

Efficacy and safety of percutaneous thrombectomy in arteriovenous grafts

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ABSTRACT

Acute thrombosis of arteriovenous grafts is a frequent complication in patients on maintenance haemodialysis. Until recent years surgical thrombectomy was the only solution. The aim of this study is to assess the efficacy and safety of percutaneous thrombolysis after thrombosis of arteriovenous PTFE grafts.

We analyzed 50 percutaneous thrombolytic procedures in 25 patients with end-stage renal disease on maintenance hemodialysis (12M, 13F, mean age 56.5 ± 13.8 years, mean time on haemodialysis 61.8 ± 55.7 months, mean \pm SD). In all cases the arteriovenous access was a PTFE vascular graft. Thrombolysis was performed within 3 days after thrombosis in all cases.

The median survival of PTFE graft after surgical implantation was 14.5 months (range

1-70). The primary patency rate of the procedure was 71%. The efficacy of first thrombolysis was higher than for the second or third event (86.6%, 61%, and 28% respectively, $p=0.008$ first vs third thrombectomy). The survival rate at 90 days after first thrombolysis was 52%, and after second thrombolysis was 33% (log-rank test $p=0.15$). Complications after the procedure were observed in 10 of 50 patients (20%), the most frequently complication being local haematoma.

Percutaneous thrombolysis is an alternative to surgical procedure in vascular grafts thrombosis, with high efficacy and safety in the short-term. However, in terms of long-term efficacy and economy we consider that only the first thrombolysis is useful because after the second procedure the efficacy and long-term is clearly decreased.

Key-words: acute thrombosis; arteriovenous graft; haemodialysis.

INTRODUCTION

One of the principal problems in patients on maintenance haemodialysis is vascular access-related complications. Thrombosis of the vascular access is the principal cause of failure of both arteriovenous fistulas^(1,2) and the polytetrafluoroethylene (PTFE) graft access^(3,4).

When faced with a patient with a thrombosed vascular access graft, most nephrologists have two choices, to try the surgical repair of the access or to insert a central venous dialysis access catheter. Both choices are associated with significant problems. Surgery is invasive, results in a considerable blood loss, may require general anesthesia, and is associated with pain and discomfort immediately and for several days afterwards, frequently requires hospitalization, has a small but significant risk of infection, and frequently causes delays of missed dialysis treatments⁽⁵⁾. The insertion of a central venous dialysis access catheter results in a definitive loss of the vascular access and can result in a risk of infection and the possibility of central venous stenosis in the long-term which may compromise the efficacy of dialysis and the long-term patency of the vascular access in the upper extremities.

Thrombolysis followed by percutaneous transluminal balloon angioplasty (PTA) of associated vascular stenoses has been suggested as an alternative mean of salvaging thrombosed accesses⁽⁶⁻¹⁰⁾.

In a recent study, mechanical thrombolysis as described above was more effective in the treatment of thrombosed PTFE accesses than surgery⁽¹¹⁾.

Recently, a thrombolysis technique has been developed incorporating a combination

of enzyme lysis with urokinase administered using pulse-spray catheters followed by mechanical maceration and removal of the clot. Using this combination of pharmacological and mechanical factors, over 98% of cases can be successfully treated within one of two hours with a very low incidence of side effects⁽¹²⁻¹⁶⁾.

The aim of this single-center prospective study is to assess the efficacy and safety of percutaneous thrombolysis after thrombosis of arteriovenous PTFE grafts.

PATIENTS AND METHODS

Patient population

We analyzed 50 consecutive thrombolytic procedures in 25 patients with end-stage renal disease on maintenance hemodialysis with arteriovenous PTFE grafts, performed in our hospital between 1996 and June 2000. All arteriovenous grafts were PTFE (20 Diastat®, 10 Goretex®). Of the thrombolysis procedures, 26 cases were performed using the technique of pharmacomechanical thrombolysis (pulsed-spray®) and the remainder were performed using mechanical thrombolysis (Hydrolyzer®, Angiojet®).

In all cases the thrombolysis procedures were performed within the first 3 days after detection of arteriovenous graft thrombosis.

Technique

Mechanical thrombolysis has been previously described in detail⁽¹⁶⁾. Although the basic procedure has not changed, minor modifications

have been introduced with time. It is a combined procedure consisting of three components: angiography (venogram), thrombolysis done mechanically, and angioplasty of the venous stenotic lesions that are generally present.

In the case of the pharmacomechanical thrombolysis the procedure was the same but with the co-administration of a fibrinolytic enzyme (urokynase) where the clot was placed. Patients were treated with sodium heparin in perfusion adjusted to achieve an APTT between 60-85 seconds for the 24 hours following thrombectomy. Finally, antiplatelet agents (aspirin and or ticlopidine) were prescribed to all patients unless contraindicated.

