

CABG late angiographic grafting patency analysis in patients with recurrent symptoms

Análise angiográfica tardia dos enxertos empregados na revascularização miocárdica de pacientes com retorno de sintomas

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Abstract

Objective: Left internal thoracic artery (LITA) grafting has become essential in coronary artery bypass graft procedure (CABG). In order to optimize the use of LITA or other grafts, sequential anastomosis has been used. There is no consensus on equivalence between isolated *versus* sequential grafts. The aim of this study is to compare isolated *versus* sequential grafts.

Methods: From January 2000 to August 2007, a retrospective patency analysis of the grafts used in 88 symptomatic patients who underwent CABG procedure in our Service was performed through cinecoronariography. Statistical analysis was performed through Student's t test. Each distal anastomosis was considered an independent graft.

Results: The mean postoperative period was of 53 ± 138 months and mean age was 64 ± 11 years. LITA isolated grafts presented patency rate significantly higher than the sequential grafts, respectively 92% (46/50) and 77% (30/39) $P = 0.02$. However, in injured coronary arteries of $\geq 70\%$, isolated LITA patency rate was similar to sequential grafts, (95%; 37/39) and (93%; 26/28) respectively; $P = 0.37$. Mean radial artery patency rate was similar to isolated 71% (5/7) and sequential 90% (19/21) grafts; $P = 0.10$. Saphenous vein

patency rates were similar for isolated 72% (31/43) and sequential 81% (73/90) grafts; $P = 0.12$. There was no difference between radial artery and saphenous vein patency rates.

Conclusion: In symptomatic patients, isolated LITA patency is superior than sequential LITA. However, in coronary injuries of $\geq 70\%$, the isolated and sequential patency rates are similar. Sequential grafts from radial artery and saphenous vein are similar to their respective isolated grafts.

Descriptors: Radial artery. Mammary arteries. Saphenous vein. Coronary disease/surgery. Myocardial revascularization.

Resumo

Objetivo: A Artéria Torácica Interna Esquerda (ATIE) é o padrão ouro como enxerto na revascularização miocárdica (RM). Para otimizar seu uso, e de outros enxertos, têm sido usadas anastomoses sequenciais. Não há consenso da equivalência dos resultados entre enxertos isolados e sequenciais. O objetivo é comparar a perviabilidade dos enxertos isolados *versus* sequenciais.

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Métodos: Análise retrospectiva da patência dos enxertos empregados na RM por meio de cinecoronariografias realizadas no período entre janeiro/2000 e agosto/2007, em 88 pacientes com retorno de sintomas, operados em nosso serviço. Foi utilizado o teste *t* de Student para a análise estatística dos resultados. Cada anastomose distal foi considerada como um enxerto independente.

Resultados: O período médio de pós-operatório foi de 53 ± 138 meses e a idade média foi de 64 ± 11 anos. Os enxertos isolados de ATIE apresentaram patência superior aos dos enxertos sequenciais, sendo respectivamente de 92% (46/50) e 77% (30/39), com $P = 0,02$. Entretanto, em artérias coronárias com lesões $\geq 70\%$, a patência da ATIE isolada é semelhante à sequencial, sendo, respectivamente, 95% (37/39) e 93% (26/28), com $P = 0,37$. A patência média de artéria

radial para enxertos isolados e sequenciais foi, respectivamente, 71% (5/7) e 90% (19/21), com $P = 0,10$. A patência média da veia safena para enxertos isolados e sequenciais foi, respectivamente, 72% (31/43) e 81% (73/90), com $P = 0,12$. Não houve diferença entre a patência da artéria radial e da veia safena.

Conclusão: Em pacientes com retorno dos sintomas, a ATIE isolada apresenta patência superior à sequencial. Entretanto, em lesões coronarianas $\geq 70\%$, a patência da ATIE isolada é semelhante à sequencial. Os enxertos sequenciais de artéria radial e de veia safena são semelhantes aos seus respectivos enxertos isolados.

