Basilic vein transposition fistula: A good option for maintaining hemodialysis access site options?

Rajeev K. Rao, MD, G. Darius Azin, MD, Douglas B. Hood, MD, Vincent L. Rowe, MD, Roy D. Kohl, MD, Steven G. Katz, MD, and Fred A. Weaver, MD, Los Angeles, Calif

Purpose: The primary use of autogenous arteriovenous access for chronic hemodialysis is recommended by the National Kidney Foundation–Dialysis Outcomes Quality Initiative practice guidelines.1 These guidelines, first published in 1997, were based on an extensive review of the available literature with the goal to make dialysis both more safe and more cost-effective. One of the recommendations was to achieve a 50% fistula creation rate to reach a 40% prevalence. In this country prosthetic grafts have been used preferentially, likely because of the greater ease of handling and the ability to be punctured in a relatively short period of time. Because of NKF-DOQI, there has been a resurgence of enthusiasm in placing primary AV fistulas and subsequently more interest in alternative autogenous fistula techniques. The basilic vein transposition arteriovenous fistula (BVT), described in 1976 by Dagher et al,3 reviewed again in 1986,4 is enjoying a renewed popularity as surgeons strive to increase autogenous fistula creation rates. Well-described advantages of using AV fistulas include increased patency rates and decreased infection rates compared with prosthetic grafts.4-7 Potential disadvantages include a more technically difficult surgical procedure, increased length of time to maturation, and a potentially higher risk of wound complications. This study reviews our experience with BVT, particularly in older patients and those with prior access failures, to assess its maturation rate and patency, as well as to examine its potential for promoting efficient use of available access sites.

MATERIAL AND METHODS

All patients undergoing construction of a BVT from April 1998 to May 2002 were identified by using an office-based computerized registry. Patients were selected for basilic vein transposition on the basis of individual surgeon preference in the absence of a specific institution selection protocol. Perioperative characteristics such as age, medical comorbidities, the presence of previous and subsequent dialysis access procedures, the use of preoperative duplex vein mapping, procedural complications, and time to first puncture were tabulated. Patency rates were determined by using Kaplan-Meier life table methods. Univariate and logistic regression analyses were then performed by using the previously mentioned perioperative characteristics to search for factors affecting maturation and patency. On the basis of guidelines by the SVS/AAVS Committee on Reporting Standards for Arterio-Venous Accesses, the following definitions are used: primary patency is the interval from the time of access placement until any intervention de-
signed to maintain or re-establish patency, access thrombosis, or the time of measurement of patency; primary assisted patency is the interval from the time of access placement until access thrombosis including intervening manipulation designed to maintain the functionality of a patent access; and secondary patency is the interval from the time of access placement until access abandonment, thrombosis, or the time of patency measurement including intervening manipulations designed to re-establish functionality in thrombosed access.8

Preoperative duplex imaging. Vein mapping studies were performed by using HDI 5000 and HDI 3000 duplex scanners. All studies were performed in an accredited registered vascular laboratory and reviewed by attending vascular surgeons or radiologists. Superficial veins from the distal forearm to the axilla were assessed for patency and measured. Axillary, subclavian, and internal jugular vein assessment was also routinely performed.

Technique. A longitudinal incision was made over the medial aspect of the upper arm. The basilic vein was identified and exposed from the antecubital fossa toward its junction with the axillary vein. The medial cutaneous nerves were carefully protected. The brachial artery was identified just above the antecubital fossa through the same incision and mobilized. The numerous side branches of the basilic vein were then isolated, ligated, and divided. The vein was marked before distal division to prevent twisting. A subcutaneous tunnel was created laterally on the arm. The basilic vein was divided distally at the level of the antecubital fossa, brought over the biceps muscle through the subcutaneous tunnel, and anastomosed in an end-to-side fashion to the distal brachial artery. The skin was then closed in two layers by using absorbable sutures. Routine intraoperative heparinization was not used.

Statistics. Data were entered into a Microsoft Excel (Microsoft Corp, Redmond, Wash) spreadsheet for analysis. Statistical analysis was performed by using SAS System, Release 8.2 (SAS Institute Inc, Cary, NC). The χ2 test was used to determine significance within groups. The Fisher exact test was used to determine significance between groups. Kaplan-Meier analysis was used to determine life-table patency curves. Log-rank testing was used to determine significance between curves. Binary logistic regression was performed to analyze factors affecting patency. Receiver operator characteristic curves were used to determine age cutoffs. Significance was determined at a P value < .05.

