# *Consultations and hospitalizations in a population from a hemodialysis center*

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**SUMMARY**

*The hemodialysis (HD) population continues growing and aging, reason why they are required to adapt the human, economic and materials resources to be taken care of.* ***Objective:*** *To analyze the distribution of the consultations and the times of admissions in the different Hospital services of which an peripheral arranged HD Center depends.* ***Method:*** *We analyzed all the consultations to the Hospital Urgencies Departments and Hospitable admissions of all the patients who received HD in the arranged Center Ponfedial (sanitary area Ponferrada of 150,000 inhabitants) in period 01/12/02 to the 31/05/05.* ***Results:*** *We prospectively examined a population of 87 HD patients (71,0 ± 12,5 years, 77,9 % male, 31,4% diabetics) time in HD 21,0 ± 22,7 months. They were a total of 286 (9,5/month) consultations in the Service of Urgencies (2,31 consult/patient/year), 37,4% of them did not motivate admissions. The most frequent consultation (28,9%) was the complications of vascular access (70,9% of them required positioning a transitory catheter; 1,1 complication of catheter/months), cardiac causes 10,3%, acute pulmonar edema: 9,3%, infectious: 8,4% and traumatologic: 8,4%. There were 179 admissions (5,9/month; 1,44 hospitalizations/patient/year; 4,0 ± 14,2 days of admissions): cardiovascular cause: 37,4%, by vascular access: 18,4%, infectious disease: 17,0%, digestive: 6,7%, traumatologic: 3,9% and by other causes: 11,0%. The cardiovascular group takes 46,5% (60,8% of them by vascular peripheral disease) of the total of days of hospitalizations, infectious 16,7%, neoplasic 8,4% and vascular access 7,6%. The neoplasic causes were the greater average with 36,0 ± 21,6 days of hospitalization, by amputations 23,0 ± 38,1 days, by stroke 14,5 ± 10,6 days, infected ulcers of lower extremities members 10,0 ± 19,0, other vascular treatments 10,0 ± 4,7, ischemic heart disease 8,5 ± 20,3 and heart failure 7,5 ± 5,2 days. Our prevalent population of 49,5 patients needed 3 to 7 hospitable beds, 0,33 temporal catheter, 1 tunneled permanent catheter and 1 fistulography per month.* ***Conclusions:*** *The cardiovascular causes, the accesses and the infectious ones are the main causes of consultations, hospital admissions and time of hospitalizations.*

Key words: ***Hemodialysis. Hospitalizations.***

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## CONSULTAS E INGRESOS HOSPITALARIOS DE UNA POBLACIÓN DE UN CENTRO DE DIÁLISIS

