05$.

Results: Leg wound complications observed more in traditional long incision vein harvesting technique ($P=0.0005$). Female gender, obesity, diabetes are associated with an increased incidence of wound problems ($P < 0.05$).

Conclusions: Saphenous vein harvest using saphenous vein tunneling was associated with fewer wound complications than the traditional longitudinal method.

Descriptors: Cardiac surgical procedures. Myocardial revascularization. Saphenous vein/surgery. Coronary artery bypass. Surgical wound infection.

Resumo

Objetivo: A exérese da veia safena pode estar associada a complicações da ferida, dor da incisão, infecção e resultado cosmético ruim. O objetivo deste estudo é determinar a diferença de complicações da ferida e as taxas de infecção entre as duas técnicas de exérese de veia safena, incisão longa versus múltiplas incisões curtas separadas (tunneling)

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para a revascularização do miocárdio no Hospital Universitário King Abdullah, Jordânia.

Métodos: Analisamos, retrospectivamente, os dados de 1.050 procedimentos eletivos consecutivos de revascularização do miocárdio realizados no período de 5 de maio de 2003 a 31 de dezembro de 2007, em nossa instituição. Safenectomia utilizando exérese tradicional por incisões contínuas (Grupo 1) foi realizada em seiscentos e cinquenta pacientes (n=650), enquanto a safenectomia utilizando múltiplas incisões com pequenos *patches* de pele - tunelização (Grupo 2) foi empregada em quatrocentos (n=400). Safenectomia foi realizada pelo assistente ou pelo cirurgião cardíaco principal. Reação inflamatória, deiscência, celulites, linfangite, drenagem, necrose ou abscesso que necessitasse curativo, antibióticos ou desbridamento antes da cicatrização completa sem escara foram definidos como

complicações da ferida. Não houve diferença estatística entre os grupos com relação aos fatores de risco pré-operatório em ambos os grupos. Os resultados dos testes foram considerados significativos quando $P < 0,05$.

Resultados: As complicações da ferida foram observadas com maior frequência nos pacientes submetidos à técnica tradicional de exérese por incisão contínua ($P = 0,0005$). Sexo feminino, obesidade e diabetes estão associados a aumento da incidência de complicações na ferida ($P < 0,05$).

Conclusões: A exérese da veia safena utilizando tunelização foi associada a menores complicações da ferida do que o tradicional método longitudinal.

Descritores: Procedimentos cirúrgicos cardíacos. Revascularização miocárdica. Veia safena/cirurgia. Ponte de artéria coronária. Infecção da ferida operatória.

INTRODUCTION

Long saphenous vein conduit in coronary artery bypass grafting (CABG) remains the most commonly used conduit after the internal mammary artery. Traditional open saphenous vein harvesting (OVH) using longitudinal incision along the anatomical long saphenous vein site from ankle to groin may lead to significant wound complications, postoperative pain, prolonged convalescence, and poor cosmetic outcome [1,2]. Usually, conventional open saphenectomy with a long continuous incision or small skin bridges with multiple incisions are the two most common used techniques for saphenectomy in coronary artery bypass grafting, but these techniques and postoperative wound complications are fairly common [3-6].

Multiple incisions with small skin bridges require traction on the vein to facilitate proper exposure of the vein under the created tunnel with technically difficult ligation of its side branch. This excessive surgical manipulation will lead to endothelial cell function impairment and reduces the bioavailability of nitric oxide [7-9]. Resulting endothelial injury will enhance the platelet and leukocyte adhesion that accelerate the intimal hyperplasia through the smooth muscle cell proliferation which is the common cause of vein graft occlusion [10-12]. The harvested and prepared saphenous vein depends on its functional integrity for immediate and long-term graft patency [13]. Leg wound complications related to saphenous vein harvesting account 3% to 30% in patients who undergo coronary artery bypass grafting [4,6].

These complications will lead to increase morbidity, and medical costs. Simple wound complications are more common and these usually presented as wound pain,

lymphedema, hematoma and saphenous neuralgia. Fortunately, severe complications presented as nonhealing ulcers, severe soft-tissue infection, and gangrene that require amputation are rare. Female sex, obesity, diabetes, lymphedema, peripheral vascular disease, and smoking are factors associated with an increased incidence of wound problems [5]. Minimally invasive saphenous vein harvesting technique decrease the risk of wound complications as it reduces the length and number of skin incisions [14-18].

