

Ambulatory surgery of patients with arteriovenous fistulas for haemodialysis. Integrated activity in a department of general surgery

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Nefrologia 2010;30(4):452-7

doi:10.3265/Nefrologia.pre2010.May.10420

ABSTRACT

Introduction: The increase of prevalent haemodialysis patients is a challenge for surgery units. Vascular access related complications are the main cause of hospital admissions in many dialysis units. Outpatient surgery could decrease waiting lists, cost and complications associated to vascular access. **Material and methods:** We have performed a prospective study of the vascular access related surgery in a ten year period. Outpatient surgery was included with the rest of the activity in a general surgery unit and was performed by not exclusive dedicated surgeons. **Results:** Since 1998 to December 2009 we performed 2,413 surgical interventions for creating and repairing arteriovenous fistula in 1,229 patients, including elective and emergency surgery (74.8% and 25.2% respectively). Outpatient procedures were performed in 82% of cases (89% in elective and 60% in emergency surgery). There were unexpected admissions secondary to surgical complications in 6% of patients. There was no postoperative mortality. The rate of admissions was 0.09 events and 0.2 days per patient/year. **Conclusions:** Outpatient surgery is possible in a high percentage of patients to perform or to repair an arteriovenous fistula, including emergency surgery. Vascular access surgery can be included in ordinary activity of a surgical unit. Outpatient vascular access surgery decreases unnecessary hospital admissions, reduces costs and nosocomial complications.

Key words: Hemodialysis vascular access, Outpatient surgery.

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Cirugía sin ingreso de pacientes con fistulas arteriovenosas para hemodiálisis. Actividad integrada en un servicio de cirugía general

RESUMEN

Introducción: El aumento de pacientes que precisan tratamiento renal sustitutivo, sobre todo en el grupo de pacientes sometidos a hemodiálisis, supone un reto en incremento de actividad y de ocupación de recursos para los servicios de cirugía. Las complicaciones relacionadas con los accesos vasculares son la causa fundamental de ingresos en muchas unidades de diálisis. La cirugía sin ingreso puede disminuir la ocupación de camas hospitalarias, reduce la lista de espera y las complicaciones relacionadas con un ingreso innecesario. **Material y métodos:** Hemos realizado un estudio prospectivo de las intervenciones realizadas en el período 1998-2009 para la creación o la reparación de fistulas arteriovenosas (FAV) para hemodiálisis, con el objetivo de conocer el nivel de ambulatorización, resultados, complicaciones y su posible impacto en la tasa de ingresos de los pacientes en hemodiálisis. La actividad fue realizada dentro del funcionamiento global del servicio de cirugía general sin unidad específica de cirugía mayor ambulatoria (CMA). Las intervenciones las realizaron varios cirujanos del servicio interesados en el tema, pero sin dedicación exclusiva a éste (su actividad es la de cualquier cirujano general) y sin guardias específicas. La cirugía ambulatoria se organizó dentro de la actividad ordinaria del servicio de cirugía general sin una unidad específica, ni cirujanos especialmente dedicados a la misma. **Resultados:** Desde la apertura de nuestro hospital en 1998 hasta diciembre de 2009 hemos realizado un total de 2.413 intervenciones en 1.229 pacientes (primeros accesos y reparaciones de los mismos). La cirugía programada supuso el 74,8% de las interven-

ciones; el 25,2% restante fueron intervenciones urgentes. El porcentaje global cirugía ambulatoria fue del 82% (89% en cirugía programada y 60% en cirugía urgente). Se produjeron un 6% de ingresos imprevistos. No hubo mortalidad postoperatoria. El número de ingresos fue de 0,09 episodios por paciente año con una estancia media de 0,2 días por paciente y año. **Conclusiones:** La mayoría de las intervenciones relacionadas con las FAV, incluso la cirugía urgente, se pueden realizar en régimen ambulatorio dentro de la actividad habitual de un servicio de cirugía. Se evitan así costes asociados con la ocupación de camas hospitalarias y se disminuyen las complicaciones relacionadas con el ingreso.