**RESUMEN**

*La población en hemodiálisis (HD) continúa creciendo y envejeciendo, por lo que se requieren adecuar los recursos humanos, materiales y económicos para ser atendida.* ***Objetivo:*** *Analizar la distribución de las consultas, los ingresos y los tiempos de estancia hospitalaria en los distintos Servicios Hospitalarios de los que depende un Centro de HD concertado.* ***Método:*** *Analizamos todas las consultas al Servicio de Urgencias (SºU) e ingresos hospitalarios de todos los pacientes que recibieron HD en el Centro concertado Ponfedial (área sanitaria Ponferrada de 150.000 habitantes) en el período 01/12/02 al 31/05/05.* ***Resultados:*** *Se dializaron 87 pacientes (media de 49,5 pacientes/año, edad media de 71,0 ± 12,5 años, 77,9% masculinos, 31,4% diabéticos) tiempo en HD 21,0 ± 22,7 meses. Fueron un total de 286 consultas en el SºU (2,31 consultas/paciente/año), de ellas 37,4% no motivaron internaciones. La consulta más frecuente 28,9% fueron las complicaciones del acceso (de ellas 70,9% requirieron colocación de catéter transitorio; 1,1 complicación de catéter/mes), causas cardíacas 10,3%, edema pulmonar: 9,3%, infecciosas: 8,4% y traumatismos: 8,4%. Fueron 179 ingresos (1,44 hospitalizaciones/paciente/año; 4,0 ± 14,2 días de estancia hospitalaria): causa cardiovascular 37,4%, por angioacceso 18,4%, infecciosas 17,0%, digestivas 6,7%, traumatológicas 3,9% y por otras causas 11,0%. El grupo cardiovascular se lleva el 46,5% (60,8% de ellas por vascular periférico) del total de días de ingreso, las infecciosas 16,7%, neoplásicas 8,4% y angioacceso 7,6%. Las causas neoplásicas tuvieron la media mayor con 36,0 ± 21,6 días de estancia hospitalaria, por amputaciones 23,0 ± 38,1 días, por accidente cerebro vascular 14,5 ± 10,6 días, úlceras infectadas de miembros inferiores (MMII) 10,0 ± 19,0, otros tratamientos vasculares 10,0 ± 4,7, coronariopatías 8,5 ± 20,3 y descompensación cardíaca 7,5 ± 5,2 días. Fueron de 3 a 7 camas/mes ocupadas por nuestros pacientes hospitalizados.* ***Conclusiones:*** *Las causas cardiovasculares, los accesos y las infecciosas son las principales causas de consultas, ingresos y estancias hospitalarias.*

Palabras clave: ***Hemodiálisis. Consultas al Servicio de Urgencias. Ingresos hospitalarios.***

## INTRODUCTION

Nephrologists from satellite hemodialysis centers are witnessing a rapid increase in the number, aging, and comorbidity of our population, which implies a greater number of consultations and admissions in the different hospital services. Fifty percent of hemodialysis (HD) costs are due to hospitalizations and these patients are admitted twice as much as the normal population. We aimed at analyzing the consultations from our Center, which covers the Ponferrada health care area (León) and represents about 149,169 population distributed in the counties of Bierzo, Ancares, Laciana and La Cabrera Baja. This population can have access to chronic hemodialytic therapy at two centers: the Hospital of el Bierzo (HeB), with about 34-40 vacancies and the private concerted center of Ponfedial.

We will evaluate the causes for consultation at the Emergency Service (ES), hospital admissions and stays (HS) at the different hospital services that took place during 30 months only for the population treated at Ponfedial, and in this way trying to reflect the different morbidity causes that nephrologists must face at concerted hemodialysis centers.

## MATERIAL AND METHODS

The clinical charts of all patients receiving HD at Ponfedial were analyzed from 12/01/02 to 05/31/05. All consultations to the ES of HeB (either referred by the nephrologist at Ponfedial or not) and either motivating or not admission at the different Hospital services were analyzed. Also included are those consultations to the ES and admissions at the Hospital Center

of León (the Hospital of León is the reference center for those specialties not covered by the HeB – mainly vascular surgery, vascular radiology, and oncologic radiotherapy services). New arterial-venous fistulae (AVF) and simple repairs of AVF are performed at the San Juan de Dios Hospital of León. Temporary catheters (TC) are placed at HeB but permanent funneled catheters (PFC) and fistulographies are performed at the Vascular Surgery Department of the Hospital Center of León.

Qualitative variables are expressed as percentages and quantitative ones as mean ± standard deviation.

## RESULTS

### Population characteristics

During the period 12/01/02-05/31/05 eighty-seven patients received dialysis at Ponfedial (annual mean of 49.5 patients, with an annual incidence of 9.5%). Mean age at HD onset was 71.0 ± 12.5 years (range 34-83 years and 12.6% older than 80 years). Seventy-seven point nine percent were of male gender. Mean dialysis duration was 21.0 ± 22.7 months (range 3-129 months). Thirty-one point four percent were diabetic, and the etiologies for chronic renal failure were: unknown 25.6%, glomerulopathies 16.3%, polycystic renal disease 5.8%, obstructive 5.8%, restoration of HD program for failure of renal transplantation 5.8%, nephroangiosclerosis 4.6%, renal tumors 2.3%, and others 4.6%. During the 30-months study period 38 patients quitted the Center: 10 due to renal transplantation, 13 due to exitus, 11 came back to HeB because of their clinical condition, and 4 for change of residence place.