Descritores: Artéria radial. Artéria torácica interna. Veia safena. Coronariopatia/cirurgia. Revascularização miocárdica.

INTRODUCTION

The Left Internal Thoracic Artery (LITA) is the graft of choice in Myocardial Revascularization (MR) due to its high rate of patency and early and late survival [1].

To expand its use, the LITA became to be used sequentially to the diagonal branch (DB) and anterior descending artery (ADB), however, the results of this sequential grafts are controversial [2-4]. Similarly, other grafts also used sequentially, have become popular [5,6]. As reoperations are becoming more frequent, optimization of the use of grafts by using sequential anastomoses may be advisable. The graft of radial artery (RA) and saphenous vein (SV) with sequential anastomoses for DB showed to be superior than their respective isolated grafts for this branch [5,7]. Our group reported that the LITA and RA used isolatedly or sequentially show similar results [8,9].

There is no consensus if there is difference between isolated *versus* sequential grafts.

This study aims to analyze the angiographic study of LITA, RA and SV used in CABG of patients who had recurrence of symptoms during the postoperative, by comparing the isolated and sequential grafts.

METHODS

This study was approved by the Research Ethics Committee of the Paulo Sacramento Hospital. We assessed all angiographies performed between January 2000 and August 2007 of patients previously undergone CABG, in the database of the Hemodynamics Service of the Paulo Sacramento Hospital. In this period, 4,552 angiographies and 869 CABG surgeries were performed. To obtain confirmation of the grafts used and to achieve uniformity of the surgical technique, we selected the patients who underwent surgery in our service. The total group consisted of 88 patients on which the surgeries were performed

between 1998 and 2006. The mean postoperative period was 53 ± 138 months and the mean age was 64 ± 11 years.

We analyzed the number and type of the grafts. All distal anastomoses were considered as independent grafts. The angiographic findings were classified into two categories: occluded (graft lesion greater than 70%) and patent (lesion up to 70%). We considered occluded those grafts with lesions greater than 70%, thus unifying the grafts that theoretically would need reapproach. Grafts whose catheterization was not possible were considered occluded. The definition of the degree of graft's lesion was established by comparison of the existing report and re-analysis of the exams. In case of disagreement, an outer observer defined the degree of lesion. Free or compound LITA grafts with SV were excluded from the study.

The patients were divided according to the analyzed graft: LITA, RA and SV. Each patient could participate in more than one group if he had different grafts.

The mean time of postoperative period of LITA, RA and SV were, respectively 41 ± 24.9 , 28 ± 19.8 and 41 ± 25.7 months and the mean ages were, respectively 63 ± 10.2 , 51 ± 7.9 and 67 ± 10.0 years.

Each type of graft was divided into two groups as follows: sequential LITA and isolated LITA; sequential RA and isolated RA and sequential SV and isolated SV.

For each type of graft the patency was compared between the groups.

The groups isolated LITA and sequential LITA were subdivided as the lesion degree of the coronary bed. The subgroup isolated LITA $\geq 70\%$ and sequential LITA $\geq 70\%$ for coronary arteries with lesions greater than or equal to 70%, with comparison of the patency between these subgroups. And, similarly, the subgroup isolated LITA $< 70\%$ and sequential $< 70\%$ for coronary arteries with lesions smaller than 70%, also with comparison of patency between these subgroups. The arrangement of groups is shown in Figure 1.

