Early Cannulation of Percutaneously Created Arteriovenous Hemodialysis Fistulae

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INTRODUCTION

Hemodialysis using an autogenous vascular access is associated with lower morbidity and mortality rates in addition to lower costs when compared to grafts or catheters (1,2). However, the traditionally reserved for arteriovenous fistula (AVF) access maturation has been a major point of concern for creating AVFs in some groups of dialysis patients (3). A three-month waiting period prior to cannulation was common in past years but has now decreased to 6-8 weeks in many reports. At least one report suggests two months maturation is safe (2,3,5). This timeframe still requires central venous catheter placement for many patients. Although not widely accepted, cannulation of AVF has been accomplished successfully very early in the post-operative period (4). In fact, the fistula AVF for hemodialysis created by Kenneth Appel in 1965 were successfully cannulated within 10 days of surgery (5). Early cannulation in this report refers to AVF access within one or two weeks following the fistula creation, in which the plan is used for avoidance of a central venous dialysis catheter and is specific to the techniques and procedures described herein.

METHODS

We reviewed all consecutive hemodialysis patients who underwent cannulation of a new arteriovenous fistula within two weeks of access creation. In addition to physical examination, each patient underwent a vascular ultrasound (US) examination by the operating surgeon during the initial evaluation prior to AVF creation (9). Patients were followed in the vascular surgery clinic with a 3-month follow-up in addition to reports from the dialysis center nursing staff. Individual patients were re-evaluated sooner if the dialysis nursing staff noted any problem such as difficult cannulation, low flow, infection, thrombosis, retraction, or post-cannulation bleeding.

We recommend a cephalic arteriovenous anastomosis (AVF) at the wrist as the first choice for vascular access in patients where vessels are adequate and the AVF is likely to mature (10). These patients are usually the minority of the referrals seen in our practice. Our second choice and most common procedure for vascular access is a proximal radial artery (PRA) AVF (11). We now create PRA-AVF using a percutaneous technique with proximal radial artery inflow and outflow via the deep communicating and cephalic veins (12). The Ellipsys® AVF device creates a thermal based fistula with minimal trauma and has been described previously (13). These new percutaneous AVFs may be utilized during the same procedure with balloon dilation if needed, yielding adequate flow for immediate cannulation and functional fistulas (14). A video of the procedure is available at http://www.youtube.com/watch?v=E1UQ1sQjw70. Intrasumed’s carotid stent sheath (CS-Int) introduced over a rigid guidewire is standard care for peripheral vascular access. They are constructed of fluorinated ethylene propylene and have been reported in use for AVF cannulation within the first weeks following access creation (15). CS-Int was used for immediate cannulation in patients in this report along with US guidance when necessary.

The percutaneous AVF procedures were performed at a university affiliated medical center outpatient department with regional block anesthesia. Primary cannulation was performed at the time (before) arteriovenous procedure and without intervention. Primary cannulation was the time of unintended postoperative fistula access intervention was necessary. Cannulation (secondary) puncture was the time from the original AVF creation, until abdomen of the access or until completion of the study period, regardless of interventions or thrombosis. The Institutional Review Board approved this study.

RESULTS

Eight patients underwent cannulation of a new AVF within two weeks of access creation. Each patient had a percutaneous proximal radial artery (PRA) AVF/AV graft created at the juxta-renal communicating vein and the proximal radial artery (PRA). Medical Centre Montsoursis Paris using the Ellipsys® AVF System, which creates a thermal anastomosis through a single ultrasound (US) guided catheter technique. Standard intrasumed carotid stent were used for immediate AVF cannulation. Results: Eight patients underwent cannulation of a new AVF within two weeks of access creation and were stable and able to wait longer to initiate dialysis. We feel these other patients would have also been candidates for early cannulation if needed.

CONCLUSIONS

This preliminary report found that early AVF cannulation within two weeks is both feasible and reliable for selected dialysis patients. The combination of percutaneous PRA-AVF (Ellipsys® AVF) cannulation facilitates early cannulation and ultrasonic guided puncture when necessary. Our review found that the combination of creating a moderate flow percutaneous PRA-AVF with IV-Cath puncture may avoid the need for early cannulation AV grafts in selected patients. We feel that many central venous catheters may be avoided with these techniques. It is important to note that creation of an Ellipsys® AVF/AV graft following creation of this study required branch coil occlusion or ligation during the follow-up period. This approach offer several advantages including decreased risk of congestive heart failure, steal syndrome, post-dialysis bleeding, and aneurysm formation. Moderate venous outflow pressures have been shown to cannulate AVF survival (16). Less intraluminal turbulence and vessel wall shear stress may also result in decreased thrombolysis with associated better laminar flow and access.

We fast initial cannulation with an IV-Cath inserted over a guidewire results in an important component of the success in immediate cannulation for our patients, however IV-Caths should be performed only after one month of fistula creation unless there is need for immediate dialysis access (17). The percutaneous AVF fistula creation leaves all surrounding tissue intact and results in the local inflammatory component of a surgical incision. We now leave all central venous branches open unless a branch vein edema limits to dominate AVF outflow. We carefully evaluate each vessel by brachial Doppler and ultrasonic imaging and flow volume measurements. None of the patients in this study required branch coil occlusion or ligation during the follow-up period. This approach had the particular benefit in some patients allowing early initial cannulation of the central inflow and moderate outflow within the central fistula. The sites close to the fistula AVF would not be immediately available if a surgical incision was needed for standard AVF construction.

Our review found that the combination of creating a moderate flow percutaneous PRA-AVF (avoiding surgical dissection, associated inflammation, and recovery period). Initial cannulation can be performed in a single ultrasound guided puncture (US) in these patients. Our review found that the combination of creating a moderate flow percutaneous PRA-AVF with IV-Cath puncture may avoid the need for early cannulation AV grafts in selected patients. We feel that many central venous catheters may be avoided with these techniques. It is important to note that cannulation of an Ellipsys® AVF/AV graft following creation of this study required branch coil occlusion or ligation during the follow-up period. This approach offer several advantages including decreased risk of congestive heart failure, steal syndrome, post-dialysis bleeding, and aneurysm formation. Moderate venous outflow pressures have been shown to cannulate AVF survival (16). Less intraluminal turbulence and vessel wall shear stress may also result in decreased thrombolysis with associated better laminar flow and access.

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