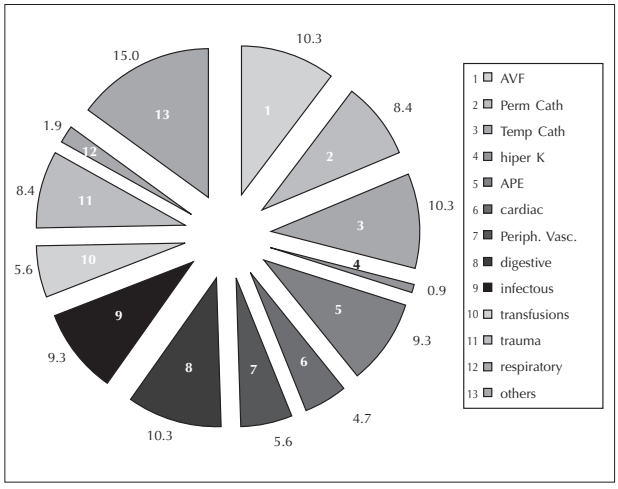


*Fig. 1.*—Percentage of the distribution of consultations at the Emergency Department that did not motivate hospital admissions. *AVF: arterial-venous fistula; Perm Cath: funneled permanent catheter; Temp cath: temporary catheter; hiper-K: hyperkalemia; APE: acute pulmonary edema; peripheral V: peripheral vascular.*

### Consultations

During the study period, 286 consultations to the ES of HeB, with an annual mean of 49.5 patients: 2.31 consultations/patient/year). Of them 107 (37.4%) did not imply hospital admission. The most frequent consultation (28.9%) was for complications of the vascular access (70.9% required TC placement), which were evenly divided among TC, PFC or AVF (Fig. 1). The next following frequent consultations were for acute pulmonary edema and infectious causes (9.3% each) and trauma (8.4%). The category representing others is a miscellaneous of consultations due to dog bites, insect bites, lightheadedness, bronchospasm, motor vehicle accidents, etc.

### Hospital admissions

There were 179 admissions accounting for 1703 days of hospital stay, with an average of 1.44 hospitalizations/patient/year. Sixty-seven (77.0%) out of 87 patients receiving hemodialysis at Ponfedial during the 30 months period were admitted at least once to the hospital, and of them 33 (49.2%) had between 2 and 4 admissions, and 11 patients (16.4%) had more than 4 admissions. Table I and Fig. 2 show hospitalizations in more detail. As it may be observed, the main hospitalization cause was cardiovascular (37.4%), followed by vascular accesses (18.4%), and infectious causes (16.8%). Cardiovascular causes may be divided into cardiac causes (56.7%) (coronary heart disease, arrhythmias, and heart decompensation at similar percentages) and peripheral vascular causes (43.3%), mainly represented by ischemic causes of the lower limbs (LLI) (44.8%), lower limb amputations (17.2%), and cerebrovascular accidents (20.9%). Two thirds of hospitalizations due to vascular access were due to AVF complications and for creation of the AVF in 27.3%. During the 30 months of the study, 49 patients started on HD at Ponfedial. Of them, 9 (18.3%) needed hospital admission for creation of an AVF.

Among infectious causes, respiratory ones predominate (43.3%), which are two-fold those with an unidentified origin (20.0%), followed by infection of lower limb ulcerations (16.7%). There only was one hospitalization due to infectious complication of the catheter, representing one bacteriemia. There was only one case of sepsis of urinary origin, although it implied 45 days of HS.

