Cephalic veins in coronary artery bypass surgery

Abstract Various alternative conduits for aortocoronary bypass grafting have been suggested when the saphenous vein quality is inadequate. During a 10-year period we have used the cephalic vein in 39 patients. Eighteen entered an angiographic follow-up study. A total of 31 arm vein grafts were used with 43 distal anastomoses. When calculating patency by number of patent distal anastomoses, this was 46% (median follow-up was 31 months), but calculating by the number of patent grafts we found 52% patency (median follow-up 31 months). In conclusion, we discourage others from using arm veins in aortocoronary bypass operations.

Key words Cephalic vein • Patency • Coronary bypass

Introduction

In coronary artery bypass grafting (CABG) the internal mammary artery has shown superior patency rates compared with other conduits. With more extensive lesions, however, additional graft material is needed, preferably the saphenous vein. When this has been unavailable due to prior removal or insufficient quality, several substitutes have been used: cephalic vein [13, 19, 20, 25, 28, 32], radial artery [1, 4, 6, 8, 10], homologous saphenous veins [3], polytetrafluoroethylene graft [23], umbilical vein [27], splenic artery [9] and more recently the gastroepiploic artery [17, 22, 29], inferior epigastric artery [11, 21, 31] and bovine internal thoracic artery graft [30].

Cephalic veins are still being used as alternative conduits in various centers. We have used it for the last decade. Only a few series on its patency as a conduit in CABG have been reported. We have therefore found it of interest to perform a follow-up study to evaluate our experience with cephalic vein grafts during a 10-year period.

Materials and methods

During a 10-year period of total of 1188 aortocoronary bypass operations were performed. In 39 patients cephalic veins were used as conduits (3%). The indications were: prior use of leg veins for bypass operations in two cases (5%), prior stripping of leg veins in 19 cases (49%) and varicosities in leg veins in 18 cases (46%). The male:female ratio was 29:10. Eight patients died during the follow-up period (21%), seven most likely from cardiac disease and one died of lung cancer. Two died during the 1st postoperative week. Of the remaining 31 patients, 18 were willing to enter a follow-up study. Of the 13 patients not participating, two had suffered a stroke with hemiparesis, two had suffered from myocardial infarction, two had left the county and the remaining seven refused to undergo an invasive angiography. Five of the latter seven were asymptomatic and two had stable angina. The 18 participating patients had a median age at follow-up of 65.5 years (47–78), median observation time was 30 months (16–90), and mean observation time was 44 months. A total of 47 grafts, had been inserted: 31 cephalic veins (66%), 12 mammary arteries (26%) and 4 saphenous veins (8%). The average number of grafts per patient was 2.6. Of the 31 cephalic veins, 21 were single aortocoronary anastomoses, eight had two sequential anastomoses and two had three sequential anastomoses. Eleven left internal mammary arteries and one right internal mammary artery had
been used. Of the four saphenous veins used two had single anastomoses, one had two sequential, and one had three sequential, anastomoses.

Of the seven deceased, who had most probably died due to cardiac events, eight arm veins had been inserted with a total of 15 distal anastomoses.

The follow-up consisted of left heart catheterization with coronary angiography and ventriculography. Judkins technique was used with the introduction of a pigtail catheter into the left ventricle. Left and right coronary arteries were selectively catheterized along with internal mammary arteries and aortocoronary venous bypass grafts. Cine-filming with 50 frames/s was performed in standard projections. All examinations were performed and evaluated by the same person. The data are presented as observed.

Results

At angiography all internal mammary arteries were patent (100%). The median follow-up time was 30 months (17–87). Cephalic vein grafts with single anastomoses were patent in 12/21 (57%) after a median follow-up time of 31 months (16–90). Cephalic vein grafts with two sequential anastomoses were patent in 3/8 (38%) after a median follow-up time of 27 months (16–87). Of the two cephalic vein grafts with three sequential anastomoses, one was occluded and one was patent as far as the second anastomosis but occluded distal to this; both had a follow-up of 89 months. Both saphenous vein grafts with single anastomoses were patent at 17 months of follow-up. The saphenous vein graft with two sequential anastomoses was occluded (follow-up 83 months) but the saphenous vein graft with three sequential anastomoses was patent (follow-up 26 months).

Intraluminar disease was noticed in 12/31 (39%) of the arm veins. Mild dilatations were seen in six grafts (19%) but no aneurysms were observed. We found a 66% stenosis at the anastomotic site in one internal mammary artery. In the cephalic vein grafts we found two 75% stenoses in two single vein grafts, two 50% stenoses in a two sequential vein graft and one 50% stenosis in a three sequential vein graft. No stenosis was found in the saphenous vein grafts.

