Angioplasty Vs. Surgical Revision Of Arteriovenous Graft Occlusion

Chun Lam

A. Study purpose and rationale

Vascular access complications remain the greatest cause of morbidity in hemodialysis patients. Formerly, the most common type of access was the primary arteriovenous fistula, constructed with endogenous vessels. As the number of elderly and seriously-ill patients dependent on dialysis increased, however, their lack of suitable vascular anatomy led to the use of synthetic grafts, most commonly polytetrafluorethylene (PTFE). The majority of patients in most dialysis centers today have PTFE grafts, though native fistulae are still preferred because of their lower infection, stenosis and thrombosis rates.

The average time to graft occlusion is approximately one year, and is considerably shorter in patients with certain risk factors, including diabetes mellitus, hypotension and accidental compression, among others. Venous anastomotic stenosis leading to thrombosis is the leading cause of graft failure, but stenosis may occur anywhere in the vein or the graft itself, and is caused by intimal hyperplasia; the accumulation of extracellular material and proliferation of smooth muscle cells may be stimulated by a variety of factors released by platelets, endothelial cells and inflammatory cells as a response to intimal injury. Other causes of graft occlusion include hypercoagulable states or hypotension.

Surgical revision has traditionally been the treatment for graft occlusion, though in recent years, percutaneous transluminal angioplasty (PTA) has emerged as an effective alternative. The advantages of PTA are numerous: preservation of proximal venous sites for later use; reduction of the number of central venous cannulations for acute dialysis; shorter hospital stay/lower cost; reduction of anesthesia (local vs. general). Furthermore, PTA is less invasive and those who fail it may still go on to surgery.

The literature on success rates of PTA and surgical revision has been somewhat contradictory: 1-month, 3-month, and 6-month durations of patency of 91%, 61% and 38%, respectively, have been reported, compared to surgical revision patency rates of 32% at 6 months. and between 37-75% after 1 year. Others have found significantly lower patency rates for PTA than for surgery. Timing of intervention and patient variability may, in part, explain such differences. Direct comparisons of the two treatments have largely been retrospective. Dapunt, et al. reported 1-wk., 1-mo., 1-yr. and 15-mo. patency rates of 95%, 72%, 31% and 27%, respectively, for 22 PTA patients and 78%, 64%, 19% and 19%, respectively, for 22 surgical patients. A randomized prospective study by Brooks, et al. showed median patency of 4 mos. for 24 PTA subjects and 12 mos. for the surgical group of 19 patients; this study, however, did not document clear inclusion, exclusion or patient selection criteria. A third study comparing thrombectomy with PTA vs. thrombectomy with surgical revision for PTFE graft thrombosis found comparable patency rates for PTAland surgical revision.

The purpose of this study is to compare thrombolysis with angioplasty to surgical thrombectomy with revision in the treatment of PTFE vascular access graft occlusion.

B. Study Design

The study will be a prospective randomized trial. Patients will receive either thrombolysis and angioplasty or surgical thrombectomy and revision.

The endpoints are 1) length of time to occlusion and 2) efficacy in re-establishing patency. PTA failure is defined as (post-treatment stenosis >=50% and or) absence of blood flow during dialysis, with the resultant need for surgical revision. Surgical failure is defined as lack of suitable site for jump grafting, and also as absence of blood flow via cannulation of graft for dialysis following repair; the only recourse is the creation of an entirely new graft (site). Cost is a secondary endpoint.

Follow-up: Patients will return to CPMC in the event of a graft occlusion, the criterion for which is inability to achieve blood flow via cannulation of the graft for dialysis. Because CPMC is not a chronic dialysis center, biweekly calls will be made to subjects' regular dialysis center to ascertain whether 1) the graft is functioning for dialysis and 2) the subject is still being dialyzed at the center.

C. Study procedures

Subjects randomized to the PTA arm will first receive a continuous urokinase infusion at 100,000 U/h via a catheter wedged within the clot until a bruit is auscultated or a thrill is palpable. Thrombolysis is continued if neither is noted, to a maximum of 5 hours. Otherwise, angioplasty will be done by interventional radiology with a Meditech angioplasty balloon 8mm in diameter and length, and 7-F external diameter. Technical success is defined as a reduction of the stenosis to <50% as demonstrated by post-PTA angiograin but ultimately as blood flow from the graft during dialysis.