**Table I.** Distribution, percentage and hospitalization days for the different admission etiologies and for diabetic patients. It may be seen that the first cause for admission is cardiovascular with 67 admissions, accounting for 37.4% of all admissions; among them peripheral vascular disease (29 admissions) represented 43.3% of cardiovascular causes and comprised 495 days of hospital stay, 60.8% of hospitalization days for cardiovascular cause (this represents 46.6% of the days for all causes) with an average of 10 hospitalization days. It may be observed that in diabetic patients neoplasic, digestive, and infectious causes predominate (75%, 58.3%, and 53.3% of admission causes) and the average of hospitalization days is in general higher than for non-diabetic patients. 1st AVF: hospitalization for first time creation of an AVF; AMI: acute myocardial infarction; HT: hypertension; CVA: cerebrovascular accident; LLI: lower limb ischemia; LLU: infected ulcerations of the lower limbs

| Cause | Numer of admissions | % | | % the group | days of HS | % | | % by days of HS | mean of days of HS | admissions for diabetics | % | days of HS | mean of days of HS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vascular access cause | 33 | 18.4 | | | 130 | 7.6 | | | 2.5 ± 4.6 | 6 | 18.2 | 46 | 4.0 ± 9.7 |
| 1st AVF | 9 | | | 27.3 | 21 | | | 16.1 | 2.0 ± 0.5 | 1 | | 2 | 2.0 |
| AVF complication | 22 | | | 66.6 | 95 | | | 73.1 | 3.0 ± 5.4 | 5 | | 44 | 5.0 ± 10.4 |
| Catheter complication | 2 | | | 6.1 | 14 | | | 10.7 | 7.0 ± 5.6 | 0 | | 0 | 0.0 |
| | | | | 100 | | | | 100 | | | | | |
| Cardiovascular cause | 67 | 37.4 | | | 793 | 46.5 | | | 5.0 ± 17.9 | 28 | 41.8 | 263 | 3.0 ± 23.9 |
| cardiac | 38 | | 56.7 | | 298 | | 39.2 | | 3.0 ± 12.5 | 13 | | 126 | 2.0 ± 20.0 |
| AMI, angina | 12 | | | 31.6 | 164 | | | 55.0 | 8.5 ± 20.3 | 3 | | 78 | 2.0 ± 41.6 |
| cardiac decomp. | 10 | | | 26.3 | 72 | | | 24.2 | 7.5 ± 5.2 | 3 | | 16 | 4.0 ± 4.2 |
| arrythmias | 13 | | | 34.2 | 52 | | | 17.5 | 2.0 ± 4.9 | 6 | | 31 | 2.0 ± 7.3 |
| BP abnormality | 3 | | | 7.9 | 10 | | | 3.3 | 2.0 ± 3.2 | 1 | | 1 | 1.0 |
| | | | | 100 | | | | 100 | | | | | |
| peripheral | 29 | | 43.3 | | 495 | | 60.8 | | 10.0 ± 22.4 | 15 | | 261 | 10.0 ± 26.9 |
| CVA | 6 | | | 20.9 | 108 | | | 21.8 | 14.5 ± 10.6 | 2 | | 42 | 21.0 ± 12.7 |
| LLI | 13 | | | 44.8 | 148 | | | 29.9 | 3.0 ± 18.4 | 9 | | 40 | 3.0 ± 3.6 |
| amputations | 5 | | | 17.2 | 200 | | | 40.4 | 23.0 ± 38.1 | 4 | | 179 | 25.5 ± 42.3 |
| mesenteric infarction | 2 | | | 6.9 | 4 | | | 0.8 | 2.0 | 0 | | 0 | 0.0 |
| other | 3 | | | 10.3 | 35 | | | 7.6 | 10.0 ± 4.7 | 0 | | 0 | 0.0 |
| | | | 100 | 100 | | | 100 | 100 | | | | | |
| GI cause | 12 | 6.7 | | | 70 | 4.1 | | | 2.5 ± 6.3 | 7 | 58.3 | 21 | 2.0 ± 1.8 |
| Trauma | 7 | 3.9 | | | 65 | 3.8 | | | 5.0 ± 7.8 | 2 | 28.6 | 31 | 15.5 ± 0.7 |
| Infectious cause | 30 | 16.8 | | | 285 | 16.7 | | | 6.0 ± 11.2 | 16 | 53.3 | 198 | 8.5 ± 14.5 |
| respiratory | 13 | | | 43.3 | 80 | | | 28.2 | 6.0 ± 3.8 | 6 | | 37 | 6.5 ± 3.1 |
| u.o. | 6 | | | 20.0 | 49 | | | 17.2 | 5.0 ± 7.2 | 3 | | 25 | 3.0 ± 10.1 |
| LLU | 5 | | | 16.7 | 83 | | | 29.1 | 10.0 ± 19.0 | 4 | | 81 | 11.0 ± 19.9 |
| urinary | 2 | | | 6.7 | 10 | | | 3.5 | 5.0 ± 4.2 | 2 | | 10 | 5.0 ± 4.2 |
| catheter | 1 | | | 3.3 | 5 | | | 1.8 | 5.0 | 0 | | 0 | 0.0 |
| sepsis | 1 | | | 3.3 | 45 | | | 15.7 | 45.0 | 1 | | 45 | 45.0 |
| others | 2 | | | 6.7 | 13 | | | 4.5 | 6.5 ± 2.1 | 0 | | 0 | 0.0 |
| | | | | 100 | | | | 100 | | | | | |
| Respiratory | 4 | 2.2 | | | 21 | 1.2 | | | 5.5 ± 3.3 | 0 | | 0 | |
| Neoplasic | 4 | 2.2 | | | 144 | 8.4 | | | 36.0 ± 21.6 | 3 | 75.0 | 119 | 47.0 ± 24.8 |
| Diabetes | 2 | 1.2 | | | 7 | 0.4 | | | 3.5 ± 2.1 | 2 | 100.0 | 7 | 3.5 ± 2.1 |
| Other | 20 | 11.0 | | | 188 | 11 | | | 3.0 ± 13.7 | 4 | 20.0 | 70 | 12 ± 21.1 |
| TOTAL | 179 | 100 | | | 1703 | 100 | | | 4.0 ± 14.2 | 68 | 37.9 | 879 | 5.0 ± 19.3 |

