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Saphenous vein versus total arterial graft in coronary artery bypass graft

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Original Article

Abstract

BACKGROUND: Coronary artery bypass graft (CABG) surgery remains the gold standard treatment for left main coronary artery and multivessel disease. In the last decade, arterial conduit clearly has had superiority over venous conduit. The aim of this study is to report and compare both types of conduit in Erbil Cardiac Center, Iraq.

METHODS: A retrospective cohort study was used to compare patients who received total arterial grafts (n = 25) with patients who had saphenous-vein bypass grafts (n = 25), at the point of gender, age, operation duration, post-operative complications, hospital stay, and the 6-month cardiac ejection fraction (EF) improvement.

RESULTS: All patients of arterial group were men in comparison to 68% men versus 32% women in venous group; mean age of the patients was 50 years and 61 years for arterial and venous conduits, respectively. Duration of operation was 3.97 hours and 4.27 hours, hospital stay was 5.42 days and 7.20 days, and EF improvement was 11.48% and 4.40% for arterial and venous conduits, respectively. Although the duration of operation was not statistically significant, the total duration of hospital stay and EF improvement were statistically significant.

CONCLUSION: Arterial conduit has started in the last decades. Although it technically needs more accuracy and time, it has a better outcome compared to the venous conduit.

KEYWORDS: Saphenous Vein, Arterial Graft, Coronary Artery Bypass

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Introduction

In severe coronary artery disease (CAD), coronary artery bypass graft (CABG) surgery is indicated to re-establish an adequate blood supply to the ischemic myocardium.[1,2] CABG is a standard surgical procedure for advanced CAD. It is well known for decreasing the symptoms and improving survival.[3-5]

It reduces morbidity and mortality in patients with left main stem (LMS), triple-vessel disease (TVD), and/or proximal stenosis of the left anterior descending coronary artery (LAD) compared to medical therapy,[2,6,7] and decreases coronary repeated revascularization rate in comparison to percutaneous coronary intervention (PCI).[2,8] Advances in medical therapy for ischemic heart disease (IHD) and heart failure (HF) have improved the outcomes of patients with CAD. The survival advantage of CABG surgery over medical therapy in patients with stable angina has been challenged.[9] Effectiveness of CABG surgery is directly related to graft patency.[2,10]

The efficacy of CABG is dependent on the long-term patency of the selected conduits. The left internal thoracic artery (LITA) is established as the best conduit for CABG, particularly for grafting the LAD.[11] After initially unfavorable outcomes,[12] there has been an emerging and renewed enthusiasm for the radial artery (RA) as an alternative conduit through the use of improved harvesting techniques and antispasmodic medications.[13]

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Conduits are divided into two groups: arterial and venous.

Venous conduits [saphenous vein grafts (SVGs)]

Excellent patency can be achieved in the first five years with SVGs. They are unaffected by native coronary artery stenosis (NCAS); however, endothelial and media hyperplasia (5-8 years post-operatively) and subsequent atherothrombosis markedly diminish patency. Attention to harvesting, avoidance of trauma, over-distension, and preservation of vessel wall integrity and vasa vasorum may contribute to longer-term patency, as may the use of statins.

Arterial conduits

LITA: Since the publication by Tatoulis et al. in 1986 (and other publications around that time), it has been universally accepted that LITA is the best coronary graft and LITA to LAD is the single most important component of any coronary revascularization in reducing recurrent cardiac events and enhancing survival.[14] LITA-LAD improves perioperative mortality and is strongly recommended in all situations including emergency revascularization, older age, and in patients with co-morbid states [diabetes, obesity, renal dysfunction, and chronic obstructive airway disease (COAD)].[15]

The right internal thoracic artery (RITA)

The RITA is biologically identical to the LITA.[16-20] Hence, it is not logical to universally proclaim the LITA as the best conduit. The RITA is usually of greater diameter than the LITA in right-handed people and potentially easier to use.

