

EFFICACY OF PERCUTANEOUS TRANSLUMINAL ANGIOPLASTY IN THE MANAGEMENT OF CHRONIC HEMODIALYSIS PATIENTS

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Percutaneous transluminal angioplasty (PTA) has gained wide acceptance as an effective technique for the dilatation of stenoses in the arterial tree. We evaluated the long-term results of vascular access in a group undergoing hemodialysis, in particular the effects of PTA. Twenty-four percutaneous procedures were performed on 18 patients. Detection was based on physical examination, flow rate measurements, venous pressure, and analytical determinations performed at dialysis. The initial success rate was 87.5%, with 1-, 6-, and 18-month patency rates of 82.6, 67.5, and 38.5%, respectively. There was no difference between primary and secondary patency rates. The assisted primary patency rates for PTA and surgical revision were not significantly different. Although neither surgical nor endovascular management resulted in long-term function for the majority of shunts after stenosis or thrombosis, endovascular treatment can extend the life of dialysis shunts with results similar to surgical revision. Transluminal dilatation may be performed in appropriate cases to obviate the need for surgery.

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Key words: Hemodialysis, Blood access trouble, PTA

INTRODUCTION

Dysfunction of hemodialysis fistulas and grafts is a problem frequently encountered in hemodialysis patients. Because the number of patients with endstage renal disease being treated by hemodialysis is rising steadily¹⁾, the choice of an adequate treatment technique to maintain vascular access is of growing importance for both the patient and physician. The average primary patency of hemodialysis shunts ranges from 1 to 3 years in numerous reports²⁾. The population undergoing dialysis is older, has more comorbidity, and is less likely to have suitable veins for autologous access.

The stenotic segment of an AV fistula may be surgically revised to prevent fistula failure³⁾, but this often requires incisions over the optimal site of the fistula puncture. In addition, an angiogram sometimes reveals multiple sites of stenosis, and it is difficult to determine which of these are hemodynamically significant.

Recently, percutaneous techniques for dialysis shunt angioplasty and thrombectomy have been reported⁴⁾. These are now widely used to open shunts and preserve function as an alternative to surgical therapy. The results with endovascular shunt salvage have been reported to be as good as or better than surgical salvage techniques⁵⁾. Our approach to the problem and the results obtained with PTA are the basis of this report.

METHODS

Patients : Between April 2000 and September 2001,

eighteen patients who developed hemodynamic problems while on dialysis were considered as candidates for balloon catheter dilatation. These patients had inadequate flow on dialysis caused by narrowing of the AV anastomosis or had complete obstruction of the shunts. Indications for angiographic evaluation included recurrent thrombosis (5 patients), elevated venous pressure (4 patients), and high urea recirculation (2 patients), difficulty in access (1 patient), extremity swelling (3 patients), and pain and numbness during dialysis (3 patients). There were 11 male and 7 female patients aged 27 to 84 years (Table 1). The patients had been undergoing hemodialysis for a mean of 38 months (range 6–196 months) and had undergone a mean of 2.5 prior access revisions. The type of fistula was a forearm radiocephalic Brescia-Cimino fistula in 14 patients, an upper-arm brachiocephalic AV fistula in 3 patients and a femoral polytetrafluoroethylene (PTFE) graft AV fistula in 1 patient. All patients had end-stage renal disease, including diabetic nephropathy in 6 patients. Treatment was performed on the same day fistula dysfunction was diagnosed. The procedure

Table 1. Patient characteristics in 18 patients with shunt dysfunction

Age (average)	63±13 years
Sex (male/female)	11/7
Diabetes	33.3%
Median follow-up (range)	8 months (1–19)
Median shunt age at time of procedure	30 months (6–150)
Average time of shunts revised	2.5 times (0–4)

was performed as an inpatient procedure in all cases.

Treatment procedure: Fistula pathology was visualized by puncturing the outflow vein in a retrograde fashion against the flow direction with the use of local anesthesia and a 6-F introducer sheath for arteriovenography. In the occluded segment, a hydrophilic-coated and steerable 0.035-inch guide wire was passed across the anastomosis until the arterial segment was reached. Balloon dilation was regularly performed to either treat the underlying stenosis or compress residual thrombus material. The balloon catheter size was usually 5 to 7×20 or 40 mm (generally oversizing by 1–2 mm). Four×20 mm balloons were chosen for angioplasty close to the AV anastomosis. High-pressure balloons were used because not infrequently they are required to break fibrous stenoses. The balloon was inflated until all wasting was eliminated or a maximum of 17 atm. A periprocedural parenteral anticoagulant was administered regularly at the beginning of the intervention (2,000 IU heparin). After the procedure was terminated, all patients underwent regular hemodialysis.

