Access surgery for hemodialysis in the Cayman Islands: Preliminary results of a vascular access service

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OBJECTIVE: In the Cayman Islands, a vascular access service was created in 2005 to facilitate the creation of vascular access for hemodialysis by local surgeons. The present retrospective audit aims to establish the outcomes of this practice in the Cayman Islands.

METHODS: Data from the operative log of the Cayman Islands Hospital was collected over a period of 36 months. The data were analyzed using SPSS version 12.0 (SPSS Inc, USA). Statistical analyses were performed using Student's *t* tests and Fisher's exact tests.

RESULTS: A total of 19 operative procedures were performed to create vascular accesses in 12 men and seven women. Thirteen procedures (68%) created autogenous arteriovenous fistulas (AVFs) and six (32%) involved the insertion of a prosthetic arteriovenous graft

(AVG). There were six incident dialysis patients, all of whom had an AVF created. The remaining 13 prevalent dialysis patients had new accesses in the form of AVFs (n=7) or AVGs (n=6).

The statistical analyses were limited by sample size, but with AVFs, there were trends toward reduced incidence of secondary failure (four of 13 versus four of six), thrombosis (four of 13 versus two of six), infectious morbidity (zero versus two of six) and less demand for interventions to maintain patency (one of 13 versus two of six) with AVFs. There were also trends toward superior primary (461 days versus 227 days) and secondary (803 days versus 205 days) patency rates for AVFs.

CONCLUSIONS: In this setting, the rate of AVF creation exceeds the goals set by the National Kidney Foundation Kidney Disease Outcomes Quality Initiative and the Fistula First Breakthrough Initiative. To ensure continued delivery of modern quality care, further audits of the local practice will be required at regular intervals.

Key Words: Arteriovenous fistula; Arteriovenous graft; Hemodialysis; Vascular access

The prevalence of end-stage renal disease (ESRD) in the Cayman Islands has been reported to be 0.975 cases per 1000 people (1). This is similar to the prevalence of ESRD in other developing Caribbean nations (2).

The Health Service Authority of the Cayman Islands manages the only two facilities nationwide that provide maintenance hemodialysis services to patients with ESRD. In the past, these patients were transferred to overseas centres to establish vascular access for hemodialysis.

In 2005, the Health Service Authority established a vascular access service to facilitate the creation of hemodialysis accesses by local surgeons. This local vascular access service is supported by dedicated nephrology services, immediate access to an on-site hemodialysis unit, specialized operative equipment and a full range of auxiliary services, including Doppler ultrasound, vascular mapping and intraoperative fluoroscopy.

Central vein catheters were usually used to provide temporary vascular access, while long-term access was achieved by the creation of arteriovenous fistulas (AVFs) or interposition of arteriovenous grafts (AVGs). We performed a retrospective audit of AVF and AVG creation in this setting to establish the outcomes of this practice in the Cayman Islands.

METHODS

Since 2005, the local vascular access team has performed hemodialysis access operations at the Cayman Islands Hospital

(CIH) in Georgetown (Grand Cayman, British West Indies). Ethical approval from the CIH was secured to collect and analyze data for the present study. The operative log at the CIH was retrospectively evaluated to identify all patients with ESRD who underwent operative procedures to establish vascular accesses between April 1, 2005, and April 1, 2008. The patients' hospital records were retrieved for detailed analysis.

Only patients who had procedures to create new AVFs or AVGs were evaluated. Patients were excluded from analysis if their hospital records were unavailable or incomplete. All patients with access failures had either new accesses created, or operative or percutaneous intervention for AVF or AVG preservation. However, the operations intended to achieve secondary patency in failed accesses were not included in the present analysis. Patients who had additional intraoperative procedures were included if they had AVF or AVG creation at the same sitting.

The data extracted from hospital records included patient demographics, details of previous accesses, location and type of new access, operative details, morbidity, duration of patency and details of repeat interventions. The data were entered into a Microsoft Excel (Microsoft Corp, USA) worksheet and analyzed using SPSS version 12.0 (SPSS Inc, USA). The Student's *t* test and Fisher's exact test were used to determine significance. $P \leq 0.05$ was considered to be statistically significant.

