

Radial Artery Versus Saphenous Vein As Conduits In Coronary Artery Surgery: Comparison Of Intermediate To Long-Term Outcomes

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Abstract

BACKGROUND AND AIMS

The radial artery has become an increasingly popular arterial conduit in coronary artery bypass graft surgery (CABG), however little data exists with regard to comparison of quality of life in patients undergoing CABG with radial artery grafts and those with conventional saphenous vein grafts. The aims of this study were therefore to identify any difference in long term quality of life in surviving patients between those undergoing CABG with radial artery grafts and those with saphenous vein grafts.

METHODS

Standardised questionnaires (SF-36 and Euroqol EQ5D) were sent to assess quality of life in 130 patients who had undergone CABG with venous grafts (Group A) and 130 patients who had undergone CABG with radial artery grafts (Group B). Information was also gathered to determine any angina recurrence following CABG in the patients included in the study. In addition, information on any major adverse cardiac events (MACE) occurring post-CABG was collected.

RESULTS

70 responses were received from Group A and 82 from Group B. The mean follow up time was 6 years in both groups. On analysis there was no statistically significant difference between both groups with regard to quality of life (based on SF-36 and EQ5D scores), angina recurrence or MACE.

CONCLUSION

Our study identified no additional benefit in using radial artery grafts over saphenous vein grafts with regard to quality of life, MACE or angina recurrence in the medium term.

Introduction

The advantages of arterial endothelium have resulted in the use of arterial conduits in coronary artery bypass graft surgery (CABG), and this has become an increasingly popular alternative to saphenous vein grafts (SVGs). This is largely due to low rates of recurrent atherosclerosis in arterial grafts, which consequently results in lower incidence of recurrence of symptoms of myocardial ischaemia.^{1, 2} The left internal mammary artery (LIMA) is considered the “gold standard” conduit in myocardial revascularisation due to excellent long term patency.¹⁻³ The poor long term results seen with SVGs, and promising results seen with LIMA has led to the search for additional arterial conduits for CABG.⁴ The radial artery (RA) is being used more commonly as a conduit for CABG. Studies have demonstrated

superior patency rates in patients receiving RA grafts over SVGs. 3,5 It is well known that vasoactive substances produced by arterial endothelium are protective and so are likely to have a role in the excellent patency rates of arterial conduits seen in those such as the RA.6, 7 Despite this, there is some angiographic data in early post-operative patients suggesting poor RA graft patency. This may be related to the spasmogenic nature of the radial artery.8 Indeed; it was noted soon after Carpentier et al first proposed the use of radial arteries for CABG in 1973 that spasm and occlusion occurred in these grafts.9 This led to the RA being abandoned before being introduced again in 1992 by Acar et al.9, 10 The benefits of the radial artery in the longer term should therefore be ascertained to determine its suitability as a potential alternative to venous grafting. In particular, the benefits on patients' quality of life should be identified to help in determining the suitability of the radial artery as a conduit for CABG. We therefore selected a sample of surviving patients in the period 2001- 2002 who underwent CABG and received RA grafts. We analysed their perceived health related quality of life (QOL) and any major adverse cardiac events (MACE) occurring post-CABG and compared this to data obtained from patients who had received SVGs at CABG in the same period. Data was also gathered relating to angina recurrence and further cardiac procedures performed after CABG such as percutaneous coronary intervention (PCI). Based on available data, it was hypothesised that those receiving RA grafts would report a higher quality of life, less angina, and fewer MACE than those receiving SVGs.