In this study, we are comparing the outcomes with regards to leg wound infection rates between conventional open saphenectomy with a long continuous incision and minimally invasive saphenous vein harvest using multiple incisions with small skin bridges which is the only minimal invasive saphenous vein harvesting technique used at our institution.

METHODS

We retrospectively analyzed data collected from 1,050 consecutive patients who had undergone coronary artery bypass grafting (CABG) with use of saphenous vein grafts (SVGs) from May 5, 2003 to December 31, 2007. Demographic characteristic and risk factors for patients are presented in Table 1. Patients having a redo CABG or other surgical intervention at the time of bypass grafting, early postoperative deaths, not related to infection were excluded at the beginning from the study groups (not included in the study groups). Patients that we couldn't find proper follow up in their medical files also were excluded from the study. Saphenectomy using traditional single long incision vein harvesting technique (Group 1) consisted of 650

Table 1. Demographic characteristics and risk factors

	Single long incision (Group 1) n=650	Multiple small incisions (Group 2) n=400	P value
The average age	64.9 years (range, 39 to 83 years)	63.2 years (range, 36 to 80 years)	
Male	456	298	
Female	194	102	0.1285
TIA	17	7	0.3621
Diabetes	182	146	0.0039
C.R.F	5	1	0.2783
P.V.D	10	4	0.4600
COPD	34	19	0.7296
Smoking	260	152	0.5192
Steroid use	5	2	0.6026
Emergency	6	5	0.6133
Obesity (BMI >30 kg/m ²)	7	3	0.5963

TIA: Transient ischemic attacks; C.R.F: Chronic renal failure; P.V.D: Peripheral vascular disease; COPD: Chronic obstructive pulmonary disease; BMI: Body mass index.

(61.90%) patients. Saphenectomy using multiple short interrupted incisions leaving intact skin bridges (Group 2) consisted of 400 (38.10%) patients. Incisions type and gender of patients are presented in Table 2. In Group 1, the average age was 64.9 years (range, 39 to 83 years), in Group 2 the average age was 63.2 years (range, 36 to 80 years).

As our comparative study was directed to leg infections between two groups, we could not collect data about noninfective wound healing complications. Depending on World Health Organization standards, obese patients were classified if the body mass index (BMI) >30 kg/m². Ten of our patients only with body mass index >30 kg/m².

Demographic characteristic, risk factors, leg wound complications, discharge status, mortality, and hospital readmission was collected from the Summit Medical database by a cardiac surgeon. Wound complications were defined as inflammation, dehiscence, cellulitis, lymphangitis, drainage, necrosis, or abscess necessitating dressing, antibiotics or debridement before complete healing without eschar [5]. Leg wounds were assessed according to our post operative care protocol during daily round by cardiac fellow while patients were hospitalized. Then wounds were examined at discharge (5-7 day post surgery if there is no any surgical complications), after discharge at one week in the outclinic, and at 3 to 4 weeks

after surgery by cardiac surgeon. Multiple logistic regression analysis was applied to look for independent risk factors for wound infection; these analyses include the technique of vein harvesting, age, sex, obesity, diabetes mellitus, hypertension, renal disease, peripheral vascular disease. Test results were considered significant when $P < 0.05$. The study has been and approved through The Jordanian University of Science and Technology Institutional Ethics Committee - Jordan-Irbid.

Surgical techniques

After the general anesthesia, insertion of central venous line and arterial line, the patients were prepared with a supine position, with both legs externally rotated, semiflexed (frog-leg position) and elevated on rolled sheets that were placed under the thighs to avoid pressure on the peroneal nerve. Scraping was performed with povidone-iodine solution. In long incision group the incision was started one centimeter above and lateral to the medial malleolus or starting at the groin. The vein was identified, then the incision going along the whole course of long saphenous vein in different length variety depending on the amount of vein required. Using sharp and blunt dissection the vein was cleared from the adventitia and connective tissue. Side branches were ligated using 3/0 silk ties on the vein side and metal clips on the patient side.