The outcome measures that were defined included the procedure-related complications and the end points of cumulative primary and assisted primary patency⁶⁾

Statistical analysis: Statistical differences between two groups were computed using the Kaplan-Meier method with $p < 0.05$ considered significant by the log-rank test.

RESULTS

Crossover: Twenty-four dilatations were performed on 18 patients. Two patients died with patent fistulas 2 months and 4 months after dilatation, respectively. The median procedure time from administration of the local anesthetic to acquisition of the last fistulogram was 65 minutes.

Primary patency (time to the second stenosis or

thrombosis of dialysis shunts following initial angioplasty without additional intervention or surgical revision) rates at 1 month, 6 months, and 18 months were 82.6, 67.5 and 38.5%, respectively. The technical success rate was 82.5%. The mean patency following PTA was 5.0 months. Complications occurred in 16.0% and included immediate shunt failures (12.0%) and ruptured native veins (4.0%).

Primary and secondary patency rates: Of the 18 cases of shunt trouble evaluated, five patients underwent PTA procedures more than two times because of poor shunt flow or shunt thrombosis. The secondary patency (time period to stenosis or thrombosis of dialysis shunts more than three times following angioplasty more than two times without additional intervention or surgical revision) rate was 80.0% at 6 months (Fig. 1). There was no significant difference between the rates of primary and secondary patency.

Assisted primary patency rate: To salvage stenotic or thrombosed dialysis shunts, surgical thrombectomy with or without revision has been routinely performed in our hospital. Before 1999, surgical shunt salvage was performed for 19 patients. The clinical characteristics (lesion morphology, age, sex, complications, and average shunt age at the time of procedure) of PTA and surgical groups were similar in all categories (data not shown). The cumulative assisted primary patency (time to the initial angioplasty or second surgical revision due to shunt stenosis or thrombosis in patients with prior surgical salvage) rates are shown in Fig. 2, with a median follow-up period of 35 months. The assisted primary patency rates at 12 months were 88.0% for the PTA group (one case with PTFE graft excluded) and 78.9% for the surgical group (all of those with native shunts), 80.7% and 57.5% at 3 years, and 40.4% and 25.5% at 8 years, respectively. There was no significant difference in the rate of assisted primary patency for the two forms of treatment.

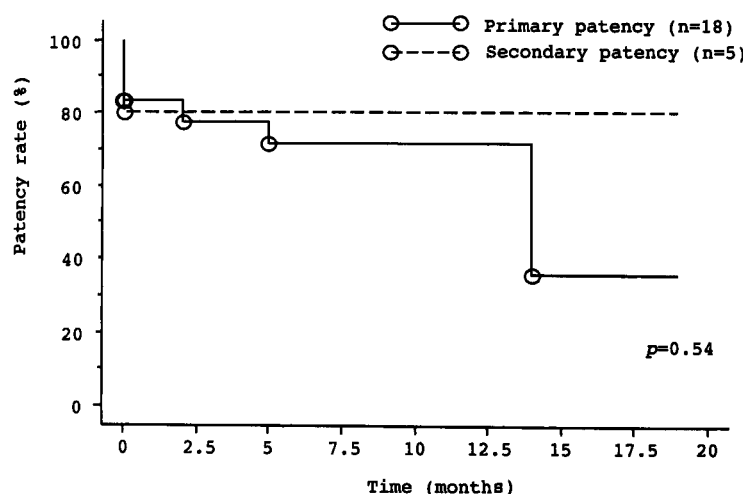
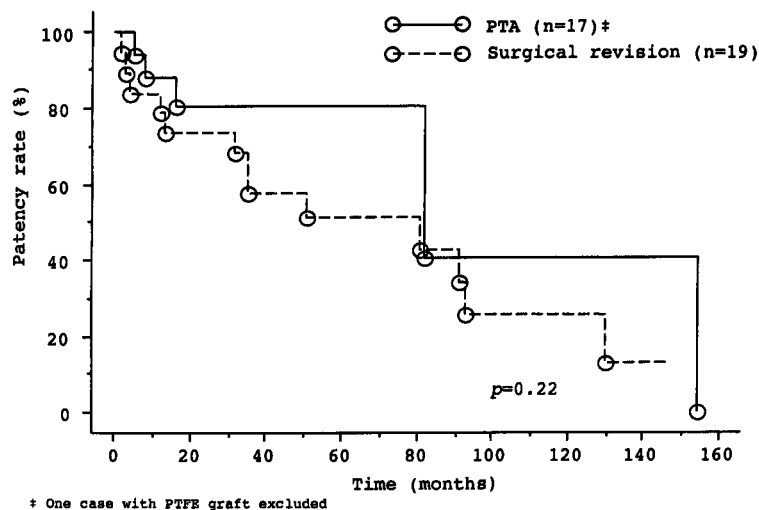


Fig. 1. Primary and secondary patency rates.