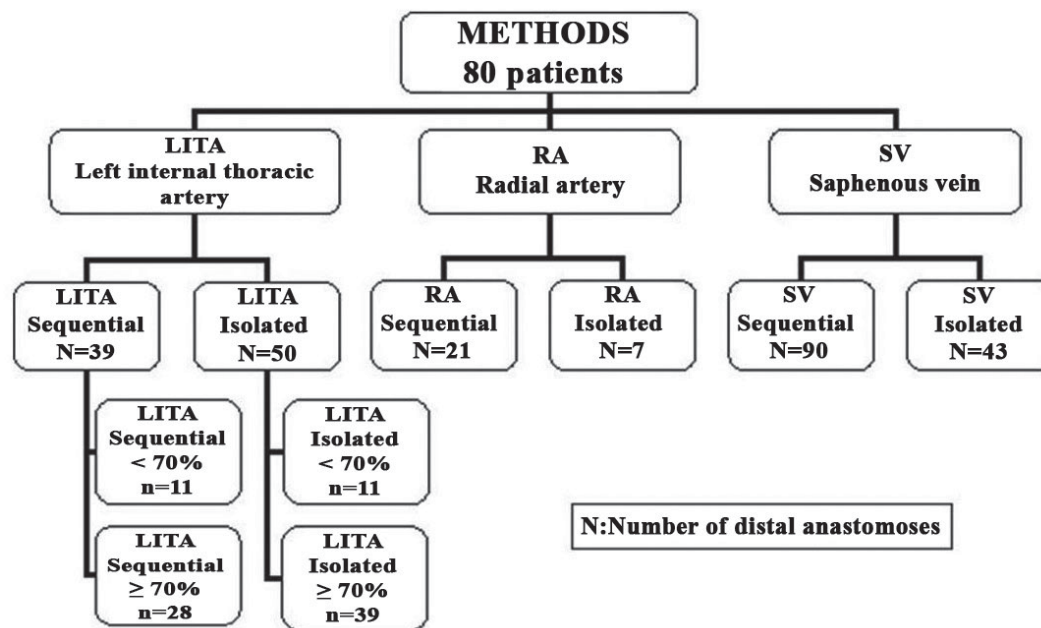


Fig. 1 – Characterization of the studied groups

Due to the fact that the target-coronary arteries of the revascularization were similar in the groups RA and SV, the patency between these groups was also compared.

The group isolated LITA consisted of 50 patients and the group sequential LITA, 19 patients. The grafts of sequential LITA totaled 39 distal anastomoses (16 DB-ADB, 1 DB-DB-ADB, 1 DB-marginal and 1 ADB-ADB).

The RA group consisted of seven patients with isolated grafts and nine patients with sequential grafts. The RA sequential grafts totaled 21 distal anastomoses.

The SV group presented 34 patients with 43 isolated grafts and 37 patients with 90 sequential grafts.

For the statistical analysis of these comparisons we used the Student's t-test.

RESULTS

For the LITA grafts, we noted a patency of the isolated LITA group significantly superior to sequential LITA, respectively of 92% (46/50) and 77% (30/39), with $P = 0.02$.

Following, the analysis of LITA subgroups:

1. In subgroups with coronary bed lesion $\geq 70\%$, we noted similar patency of subgroups isolated LITA and sequential LITA.

2. In subgroups with coronary bed lesion $<70\%$, we noted patency of isolated LITA significantly higher than the sequential LITA.

3. The isolated LITA grafts present patency similar, both in native bed with lesion $\geq 70\%$ as in native bed with lesion $<70\%$.

4. Sequential LITA grafts present patency significantly higher in native bed with lesion $\geq 70\%$ than the native bed with lesion $<70\%$.

Data from LITA subgroups are represented in Table 1.

The mean patency of RA for isolated and sequential grafts was similar, respectively 71% (5/7) and 90% (19/21), with $P = 0.10$.

The mean SV patency for isolated and sequential grafts was also similar, respectively 72% (31/43) and 81% (73/90), with $P = 0.12$.

Table 1. Relationship of the lesion degree of the native bed versus isolated and sequential LITA patency.

Coronary bed	LITA patency		P
	Isolated	Sequential	
Lesion $\geq 70\%$	37/39 (95%)	26/28 (93%)	0.37
Lesion $< 70\%$	9/11 (82%)	4/11 (36%)	0.01
P	0.08	0.001	

In the SV group, 10 patients presented sequential graft failure. Of these, three patients (30%) presented total occlusion of the graft, resulting in seven closed distal anastomoses. The other seven (70%) showed partial

Table 2. Saphenous grafting with partial failure: grafts' pervious segments.