RA

The RA is often considered as the second graft of choice after the ITA, having a high patency rate close to 90% up to 10 years after CABG.[21]

As known well, the LITA is the preferred graft in myocardial revascularization due to high patency in addition to early and late survival rates. The radial and gastroepiploic arteries may also be considered as alternative arterial grafts. SVGs are the most commonly-used venous grafts. Arterial grafts are superior to venous grafts due to their long-term patency rates. According to the literature, 90% of ITAs remain patent 10 years after surgery, while only 50% of saphenous grafts remain patent.[22]

In 1973, Carpentier et al. first performed surgery using an RA. Subsequently, they recommended that RA should not be used due to the 35% incidence of narrowing or stenosis of the conduit.[12] In 1992, Acar et al.[13] reported promising mid-term and long-term patency rates for RA and argued that it had gained widespread acceptance as a conduit for CABG as a result of its suitable inner diameter, good length, minimal donor site discomfort, ease of handling, and excellent early clinical results. Improvements in the harvesting techniques and postoperative administration of calcium channel blockers (CCBs) were also expected to improve the results. Today, RA as an arterial graft is the second preferred graft after LITA for CABG. In our study, we compared the long-term patency rates of arterial and venous grafts by angiography in patients with recurrent ischemic symptoms.

Despite the patency rate difference between different types of grafts, technically they are different during harvesting and grafting on the epicardium. On the other hand, harvesting site may affect the patient's condition at perioperative period and hospitalization in general.

The superiority of the arterial conduit to the venous graft is well studied and mentioned in different literatures and still is discussed. The aim of this study is to evaluate the outcome of patients of both groups and to give patients the greatest possible benefit of CABG.

Materials and Methods

This retrospective cohort study included candidates for doing bypass graft surgery. Only cases with three graft operations were selected; then patients were divided into two

groups, first those with arterial conduit LITA, RITA, and RA harvested from left forearm and second group were cases whose great saphenous vein (GSV) was used as a conduit. Data were collected carefully from each patient: gender, age, operation duration (duration of bypass and duration of cross clamp), post-operative complications (reopening and infection), day of mobilization, total hospital stay, and the 6-month cardiac ejection fraction (EF) improvement.

Data entry and coding were performed using Microsoft Excel (version 2016). The data were transferred to and analyzed by SPSS software (version 20, IBM Corporation, Armonk, NY, USA). Descriptive statistics [percentage, mean, and standard deviation (SD)] were used. T-test was used to test statistical significance between two groups. The ethical clearance (R-C-64) was obtained from the Ethical Committee of Surgical Specialty Hospital, Hawler Medical University, Erbil, Iraq.

Results

The study included 50 patients, 25 patients for each group. From venous group 17 (68%) were men and 8 (32%) were women, while all patients from arterial group were men (P = 0.002) (Tables 1 and 2).

Table 1. Association between study groups and gender

Gender	Groups		Total
	Venous conduit [n (%)]	Arterial conduit [n (%)]	
Male	17 (68.0)	25 (100)	43 (84.3)
Female	8 (32.0)	0 (0)	8 (15.7)
Total	25 (100)	25 (100)	51 (100)

Mean and SD of age of venous group was 60.92 ± 6.70 years and for arterial group, it was 50.46 ± 5.03 years (P = 0.001) (Figure 1). Duration of operation was 4.27 hours for venous group and 3.97 hours for arterial group, which was not statistically significant (P = 0.040) (Figure 2).

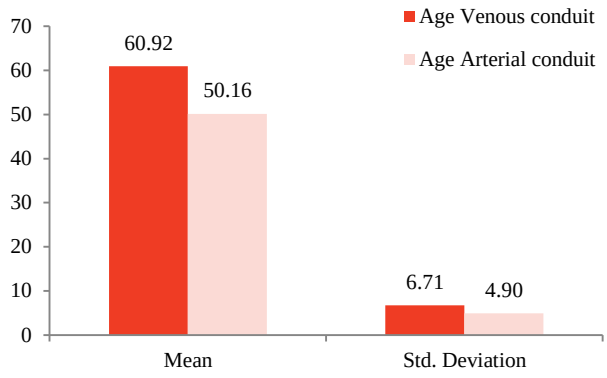

Figure 1. Saphenous vein graft (SVG) versus total arterial graft in coronary artery bypass graft (CABG) according to age

Table 2. Comparison between venous and arterial conduits in regard to different variables

Variables	Groups	N	Mean ± SD	P
Age (year)	Venous conduit	25	60.92 ± 6.70	0.001
	Arterial conduit	25	50.46 ± 5.03	
Hospital stay	Venous conduit	25	7.20 ± 1.32	0.001
	Arterial conduit	25	5.42 ± 0.75	
Duration of operation	Venous conduit	25	4.27 ± 0.51	0.040
	Arterial conduit	25	3.97 ± 0.56	
Duration of cross clamp	Venous conduit	25	30.92 ± 3.95	0.001
	Arterial conduit	25	45.73 ± 5.22	
Duration of bypass	Venous conduit	25	62.08 ± 7.80	0.001
	Arterial conduit	25	48.31 ± 5.16	
EF	Venous conduit	25	52.72 ± 7.46	0.006
	Arterial conduit	25	57.23 ± 2.61	
Mobilization day	Venous conduit	25	2.44 ± 0.50	0.001
	Arterial conduit	25	1.19 ± 0.40	