Methods

Ethical approval was obtained from the Lothian Research Ethics Committee. Between January 2001 and December 2002,11,12 patients underwent primary isolated first time CABG at the Royal Infirmary of Edinburgh. Of these patients 1073 had 3-vessel disease. Patients were divided into three groups depending on the conduits used for surgery. Group A consisted of patients who received a LIMA graft and one or two SVGs. Group B consisted of patients who received a LIMA graft, and a RA graft with or without additional SVGs, as required. All other patients, who received only veins, bilateral mammary artery grafts, or other conduits were put into group C and excluded from the study. Group A consisted of 591 patients, and Group B consisted of 194 patients. Patients who died in hospital were excluded from both groups. Data was obtained from the Registry Office to exclude patients who died after discharge from hospital. Of the surviving patients, the first 130 in chronological order of operation date from each group were selected for the purpose of this study. Patients in both groups were sent questionnaires to assess QOL. Standardised questionnaires, the EuroQol EQ5D and the SF-36 Health Survey were used. 11, 12 To assess for the presence of exertional chest pain, the shortened ROSE angina questionnaire was used.13, 14 In addition, a separate questionnaire was written to collect data on patients' current medication, MACE occurring post-CABG and any strokes, angina recurrence, follow up percutaneous coronary intervention (PCI) or CABG and any pain from the conduit harvest sites or from the sternal wound. It was assumed those reporting higher health related QOL scores in the EQ5D and SF-36 questionnaires would be less physically and mentally restricted by their ischaemic heart disease and would have had a good outcome from their CABG. Similarly with angina recurrence and MACE, lower reported rates of these would suggest a more positive outcome overall and a higher QOL. Patients were asked to complete and return the questionnaires in the prepaid envelope provided. Those who did not reply were sent reminders after 3 weeks to maximise the number of responses. The replies received were then entered onto a spreadsheet and quality of life scores calculated.

Results

STATISTICAL ANALYSIS

Data collected from questionnaires was stored on a spreadsheet and analysed using SPSS v13.0 for Windows.¹⁵ Continuous variables were expressed as the mean \pm standard deviation and analysed using the student's t-test. Categorical variables were analysed using the chi square test or Fisher's exact test, as appropriate. A p value of <0.05 was considered statistically significant. 130 questionnaires were sent to each group. In group A, 46 reminders were sent and a total of 70 responses were received. In group B, 58 reminders were sent, and a total of 82 responses were received. Patients who did not respond were excluded from the study. Questionnaires were received from 152 patients. The calculated scores and totals for the domains assessed in group A (n=70) and group B (n=82) were then compared. The patient characteristics are shown in Table 1.

Results and comparison of the assessed domains is shown in Table 2.

MEAN FOLLOW-UP

The mean follow-up in Group A was 78 months, and in Group B, 72 months.

AGE and OPERATIVE RISK

Patients who received vein grafts, i.e. group A, were on average older than group B patients who received radial artery grafts, as shown in Table 1.

MAJOR ADVERSE CARDIAC EVENTS (MACE) & STROKE

As shown in table 2, most patients in both groups were taking statin medication at the time of completing the questionnaire (83% and 85% in group A and B respectively). With regard to MACE, 3 patients in each group had suffered an MI (p=0.84) where as 2 people suffered a stroke in group A and 3 in group B (p=0.79) (See Figure 1). No patients in either group underwent a further CABG operation.

PERCUTANEOUS CORONARY INTERVENTION (PCI)

12 (17.1%) in group A and 13 (15.8%) in group B had undergone PCI following their CABG operation (see Figure 2). However, there was no statistical significant difference (p=0.8). PCI was performed at a mean of 59 months after CABG in Group A, and 60 months in Group B.

ANGINA RECURRENCE and CHEST PAIN

In group A, a total of 8 patients (11.4%) reported recurrent angina where as 15 (18.3%) in group B had experienced angina following CABG (p=0.23). ROSE scores showed similar numbers of patients in both groups experienced exertional chest pain following CABG.¹³ (See Figures 3&4) 9 from group A and 13 from group B (p=0.18) complained of pain in the sternal wound. When reviewing comments made by patients, it was noted that most who experienced this described discomfort or an itch as opposed to pain per se. Some patients complained of reduced sensation on the left side of the chest, correlating with the use of LIMA. A number of patients, particularly in group B, complained of itching and discomfort in the conduit harvest sites.

QUALITY OF LIFE

Health related QOL was assessed by administration of Euroqol EQ5D and SF-36 Health Survey.^{11, 12} After recoding, scores were calculated. The Euroqol EQ5D provided an overall score based on 5 separate health related questions, whereas the SF-36 provided scores for a number of 'health components' based on the questions answered, which were then collated to give a physical component summary (PCS) score and a mental component summary (MCS) score. Group A patients had a mean EQ5D score of 0.7994 whereas the mean for group B patients was 0.7522 (p=0.26). The mean SF-36 PCS score for group A was 41.6,

whereas in group B a mean score of 43 was reported ($p=0.54$). MCS scores for both groups were similar; 52.6 and 54.1 for groups A and B respectively ($p=0.36$). Both groups scored consistently higher in the mental component score. (See Figure 5). As part of the EuroQol questionnaire, patients were asked to score their own health out of a total of 100 (the Euroqol Visual Analogue Scale or EQ-VAS). The mean scores (detailed in Table 2 as Mean EQ-VAS Score) for groups A and B were, again, similar. Results showed no statistically significant difference between group A and group B in relation to MACE, PCI procedures performed after CABG, angina recurrence or QOL. A statistically significant difference was noted with regard to patient age at the time of operation ($p<0.01$).