Patients	Region of the pervious grafts segments	Pervious/occluded segment relationship
2	distal segment	2/4 (50%)
1	proximal and distal segment	2/3 (67%)
2	proximal and mean segment	4/6 (67%)
2	proximal segment	2/5 (40%)
7 (total)		10/18 (56%)

obstruction of the grafts maintaining closed 56% (10/18) of the distal anastomoses. The description of the pervious segments of these seven patients with partial failure of their grafts is in Table 2.

There was no difference between the RA patency (86%, 24/28) and SV (78%, 104/133), with $P = 0.2$.

DISCUSSION

The superiority of the LITA anastomosed with the ADB is unquestionable and our results are consistent with the literature [1,8,10].

Dion et al. [11] showed that the sequential and isolated LITA grafts present the same long-term patency. Berger et al. [12] noted that the LITA grafts have decreased patency when implanted in bed with mild-to-moderate lesion. In our study, we noted that LITA, when used sequentially was lower than if used isolatedly. However, when LITA was implanted in bed with lesion of at least 70%, the isolated and sequential grafts showed the same patency. These data suggest that sequential LITA is more susceptible to failure than the isolated one, when the coronary lesion is not critical. The possible mechanisms of this failure are the flow competition with two native beds (instead of only one in the isolated LITA) and the need for implantation of LITA in its most distal segment, and therefore with smaller size (since the LITA had to pass through the DB). However, when the coronary lesion is critical, the isolated or sequential LITA has the same excellent patency; so, its use in a sequential way should be an option in these situations due to its covering on a larger muscle territory.

The RA grafts showed excellent patency when used sequentially, consistent with the literature [8,13-16]. The isolated grafts were present in small numbers and showed a decrease of patency in relation to the sequential grafts, but without statistical difference. The sequential grafts probably have the advantage of increased flow due to increased area of capillary bed. As the largest determinant of flow is the capillary resistance, the greater the number of sequential anastomoses, the greater the theoretical flow through the graft. For the SV, the RA patency was better, but without significant difference. These data are almost

equal to the findings of Hayward and Buxton [13]. Possibly with a larger number of patients, these data may reach significant difference. Due the fact that it deals with arterial grafts, they would possibly maintain their long-term patency, increasing its difference from the SV [17].

The sequential SV grafts have shown to be better than the isolated grafts [18, 19]. In our study, we did not find significant difference, but our results are the same compared with the sequential grafts in the literature. One of the concerns in relation to sequential grafts is the obstruction of a single anastomosis that can lead to failure of the entire graft [19]. However, our study showed that it is possible to lose part of the graft and maintain the remaining viable. As the sequential grafts use a minor extension of SV to obtain the same MR, grafts are saved for a possible future reoperation. Furthermore, the use of a proximal anastomosis for more than one distal anastomosis decreases aortic manipulation and surgical time. These factors should lead to better postoperative follow-up, reducing the risk of cerebral microembolization [20-22].

A limitation of this study is the exclusive use of the data of the cineangiocoronariography and surgical description. Obviously that other data, such as associated diseases and medication under use could better characterize the patients studied. Despite the observations made with the analysis of these data, we cannot transpose these results to asymptomatic patients. Certainly the patency results of the grafts in these patients may show a superiority in relation to symptomatic patients. However, the finding of the influence of the degree of coronary lesion was decisive in the late patency of LITA grafts used sequentially and should therefore guide the choice of the technique and graft.

CONCLUSION

In patients with return of symptoms in postoperative of CABG, the isolated LITA presents patency superior than sequential one. However, in coronary lesions $\geq 70\%$, the patency of the isolated LITA is similar to the sequential one. The sequential RA and SV grafts are similar to their respective isolated grafts.

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