RESULTS

A total of 77 patients were identified who underwent creation of a BVT during the period of review. Of the 77 patients, 21 were lost to follow-up: 8 died during the study period, and their records were not available for review; 13 had relocated and could not be contacted. This left 56 patients who were available for further study. The clinical characteristics of the study group are described in Table I. The characteristics of the excluded patients did not differ significantly from the remaining patients.

### Table I. Patient characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (y)</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Male gender</td>
<td>30</td>
<td>54</td>
</tr>
<tr>
<td>Hypertension</td>
<td>44</td>
<td>79</td>
</tr>
<tr>
<td>Diabetes</td>
<td>32</td>
<td>57</td>
</tr>
<tr>
<td>Primary access</td>
<td>22</td>
<td>39</td>
</tr>
<tr>
<td>Preoperative duplex ultrasound scan</td>
<td>35</td>
<td>63</td>
</tr>
</tbody>
</table>

Complications. Perioperative complications occurred after BVT in 5 of 56 patients (9%), including hematomas in 3 and nonfatal cardiac arrest in 1. One patient died during the perioperative period from an acute myocardial infarction on postoperative day 15. Two of the patients with hematomas required operative evacuation. Late ischemic steal syndrome occurred in 3 patients on late follow-up. Two patients underwent a distal revascularization/interven ligation procedure, and another ultimately required a partial finger amputation.

Patency. Maturation time or the average time to first puncture and use of the fistula was 74 days (range, 12-265 days). Failure to mature sufficiently for access use occurred in 21 patients (38%). Univariate analysis showed that gender, the presence of diabetes or hypertension, a history of prior access procedures in the ipsilateral extremity, and the results of preoperative duplex examinations were not significantly associated with maturation failure or decreased patency. With logistic regression analysis, only age was shown to correlate with maturation failure. By analyzing the receiver operator characteristic curves, the best age cutoff was found to be 60 years of age. Patients 60 years of age or older were more likely to have fistulas that failed to mature compared with patients younger than the age of 60 years (odds ratio, 2.5; 95% confidence interval, 1.1-5.5).

Duplex ultrasound imaging was performed in 35 patients before BVT, as described in Methods. There was no significant difference in maturation or patent rates between those patients who did or did not undergo such imaging. Subgroup analysis in those patients who did undergo imaging also showed no relationship between the duplex-determined diameter of the basilic vein and maturation or patent rates.

For all BVTs, including those that did not mature, primary and secondary patencies at 1 year were 35% and 47%, respectively (Fig 1). Considering only those that matured and were accessed, primary and secondary patencies at 1 year were 53% and 75%, respectively. The only significant risk factor for graft failure was age older than 60 years (odds ratio, 1.56; 95% confidence interval, 1.1-2.2).

Life-table analysis stratified to age < 60 years versus age ≥ 60 years was also performed. For patients aged < 60 years, primary patency and secondary patencies were 53% and 67%, respectively (Fig 2). For patients aged ≥ 60 years, primary and secondary patencies were 18% and 28%, respectively (P = .0028).

Interventions. A total of 21 adjunctive procedures were performed in 17 patients for failing or failed fistulas;
13 procedures were performed for failing but patent fistulas, and 8 were performed for occluded fistulas (Table II, online only).

**Subsequent procedures.** Of 26 patients who underwent subsequent access surgery after failure of BVT, 11 (42%) had successful placement of a prosthetic graft in the ipsilateral arm. Four patients with failed BVT did not undergo subsequent dialysis access procedures. Fifty percent of patients (13 of 26) received a tunneled or nontunneled catheter central venous catheter for dialysis access, and a more definitive access procedure had not been performed by the end of the study.

**DISCUSSION**

As dialysis patients become older and long-term survival rates on dialysis improve, maintenance of viable sites for dialysis access will become increasingly important. The NKF-DOQI guidelines have been promulgated in an attempt to improve the efficiency of dialysis including issues related to vascular access. The creation of autogenous fistulas has been encouraged because they are associated with decreased rates of infection and failure and increased average patency.4-7 However, fistulas are occasionally more technically challenging to construct and are often involved
with delays in maturation, requiring the use of temporary central venous catheters. BVT has been advocated as an alternative to a nonautogenous upper arm access. First described by Dagher et al in 1976, the BVT involves transposing the basilic vein, usually located deep in the subcutaneous tissues where it is not accessible to simple percutaneous puncture, into a more superficial location along the volar surface of the upper arm. This procedure requires extensive mobilization of the vein, with an anastomosis to the brachial artery just above the antecubital fossa. Advantages of BVT include the avoidance of prosthetic material and its attendant risk of infection, the need for only one vascular anastomosis, and the potential ability to perform a nonautogenous AV graft in the same location if the fistula fails. Major disadvantages include the potential for vein injury during the required mobilization and wound complications associated with the extensive dissection, such as hematoma or injury to the median or cutaneous nerves.