Palabras clave: Fístula arteriovenosa, Cirugía sin ingreso.

INTRODUCTION

The incidence and prevalence rates of patients requiring renal replacement therapy (RRT) have increased by more than 100% over the past 15 years, from 61 and 392 per million population (pmp) in 1991 to 132 and 1,009 pmp in 2007, respectively.¹ The age group that recorded a greater percentage increase in the prevalence rate is that of patients over 75 years of age (from 8.5% in 1992 to 40% today). In this group, most patients are treated with haemodialysis (94% of incident patients) while few change techniques throughout their life. To summarise, we are seeing an increase in the demand for arteriovenous fistulas (AVF) for haemodialysis from nephrology departments. It is therefore more complicated for the departments of surgery to maintain adequate quality of care indicators. This is a national problem and some nephrology departments have decided to deal with it.²

We believe that the majority of surgical procedures for the creation and repair of AVF for haemodialysis can be performed on an outpatient basis, including emergency thrombosis repair. In this sense, we achieve a decrease in hospital stay, in unnecessary catheter use and in the waiting list of surgeries that are favoured.

Since its inauguration, our hospital has a programme of ambulatory surgery, which is integrated in the overall activity of the department of surgery. In addition, this programme is supported by a multidisciplinary team dedicated to the care of vascular access for haemodialysis, which consists of nephrologists, general surgeons, interventional radiologists and nursing professionals. The aim of this group was to standardise the procedures related to vascular access for haemodialysis (both its creation and maintenance), as well as monitoring the results through the application of quality of care indicators.³⁻⁵

MATERIAL AND METHODS

Scope

Our hospital serves the vascular access for haemodialysis in a healthcare district in the Community of Madrid of 550,000 inhabitants. In addition, it frequently serves the units in the provinces of Avila and Segovia (250,000 inhabitants). Finally, the hospital also performs procedures in other healthcare districts, where we work temporarily (Leganes, Alcala de Henares, Badajoz and Guadalajara). In our hospital, medical records are computerised and there is a specific protocol for interventions related to AVF, which the surgeon in charge fills in after the intervention. The activity was carried out within the overall functioning of the department of general surgery without a major ambulatory surgery unit (MASU). The interventions were performed by 4 surgeons of the department, who were interested in the subject but without working exclusively on it (its activity is that of any general surgeon) and without being on special duty.

Patients

The study patients were referred for their first AVF to our department following a visit of advanced chronic kidney disease (ACKD), as well as from dialysis units in the case of patients who started haemodialysis without previous vascular access. All patients were older than 18 years, since there is no child surgery or nephrology unit in our hospital.

Preoperative evaluation and selection

Almost all patients were put on the waiting list for ambulatory surgery, except in the following situations:

1. No family/companions.
2. Anticoagulation (an attempt was made to perform an outpatient reversal, but this was not always feasible).
3. Patient refusal.

AVF thrombosis was considered a complication that should be addressed urgently (within 24 to 36 hours, depending on the patient's clinical status) to avoid the unnecessary use of catheters. The emergency procedures were performed at the centre and the operating theatres of the emergency department.

The emergency interventions comprised patients admitted with a higher rate of the following:

1. Treatment of infections.
2. Social reasons at the time of the surgery.
3. Need to coordinate the procedure with the nephrology department.

4. Increased percentage of suboptimal results that required observation or imaging tests.

Surgical procedure

Almost all of the interventions (regardless of the type of AVF and its location) were carried out under local anaesthesia.

We used 1% mepivacaine in cases requiring a small volume of anaesthetic (autologous fistulas), and 0.25% bupivacaine cases where the surgical field was wider (prosthetic fistulas or complex repairs). We performed another anaesthetic technique (locregional or general) in the following cases:

1. Surgery for severe infections.
2. Lack of patient cooperation.
3. Need for extensive dissection.

Where necessary, a 6 mm expanded polytetrafluoroethylene (ePTFE) (PTFE standard wall/stretch, Gore-tex®) was the prosthesis used.