EF: Ejection fraction; SD: Standard deviation

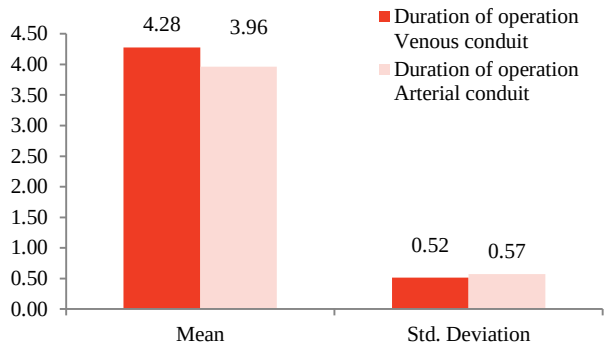

Figure 2. Saphenous vein graft (SVG) versus total arterial graft in coronary artery bypass graft (CABG) according to duration of operation

Duration of total bypass was 62.08 minutes for venous and 48.31 minutes for arterial conduits (P = 0.001) (Figure 3), while duration of cross clamp was 30.92 minutes and 45.73 minutes, respectively (P = 0.001) (Figure 4).

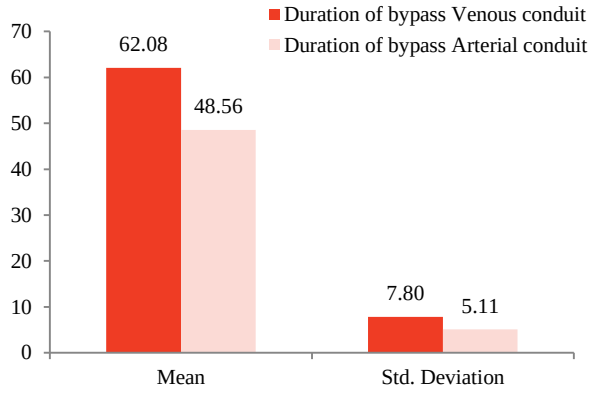

Figure 3. Saphenous vein graft (SVG) versus total arterial graft in coronary artery bypass graft (CABG) according to duration of bypass (minute)

Both of them were statistically significant. Reopening incidence was 3 cases for venous and 5 cases for arterial conduit (P = 0.470) (Table 3). Infection occurred in 5 patients of venous and 2 patients of arterial conduit (P = 0.190) (Table 4). Patients with arterial conduit were mobilized earlier than patients with venous conduit at 1.19 for arterial and 2.44 for venous conduit with statistical significance (P = 0.001) (Table 5).

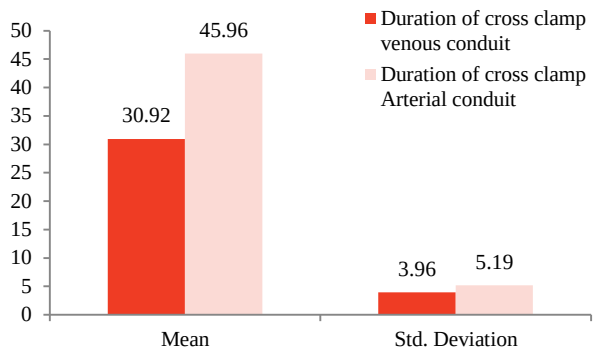

Figure 4. Saphenous vein graft (SVG) versus total arterial graft in coronary artery bypass graft (CABG) according to duration of cross clamp (minute)

Rate of improvement for EF was 4.40% for venous conduit (48.32% to 52.72%) (Figure 5), while it was 11.48% for arterial conduit (45.68% to 57.16%) which was statistically significant (P = 0.006) (Figure 6).

Table 3. Association between study groups and reopening of the operation site

Reopening	Groups		Total
	Venous conduit [n (%)]	Arterial conduit [n (%)]	
No	22 (88.0)	21 (80.8)	43 (84.3)
Yes	3 (12.0)	5 (19.2)	8 (15.7)
Total	25 (100)	26 (100)	51 (100)

P = 0.470

Overall time for hospital stay was 5.42 days and 7.20 days for arterial and venous conduit groups, respectively, which was statistically significant (P = 0.001) (Figure 7).