Regarding days of hospital stay, the cardiovascular group accounts for 46.5% (60.8% of them for peripheral vascular causes), followed by infectious causes (16.7%), neoplasms (8.4%), and vascular access (7.6%) (Fig. 3). The average for all causes was 4.0 ± 14.2 days. Neoplasic causes had the highest average

(36.0 ± 21.6 days), followed by hospitalizations due to amputations (23.0 ± 38.1 days), cerebrovascular accident (14.5 ± 10.6 days), infected ulcerations of the lower limbs (10.0 ± 19.0), other vascular treatments (10.0 ± 4.7), ischemic coronary disease (8.5 ± 20.3), and cardiac decompensation (7.5 ± 5.2 days).

Patients older than 80 years had a mean of 1.92 admissions/patient/year, a mean of 6.0 ± 4.4 days and an average of 7.6 days of HS. The causes are shown in Table II. The mean of admissions and the mean of days of HS are higher than for the whole population from Ponfedial.

During the study period, 46 patients started on HD having 70.6% of all admissions within the first 6 months of therapy (considering the admissions before and after 6 months of starting on HD), and representing 42.7% of total days of HS. The mean was 3.0 ± 8.1 days and the main cause was for creation of the first AVF (22.5%), complications of AVF (15.0%), cardiac impairments (22.5%), LLI (12.5%), infections and gastrointestinal impairments (7.5% each).

The diabetic population (31.4% of the whole) accounted for 37.9% of all admissions and 51.6% of total days of HS. They accounted for 75.0% of admissions due to neoplasic cause, 58.3% gastrointestinal causes, 53.3% infectious causes (80.0% of infected ulcerations and 100% of urinary tract infectious), and 41.8% cardiovascular causes (69.2% of the LLI and 80.0% of the amputations). The average of days of HS was generally higher (5.0 ± 19.3) and for almost all causes.