The autologous AVF thrombosis was treated with proximal re-anastomosis or repair with prosthetic bridge. The prosthetic AVF thrombosis was treated by performing a thrombectomy with Fogarty catheter and bridge to a proximal vein, proximal artery or partial replacement of ePTFE according to the cause detected. Fistulography was performed, as well as radiology treatment through angioplasty of the stenosis, if it was present, when the origin of the thrombosis was not detected during surgery (thrombectomy without difficulty and smooth functioning of the AVF).

The cases of steal syndrome were treated with banding or ligation of the AVF, according to the severity of the symptoms and the possibility of rescuing the access.

The prosthetic infections were treated with complete removal of the graft and arterial repair with a vein patch.

Surgical protocol

Following the intervention, all interventions were recorded prospectively in a specific form with the following paragraphs:

1. Demographics (age, gender, referring hospital, medical history number, date of intervention).
2. Nature of the intervention (emergency or scheduled).
3. Type of hospitalisation (MASU or hospital admission).
4. Diagnosis (first access, dysfunction, etc.).
5. Current AVF type (in repairs).

Postoperative protocol

The patients are transferred from the operating room to the day hospital, where they stayed for an average of two hours for observation. The nursing staff checked the proper functioning of the access. The patients were discharged if the constant values were normal and there were no complications. They subsequently go to nursing and nephrology consultations to decide the start of the punctures. Concerning autologous AVF, the delay is at least 4 weeks. The prosthetic AVFs are punctured in no less than 2 weeks if the patient needs them due to a malfunctioning catheter, although the guidelines recommend delaying punctures up to 4 weeks (we have not found complications secondary to a puncture at 2 weeks).

In addition, we prospectively filled in a form to know the percentage of unscheduled hospitalisations related to complications (patients initially scheduled for ambulatory surgery), the average postoperative hospital stay and the hospitalisation days in patients who required hospital stay, so that they could be analysed as an indicator (rate of hospitalisation and days of hospitalisation/patient/year).

Compliance

We reviewed all surgical protocols and forms on MASU created between 1998 and 2009 to discuss the types of intervention performed and their ambulatory implementation level.

Nurses and nephrologists in charge of the unit performed the monitoring of AVF malfunctions and, where necessary, they requested a fistulography.

Access thrombosis was considered a complication that should be addressed immediately within 24 hours to avoid the unnecessary use of catheters.

RESULTS

Since the opening of our hospital in 1998 until December 2009, a total of 2,410 interventions were performed in 1,229 patients (1.96 interventions per patient) for the creation or repair of AVF.

This type of intervention represented 22% (13-36%) of the total activity of ambulatory surgery, which belongs to the department of surgery, during this decade.

Demographic characteristics

1. Age: a mean of 68 years (range: 17-90) with 40% over 75 years.

2. Gender: 61% male and 39% female.
3. Charlson comorbidity index mean: 6.

The most frequent surgery (59%) was the creation of a new vascular access, performing 88.5% with no hospitalisation. Repairs (41% of the total interventions) were performed as ambulatory surgeries in 73% (Table 1)

Local anaesthesia was used in 98.8% of the interventions, general anaesthesia in 0.8% and locoregional anaesthesia in 0.3%.

The interventions were chosen in 74.8% of the cases. The rest (25.2%) were performed urgently in the first 24 to 36 hours of the incident in 80% of thromboses, thus achieving the rescue of the AVF in 80% of the cases. The interventions were carried out by 3 surgeons from the department of general surgery. With their on-duty days (5 days per month per surgeon), care was covered for 50% of the days.

A total of 1,980 interventions were carried out without hospitalisation (82%). Ambulatory surgery was 89% when the surgery was scheduled. Concerning emergency surgery, ambulatory surgery accounted for 60%.

Unscheduled hospitalisations were 6% (the most frequent causes involved early malfunction of the access and haemorrhage).

The mean postoperative hospital stay was 112 min, while there were no postoperative deaths.