Discussion

Despite the increasingly popular use of the RA as a conduit for CABG, this study has shown no statistically significant difference in the long term with regard to health related QOL, angina recurrence or major adverse cardiac events between those undergoing CABG with SVGs and those receiving RA grafts. The results obtained are contrary to what we believed, as it was anticipated those undergoing CABG with RA grafts would report lower rates of angina recurrence, lower rates of MACE and a higher QOL. The results are somewhat contradictory to the popular conception that RA grafts are superior to venous grafts.^{10, 18, 19} Promising data from Shah et al demonstrated patency rates of RA grafts to be as high as 96% after 5 years, in a sample of 209 post-CABG patients. Certainly, others have confirmed similar findings.²⁰ This has led to some considering the RA a second choice conduit after the “gold standard” LIMA. ^{21,22} In our study, all patients received left internal mammary artery (LIMA) to left anterior descending (LAD) grafts. Based on strong evidence from numerous studies, the LIMA has been shown to have particularly high patency rates.²³⁻²⁵ The LAD artery is the most important of the three coronary arteries, and grafting this with the LIMA is responsible for the majority of the beneficial effect of CABG operation. In our study we compared the RA versus SVG applied to the second and third most important coronary arteries. The possible additional benefit of using RA grafts was studied and showed no difference in QOL or angina recurrence. Although no specific studies have been conducted into QOL in this context, many have looked at angiographic data in patients who had received RA grafts and compared this to those who have undergone CABG with SVGs. Calafiore et al identified improvement in long term angiographic outcomes in patients receiving RA grafts as compared to those receiving SVGs and showed that vein graft patency was worse (91.7%) than radial graft patency (99%) suggesting a greater incidence of angina recurrence in those receiving SVGs.⁵ Our study is unique in that the comparison of health related QOL in patients receiving venous and arterial grafts is not well documented. Studies have looked at the effects on QOL post CABG and have demonstrated supremacy against medical treatment of coronary artery disease.²⁶ Despite this there has been no specific study assessing QOL and comparing this in those who have undergone bypass with venous or arterial grafts. As mentioned, the QOL scores in both patient groups were similar. The difference between SF-36 health scores of both groups was not statistically significant, similarly with EQ-5D scores. Even with numerous studies demonstrating superiority of the RA over SVGs in terms of patency rates, this it appears did not translate to a higher patient perceived health related QOL in the RA group of our study. The similarity in results may be accounted for by use of LIMA, in that the use of this “gold standard” conduit may have had such a dominant influence on outcome in the studied patients due to its excellent long term patency, resulting in both groups experiencing similar results and therefore reporting similar QOL and to some extent, angina recurrence. As well as this, the length of follow up in the study may have had a role to play. In our study, the average follow up was 6 years and so an even longer follow up may have identified a more significant difference in QOL and in angina recurrence. With regard to the age of the patients studied, the mean age of group B was significantly less than that of group A. As patients in group A were older, it is likely that many of these

patients suffer co-morbidities, such as musculoskeletal or respiratory disease and most likely this would produce a lower QOL score. As patients in group B were younger, this would not seem to account for the similarity in QOL scores observed as one would expect these to be higher than group A scores. This may suggest those in group B are more limited from their cardiovascular disease. However, as the number of those reporting angina recurrences and other MACE is similar, it would not seem appropriate to draw the conclusion that quality of life is lower than what one would expect in this group.

A limitation of the study is the relatively small sample size and that despite showing a marginal difference between both groups, this possible difference did not reach statistical significance to allow us to draw fully valid conclusions. A further, larger follow up study would be a suitable means of assessing any possible difference in QOL, angina recurrence and MACE. In addition, matching patients, particularly in terms of age may help to provide a more accurate assessment of quality of life between both groups as the impact of illness and disease is highly likely to have an influence on the quality of life of a patient at different ages in life.

CONCLUSION

In summary, our results show that the use of the RA as a conduit for CABG does not confer any additional benefit over SVGs in the intermediate-to-long term with regard to QOL, angina recurrence or MACE. ■

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