Update in the Endovascular Management of Failing Dialysis Access

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Abstract

When a stenotic lesion is suggested, the patient should be evaluated with angiography to determine if an anatomically significant lesion is actually present. Lesions that represent 50% stenosis or greater should be treated. Angioplasty should be regarded as a standard option for the management of venous stenosis associated with dialysis access. There should be no more than a 30% residual stenosis following angioplasty; however, the current literature recommends that the goal should be no residual stenosis following treatment.

Currently, the most frequent form of tPA in use for dysfunctional dialysis catheters is alteplase (Cathflo). This is a recombinant form of the naturally occurring tPA.

Keywords:

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Content

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AV: Arterio venous
AVF: Arterio venous fistula
AVG: Arterio venous graft
bFGF: Basic fibroblast growth factor
CAB PTA: Cutting angioplasty balloon – percutaneous transluminal angioplasty
CAB: Cutting angioplasty balloon
CRF: Chronic renal failure
DRIL: Distal revascularization-interval ligation
DSA: Digital subtraction angiografy
DVT: Deep venous thrombosis
ECs: Endothelial cells
ePTFE: Expanded polytetrafluroetheline
ESRF: End stage renal failure
GFR: Glumeroluar filteration rate
HD: Hemodialysis
IJV: Internal jugular vein
IP: Implanted port
IVC: Inferior vena cava
K/DOQI: Kidney disease outcome quality initiative
MRA: Magnetic resonance angiography
NKF: National kidney foundation
NKF-KDOQI: National kidney foundation- kidney disease outcome quality initiative
PDGF: Platelet-derived growth factors
PF: Primary failure
PST: Pulse spray technique
PTA: Percutaneous transluminal angioplasty
PTD: Percutaneous thrombectomy device
rtpa: Recombinant tissue plasminogen activator
SF: Secondary failure

SMCs: Smooth muscle cells
SVC: Superior vena cava
tPA: Tissue plasminogen activator
UK: Urokinase

Introduction

CHAPTER 1

Introduction

Vascular access complications are one of the leading causes of morbidity and mortality in patients with end stage renal disease. As the life span of patients on hemodialysis increases, the need for durable solutions to access problems has become paramount. The National Kidney Foundation (NKF) has encouraged surgeons to place primary fistulas. Aggressive surveillance and early recognition and treatment of access problems have also been recommended. In this way, the assisted patency of fistulas and grafts can be extended to meet the needs of these patients during their entire lives. The creation and long-term management of dialysis accesses has been and remains a challenging aspect of vascular surgery practice. In the last 10 years, percutaneous approaches have become widely adopted as new devices and techniques are developed **(Gram and Jeffrey, 2006).**

There is a tendency for arteriovenous fistula to develop problems as they age due to the presence of intimal hyperplasia, proliferation of vascular smooth muscle cells and accumulation of matrix, which progressively occludes the vascular lumen with reduction in blood flow leading to stenosis and thrombosis **(Roy-Choudhury, 2006).**

As with all endovascular therapies, short-segment lesions and anastomotic stenoses appear to respond best to percutaneous management **(Hallett et al, 2004).** Furthermore thrombolysis can be used for treatment of thrombosis of dialysis access **(Lok et al, 2007).**

Central Vein Stenotic lesions are ideally suited to a percutaneous approach. This avoids the obvious morbidity of a

sternotomy or thoracotomy. In distinction to more peripheral stenosis, primary stenting has been shown to result in markedly improved patency and is usually recommended **(Dammers et al, 2003).**

The use of stents is indicated in clinically symptomatic patients who have radiographic abnormalities of acute elastic recoil of the vein following percutaneous transluminal angioplasty (PTA) or recurrent stenosis within a 3-month period **(Levit et al, 2006).**

Covered stenting is a good option for treating aneurysms and pseudoaneurysms. It allows for preservation of the access and may be preferable to interposition grafting or bypass and exclusion. In recent series, the patency rates with covered stents have been excellent at least to 1 year **(Najibi et al, 2002).**

The central venous approach for dialysis access has been available since the original description of femoral cannulation was provided by Shaldon in 1961. Their technique required placement of both arterial and venous cannulae to accomplish effective dialysis **(Shaldon et al, 1961).**

Introduction of dual-lumen catheter for subclavian vein cannulation was in 1980 when the modern era of percutaneous venous access for dialysis began. Further evolution in both catheter design and placement techniques has resulted in the more frequent and broader application of central venous catheters to maintain patients on hemodialysis **(Uldall et al, 1980).**

The introduction of foreign indwelling objects into the central veins leads to the development of central venous stenosis. Primary attention has been directed toward indwelling

catheters as the etiology for this problem among dialysis patients **(Yevzlin, 2008).**

Problems caused by central vein stenosis are primarily related to the presence of an ipsilateral peripheral dialysis access that drains into the affected central veins. The patient frequently develops rapidly increasing massive edema of the access arm, with pain and discomfort that is commonly aggravated by the dialysis session **(Itkin, 2004).**

In order to understand the complications of AV access, some terms need to be defined. **Inadequate maturation** is defined as insufficient access flow to maintain dialysis or the inability to cannulate an arteriovenous fistula (AVF), if required, at 6 wk after surgery. **Primary failure** (PF) was defined as an AVF that did not develop to maintain dialysis or thrombosed before the first successful cannulation for hemodialysis treatment, regardless of eventual AVF abandonment. This definition includes: (1) inadequate maturation, (*2*) early thrombosis, (*3*) failure of first cannulation, and (*4*) other complications such as ischemia or infection. **Secondary failure** (SF) was defined as permanent failure of the AVF, after it had achieved adequacy for hemodialysis **(Sidawy, 2002).**

Fistula failure is defined as inability to use the fistula for haemodialysis due to a cause other than transplantation or death. Operative ligations are classified as failures. Patients who underwent renal transplantation are considered as lost to follow up and not as technical failures. Deaths being unrelated to fistula failure is also treated as lost to follow up **(Murphy et al, 2002).**

The failing to mature AVF was defined as an AVF that had been created for at least 8 wk but had not matured enough to