The number of admissions in relation to AVF surgery (excluding admissions related to catheters) in our health district was 0.09 per patient per year. The average hospital stay in our hospital associated with surgery for arteriovenous AVFs for haemodialysis was 0.2 days per patient per year. These admissions constitute 12% of all admissions of patients on haemodialysis.

DISCUSSION

Surgery departments are facing a major healthcare challenge generated by the increasing number of patients on haemodialysis.^{1,2} The maintenance of appropriate quality indicators gives rise to a high number of surgeries per year, which leads to an increase in waiting lists and occupancy of hospital beds. In our experience, this constitutes the second most common disease operated with ambulatory surgery (this is partly due to the performance of AVF surgery at other centres.) This is an important intervention for the outcome of patients on haemodialysis, and it is a well-known factor which has a significant impact on the survival of patients on haemodialysis.^{6,7}

Both the creation and repair of an AVF are technically complex surgeries, which should be performed by trained

Table 1. Type of surgical interventions

Diagnosis	Procedure	MASU (%)
New AVF 59%		88.5%
	<i>Autologous AVF (total)</i>	91.5%
	Radial fossa	86%
	Radiocephalic	92.7%
	Humero-cephalic	89.3%
	Humero-basilic	92.3%
	<i>Prosthetic AVF (total)</i>	80%
	ePTFE antebrachial loop	88%
	Humerus axillary ePTFE	75%
AVF malfunction 41%		73%
	Proximal radiocephalic	89%
	Venovenous ePTFE	87%
	Simple thrombectomy	63%
	Thrombectomy and <i>bypass</i>	65%
	Partial ePTFE substitution	71%
	Removal of prosthesis	51%
	<i>Banding</i>	92%
	Ligature of collateral branches	69%
	AVF ligature	92%
Total No of interventions		82%
Scheduled surgery		89%
Emergency surgery		60%

surgeons. However, they are carried out in a surgical field that is limited in size and depth, which allows for the use of local anaesthesia. The technical results can be assessed immediately: haemorrhage and early failure of the access can be treated in the same episode, thus maintaining ambulatory surgery in some cases. The patient hospitalisation does not modify the frequency of appearance of other late complications (infection or steal syndrome). For all these reasons, with a few exceptions, surgery related to AVFs can be performed without problems in ambulatory surgery.⁹⁻¹⁶

Ambulatory surgery can be arranged at a hospital as an activity or as a separate unit. Due to the characteristics of our hospital, in our case it is organised as an activity within the department of general surgery, since there is no unit of ambulatory surgery.

Approximately 60% of the interventions were carried out for the creation of an access and 40% to treat malfunctions. When a patient was operated to create a new vascular access, the percentage was closer to 90%, including the placement of prosthetic parts. The intervention with the smallest percentage is the treatment of infections of the vascular access with systemic impact (2% of interventions), which in our experience require complex surgical procedures for the removal of the access and vascular repair. In these cases, 100% of the patients were admitted, while general or locoregional anaesthesia was mostly used.

In surgical emergencies, ambulatory surgery was more complex; however, we managed to perform it in approximately 60% of the interventions.

Some of the reasons for hospital admission (emergency surgery, social problems and suspected early malfunction) could be avoided; however, this requires a greater allocation of resources for the continuous attention of the departments involved.

We believe that one of the pillars of the high percentage of patients treated as outpatients is the use of local anaesthesia in the vast majority of interventions (98.8%). We found no adverse reactions related to the use of 1% mepivacaine or 0.25% bupivacaine. We have therefore avoided any possible admissions associated with anaesthesia complications.

In this series, the unscheduled hospitalisations (6%) were mostly secondary to surgical complications (haemorrhage and malfunction in 90% of the cases). Haemorrhagic complications were primarily self-limited hematomas, and in very few cases required review surgery, where patients were admitted for observation. The other most common reason for admission was observation following the review of an access with early failure or malfunction (in these cases, the surgeon decided to admit the patient with empiric heparinisation for a

few hours). In most cases, hospital admission was limited to a 24-hour observation.