In this report we show lower maturation and patency rates than in other series on BVT, particularly in older patients. In our experience, BVT does not perform well in patients 60 years or older. In this age group, failure occurred in 54% of patients before the fistula was ever accessed. This higher initial failure rate appears to be the largest contributor to the lower overall patency rate in older patients. The reason for a higher incidence of maturation failure in older patients is unclear. Potential causes include a higher incidence of atherosclerotic proximal arterial occlusive disease that limits the inflow of blood to the fistula. Alternatively, there might be a higher incidence of cardiac or respiratory dysfunction in this age group that diminishes cardiac output. Unfortunately, in this retrospective review, we were not able to systematically collect data regarding these parameters for all patients in this series, and these hypotheses could not be tested.

Some investigators have shown that preoperative duplex ultrasound assessment might improve successful fistula creation rates. We were not able to demonstrate any significant effect of preoperative mapping on fistula maturation or long-term patency within our sample. This might be due to selection bias; if preoperative duplex scanning showed a small-diameter basilic vein, BVT might not have been attempted. The use of preoperative imaging was not standardized in this series; therefore, it is not possible to make any definitive conclusions about its role. However, the role of duplex scanning is emerging as part of the routine work-up for vascular access procedures, and it is recommended by the NKF-DOQI guidelines.

One of the key purported advantages of BVT is the ability to place a nonautogenous graft subsequently in the same upper arm location if the fistula should fail. Of 26 fistulas that failed during the study period and underwent a subsequent dialysis access procedure, 11 ipsilateral upper arm grafts were subsequently placed. This represents a substantial number of potential patients who might benefit from an additional access site. The exact reasons that additional upper arm grafts were not placed are unknown; however, it is possible that the presence of central venous stenosis or occlusion could have effectively eliminated the use of that extremity for future access procedures. However, because these lesions are being more effectively treated via endovascular means, utilization of upper arm sites might improve.

The number of patients on dialysis continues to increase. Contributing to this is the improved survival of patients on dialysis, as well as the application of dialysis to younger populations as the transplant pool remains constant. In younger patients, BVT performed significantly better when compared to older patients. In this subgroup, the BVT might prove a significant addition to the armamentarium of the vascular surgeon. Younger patients on hemodialysis are likely to face eventual challenges regarding access locations because most accesses ultimately will fail. The use of BVT, especially in younger patients, can effectively increase these options by allowing the use of the upper arm for two separate access procedures.

**CONCLUSION**

BVT frequently does not mature sufficiently in patients older than 60 years, which compromises its utility as a primary access. However, BVT that matures provides acceptable 1-year patency rates and frequent successful conversion to a nonautogenous access after fistula failure, thereby extending the life of the ipsilateral upper arm as an access location. Younger patients, who have a prolonged life expectancy with modern hemodialysis techniques, might benefit from BVT.

**REFERENCES**

10. Gibson KD, Gillen DL, Caps MT, Kohler TR, Sherrard DJ, Stehman-Breen CO. Vascular access survival and incidence of revisions: a comparison of prosthetic grafts, simple autogenous fistulas, and venous transposition fistulas from the United States Renal Data
DISCUSSION

Dr Willis H. Wagner (Los Angeles, Calif). Following the 1976 report by Dr Dagli, the founding members of our practice, Bud Foran and Dick Treiman, performed many basilic transpositions without the aid of preoperative duplex imaging. Unfortunately, the failure rate was unacceptable and the procedure was discarded. After dissemination of the Dialysis Outcomes Quality Initiative guidelines in 1997, we attempted to increase our utilization of autogenous fistulas, as did many of the surgeons in this audience. One of the advanced age of our dialysis population, the cephalic vein is frequently not usable. The basilic vein transposition has now become our most common primary fistula. Since 1998, we have performed 173 basilic transpositions using the same surgical technique described by Dr Rao. However, our experience has been very different from these authors. Their 1- and 2-year primary patency rates were 85% and 18%, respectively. In contrast, 80% of our patients who had basilic transpositions have not required any further fistula or graft. Only 63% of their patients had preoperative duplex imaging. We have uniformly used the protocol recommended by Michael Silva that not only documents the caliber and the course of the basilic vein but also the adequacy of the arterial inflow and proximal veins. My first question is, did your duplex protocol include interrogation of the axillary and subclavian veins to rule out proximal obstruction and did you establish the adequacy and caliber of flow in the brachial artery?