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TABLE 1
Outcomes of vascular access creation by the Cayman Islands Hospital (Georgetown, Grand Cayman, West Indies) local vascular access service

	AV fistula (n=13)	AV graft (n=6)	P
Previous surgical access, n (%)			
None	11 (84.6)	0 (0)	
<2	1 (7.7)	3 (50)	
≥3	1 (7.7)	3 (50)	
Outcome measures			
Access failures			
All access failures, n	5	4	
Primary failure, n (%)	1 (7.7)	0 (0)	>>0.05
Secondary failure, n (%)	4 (30.8)	4 (66.7)	0.32
Duration of patency, days			
Primary patency			
Mean ± SD	460.92±367.81	227±145.24	0.16
Range	60–1288	180–230	
Median	384	202.5	
Mode	384	–	
Secondary patency			
Mean ± SD	803	205±35.36	–
Range	–	180–230	
Median	–	205	
Mode	–	–	
Interventions for 2° patency, n (%)	1 (7.7)	2 (33.3)	0.22
Ligation of tributaries, n	1	0	
Operative thrombectomy, n	0	2	
Complications, n (%)			
Infection	0	2 (33.3)	0.09
Bleeding	0	0	–
Steal syndrome	0	0	–
Thrombosis	4 (30.8)	2 (33.3)	>>0.05
Mortality	0	0	–

2° Secondary; AV Arteriovenous

A direct anastomosis between an autogenous artery and vein was considered to be an AVF. Once the surgeon interposed prosthetic material (a polytetrafluoroethylene or Dacron graft) between the native vessels, the access type was considered to be an AVG.

The vascular access was considered functional if it was able to support the patient's dialysis prescriptions by providing blood flow of 300 mL/min or greater during dialysis sessions. An AVF or AVG that could not provide blood flow of 300 mL/min or greater for adequate dialysis was considered to be a failed access.

Primary failure was defined as an access that could not be cannulated or maintain a blood flow of 300 mL/min or greater after allowing six weeks for maturation. Secondary failure was defined as the failure of an access that was previously used for successful dialysis.

Primary patency was defined as the interval between access placement and the first endovascular or surgical intervention to address access failure. Secondary patency was the interval between access placement and abandonment, including any period after surgical or endovascular interventions. Cumulative patency was defined as the number of accesses that remained patent over a given time period, regardless of the number of interventions performed.

RESULTS

During the study period, 19 operations were performed to create vascular accesses. All patients had routine venous mapping evaluations before vascular access operations. There were 12 men with a mean (± SD) age of 59.1±13.7 years (range 40 to 79 years, median 63 years, mode 79 years) and seven women with a mean age of 49.7±13.4 years (range 35 to 67 years, median 51 years, mode 51 years).

Six of these patients had not commenced dialysis and all had AVF created as their first access, pre-empting the need for dialysis (incident). The remaining 13 patients had already commenced dialysis, and had new accesses created in the form of AVFs (n=7) or AVGs (n=6).

Overall, 13 (68.4%) patients underwent AVF creation using 7/0 polypropylene sutures and surgical loupes (×2.5 magnification) as visual aids (radial-cephalic vein, n=7; brachial-cephalic vein, n=5; transposed basilic vein, n=1). Of these 13 patients, there were six (46.2%) incident patients and seven prevalent patients; five had catheter access and two had previous AVGs (brachial-basilic) created at overseas referral centres. Both patients with previous AVGs had successful conversion to native radial-cephalic AVFs by the local vascular access service.

In the AVF group, there was one (7.7%) primary failure and four secondary failures due to thrombosis. At the termination of the study period, eight (61.5%) patients were still being dialyzed across their AVF after a mean time of 530.25 days.

Grafts were used for access in six (31.6%) cases (brachial-basilic vein, n=4; brachial-axillary vein, n=1; femorofemoral vein, n=1). In all cases, 6 mm Gore-Tex (expanded polytetrafluoroethylene; WL Gore & Associates, USA) prostheses were interposed between native vessels using 7/0 polypropylene sutures for the anastomoses. These were all prevalent dialysis patients who had at least one previous failed AVF on presentation.

At the termination of the study period, only two (33.3%) AVGs were still being used for dialysis after a mean of 395 days. The remaining AVGs were abandoned due to access failure from graft thrombosis (n=2) and graft infections (n=2).