The results of our group regarding ambulatory percentages are comparable to those referred to in previous publications¹⁷⁻²⁶ by reference groups. However, it should be noted that the activity was carried out under the overall functioning of the department of general surgery without a specific MASU unit by a number of surgeons interested in the subject but not working exclusively on this (their activity is that of any general surgeon) and without being on special duty.

To conclude, we believe this working protocol has a clear impact on the reduction of hospitalisations related to vascular access complications, which in our experience is inferior to those mentioned in other publications,²⁷⁻²⁹ concerning both the rate of hospitalisations as days of hospitalisation and the cause of admission compared with other diseases. These results can be improved, especially in cases of emergency surgery attempting to rescue the majority of the AVFs. Nevertheless, this requires the presence of a coordinator and special on-duty days for the members of the working group (surgery, nephrology, interventional radiology and nursing in dialysis).

REFERENCES

1. Sociedad Española de Nefrología. Diálisis y trasplante en España. Informe preliminar del Registro Español de Enfermos Renales (2007). XXXVIII Congreso Nacional de la Sociedad Española de Nefrología.
2. García-Trío G, Alonso M, Saavedra J, Cigarrán S, Lamas JM. Gestión integral del acceso vascular por los nefrólogos. Resultados de tres años de trabajo. *Nefrología* 2007;27:335-9.[PubMed]
3. Gruss E, Portolés J, Jiménez P, Hernández T, Rueda JA, Del Cerro J, et al. Seguimiento prospectivo del acceso vascular en hemodiálisis mediante un equipo Multidisciplinar. *Nefrología* 2006;26:703-10. [PubMed]
4. Jiménez-Almonacid P, Gruss E, Lorenzo S, Lasala M, Hernández MT, Portolés J, et al. Definición de procesos e indicadores para la gestión de accesos vasculares para hemodiálisis. *Cir Esp* 2007;81(5):257-63.[PubMed]
5. López Revuelta K, Barril G, Caramelo C, Delgado R, García F, García J, et al. Grupo de gestión de calidad SEN: Álvarez Ude F, Angoso M, Aranaz J, Arenas MD, Lorenzo S, López Revuelta K. Developing a clinical performance measures system for hemodialysis, quality group, spanish society of nephrology. *Nefrología* 2007;27(5):542-59.[PubMed]
6. Gruss E, Portolés J, Tato A, Hernández MT, López-Sánchez P, Velayos P, et al. Clinical and economic repercussions of tunneled hemodialysis catheter use in a health care area. *Nefrología* 2009;29(2):123-9.[PubMed]
7. Allon M, Daurgidis J, Depner TA, Greene T, Ornt D, Schwab SJ. Effect of change in vascular access on patient mortality in hemodialysis patients. *Am J Kidney Dis* 2006;47(3):469-77.[PubMed]

