Femoro-femoral PTFE prosthetic implants for hemodialysis: Radiologic monitoring

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Purpose

Maintaining a functioning vascular access in hemodialysis patient remains an important and difficult problem. The gold standard in these patients is the autologous arteriovenous fistula (AVF). Sometimes the situation is different and complicated. In this case one must resort to the heterologous prosthetic implants, of which the PTFE (polytetrafluoroethylene) is the most used and recommended by the National Kydney Foundation (NKF) in clinical practice guide (DOQI).

The number of patients requiring hemodialysis HD for a long time is increasing, there for we recommend these accesses preserved as long as possible

In many cases the autologous and prosthetic vascular access is depleted in both upper limbs, the next step for obtaining a peripheral vascular access for hemodialysis, is the realization of a femoro - femoral PTFE prosthetic implants.

The purpose of our study is to demonstrate our experience in the radiological management of femoro-femoral PTFE prosthetic implants, including indications, diagnosis, monitoring and treatment of the most common complications like stenosis, thrombosis, prolonged bleeding, rupture, bruising, trauma, infections, among others.
Methods and Materials

The Vascular Interventional Radiology Unit of Reina Sofia Hospital, in Murcia, Spain, is one of the principal unit for hemodialysis vascular access in our region. It covers three secondary hospitals, with their corresponding hemodialysis units, and 7 peripheral dialysis centers.

We performed a retrospective study from January 2005 to December 2012. We analyzed all cases with femoro-femoral PTFE prosthetic implants. Of all patients analyzed, only 8 femoro-femoral PTFE prosthetic implants were found, (3 in the right lower limb and 5 in the left lower limb) in 7 patients. One patient had 2 PTFE. (Fig. 1 on page 5)

The gender distribution was 5 men (71.40%) and 2 women (28.60%), with an average age of 63 (R= 45 - 79). (Fig. 2 on page 5)

All patients had cardiovascular risk factors; the main cardiovascular risk was arterial hypertension (55% of cases), also diabetes (15%), dyslipidemia (30%) and smoking (30%), among others. (Fig. 3 on page 6)

The patients analyzed were heterogeneous, they came from five different hemodialysis units.

In general, patients have multiple diseases at the same time, with a long history of hemodialysis. The average time was 93 months (R: 22-183).

All patients had exhausted all vascular access sites in both upper extremities and suffered central venous injuries that made it impossible to place a central venous catheter.

For diagnostic and therapeutic reasons, we had 61 assists for the Vascular Interventional Radiology Unit, with an average of 8.7 assists per person.

The average age of the vascular access was 27.4 months (r: 3-109). (Table 1 on page 7)

The reasons for the consultation were very different. The most frequent reason for visits was prophylactic angioplasty which occurred in 19 cases.
Other reasons for which patients attended were: radiological controls and multiple complications of the PTFE, including thrombosis, rupture (Fig. 15 on page 18), hematoma, prolonged bleeding, puncture difficulty, edema, among others. (Fig. 4 on page 8)

Of the total visits, ultrasound guidance was performed on one hand in 9 instances without intervention, on the other hand, the 52 remaining visits needed some type of vascular intervention.

Hematoma was the most common injury monitored with ultrasound and without other radiological technique (37.5% of all lesions detected by ultrasound). Other injuries have been found, rupture (Fig. 5 on page 9), subcutaneous edema and pseudoaneurysm (Fig. 6 on page 10 - Fig. 7 on page 11).

On 11 occasions we objectively evaluated graft thrombosis, for an average time of fistula thrombosis of 4.7 days. (R: 1-14. (Fig. 8 on page 12 - Fig. 16 on page 19)

In total we performed 27 angioplasties, (Fig. 17 on page 20 - Fig. 18 on page 21) (14 angioplasties performed on the same patient). The dilatation balloons used were: CONQUEST 7 x 40, 10 x 40, 12 x 40, 14 x 40, 8 x 80; ATLAS 14 x 40, 16 x 40; BLUE MAX 6 x 40, 7 x 40, 8 x 40. The most commonly used was ATLAS 14 x 40 (24%), the second CONQUEST 10 X 40 (21%). In most cases, we used more than one balloon in the same intervention, starting with the smaller caliber ones and ending with the highest caliber. (Fig. 9 on page 13 Fig. 10 on page 14 Fig. 11 on page 15 Fig. 12 on page 16)

We performed five thrombectomies, 4 of them were only with manual aspiration maneuvers and in only one we needed a Fogarty.

We have implanted 11 stents (Fig. 19 on page 22) (5 VIABHAN, 5 FLUENCY and 1 EVERFLEX) in 4 patients. The main cause of stent implantation was the pseudoaneurysm (36% of the stent), other causes were: Iliac vein stenosis, stenosis elastic with a tendency to shrink, loop, Elastic Recoil, mural thrombus attached and in one case, a rupture of a previous stent. (Fig. 13 on page 17)
Fig. 1: Fistula location.

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Fig. 2: The gender distribution.
Fig. 3: Cardiovascular risk factors

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**Table 1:** Distribution of hemodialysis patients according to treatment.

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Fig. 4: Reason for visits

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Fig. 5: Power Doppler images show PTFE rupture

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Fig. 6: Gray-scale US image shows heterogeneous mass. Color Doppler image shows normal flow next to the hematoma.

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Fig. 7: Gray-scale US image show subcutaneous edema, like an incidental diagnosis.

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Fig. 8: Graft thrombosis.

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**Fig. 9:** fistulography with occlusion, after the procedure.

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Fig. 10: Fistulography with occlusion, below the procedure (PTA)

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**Fig. 11:** PTA procedure.
Fig. 12: PTA procedure.

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**Fig. 13:** Prosthetic dialysis fistulas with stents.

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Fig. 15: Video show PTFE rupture

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Fig. 16: Graft thrombosis

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Fig. 17: Fistulography with occlusion, after the procedure

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Fig. 18: Fistulography with occlusion, below the procedure (PTA)

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Fig. 19: implantacion stent

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Results

Of all angioplasties performed, 19 were prophylactic, with a mean time interval between them of about 2.2 months.

Of 27 angioplasties performed, there were no immediate complications, getting a good post angioplasty flow in 100% of cases, objectified by physical examination and ReoCath catheter’s flow measurement. (Fig. 14 on page 25) The most common lesion was dilated venous anastomosis (#10). Table 1 on page 25

We had no immediate complications during thrombectomy resulting in permeability and good flows immediately post interventional.

In 24 cases the flow was measured with ReoCath catheter, showing an average flow of 1120 ml/min. In 22 cases the flow was measured by ultrasound, showing an average flow of 1287 ml/min.

Overall results:

• Of 8 PTFE in 7 patients, 3 were functioning until the end of the follow up.
• Mean survival was 27 months (range 4-108 months).
• The secondary permeability at 6, 12 and 24 months respectively were 62.5% +/−17.1, 62.5% +/−17.1% and 37.5 +/−17.1.
Images for this section:

Fig. 14: US and ReoCath flow measurement.

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Conclusion

- Performing femoro-femoral PTFE prosthetic implants is a very good intervention of patients exhausted of all vascular access sites in both upper extremities and central venous injuries that made it impossible to place a central venous catheter.

- The femoro-femoral PTFE prosthetic implants of vascular interventional radiology follow-up and monitoring suppose a permeability’s time prolongation. We have to performe a periodic evaluation of the function and correction of detected faults.

- Our results clearly demonstrate the importance of an active attitude to these patients and the intervention by a specialized team, with extensive experience and adequate infrastructure.
References
