NEFROLOGÍA. Volumen 25. Número 3. 2005

Permanent vascular access in the elderly patient who starts on hemodialysis: fistulae or catheter?

Mª. J. García Cortés, G. Viedma, M. C. Sánchez Perales, F. J. Borrego, J. Borrego, P. Pérez del Barrio, J. M. Gil Cunquero, A. Liébana and V. Pérez Bañasco
Nephrology Department. Hospital complex of Jaén.

SUMMARY

Autologous access is the best vascular access for dialysis also in older patients and it should be mature when patient needs hemodialysis. It is not always possible. Surgeon availability and demographic characteristics of patients (age, diabetes, vascular disease...) are factors that determine primary vascular access.

Aim: *To analyse outcome and vascular access complications in elderly who start hemodialysis without vascular access.*

Patients and Methods: *All patients older than 75 years who initiated hemodialysis without vascular access between January 2000 and June 2002 were included, They were divided en two groups depending on primary vascular access. GI: arterio-venous fistulae. GII: Tunnelled cuffed catheter. Epidemiological and analytical data, vascular access complications related, as well as patient and first permanent vascular access survival from their inclusion in dialysis up to December 2002 were analysed and compared in both groups.*

Results: *32 patients were studied. GI: n = 17 (4 men) and GII: n =1 5 (8 men), age: 79.9 ± 3.8 and 81.7 ± 4 years respectively (ns). There were no differences in sex and comorbidity (diabetes, ischemic heart disease, peripheral vascular disease and hypertension). It took GI 3 months to get a permanent vascular access suitable for using, while it took GII 1.3 months ($p < 0.005$) The number of temporary untunnelled catheters was higher in GI (3.35* vs *1.87 $p < 0.05$).*

Vascular access complications: *70.6% of infections occur in GI (incidence (I) = 48 infections/100 patients-year) while only 29.4% were detected in GII (I = 25 infections/100 patients-year). 70% of central venous thrombosis happen in GI (I: 25 CVT/100 patients-year) vs 30% in GII (I = 14.4/100 patients-year) (ns). No significant differences neither in bleeding (66.7%* vs *33.3%) nor ischemia (75%* vs *25%) were found. Dialysis dose (Kt/V) as well as anaemia degree were similar in both groups. Permanent vascular access survival after 2 years was 45.8% in GI and 24 % in GII (ns). Patient survival was similar in GI and GII (72%* vs *51% ns).*

Conclusions: *Elderly who start hemodialysis without vascular access took longer to get a suitable permanent vascular access when arterio-venous fistulae is*

Correspondence: Dra. M.ª José García Cortés
C/ Manuel Caballero Venzalá, n.º 2, 6.º C
23009 Jaén
E-mail: mjgarciac@supercable.es

placed than with a tunnelled cuffed hemodialysis catheter. As a consequence, vascular access complications are larger, infection ones are the most common. In these patients a tunnelled catheter should be inserted at the time a peripheral arterio-venous access is created, in order to avoid temporary untunnelled catheters

Key words: **Vascular access. Elderly. Catheter. Arteriovenous fistulae**.

ACCESO VASCULAR PERMANENTE EN PACIENTES DE EDAD AVANZADA QUE INICIAN HEMODIÁLISIS: ¿FÍSTULA O CATÉTER?

RESUMEN

Introducción: *La fístula arteriovenosa (FAV) autóloga es el acceso vascular permanente (AVP) de elección en los pacientes en hemodiálisis y debería realizarse en prediálisis. Esta situación ideal no siempre es posible. La disponibilidad del cirujano vascular y las características del paciente (edad, comorbilidad..) son factores que, entre otros, determinan el acceso vascular de inicio.*

Objetivo: *Estudiar la evolución y complicaciones derivadas del acceso vascular en pacientes de edad avanzada, que comienzan hemodiálisis sin acceso vascular funcionante.*

