Long-term Outcomes of Brachiobasilic Transposition Fistula for Haemodialysis

A. Taghizadeh, P. Dasgupta, M. S. Khan, J. Taylor and G. Koffman

Department of Urology and Nephrology, Guy’s Hospital, Thomas Guy House, London, UK

Objectives. The transposed basilic vein to brachial artery arteriovenous fistula provides secondary vascular access for haemodialysis. The long-term results of such fistulae are assessed in this retrospective series.

Material and methods. Over a 5-year period 75 brachiobasilic transposition fistulae were performed in 74 patients. There was a median follow up of 14 months.

Results. Primary patency was achieved in 69 (92%) of the fistulae, and secondary patency in 74 (99%) of the fistulae. Successful interventions included angioplasties in four, and saphenous vein interposition in one, whilst three patients had failed thrombectomies. Dialysis was performed using 69 (92%) of the fistulae while 6 (8%) were never used. Of the 75 fistulae 47 (63%) were patent at follow up. Cumulative secondary patency was 66% at 1 year, 52% at 2 years, and 43% at 3 years. Complications developed in 41 (55%), and included thrombosis, infection, stenosis, arm oedema, bleeding, steal syndrome and microaneurysm formation.

Conclusions. Brachiobasilic transposition fistulae have good long-term patency rates. The complication rate, although high, is lower than that reported for PTFE grafts. Brachiobasilic fistulae should be used in preference to PTFE grafts for secondary access.

Key Words: Arteriovenous shunt; Brachial artery; Veins; Renal dialysis.

Introduction

The ideal vascular access for haemodialysis is either a radiocephalic fistula or a brachiocephalic fistula. However, in those patients in whom these fail, or in whom the cephalic vein is not available, another solution is sought. A frequently used option is to use a graft such as polytetrafluoroethylene (PTFE). However, these are associated with a substantial complication rate.1,2

The alternative to a PTFE graft is to transpose the basilic vein through a subcutaneous tunnel to an anterior position in the upper arm, where it is accessible for cannulation. The vein is then anastomosed end-to-side to the brachial artery in the antecubital fossa.3 Because of the position of the basilic vein deep to the fascia it has rarely suffered venopuncture or cannulation and with its large calibre, usually proves a satisfactory conduit.

In this study of patients who had undergone brachiobasilic transposition fistula long term patency rates and complications were examined. In addition the effect of concurrent disease on patency was also evaluated.

Material and Methods

Brachiobasilic transposition fistulae were created for patients in end stage renal failure in whom haemodialysis was being considered. These were either patients in whom previous vascular access had failed, or in whom alternative vascular access such as radiocephalic or brachiocephalic fistula were not possible. Patients who had previously had central vein cannulation for haemodialysis access on the same side as the proposed fistula underwent preoperative imaging to exclude central venous stenosis.

Brachiobasilic fistulae were created using a technique similar to that described by Dagher et al. A3 transverse incision across the antecubital fossa was made and then extended longitudinally up the medial aspect of the upper arm to expose the basilic vein, lying adjacent to the brachial artery. Care was taken to avoid damage to the medial cutaneous nerve of the arm. The vein was dissected out and its tributaries tied using 3-0 polyglactin. The vein was then tied and
divided distally at the level of the elbow. The free end of the vein was then tunneled in a subcutaneous position down the anterior aspect of the upper arm. In the antecubital fossa it was anastomosed end-to-side with the brachial artery using 6-0 polypropylene. The subcutaneous tissues and skin were closed with an absorbable suture. The fistula was then used for dialysis after an interval of 6 weeks.

Patient notes were examined retrospectively. Duration of follow-up and patency were recorded. Patency was assessed either by palpation for a thrill, auscultation for a bruit, or by using a Doppler probe. Primary patency was said to be achieved if there was satisfactory flow in the fistula at 6 weeks without further intervention. The fistula was considered to have developed secondary patency if another invasive procedure, such as angioplasty or thrombectomy, was required. Cumulative secondary patency rates included both those who developed primary and secondary patency.

In addition, a note was made of the presence of factors such as gender, hypertension, cardiovascular disease, diabetes mellitus, smoking, previous vascular access, and the use of medication such as aspirin, warfarin or erythropoietin. These factors were compared between the group that had remained patent, and the group that occluded.

The Mann–Whitney test was used to compare age and number of previous access attempts, t-test was used to compare haemoglobin and albumin, and chi-square tests were used for the remaining variables. Because repeated comparisons were made, a Bonferroni correction was applied to the p value calculated. A p value of 0.004 (i.e. 0.05/12) was required to be considered significant.

### Results

Seventy-five brachiobasilic transposition fistulae were created in 74 patients, median age 49 years (range 6–77 years). There was a median follow-up of 14 months (range 8 days (no patency)—54 months).

Primary patency was achieved in 69 (92%) of the fistulae, and a cumulative secondary patency in 74 (99%) of the fistulae. Of those who developed secondary patency, four underwent successful angioplasties, and one required a saphenous vein interposition as a secondary procedure. Unsuccessful secondary procedures were exploration and thrombectomy in three patients, in whom patency was not achieved.