Your analysis suggested that the only factor associated with failure of graft maturation and preocclusion was age over 59 years. Sixty-one percent of our patients were 60 years of age or over and the results are identical in patients above and below this cutoff. This is consistent with a study by Gibson from our colleagues at the University of Washington (referred to in your paper) that found that age was not a factor in the patency of 181 basilic transpositions. Surprisingly, the size of the vein on preoperative imaging did not influence outcome in your series. Do you have any explanation of why the vein caliber did not seem to influence maturation or patency? Also, are there other technical factors or intangibles, such as the experience of the dialysis nurses, that do not lend themselves to statistical analysis but that could have affected maturation and patency?

The DOQI work group suggested that allowing a fistula to mature for 3 or 4 months before use may be ideal. We routinely use 3 months, yet your average time to use was 74 days, including a minimum of 12 days. Do you feel that any of your fistulas failed due to early use?

After an occlusion of a basilic transposition, we have usually placed a new bridge graft in the same arm with polytetrafluoroethylene. In your presentation, the assisted primary patency curve was nearly identical to the secondary patency curve. Do you feel there is merit to aggressive operative or percutaneous thrombectomy after graft occlusion? We have been reluctant to use chemical thrombolysis in an occluded fistula due to the risk of bleeding from multiple prior access sites. Could you share your technique of percutaneous thrombolysis? In particular, do you use mechanical or chemical lysis?

Finally, could you explain why 50% of your patients with failed basilic grafts received only venous catheters for continued access?

I’d like to congratulate Dr. Rao for an excellent presentation of his work. I agree that the transposed basilic vein is a very good access option. However, I have reservations about excluding its use in an older dialysis population.

Dr Rajev K. Rao. Obviously we just spent a little bit of time discussing preoperative vein mapping strategies and the use in fistula creation. At our primary institution, we do have a protocol for preoperative vein mapping. At the other institution we don’t have that quite in place. Clinical criteria are used more often. However, we are not routinely interrogating the arterial inflow on these patients and merely have been using clinical criteria. Certainly, as mentioned by Dr Wagner, Silva et al showed that the use of measuring the radial artery and assessing brachial artery inflow has been one of their adjunctive therapies to increase their rate of fistula use. It is certainly something that could be suggested. We do evaluate the complete venous outflow. However, once again, one of the potential weaknesses of our experience is that we do not have a rigid preoperative venous mapping protocol, and many patients underwent just simple surgical exploration prior to their basilic vein transposition.

As I mentioned, there doesn’t seem to be a trend with the increase in venous size that we noted. I don’t personally know of any literature that does talk about the size of the basilic vein per se; however, that doesn’t mean it isn’t out there. Once again we don’t really use that as criteria to determine whether or not we are going to attempt a fistula.

One of the other things mentioned is that the majority of our patients are dialyzed at outside centers, and often the primary access when the fistulas are used is determined by the dialysis center and not necessarily decided on by the vascular surgeon in question. That is why there is an extreme variability in the maturation time or the time that we use to access these fistulas. There is one there that was 12 days as mentioned. Incidentally, I was unable to find out why that fistula was accessed 12 days after surgery. However, I do know that that particular fistula did last to the end of the study, which was over a year, so I really don’t have an explanation. You would expect that fistula to be the one to fail. We don’t control within our institution; within our institution we are able to control and get some experience with the dialysis nursing; however, since there are approximately 15 to 20 dialysis centers that these patients are seen at, I can’t comment on whether or not there is technical inadequacy with dialysis access.

There was an initial feeling that the basilic vein was a thin vein, that it would become aneurysmal and that these technical things would cause problems with access. Once again, I did not see that when I reviewed our experience. There was very little aneurysmal dilatation noted and there weren’t significant bleeding complications associated with access.

Part of the secondary procedures that we used, primarily for an occluded graft, was a combination of pharmacologic and mechanical lysis—lyse and go technique if you will—where we instill a thrombolytic agent immediately followed by balloon maceration of any thrombus within the fistula, and almost always we have found that there is some sort of stenotic lesion within the venous side of the fistula that is treated at the same time.