Surgical treatment consists of. pre-operative prophylactic antibiotics; intraoperative thrombectomy by opening the graft longitudinally and passing a No.3 Fogarty embolectomy catheter into the vein to remove the clot; this is followed by anastomosis of a segment of PTFE graft of suitable length in an end-to-side fashion to a proximal venous site, and then a graft-to-graft anastomosis. Successful revision is defined as a palpable thrill in the vein distal to the surgical site followed by presence of blood flow from the graft during dialysis.

All procedures will be started under local anesthesia where appropriate, with general or regional anesthesia added as necessary.

These study procedures would otherwise be required for a patient's clinical management and do not deviate from standard clinical care. No procedure will be done solely for study purposes.

Probable duration of the study is approximately 3 years; patients are expected to remain for this time.

D. Study drugs

Urokinase, I.V. 100,000 U/h to patients in the PTA arm of the study. Side effects are bleeding, nausea, vomiting and mild to moderate hypotension.

E. Medical devices

No. 3 Fogarty embolectomy catheter, Meditech Blue Max angioplasty balloon, PTFE graft material.

F. Study questionnaires

N/A

G. Subiects

Inclusion criteria≥18 years old; minimum of 4 hours of HD, 3 times per week; PTFE graft age ≥1 month. Criteria for recruitment: graft occlusion as evidenced by absence of blood flow from graft during dialysis.

Exclusion criteria: native fistulae; non-surgical candidates; current infection; prior dilation of graft within 1 month.

Recruitment will take place at CPMC. Subjects will be approached during dialysis treatments by physicians informed of the enrollment criteria. Referral is immediate upon graft function failure. Patients not eligible for the study are given the same options of angioplasty or surgery.

H. Confidentiality

Personal information accessible only to the investigators.

I. Location of study

The study will take place in the dialysis center and the operating rooms at CPMC.

J. Risks and benefits

Risks include adverse reactions to: intravenous antibiotics and contrast medium (allergic reactions); urokinase (nausea, vomiting and hypotension); and anesthesia (general- -laryngosp asin requiring cracothyrototomy, malignant hypothermia; regional-hypotension, bradycardia, nerve damage/trauma, inadvertent intravascular injection of anesthetic; and local nerve damage, intravascular injection).

K. Alternative therapies

The study involves no experimental therapy; standard treatment options for graft occlusion are angioplasty or surgical repair.

L. Compensation and costs

Compensation will not be provided, as subjects will not incur any additional costs beyond those expected for standard treatment.

M. Minors and research subjects

N/A

N. Radiation

Intravenous contrast medium will be used for angiograin and PTA procedures. Exposure will be equal to that for standard treatment.

O. References

Beathard GA: Percutaneous transvenous angioplasty in the treatment of vascular access stenosis. Kidney International 42:1390-97, 1992.

Berkoben M, Schwab SJ: Maintenance of permanent hemodialysis vascular access patency. ANNA 22(l):17-24, 1995 Feb.

Brooks JL, Sigley RD, May KJ, Mack RM: Transluminal angioplasty versus surgical repair for stenosis of hemodialysis grafts. Am J Surg 153:530-1, 1987 June.

Dapunt 0. Feurstein M, Rendl, Prenner K: Transluminal angioplasty versus conventional operation in the treatment of hemodialysis fistula stenosis: results from a 5-year study. Br J Surg 74(11):1004-5, 1987 Nov.

Fan, PY, Schwab SJ: Vascular access: concepts for the 1990s. J Am Soc Nephr 1992; 3:1-11.

Lumsden AB, MacDonald MJ, Kikeri DK, Harker LA, Allen RC: Hemodialysis access graft stenosis: percutaneous Transluminal angioplasty. J Surg Research 68:181-5 (1997).

Schwartz CI, McBrayer CV, Sloan JH, Meneses P. Ennis WJ: Thrombosed dialysis grafts: comparison of treatment with Transluminal angioplasty and surgical revision. Radiology 1995; 194:337-41.

Tannenbaum G. Bixon R. Chabot J. Benvenisty AI, Hardy MA: Angioplasty versus segmental replacement in angio-access revision. In: Ch.7, 85-95.

Windus DW: Permanent vascular access: A nephrologist's view. Am J Kidney Dis 21(5):457-71, 1993 May.