Pacientes y Métodos: *Incluimos los pacientes mayores de 75 años que iniciaron hemodiálisis desde Enero del 2000 hasta Junio del 2002 sin acceso vascular permanente funcionante. Los clasificamos en dos grupos según el primer AVP realizado (Grupo I: FAV, Grupo II: Catéter Permanente). Analizamos y comparamos en ambos grupos datos epidemiológicos, analíticos, complicaciones derivadas del acceso vascular y supervivencia de pacientes y del primer AVP funcionante desde su inclusión en diálisis hasta Diciembre de 2002.*

Resultados: *Estudiamos 32 pacientes. GI: n = 17 (4 hombres) y GII: n = 15 (8 hombres), edad 79,9 ± 3,8 y 81,7 ± 4 años respectivamente (ns). No existían diferencias en sexo, nefropatía de base y comorbilidad (diabetes, cardiopatía isquémica, arteriopatía periférica e HTA). El GI tardó 3 meses en conseguir un AVP funcionante y el GII 1,3 meses (p < 0,05). El número de catéteres transitorios fue mayor en GI (3,35* vs *1,87 p < 0,05).*

Complicaciones derivadas del acceso vascular: *El 70,6% de las infecciones ocurren en GI (Incidencia (I): 48 infecciones/100 pacientes-año) frente al 29,4% en GII (I = 24 infecciones/100 pacientes-año) p < 0,05. El 70% de las trombosis venosas profundas se dan en GI (I: 25 TVP/100 pacientes-año) frente 30% en GII (I = 14,4/100 pacientes-año) (ns). No se encontraron diferencias en hemorragias (66,7%* vs *33,3%) ni isquemia (75%* vs *25%). La eficacia de diálisis (Kt/V) y el grado de anemia fue similar en ambos grupos. La supervivencia del AVP a los 2 años en GI fue 45,8% y en GII 24 % (ns). La supervivencia de los pacientes fue similar en GI y GII (72%* vs *51% ns).*

CONCLUSIONES: *Los pacientes de edad avanzada que inician hemodiálisis sin acceso vascular tardan más tiempo en conseguir un AVP funcionante cuando se opta por una FAV frente a un catéter permanente. Como consecuencia, las complicaciones derivadas del acceso vascular son mayores, siendo más frecuentes las infecciosas. Una opción para estos pacientes sería la colocación de 1 catéter permanente como primer acceso vascular y la realización simultánea de una FAV, manteniendo el catéter hasta el desarrollo de la misma.*

Palabras clave: ***Acceso vascular. Fístula arteriovenosa. Catéter***.

INTRODUCTION

Elderly and diabetic patients with additional vascular pathology represent a growing group in every dialysis unit. Preexistent arterial and venous problems make difficult to achieve and adequate vascular access for hemodialysis.[1-8] Since creation of the arterial-venous fistulae (AVF) by Cimino and Brescia in 1966, scant technical advances have been made in this area that may bring a solution to the vascular access problem in the particular group of patients.[5,9-11] This fact contributes to the inclusion of a considerable number of patients in chronic hemodialysis program without a permanent vascular access, which forces the increasing use of catheters, both temporary and permanent, that lead to severe complications, such as infection and thrombosis,[12-17] even with optimal technical and maintenance conditions.

In this study, we seek to analyze the course and complications derived form the vascular access in elderly patients who star on hemodialysis without a functioning vascular access.

PATIENTS AND METHODS

We included all patients older than 75 years who started on hemodialysis from January 2000 until June 2002, without a permanent functioning vascular access. In all patients, a non-funneled temporary catheter was placed.

Patients were assessed by the same vascular surgeon, who determined the type of permanent vascular access with the highest success chance according to arterial and venous possibilities in the upper limbs. Assessment included a physical examination, Doppler ultrasound and/or phlebography depending on the vascular surgeon's judgment. This decision categorized patients into two groups: group I (G I) was made up of patients scheduled to AVF creation, both autologous or prosthetic; and group II (G II) was made up of patients scheduled to placement of a funneled catheter in the jugular vein.