* One case with PTFE graft excluded

Fig. 2. Assisted primary patency life table by group.

DISCUSSION

The ideal hemodialysis fistula would be durable, easy to cannulate, and permit adequate flow rates with low pressure and minimal or no recirculation. Early detection and treatment of complications are essential to achieve long-term functional access for the hemodialysis patient. Stenosis or thrombosis of dialysis fistulas and grafts represents a frequent complication⁷⁾.

One limitation of the surgical approach is the lack of imaging guidance in the operating room to detect additional stenoses and obtain information on the often complex vessel anatomy. Conversely, performance of surgical thrombectomy in the radiologic laboratory requires a considerable amount of organization and a large staff. A solely percutaneous approach is therefore a cost-reducing, attractive alternative⁸⁾.

Some retrospective and prospective studies that compared surgical and endovascular treatments of autogenous A-V fistulas have been reported^{9,10)}. Burger et al. included 1179 interventions and reported a secondary cumulative patency rate at 2 years of 65% for patients with surgery as compared with 80% for endovascular treatment, a difference that was not statistically significant¹⁰⁾. Our retrospective study that compared percutaneous and surgical management to date may be inconclusive because of inadequate numbers or an inadequate length of follow-up. Thus we conclude that although long-term success is limited with both approaches, the patency rates for the patients who undergo treatment with endovascular therapy are comparable with the rates for the patients who undergo surgical treatment.

Numerous studies have shown transluminal angioplasty to be a useful procedure in treating stenoses of hemodialysis accesses^{2-5,9)}. Retrospective studies have reported success rates of 70% to

90% using PTA techniques to restore a functional shunt^{11,12)}. The primary patency rates were reported 50 to 80% at 3 months, and 40 to 50% at 6 months¹¹⁻¹³⁾. Fujiwara et al. suggested that repeated procedures allowed a significant improvement in secondary patency rates after PTA¹⁴⁾. We could not demonstrate a significant difference in the rates between primary and secondary patency because of the small number of patients and short length of follow-up, but our results suggested that repeated PTA has the possibility to increase patency.

Acute shunt thrombosis after PTA was seen in three cases of our series, suggesting the causes of elastic central vein stenoses. Stents may be useful in selected instances with limited residual access sites or surgically inaccessible lesions^{13,15)}.

The ideal test for determining dysfunction should be simple, inexpensive, and safe. Since no such ideal test exists, some authors have placed particular emphasis on routine physical examination, and the screening programs successfully detected access dysfunction¹⁶⁾. Our study did not place special emphasis on physical examination but attached greater importance to the venous pressure measurement, in particular to a gradual rise in pressure, and to the analytical determination results.

CONCLUSION

It is concluded that PTA can prolong hemodialysis fistulas successfully with a low level of complications. The lesions tend to recur, but they have a possibility to be retreated successfully, obviating surgery and preventing the depletion of potential vascular access sites.

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和文抄録

内シャント狭窄に対する PTA の有用性

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血液透析患者の内シャント不全に対する PTA の有用性を検討した。2000年4月から2001年11月までの19カ月間に行った18例24回の PTA について retrospective に検討した。男性11例, 女性7例, 平均63歳であった。狭窄部位は, 吻合部5病変, シャント静脈22病変, 計27病変であった。手技的成功率は82.5%, また1次開存率は1カ月で82.6%, 3カ月で74.5%, 半年で67.5%であった。5例で2次 PTA を施行し, その開存率は1次開存率と有意差を認めなかった。また

1次 PTA 群と外科的再建群での開存率に有意差を認めなかった。内シャント不全に対する PTA の1次開存率は外科的再建術と同等なものの, 初回 PTA 後の開存率は必ずしも高くない。また, 複数回の PTA 施行による開存率の向上が示唆された。重篤な合併症も見られず, PTA は内シャントトラブルに対する初回治療としての有用性が示唆された。

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