Table 4. Association between study groups and infection of site of operation

Infection	Groups		Total
	Venous conduit [n (%)]	Arterial conduit [n (%)]	
No	20 (80.0)	24 (92.3)	44 (86.3)
Yes	5 (20.0)	2 (7.7)	7 (13.7)
Total	25 (100)	26 (100)	51 (100)

P = 0.190

Discussion

Despite the proven benefits of ITA on long-term outcome,[23,24] the SVG has been widely

accepted as the conduit of choice for myocardial revascularization.

Table 5. Comparison between venous and arterial conduits in regard to mobilization day

Variables	Groups	N	Mean ± SD	P
Mobilization day	Arterial conduit	25	57.23 ± 2.61	0.001
	Venous conduit	25	2.44 ± 0.50	
	Arterial conduit	25	1.19 ± 0.40	

SD: Standard deviation

Other studies show that SVGs patency is still problematic at 10 years.[16,18] On the other hand, the difference between them during perioperative period also plays a crucial role.

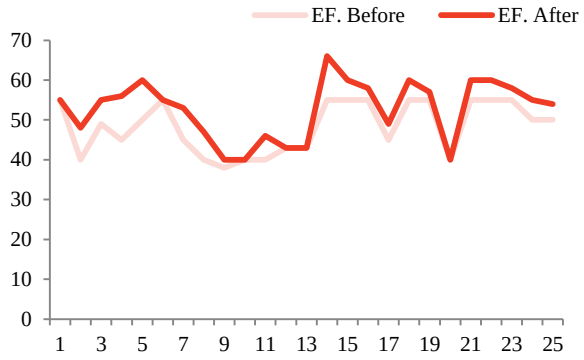

Figure 5. Saphenous vein graft (SVG) versus total arterial graft in coronary artery bypass graft (CABG) according to rate of improvement for ejection fraction (EF) (%)

Harvesting the conduit and using it for grafting also affect the procedure in general, intra, and postoperative period more precisely.

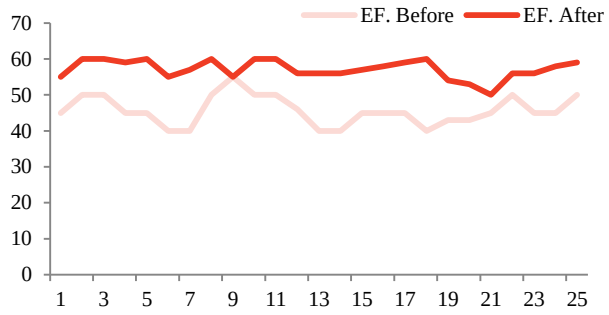

Figure 6. Saphenous vein graft (SVG) versus total arterial graft in coronary artery bypass graft (CABG) according to venous conduit (%)

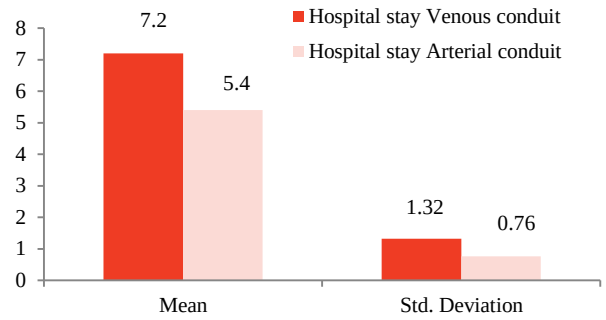

Figure 7. Saphenous vein graft (SVG) versus total arterial graft in coronary artery bypass graft (CABG) according to duration of hospital stay

Accuracy by well-trained hand and more precaution for anastomosis play an important role in intraoperative period. Venous harvesting usually needs a large wound at lower extremity with possibility of more infection which elongates the duration of hospital stay and delays mobilization postoperatively.

Total arterial conduit is more preferably done for young and male candidates for coronary bypass surgery. Cross clamp and bypass time are two important parameters during operation which determine subclinical tissue injury. Although the cross clamp time was longer for arterial group, total bypass time was significantly shorten because there was no proximal anastomosis. More tissue dissection in venous conduit leads to more incidence of infection, delayed mobilization, and prolonged hospital stay.

Conclusion

Although it is more difficult technically regarding harvesting and grafting, arterial conduit has better outcome compared to venous conduit at perioperative period with improvement of cardiac contractility later.

Conflict of Interests

Authors have no conflict of interests.

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