Observation period ended by December 2002. Patients' follow-up was done from their inclusion in hemodialysis to the end of the observation period, or switch to peritoneal dialysis, or exitus, or in G I, placement of a funneled catheter.

In both groups we determined:

– Epidemiological parameters: age, gender, cause of renal failure, time on hemodialysis, ischemic heart disease, arterial hypertension, and peripheral vascular disease.

– Analytical data, oriented to indirectly assess dialysis efficacy, at baseline, and 6 and 12 months: hemoglobin, hematocrit, phosphorus and potassium.

– We calculated BMI and Kt/V (Daugirdas 2nd generation).

– Vascular access-derived complications: infectious, hemorrhagic, and deep venous thrombosis episodes. For each group, all adverse events derived from the vascular access and that occurred during the follow-up period were recorded, independently of type of vascular access present. We define as infectious complications of the vascular access: local signs of infection or fever episodes with no other known infectious cause.

– Number of non-funneled temporary catheters placed during the observation period.

– Time elapsed from hemodialysis onset to achievement of a functioning vascular access. We define as functioning vascular access the one used for longer than a month with bipuncture and a flow over 250 mL/min.

– Maturation time, defined as time elapsed from creation of AVF to its use as a functioning vascular access.

– Number of permanent vascular access performed in each patient until achieving the first functioning one.

– Patient's survival and survival of the first functioning permanent vascular access.

Statistical analysis: results are presented as arithmetic mean ± standard deviation. For groups comparison, the Student's t test was used for non-paired samples and quantitative variables, and Chi-squared test for qualitative variables. Complications incidence is presented as number of complications/100 patients-year.

Survival analysis for patients and vascular accesses was done by Kaplan-Meier curves. For survival comparison between groups, Log-rank test was used.

A p value < 0.05 was considered statistically significant. All the analyses were done with SPSS 10.0 statistical software.

RESULTS

A total of 32 patients (12 males) were studied with a mean age of 80.75 ± 3.99 years [75-90]. Group I comprised 17 patients (4 males) and group II 15 patients (8 males). Mean age for each groups was 79.9 ± 3.8 y. and 81.7 ± 4 y., respectively (n.s.). In group I, 12 autologous (4 radial-cephalic, 7 humeral-cephalic, and 1 humeral-basilic) and 5 prosthetic AVF were done. Epidemiological characteristics for both

Table I. Comparison of epidemiological data between both groups

	Total (n = 32)	GI (n = 17)	GII (n = 15)	Sig.
Age (years)	80.7 ± 4	80 ± 38	81.7 ± 4	0.47
Time on HD (months)	19 ± 9.7	21.8 ± 10.6	16 ± 7.9	0.09
Gender Male *Female*	12 (37.5%) 20 (62.5%)	4 (24%) 13 (76%)	8 (53%) 7 (47%)	0.082
Diabetes	13 40.6%	8 47%	5 33%	0.430
AHT	8 25%	3 18%	5 33%	0.306
Ischemic heart disease	10 (31.3%)	4 (23%)	6 (40%)	0.316
Peripheral arteriopathy	5 (15.6%)	2 (20%)	3 (20%)	0.522
BMI	24.3 ± 4.6	22.9 ± 2.5	26.2 ± 6.1	0.082

groups are shown in figure 1; there were no differences by gender, age, time on hemodialysis, baseline nephropathy, and comorbidities. The proposed group for creation of an AVF took 3.0 ± 1.9 months to achieve a functioning permanent vascular access, vs. 1.3 ± 1.7 months in group II ($p < 0.05$). A total of 84 temporary catheters were inserted. Fifty-seven in G I and 27 in G II (3.35 ± 1.93 vs 1.87 ± 1.25 catheters/patient; $p < 0.05$). The site for temporary catheters was: Group I, 45 in the femoral vein (78.9%), 12 in the jugular vein (21.1%); in G II, 25 in the femoral vein (92.5%), 2 in the jugular vein (7.4%).