The leg wound was closed in layers, insertion of closed-system drainage (redivac drain) in obese patients and the skin is approximated using skin metal clips. At the multiple incisions with small skin bridges group saphenous vein was harvested with leaving skin bridge between the 8-10 cm incisions. The techniques of vein harvesting and handling were similar to the single long incision group. Same suturing technique was used with the single incision

Table 2. Incisions type and gender of patients

	Single long incision (Group 1)	Multiple small incisions (Group 2)	Total
Male	456	298	754
Female	194	102	296
Total	650	400	1050

Table 3. Incidence of leg infection in both groups.

	Single long incision (Group 1) N= 56/650		Multiple small incisions (Group 2) N= 13/400		P value
	Number	Infection %	Number	Infection %	
	56	8.6%	13	3.2%	0.0005
Male	17	3.7%	3	1.0%	0.0235
Female	39	20.1%	10	9.8%	0.0234
Diabetic	32	17.6%	9	6.2%	0.0019
Obese	6	85.7%	0	0%	0.0112

group. In obese patients always we used closed-system drainage. At the end of the coronary bypass surgery, squeezing the leg from where the vein was harvested to evacuate the remnant accumulated blood and elastic bandage wrapping will be apply around used routinely in all patients.

RESULTS

Postoperative leg wound infections (Table 3) occurred more in the (Group 1) of patients (56/650, 8.6%) than in the (Group 2) of patients (13/ 400, 3.2%; $P e=0.0005$). *Staphylococcus* was the most common organism isolated from culture (45/69, 65.22%) in these patients. These complications responded to conservative treatment (antibiotics and regular dressings). No surgical intervention required in either group. Hospital stay is more prolonged in these patients between 10-16 days.

DISCUSSION

Recently endoscopic vein harvesting technique was established in some cardiac centers with well known advantages, but in many cardiac centers, cardiac surgeons still prefer the open techniques to harvest saphenous vein segments [19]. The incidence of wound complications increased in female sex patients, obesity, diabetes, lymphedema, peripheral vascular disease, and smoking [5]. We are comparing in our study the risk, and incidence of leg infections between two open saphenectomy techniques, the traditional single long incision, and less invasive technique using multiple incisions with small skin bridges, reviewing the experience at our institution.

After coronary artery bypass grafting surgery, leg wound complications at saphenous vein harvesting site account 3% to 30% [4,6]. In their prospective randomized controlled study, Mahmood et al. [13], by using Mayo stripper during saphenous vein harvest, showed that the vein traction during the manipulation of the vein as part of the technique does not affect the endothelial function in

comparison with the traditional open harvest technique. The result by Tran et al. [20] showed that saphenous vein tunnelling is an attractive alternative to the open harvest technique in obtaining venous conduits for coronary artery bypass procedures, as they used a tunnelling technique always during harvesting thigh saphenous vein, but the open harvest technique with long incision was preserved in nearly a third of veins harvested for lower leg veins. In our study, with conventional open saphenectomy using a long continuous incision, we found that, female sex, obesity, diabetes, are factors that significantly increase the incidence of leg wound complications, as a result of increased length of incision.

Limitations of the study

This is a nonrandomized study in a new cardiac surgery center, as well as we are in the starting period in cardiac surgery since 6 years in the north of Jordan, our cases are more selective. We could not include in this study data about noninfective wound healing complications, like hematoma, lymphedema, ecchymosis, and wound dehiscence, neither proper assessment of pain in the study group patients. We could not found wide variation in complication rate between thigh or leg harvested site. We were unable to collect wound closure times, or the length of incisions in the multiple incisions with skin bridges. A prospective randomized study with a large number of patients from one surgeon will give us a proper comparison between two techniques, as will give a shadow over these negative points.

CONCLUSIONS

In our study we conclude that saphenectomy using multiple incisions with small skin bridges (tunneling) as a minimally invasive technique is easy, and give superior cosmetic outcome, and reduced wound complications, compared with traditional methods of vein harvest. Female sex, obesity and diabetes increase the risk for leg wound infection. In this group of patients we need more meticulous and less invasive surgical techniques to be applied.