Discussion

The interval mammary artery has proven the best conduit in CABG with a reported patency of up to 93% [16] after 10 years when anastomosed to the left anterior descending artery (LAD). When used as a free graft, early patency has been reported up to 91% [15]. With extensive revascularization procedures additional graft material is required. The saphenous vein is preferred, with reported 10- to 12-year patency rates up to 63% [5]. When this vein is not available, due to inadequate quality or prior removal, several substitutes have been used. The radial artery showed excellent early patency according to Acar et al. [1], Calafiore et al. [4] and Carpentier et al. [6] but not according to either Curtis et al. [8] or Fisk et al. [10]. The use of homologous saphenous vein grafts was discouraged by Bical et al. [3]. Sapsford et al. [23] tried expanded PTFE grafts and Silver et al. [27] used glutaraldehyde-fixed human umbilical vein, but both proved unsatisfactory. Edwards et al. [9] anastomosed the splenic artery to the right circumflex artery (RCA) in three patients. In recent years the right gastroepiploic artery has been used with excellent early results by Lytle et al. [17], Pym et al. [22] and Suma et al. [29]. The inferior epigastric artery has also shown excellent early patency rates according to Gurné et al. [11] and Puig et al. [21]. Finally Suma et al. [30] recently used bovine internal thoracic arteries in 29 patients without finding this suitable.

In our department we previously used the cephalic vein as an alternative to the saphenous vein. We have, however, always explored the greater as well as the smaller saphenous vein, to find a suitable segment, before using the cephalic vein as a last resort. Only few have reported on the patency of this conduit for CABG, most papers concern its use in peripheral vascular surgery, where it was first described by Kakkar [14] in 1969. Since then most authors have reported satisfactory secondary patency rates with arm veins in peripheral vascular surgery [2, 7, 12, 26]. Others have found distinct limitations [24]. The better secondary patency rate of arm veins is specific for peripheral vascular surgery, while the primary patency rates are similar to those reported in CABG.

Arm veins are smaller, thinner and more difficult to handle surgically. To compensate for this Metha et al. [19] suggest augmentation of the arm vein by creating an arteriovenous (A-V) fistula to the radial artery, before using it as a conduit in CABG. We have not used this technique. Most authors have calculated patency rate of arm veins in CABG from the number of patent grafts, others by the number of patent distal anastomoses [13]. As in our case, some grafts have sequential distal anastomoses, whereby the calculated patency rates differ. When calculating patency from the number of open distal anastomoses we find a patency rate of 46% after a median observation time of 31 months (16–90). If using the number of patent grafts, regardless of the number of distal anastomoses, we find a patency rate of 52% after a median observation time of 31 months (16–90). If we include the seven deceased, who most probably died due to cardiac events, patency may be calculated as low as 34%. One may speculate whether sequential distal anastomoses increase patency by increasing flow due to increased run-off. In our material we noted a lower patency among the grafts with sequential distal anastomoses.

Wijnberg et al. [32] used 40 arm veins in 28 patients with 77 distal anastomoses. At follow-up (mean 4.6 years) they found a patency rate of 47%. Stoney et al. [28] investigated 56 arm vein grafts in 28 patients after 24 months and found a patency rate of 57%. Seifert et al. [25] stud-
ied 17 patients after 8 months, and out of 35 grafts 23 (66%) were patent. Järvinen et al. [13] evaluated 15 arm vein grafts with altogether 31 coronary anastomoses, of which 27 (87%) were patent at a follow-up of mean 1.4 years (1–42 months). Prieto et al. [20] examined ten patients at different intervals. The early patency of arm vein grafts in six patients studied less than 9 months after operation was confirmed in 9 out of 10 grafts (90%). Four patients were followed for more than a year, after which time 5 out of 8 grafts (63%) were found to be patent. The different methods of evaluating graft patency makes comparisons difficult. Most authors performed an invasive angiographic follow-up, but Wijnberg et al. [32] used digital subtraction angiography. In our material we noticed intraluminar disease in 39% of the arm veins with four stenotic lesions, six mild dilatations but no aneurysms. Others have reported higher incidences of these complications. Marcaccio et al. [18] noted intraluminar disease in 63% of arm veins, with localized stenosis in 10% and thrombus in 6%, but this study was performed on peripheral vascular grafts.

In conclusion, we find our results comparable with those previously published. With the low patency rate of cephalic veins, however, we would discourage others from using it as a conduit in aortocoronary bypass operations. Other alternatives, mainly the right gastroepiploic artery and the inferior epigastric artery, show excellent early patency rates and good long-term results are expected.

References

12. Harward TRS, Coe D, Flynn TC, Seeg