Maturation time was 69.7 ± 38 days for AVF and 0 days for funneled catheters ($p < 0.0001$).

In 4 patients from G I (23.6%) it was necessary to perform more than one permanent vascular access before achieving the final one. In G II, 1 patient (6.7%) required placement of a second funneled catheter.

In G I, 4 patients finally had a funneled catheter after several unsuccessful tries to achieve a different type of permanent vascular access.

Vascular access-derived complications (Table II)

70.6% of infections occurred in G I (Incidence (In): 48 infections/100 patients-year) vs. 29.4% in G II (In = 24 infections/100 patients-year), $p < 0.05$. 70% of deep venous thrombosis occurred in G I (In = 25 DVT/100 patients-year) v. 30% in G II (In = 14.4/100 DVT/100 year-year), n.s. There were no differences regarding hemorrhage (12 vs 10 episodes/100 year-year) or ischemia (12 vs 5 episodes/100 year-year).

Laboratory tests data

There were no differences between groups in the studied parameters of laboratory tests (Table II). Efficacy of dialysis, measured by Kt/V, phosphorus, potassium, and degree of anemia, was similar in both groups. The 2-years survival of the first functioning permanent vascular access was 45.8% in G I, and 24% in G II (n.s.) (fig. 1). Patients' survival was 72% in G I and 51% in G II, without any statistical significant differences.

Table II. Incidence of vascular access-derived complications in both groups

Complications	GI	GII	sig
Infections/100 year-year	48	24	p < 0,05
Hemorrhage/100 year-year	12	10	n.s.
Ischemia/100 year-year	12	5	n.s
DTV/100 year-year	25	14,4	n.s

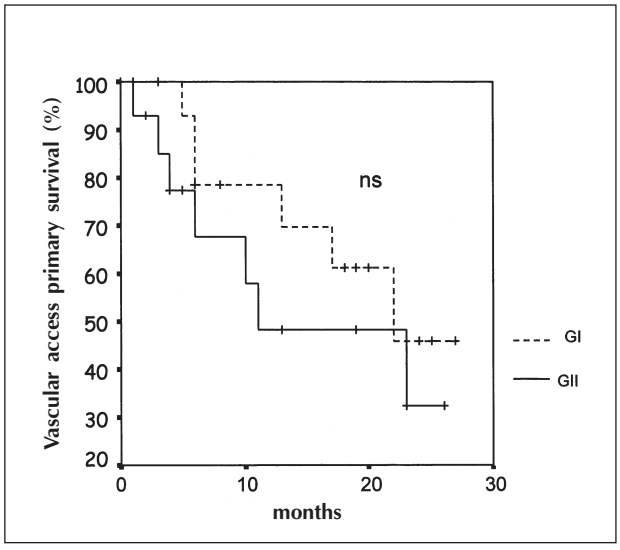

Fig. 1.—Vascular access primary survival (months).

DISCUSSION

The ideal time to perform a permanent vascular access in chronic renal failure patients would be the one that could assure dialysis onset through it without the need for a temporary catheter. With this goal in mind, a series of guiding patterns have been established that are included both in the NFK-DOQI guidelines[18] and in Nephrology Clinical Practice (NCP) rules.[19] However, in spite of guidelines and the best of intentions to fulfill them, there are still many patients who begin hemodialysis without a functioning permanent vascular access. Our population accounts for more than 82.05% of all patients older than 75 years that started on hemodialysis during the data-gathering period.

Several factors determine the type and time of primary vascular access creation. Some are related to the organization of the hospital itself, such as vascular surgeon availability, and others are related to the patient's origin. Early transfer to the Nephrology Department favors the early creation of a vascular access.[4,5,10,20] Finally, there are factors related to patient's characteristics, such as age and diabetes,[1-7,20-26], which are currently gaining importance, and that greatly determine the vascular access type.