REFERENCES

1. Wipke-Tevis DD, Stotts NA, Skov P, Carrieri-Kohlman V. Frequency, manifestations, and correlates of impaired healing of saphenous vein harvest incisions. *Heart Lung*. 1996;25(2):108-16.
2. Bonde P, Graham AN, MacGowan SW. Endoscopic vein harvest: advantages and limitations. *Ann Thorac Surg*. 2004;77(6):2076-82.
3. Matsuura JH, Dattilo JB, Poletti LF, Cohen IK, Posner MP, Makhoul RG. Minimally invasive vein harvesting: a comparison of endoscopic versus traditional open saphenectomy. *Vasc Surg*. 1997;31:519-22.
4. DeLaria GA, Hunter JA, Goldin MD, Serry C, Javid H, Najafi H. Leg wound complications associated with coronary revascularization. *J Thorac Cardiovasc Surg*. 1981;81(3):403-7.
5. Utley JR, Thomason ME, Wallace DJ, Mutch DW, Staton L, Brown V, et al. Preoperative correlates of impaired wound healing after saphenous vein excision. *J Thorac Cardiovasc Surg*. 1989;98(1):147-9.
6. Lavee J, Schneiderman J, Yorav S, Shewach-Millet M, Adar R. Complications of saphenous vein harvesting following coronary artery bypass surgery. *J Cardiovasc Surg (Torino)*. 1989;30(6):989-91.
7. Angelini GD, Christie MI, Bryan AJ, Lewis MJ. Surgical preparation impairs release of endothelium-derived relaxing factor from human saphenous vein. *Ann Thorac Surg*. 1989;48(3):417-20.
8. Bush HL Jr, Jakubowski JA, Curl GR, Deykin D, Nabseth DC. The natural history of endothelial structure and function in arterialized vein grafts. *J Vasc Surg*. 1986;3(2):204-15.
9. Lawrie GM, Weilbacher DE, Henry PD. Endothelium-dependent relaxation in human saphenous vein graft. Effects of preparation and clinicopathologic correlations. *J Thorac Cardiovasc Surg*. 1990;100(4):612-20.
10. Angelini GD, Bryan AJ, Williams HM, Morgan R, Newby AC. Distention promotes platelet and leukocyte adhesion and reduces short-term patency in pig arteriovenous bypass grafts. *J Thorac Cardiovasc Surg*. 1990;99(3):433-9.
11. Soyombo AA, Angelini GD, Newby AC. Neointima formation is promoted by surgical preparation and inhibited by cyclic nucleotides in human saphenous vein organ cultures. *J Thorac Cardiovasc Surg*. 1995;109(1):2-12.
12. Dilley RJ, McGeachie JK, Prendergast FJ. A review of the histologic changes in vein-to-artery grafts, with particular reference to intimal hyperplasia. *Arch Surg*. 1988;123(6):691-6.
13. Mahmood Z, Al Benna S, Nkere U, Murday A. Decreased morbidity following long saphenous vein harvesting using a minimally invasive technique: a randomised controlled trial comparing two techniques for long saphenous vein harvest. *J Cardiothorac Surg*. 2006;1:15.
14. Lumsden AB, Eaves FF 3rd, Ofenloch JC, Jordan WD. Subcutaneous, video-assisted saphenous vein harvest: report of the first 30 cases. *Cardiovasc Surg*. 1996;4(6):771-6.
15. Allen KB, Shaar CJ. Endoscopic saphenous vein harvesting. *Ann Thorac Surg*. 1997;64(1):265-6.
16. Cable DG, Dearani JA. Endoscopic saphenous vein harvesting: minimally invasive video-assisted saphenectomy. *Ann Thorac Surg*. 1997;64(4):1183-5.
17. Tevæarai HT, Mueller XM, von Segesser LK. Minimally invasive harvest of the saphenous vein for coronary artery bypass grafting. *Ann Thorac Surg*. 1997;63(6 Suppl):S119-21.
18. Allen KB, Griffith GL, Heimansohn DA, Robison RJ, Matheny RG, Schier JJ, et al. Endoscopic versus traditional saphenous vein harvesting: a prospective, randomized trial. *Ann Thorac Surg*. 1998;66(1):26-31.
19. Lai T, Babb Y, Ning Q, Reyes L, Dao T, Lee VV, et al. The transition from open to endoscopic saphenous vein harvesting and its clinical impact: The Texas Heart Institute experience. *Tex Heart Inst J*. 2006;33(3):316-20.
20. Tran HM, Paterson HS, Meldrum-Hanna W, Chard RB. Tunnelling versus open harvest technique in obtaining venous conduits for coronary bypass surgery. *Eur J Cardiothorac Surg*. 1998;14(6):602-6.