There were no deaths attributable to a direct complication of vascular access over the study period. Table 1 compares the outcomes of access creation by the local vascular access service in the two groups of patients.

DISCUSSION

Successful hemodialysis depends on the creation and maintenance of adequate vascular access. There is consensus that the ideal form of vascular access for hemodialysis is an AVF (3-6). A functional AVF brings lower complication rates and a longer duration of event-free patency than catheter access (3,6-9) and AVGs (9-13).

The National Kidney Foundation published the Kidney Disease Outcomes Quality Initiative (KDOQI) vascular access guidelines in 1997 in an attempt to encourage increased use of AVFs (3). The KDOQI guidelines were updated in 2006 with recommendations for hemodialysis by AVF in at least 40% of prevalent patients and at least 50% of incident patients commencing hemodialysis (4).

The United States-based Centers for Medicare & Medicaid Services (CMS) supported these guidelines when it launched

the Fistula First Breakthrough Initiative in 2005 that adopted the KDOQI recommendations (5). The CMS reported that as of 2006, 42% of hemodialysis patients used AVFs, which was a 27% increase since the initiative began in 2003. The CMS has now set stretch goals to increase the percentage of AVFs to 66% by 2009 in the United States (5).

In 2008, it was estimated that there were 40,000 people residing in the Cayman Islands (14). Although the prevalence of ESRD (0.975 cases per 1000 people) in the Cayman Islands (1) is similar to that in other developing countries (2), the absolute number of patients remains small. Therefore, the demand for vascular access in this setting remains low. Although the small number of patients makes statistical analysis less reliable, the preliminary outcomes recorded by the local vascular access service are in keeping with modern practice guidelines.

We recorded an incident AVF placement rate of 100% (six of six) that exceeds the target goals set by both the CMS and KDOQI (3-5). Our prevalent AVF placement rate of 53.9% (seven of 13) also exceeds these recommended guidelines (3). AVGs were created in 46.2% (six of 13) of prevalent dialysis patients, all with multiple previous accesses and limited availability of native vessels for AVF creation (three of six) and/or difficult vasculature on preoperative Doppler mapping (three of six).

All patients with ESRD in the Cayman Islands are managed in a centralized location at the CIH. In this setting, the patients have ready access to dedicated nephrologists, surgeons, specialized dialysis nurses, radiologists and a fully stocked hemodialysis unit. The close collaboration between these multiple disciplines has resulted in early patient referral for vascular access and we believe that this is responsible for the high prevalence of AVF use. It has been demonstrated that early referral to nephrologists and good collaboration with vascular surgeons will reduce the need for temporary dialysis access for first dialysis (15-17) and increase the rate of successful AVF placement (16,18,19).

There are significant available data to show that an AVF is the ideal form of vascular access for dialysis (3-13).

When compared with an AVG, an AVF has superior primary and secondary patency rates (3). They are also associated with a reduced incidence of overall morbidity, infectious morbidity, thromboses, operative cost and requirements for hospitalization compared with AVG creation (6,9-13).

Although the small patient numbers limit statistical analysis in the present report, our experience has been similar, with AVFs having better primary (461 days versus 227 days) and secondary (803 days versus 205 days) patency than AVGs. Vascular access by AVFs also resulted in trends toward reduced overall morbidity (four of 13 versus four of six), infectious morbidity (zero of 13 versus two of six), access thrombosis (four of 13 versus two of six) and requirements for interventions to maintain secondary patency (one of 13 versus two of six).

From a financial point of view, the operative cost of establishing vascular access in our centre was, on average, CI\$715.00 (US\$871.95). This is a cost-effective alternative to the transfer of patients overseas for access as was performed before the inception of the local vascular access teams. The nearest overseas specialist centres are located in Jamaica and the United States. Although carrier-related and seasonal variability exist, the average cost of commercial travel to these specialist centres already exceeds 50% of the average cost for AVF creation locally. Consequently, AVF placement is cost effective in our setting.

CONCLUSION

The rate of AVF creation for patients with ESRD in the Cayman Islands exceeds the goals set by the KDOQI guidelines and the Fistula First Breakthrough Initiative. To ensure continued delivery of modern quality care, further audits of the local practice will be required at regular intervals. There should also be continued close collaboration among nephrologists, surgeons, dialysis nurses and radiologists in this setting to promote further improvements in the rate of native AVF placement.

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