Currently, almost 80% of patients who start on hemodialysis are older than 65 years. Besides age, there is an increased cardiovascular morbidity. According to data from the Dialysis and Transplantation Registry from the Spanish Society of Nephrology, during 2002 in 21% of incident patients the cause for chronic renal failure was diabetes, being the number one cause. These data justify, to an extent, the difficulty in achieving a functioning permanent vascular access.[9,21,23,27]

Autologous AVF still is the first option for a permanent vascular access, even in elderly patients, since it has demonstrated to be superior with regards to permeability, survival, and it shows the lowest complications rate.[1,6,9,28-30] The main drawback is the need for a maturation time that ranges from 1 to 6 months, according to revised series,[5,18,24,27] which may be even longer in elderly patients and with added vascular morbidity.[8] As are result, the use of temporary catheters is increased leading to complications derived from this vascular access.

An alternative to AVF would be the use of funneled catheters since they may be used from the very moment of their placement.[14,18]

These assertions lead us to set up this study, which is not designed to compare complications derived from the different vascular access types, but to obtain a global insight into incidences derived from chosen permanent vascular access as first choice, in a particular group of patients (elderly), increasingly frequent, with defined conditions (without vascular access at the beginning of dialysis).

In patients scheduled to creation of an AVF, the waiting time to achieve a functioning permanent vascular access increased 3 fold since dialysis onset (3 months vs 1.3 months). This was due to:

– A longer delay in performance of a vascular access from its scheduling because of surgery waiting

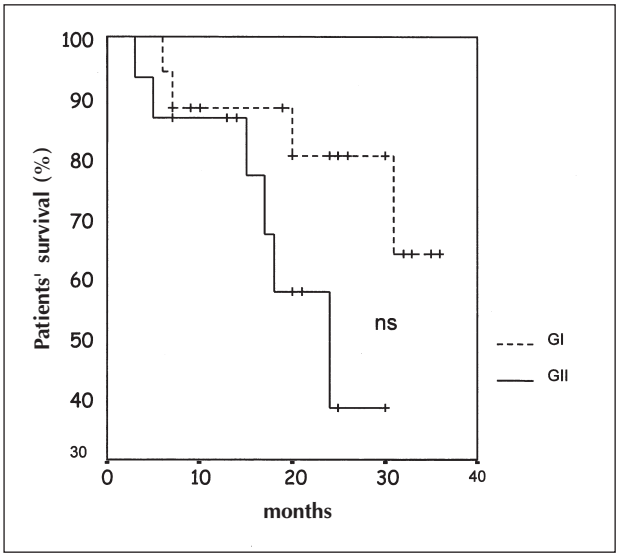

Fig. 2.—Patients' cumulative survival (months) in both groups

Table III. Laboratory test comparison between both groups

		Basal	6 months	12 months	Sig.
Hto (%)	GI	28.2 ± 4.4	32.8 ± 6.1	34.7 ± 4.1	ns
	GII	29.7 ± 3.7	35.4 ± 6.0	35.6 ± 5.2	
Hb (g/dl)	GI	9.2 ± 1.4	10.6 ± 1.9	11.2 ± 1.3	ns
	GII	9.5 ± 1.3	11.3 ± 1.7	11.5 ± 1.7	
P (mg/dl)	GI	4.8 ± 1.5	4.4 ± 1.4	4.6 ± 1.9	ns
	GII	4.3 ± 1.3	4.6 ± 1.4	5.7 ± 1.7	
K (mEq/l)	GI	4.3 ± 0.8	5 ± 1.2	4.6 ± 0.5	ns
	GII	4.9 ± 1.4	5.1 ± 1.1	5 ± 0.8	
Kt/V	GI	1.5 ± 0.3	1.3 ± 0.3	1.4 ± 0.4	ns
	GII	1.3 ± 0.4	1.3 ± 0.4	1.2 ± 0.2	

lists (it requires more than one operating room, sometimes two surgeons, and even general anesthesia).