Haemodialysis was performed through 69 (92%) of the brachiobasilic transposition fistulae. Of the 75 fistulae, 47 (63%) were patent at follow-up, including 36 (48%) that are still in use. Seven patients died with functioning fistulae, four received renal transplants, and one was not needled. Fig. 1 shows a graph of the change of cumulative secondary patency with time. Cumulative secondary patency was 66% at 1 year, 52% at 2 years, and 43% at 3 years.

A comparison between the group of patients whose fistula remained patent, and those in whom the fistula occluded are shown in Table 1. No statistically significant differences were found between the two groups.

Complications occurred in 41 (55%) of the patients, with some patients having more than one complication. These included thrombosis of the fistula in 25 (33%), stenosis in eight (11%), arm oedema in three (5%), bleeding from two (3%), and steal syndrome in one (1%). Local infection occurred in six (8%), necessitating ligation of the fistula in two. One patient (1%) had microaneurysm formation that also required ligation of the fistula.

### Discussion

With increasing numbers of patients requiring haemodialysis, there is a growing problem of how vascular access should be achieved in patients in whom radiocephalic fistula or a brachiocephalic fistula cannot be fashioned. This series is one of the largest to provide long-term follow-up information on patients who have undergone brachiobasilic vein transposition.

Good primary and secondary patency rates have been demonstrated. The results of this study are comparable to those of others previously published, where patency rates of 68–87% have been quoted.3–7

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![Fig. 1. Cumulative secondary patency of brachiobasilic transposition fistula.](image-url)
In the longer term functional patency of 70% at 8 years has been demonstrated. The National Kidney Foundation DOQI guidelines recommend that patency rates of 70% at 1 year, 60% at 2 years, and 50% at 3 years should be achievable with all kinds of arteriovenous fistula. In our study, this level is practically achieved at year one, but not met at years two and three. However, our patency matches those of other comparatively large series, suggesting perhaps that the DOQI targets may be over ambitious for this particular kind of fistula.

There is a significant complication rate in patients who have brachiobasilic transposition fistula, with half of the patients being affected. However, this compares favourably with alternative secondary access procedures, such as the use of PTFE grafts. These have patency rates of 62–70% at 1 year, 50% at 2 years and 43% at 4 years. Complications that compromise patency in these grafts include thrombosis in 21%, infection in 25% and intimal hyperplasia in 34%. Overall complication rates of 60–95% have been reported for PTFE grafts. Autologous material for arteriovenous fistulae will have better patency and less complications than prosthetic material. A direct, though non-randomised, comparison of brachiobasilic fistula against PTFE grafts has confirmed better patency of the transposed fistula. The superiority of the brachiobasilic fistula is given further weight by the practice guidelines of the National Kidney Foundation which recommend their use in preference to PTFE grafts.

In this retrospective study it is difficult to attribute any role for aspirin or warfarin in protecting graft patency. There was certainly no differences in the proportion of those taking these medications in the group who remained patent compared against the group who occluded. One explanation would be that aspirin or warfarin played no role. Another explanation may be that patients who were at higher risk of occlusion were correctly identified and adequately protected with aspirin or warfarin. The most sensible explanation would simply be that there were too few numbers for any meaningful conclusion to be drawn on this particular observation.

In summary, brachiobasilic transposition fistulae provide useful secondary access for haemodialysis, with good initial patency rates that persist out to 3 years. Although there is a significant complication rate, this compares favourably with alternative methods for secondary access. Ultimately a randomised controlled trial comparing transposed brachiobasilic fistula and PTFE grafts would establish the relative merits of these procedures.

References


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Table 1. Differences between the patients in whom the fistula remained patent, and those in whom the fistula occluded.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Patent = 46</th>
<th>Occluded = 29</th>
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<tr>
<td>Age (median)</td>
<td>50.5</td>
<td>44.0</td>
<td>0.25</td>
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<tr>
<td>Female</td>
<td>25 (54%)</td>
<td>15 (52%)</td>
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<tr>
<td>Hypertension</td>
<td>15 (33%)</td>
<td>11 (38%)</td>
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<td>Cardiovascular disease</td>
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<td>16 (55%)</td>
<td>0.096</td>
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<tr>
<td>Diabetes</td>
<td>9 (20%)</td>
<td>5 (17%)</td>
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</tr>
<tr>
<td>Aspirin</td>
<td>11 (24%)</td>
<td>9 (31%)</td>
<td>0.61</td>
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<td>Warfarin</td>
<td>6 (13%)</td>
<td>6 (21%)</td>
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<td>Erythropoietin</td>
<td>32 (70%)</td>
<td>17 (59%)</td>
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<td>Mean haemoglobin (g/dl)</td>
<td>10.2</td>
<td>9.4 ± 1.6</td>
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<tr>
<td>Mean albumin (g/L)</td>
<td>37.2 ± 5.9</td>
<td>33.5 ± 5.7</td>
<td>0.029</td>
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<td>Smoker</td>
<td>13 (28%)</td>
<td>8 (28%)</td>
<td>0.71</td>
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<td>Median previous access (range)</td>
<td>1 (0–4)</td>
<td>1 (0–4)</td>
<td>0.82</td>
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