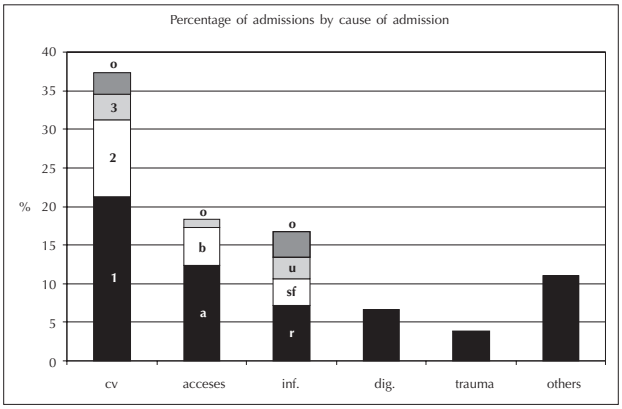


*Fig. 2.*—Percentage of the distribution of hospital admissions by etiology. *It may be seen how admissions for cardiovascular causes largely predominate (37.4%), and among these cardiac causes (21.2%). A for vascular accesses (18.4%), the main admission cause are AVF complications, and about infections (16.8%), respiratory infections and those of unknown origin. The groups "others" corresponds to miscellaneous causes. Cv: cardiovascular; 1: cardiac causes; 2: amputations and lower limb ischemia; 3: VA; a: AVF complications; b: creation of the first AVF; inf: infections; r: respiratory; u.o.: unknown origin; u: infections of ulcerations on the lower limbs; o: other causes within that group.*

**Scheduled consultations, not occurring at the emergency department, but motivating therapeutic procedures**

As mentioned, 28.9% of ED consultations corresponded to complications of the vascular access, which did not motivate hospital admission but required an intervention such as TC or PFC placement, replacement of such accesses, or trying to clear the catheter with urokinase. During the study period, 10 TC were placed for several reasons (1.0 catheter/3 months). PFC and fistulographies were scheduled consultations at the Vascular Radiology Department in León, and this is a piece of information that allowed us to see the relationship of concerted centers with such an important Department.

During the 30 months of the study period, 23 fistulographies were performed (6 with angioplasty and 2 with a stent), 13 PFC were replaced (6 due to dislodging, 3 to rupture, and 4 to malfunctioning), and 13 PFC were placed (8 due to thrombosis of the AVF and 5 due to lack of development of an AVF). We should highlight that no replacements were due to infectious processes.

In summary, there were 1.1 catheter complications/month and one PFC/1.2 months were placed. About fistulographies, including the data on the 11 first months of 2002, 34 were performed in 41 months: 1 fistulography/1.2 months.

**Estimation of hospital resources used**

With a mean of 49.5 patients/year, we obtained a mean of 9.5 consultations at the ED per month, 5.6 admissions/month were derived, and we estimated 6 occupied beds/month. Since 6.2% of HS were longer than 30 days, we estimate that there was one of such HS/3 months. On the other hand, we observed 1703 days (56.8 months) of HS within 30 months, which would represent 2 occupied beds per month for the 30 days. We may estimate that the hospital has to use 3-7 beds/month to assist these patients. In addition, a similar number of HD spots must be available to treat them. To complete the analysis of hospital services use we should remind that 1.0 TC/3 months, 1.0 PFC/1.2 months are placed, and that one fistulography/1.2 months is performed.

In this study, we cannot analyze the number of consultations to primary care or specialist doctors, which would yield a real figure of the use of the several health care services to assist the requirements of the patients from our concerted center.