– Maturation time. It took an average of 69.7 ± 38 days in order to be able to use the AVF in the bipuncture mode from its creation. Usage of the funneled catheter was immediate in all cases.

– Early failures in vascular access functioning. The percentage of radial-cephalic AVF that do not reach maturation or present early thrombosis may exceed 50% in the elderly and diabetics.[25,31] In 23.6% of patients from G I, it was required to perform more than one vascular access before achieving the final one. In G II, only one patient (6.7%) required a second funneled catheter because the first one failed.

These events favored the extension of temporary catheter permanence in the group waiting for an AVF, and increased the number of catheters needed (3.35 ± 1.93 catheters/patient in G I, and 1.87 ± 1.25 in G II).

Vascular access-derived infections were more frequent in patients in whom it was planned to perform an AVF as compared to patients in whom a permanent catheter was inserted (48 vs. 24 infections/100 patients-year; $p < 0.005$). The number of hemorrhagic episodes and deep venous thrombosis secondary to vascular access was higher in the group scheduled to receive an AVF, probably due to the longer permanence of the temporary catheter, and although these differences do not reach a statistical significant difference, we consider that they may be important from a clinical perspective. Ischemic events appeared mainly in G I, in relation to the theft syndrome secondary to functioning AVF, mainly with prosthetic AVF.

Although infections and deep thrombosis, followed by hemorrhage, are the most frequent complications associated to nay kind of catheter,[17,32,33] these results would support those obtained by others that show the greater morbidity, mainly of infectious type, associated to non-funneled catheters as compared to funneled ones.[14,17,34,35]

Dialysis efficacy follow-up measured by Kt/V, phosphorus and potassium did not show differences between both groups. The course of anemia was also similar in both groups, observing a steady hemoglobin increase at the beginning of renal replacement therapy in both groups, stabilizing later on at appropriate levels for hemodialysis patients.

The two-years survival study for AVF shows higher percentages as compared to permanent catheters, although statistical significant differences were not reached. We must consider that only functioning permanent vascular accesses are included in the analysis. Prior to achieve these functioning accesses, a total of 11 AVF (9 autologous and 2 prosthetic) that were not viable were performed; only just one permanent catheter could not be used after placement.

The two-years survival of patients scheduled to AVF is 72%, as compared to 51% in patients scheduled to funneled catheter. In the literature, we find controversial results of studies linking hemodialysis patients' mortality with the type of vascular access. Some authors conclude that there is a higher mortality between patients that carry a catheter as compared to those carrying an AVF,[36] and other recently published results[37] do not find this relationship after adjusting for comorbidities. Our groups are homogeneous with regards to age, gender, etiology, comorbidity, dialysis efficacy, and anemia, but we cannot rule out the existence of some parameter that may account for these differences and that has not been analyzed. We should remind that groups categorization depended on the vascular surgeon's judgment, mainly based in the characteristics of the patients' arterial and venous tree, an issue that might have some other clinical implications. Although the differences found in our setting do not reach a statistical significance, it is not, however, possible to obtain any conclusion considering the small sample size.

Taking into account our results, we may conclude that elderly patients who start on hemodialysis without a vascular access take longer to get a functioning permanent access when the choice is an AVF instead of a funneled catheter. This fact implies a higher number of non-funneled catheters and extension of their life span, and as a result, vascular access-derived complications are greater.

Thus, we advocate for an early performance of the vascular access, together with a previous assessment

from a vascular perspective to optimize the outcomes, and we consider that an AVF still is the first choice vascular access for chronic hemodialysis patients. However, there exist a particular group of patients comprised by elderly patients with additional vascular comorbidity in whom long-term vascular access permeability and venous map preservation are less important issues because of their reduced life expectancy. When these patients start on hemodialysis without a permanent vascular access, funneled catheters may be an option to consider as a first vascular access, while keeping in mind the idea of simultaneously performing an AVF, and keeping the catheter in place until the fistulae maturation in order to minimize the use of temporary catheters that, indeed, are the main conditioning factors of the described morbidity.

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