8. Piera L, Cruz JM, Braga-Gresham JL, Eichleay MA, Pisoni RL, Port FK. Estimación, según el estudio DOPPS, de los años de vida de pacientes atribuibles a las prácticas de hemodiálisis modificables en España. *Nefrología* 2007;27:496-504.[PubMed]
9. Jiménez-Almonacid P, Del Río JV, Lasala M, Rueda JA, Vorwald P, Fernández JM, et al. Primer acceso vascular no autólogo para hemodiálisis. Prótesis de PTFE húmero-antecubital curva de antebrazo. *Nefrología* 2004;24:559-63.[PubMed]
10. Jiménez Almonacid P, Criado Pallarés E, Quintans Rodríguez A, Sanabria Valdés J, Rueda Orgaz JA, Polo JR. Comparative study of use of Diastat versus standard wall PTFE grafts in upper arm hemodialysis access. *Ann Vasc Surg* 2000;14(6):659-62.[PubMed]
11. Polo JR, Tejedor A, Polo J, Sanabria J, Calleja J, Gómez F. Long-term follow up of 6-8 mm brachioaxillary PTFE grafts for hemodialysis. *Artif Organ* 1995;19:118-24.
12. Polo JR, Sanabria J, Serantes A, Fiuza C, Menárguez C, Gómez F, et al. Prótesis de PTFE húmero-axilares para diálisis. *Nefrología* 1992;12:416-23.
13. Polo JR, Jiménez P, Sanabria J, Polo J, Calleja J, Echenagusía A, et al. Prótesis humeroyugulares para hemodiálisis. *Angiología* 1995;2:89-94.
14. Polo JR, Sanabria J, García JL, Luño J, Menárguez C, Echenagusía A. Brachial-jugular Polytetrafluoroethylene fistulas for hemodialysis. *Am J Kidney Dis* 1990;16:465-8.[PubMed]
15. Polo JR, Polo J, Pacheco D, Vázquez R, Sanabria J, Romero R. Ambulatory surgery for PTFE grafts for dialysis. *Amb Surg* 1997;5:149-51.
16. Polo JR, Sanabria J, Serantes A, Morales R. Ambulatory surgery for vascular access for hemodialysis. *Nephron* 1993;64:323-4.[PubMed]
17. Didlake R, Curry E, Rigdon EE, Raju S, Bower J. Outpatient vascular access surgery: impact of a dialysis unit-based surgical facility. *Am J Kidney Dis* 1992;19:39-44.[PubMed]
18. Wilson SE, Connall TP, White R, Connolly JE. Vascular access surgery as an outpatient procedure. *Ann Vasc Surg* 1993;7(4):325-9.[PubMed]
19. Murphy GJ, White SA, Nicholson ML. Vascular access for haemodialysis. *Br J Surg* 2000;87(10):1300-15.[PubMed]
20. Sands JJ, Perry MA. Improving vascular access outcomes: a systems approach to eliminating structural barriers. *Blood Purif* 2003;21(1):111-7.[PubMed]
21. Mishler R, Sands JJ, Ofstun NJ, Teng M, Schon D, Lazarus JM. Dedicated outpatient vascular access center decreases hospitalization and missed outpatient dialysis treatments. *Kidney Int* 2006;69(2):393-8.[PubMed]
22. Becker BN, Breiterman-White R, Nylander W, Van Buren D, Fotiadis C, Richie RE, et al. Care pathway reduces hospitalizations and cost for hemodialysis vascular access surgery. *Am J Kidney Dis* 1997;30(4):525-31.[PubMed]
23. Rocco MV, Bleyer AJ, Burkart JM. Utilization of inpatient and outpatient resources for the management of hemodialysis access complications. *Am J Kidney Dis* 1996;28(2):250-6.[PubMed]
24. Cull DL, Taylor SM, Russell HE, Langan EM, Snyder BA, Sullivan TM. The impact of a community-wide vascular access program on the management of graft thromboses in a dialysis population of 495 patients. *Am J Surg* 1999;178(2):113-6.[PubMed]
25. Perry Arnold W. Improvement in hemodialysis vascular access outcomes in a dedicated access center. *Semin Dial* 2000;3:359-63.[PubMed]
26. Kian K, Takesian K, Wyatt Ch, Assalotti J, Mishler R, Schon D. Efficiency and outcomes of emergent vascular access procedures performed at a dedicated outpatient vascular access center. *Semin Dial* 2007;20:346-50.[PubMed]
27. Reichert J. Consultas e ingresos hospitalarios de una población de un centro de diálisis. *Nefrología* 2007;27:53-61.[PubMed]
28. Gruss E, Caramelo C, Fernández J, Martínez S, Gago C, Marco B, et al. ¿Por qué acuden los pacientes de hemodiálisis extrahospitalaria a los servicios de urgencia hospitalarios? *Nefrología* 2000;4:336-41.[PubMed]
29. Rayner H, Besarab A, Brown W, Disney A, Saito A, Ronald L, et al. Vascular access results from the Dialysis Outcomes and Practice Patterns Study (DOPPS): Performance against Kidney Disease Outcomes Quality Initiative (K/DOQI) Clinical Practice Guidelines. *Am J Kidney Dis* 2004;44(2):22-6.