Statistical analysis

To assess the efficacy of the method during first and subsequent thrombectomies, the Chi-square test and the Kaplan-Meier survival method were used. To analyze factors associated with long-term patency after thrombectomy, a log-rank test. A probability of 0.05 or less was used to determine statistical significance.

RESULTS

12 men and 13 women with mean age 56.5 ± 13.8 SD years and with mean time on hemodialysis 61.8 ± 55.7 months (mean \pm D) were evaluated.

The median survival of the PTFE graft after surgical implantation was 14.5 months (range 1-70 months).

Complications were observed in 10 of 50 performed procedures (20%):

- Local hematoma: 8/10 (80%).
- Haemorrhagic shock (colonic bleeding): 1/10 (10%).
- Lung thromboembolism (diagnosed by V/Q pulmonary scintigraphy): 1/10 (10%).

The primary patency rate of the procedure was 72 %.

The efficacy of first thrombolysis was higher than for the second and third event ($p=0.008$ first vs third event):

- first thrombectomy 86.6%
- second thrombectomy 61%
- third thrombectomy 20%.

The survival rate of patient aretrievenous grafts at 90 days after percutaneous thrombectomy was:

- after first thrombectomy 52%
- after second thrombectomy 33% (log-rank test $p: 0.15$)

DISCUSSION

The ideal technique for managing thrombosed dialysis access grafts should be easily performed, safe, effective, economic and minimally invasive.

Although it does not fulfill all of these criteria, mechanical thrombolysis provides several advantages over surgery⁽⁵⁾.

In the past twenty years, thrombolysis has undergone a significant evolution^(3,7,9,13,14,15,17-23). The history of this procedure as applied to the dialysis access started with techniques that were strictly pharmacological, involving infusion of high doses of fibrinolytic enzymes over periods of time ranging from two⁽²⁰⁾ to 72 hours⁽⁸⁾. Hospitalization was required often in an intensive care unit. Success rates as low as 14%⁽¹⁹⁾ were reported with bleeding com-

plications as high as 57%⁽²⁰⁾, arterial embolization as high as 6%⁽²²⁾, allergic complications as high as 40%⁽¹⁹⁾ and total complications as high as 85.7%⁽¹⁹⁾. Recently, the major obstacles to effective and practical percutaneous therapy of thrombosed dialysis access grafts have been largely eliminated by the development of techniques to accelerate thrombolysis using a combination of fibrinolytic therapy with concentrated urokinase and mechanical clot maceration and removal^(7,13-15). This technique, referred to as pharmacomechanical thrombolysis, has yielded success rates greater than 95% using much smaller doses of enzyme with lysis times of 40 minutes or less with very few complications.

Patients have been returned to dialysis within 30 minutes of completing the procedure. The manner in which the treatment is accomplished allows for a combined procedure that involves angiography to evaluate the grafts status and correct not only the symptom (occlusions of the graft), but also the disease (venous stenosis).

In our study we evaluated the survival rate at 90 days and at 1 year after thrombectomy that were successful in the 52% and the 30% respectively after first thrombectomy.

Another study that has evaluated the survival rate at 1 month, six months and 1 year after first thrombectomy results were 80%, 38% and 8%, respectively⁽¹⁶⁾.

In our hands, the long-term patency of this technique after the first episode is 72%, slightly lower than the 92.8% with the mechanical procedure and 93.8% with the pharmacomechanical procedure described by other groups⁽²³⁾.

Another group compared the efficacy after first episode of thrombosis with one catheter that was 55% and with two catheters that was 81%⁽¹⁶⁾.

With mechanical thrombolysis, small thrombi are undoubtedly being released into the circulation, however in our experience only 2% of the procedures was associated with clinical evidence of pulmonary embolism with satisfactory evolution.

The most frequent complication observed in our patients was local bleeding that was successfully controlled with local compression for 10 minutes and desmopressin treatment.

The age of the graft does not have any effect on the success of thrombolytic therapy⁽²⁴⁾. What interesting is the apotation of the correlation between first thrombectomy and second and third thrombectomy in the same vascular access.

In summary, percutaneous thrombectomy is an alternative to surgical procedure in vascular grafts thrombosis with a high efficacy and safety in the short term.

However, in terms of long-term efficacy and economy we consider that only the first 'thrombectomy is useful because after the second procedure the efficacy and survival are clearly decreased. Therefore, it is important to perform a careful follow-up of PTFE graft stenosis to avoid PTFE clotting in order to increase the survival of the aretriovenous access in haemodialysis patients.

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