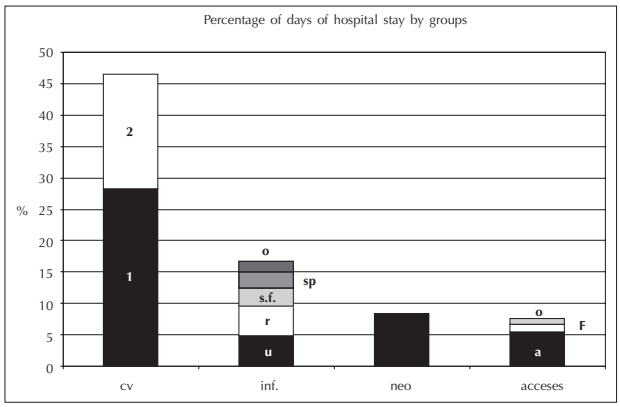


*Fig. 3.*—Percentage of hospitalization days that correspond to each group. *It may be seen how the percentage of admission days is largely greater for cardiovascular causes (46.5%) and among them almost 2/3 are due to peripheral vascular disease. Among infectious causes (16.7%), infected ulcerations of the lower limbs and respiratory infections comprise the longest hospital stays within that group. Hospital stay due to neoplasms (8.4%) is important although only representing 2.2% of all hospital admissions. Admissions due to AVF complications represent 75.0% of the days within that group (7.6%). cv: cardiovascular; inf: infections; neo: neoplasms; 1: admissions due to peripheral vascular disease; 2: cardiovascular; u: ulcers of the lower limbs; r: respiratory; u.o.: unknown origin; sp: sepsis; a: AVF complications; F: first time creation of an AVF; o: other causes within that group.*

## DISCUSSION

Nephrologists from satellite hemodialysis centers are witnessing a rapid increase in the number, aging, and comorbidity of our treated population. This implies greater resource demands to assist them. Life expectancy is reduced by at least 50%[2] and mean survival on HD is five years, although they are admitted twice as much as the normal population, which implies that 0.5% of health care beneficiaries consume 5% of the budget.[3] In the year 2003, 1% of health care budget was used for renal replacement therapies in the UK, about 32,900 euros per patient and year.[4] HD costs were divided among: hospitalizations (50%), dialysis costs (28%), honoraries (9%), and other expenses (8%).[5,6] Taking into account that the HD population is ever increasing (in Spain at about at a 4% annual rate[7]), and specially among the older population, it may be expected that consultations and hospitalizations in the different hospital services will increase.

If we analyze the consultations to the ED, we observed 2.31 consultations/patient/year, which is similar to other publications[8], although lower than what Gruss[9] observed in Spain in 1998, with 1.42 consultations/patient/year (our populations was almost 10 years older, with 7.5% more of diabetics). In our case, consultations due to failure of the vascular access predominate, either for complications of the AVF or the catheter in 28.9% of the cases, and 70.9% of them requiring the placement of a TC to keep on with hemodialysis therapy. Our consultation frequency due to that cause is higher, and we believe this might be due to the older age of our population highlighting the difficulty in obtaining and maintaining a good vascular access. The percentages of the remaining reasons for consultation are in agreement with those from other reported ones (Table III). It has been described that 29% of admitted patients have an HS longer than 1 week and the hospitalization cost is twice as much as than for non-hemodialysed patients.[8] Risk factors for attending the ED would be age, female gender, diabetes, anemia, higher number of comorbidities, EPO dose, and low Kt/V.[3,9]

**Table II.** Comparison of the different studies with distribution of admissions in percentages, averages of hospital admissions (admissions/patient/year), average and mean of hospital stays (in days), and the percentage of hospitalized patients in the studied population

| | CV | PV | Access | Infec. | Digest. | Neo | Diab. | Trauma | Others | a/pt/year | AvHS | Mean HS | % of adm. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ponfedial | 21.2 | 16.2 | 18.4 | 16.8 | 6.7 | 2.2 | 1.2 | 3.9 | 11.0 | 1.44 | 9.9 | 4.0 | 62.6 |
| Spain (DOPPS)[10] | 30.4 | | 24.8 | 14.3 | 14.3 | | | | | 0.75 | 11.4 | 7.0 | |
| Eurodopss[10] | 17.6-37.4 | 21.7-43.9 | 9.1-14.3 | 7.9-14.5 | | | | | | 0.99 | 11.0 | 6.0 | |
| Sehgal[3] | 18.0 | 4.0 | 24.0 | 9.0 | 6.0 | | 5.0 | | 27.0 | | | | 54.8 |
| Morduchowics[6] | 27.2 | | 31 | 22.5 | | 0.9 | | | 8.5 | 1.7 | | 4.8 | 72.2 |
| Gruss[9] | 13.9 | | 36.0 | 16.7 | | | | | | | 10.8 | | |
| González[23] | 18.4 | 4.9 | 21.7 | 23.0 | | | | | 32.2 | | | | |
| Röhrich[12] | 10.5 | 7.2 | 25.4 | 16.3 | 6.3 | | | 12.1 | 17.8 | 1.87 | 18.4 | | |
| > 80 years | | | | | | | | | | | | | |
| Ponfedial > 80 years | 8.3 | 20.8 | 8.3 | 37.5 | 16.7 | | | 4.2 | 4.2 | 1.92 | 7.6 | 6.0 | |

CV: cardiovascular; PV: peripheral vascular; infec: infectious; digest: digestive; neo: neoplasic; diab: diabetes; a/pt/year: admissions/patient/year; av. HS: average hospital stay; mean HS: days of mean hospital stay, and %adm.: percentage of admitted patients in each study.

In our case, 62.6% of the consultations required admission to the hospital (a similar result to Loran's[8] with a population 20 years younger), i.e. 5.6 consultations to the ED/month required admission to the hospital (1.44 hospitalizations/patient/year), which compared to the results from the DOPPS study[10] it is higher than the average for Spain and Europe (0.75 and 0.99 hospitalizations/patient/year, respectively) although we may point out that mean age in the DOPPS study is 10 years lower than ours. Our HS average (9.9 days) is lower, as well as the mean of days of HS (4.0 days). In our case, the percentage of admissions longer than 30 days (6.2%) was slightly lower (Spain 8.4% and Europe 7.9%). Our admissions longer than 30 days mainly correspond to diabetic patients (66.6% of them) and for peripheral vascular pathology (41.6%) (Table II).

In the USA, hospitalizations for cardiovascular and infectious causes increased by 7.2% and 20.1%, respectively, for the last 10 years, whereas for vascular accesses they dropped by 26.4%[11] because the number of autologous AVF as the vascular access are increasing. During that time, hospitalizations (2.0 admissions/patient/year and 2.4 for diabetics) and duration of HS (16.4-14.0 days/patient/year) have remained stable.[11] Hospitalizations decrease with time on dialysis, and the admission risk increases with age, female gender, black ethnicity, diabetes,[6] and low Kt/V.[3]

As shown in Table II, admissions due to cardiovascular, vascular access or infectious cause predominate and account for more than 2/3 of all hospital admissions. Sixty-six point eight percent of days of HS are due to cardiac or infectious causes, which represent 54.0% of mortality causes.[6] The most expensive causes of admissions were: vascular access 27%, cardiovascular 23%, and infections 5%.[5] Age, presence of vascular disease, and cancer were predictive factors of expenditure increase.[4] In our case, 71.2% of the days of HS are of cardiovascular and infectious origin, which represents that for each 10 days of HS, 4.6 days were due to cardiovascular cause (2.8 due to peripheral vascular disease), 1.7 days to infections (0.5 days to respiratory infections), 0.8 days to neoplasms, 0.7 due to access complications, and 0.3 days to trauma (Fig. 3).

Age is one the most important independent factors on morbimortality and HS. It is not surprising though age increasing is associated with pan-vascular aging and comorbidity. Patients older than 75 years have the greatest admission rate in general (2.25 hospitalizations/patient/year) and due to cardiovascular and infectious cause in particular,[11] as it occurred in our case. Our patients older than 80 years had an average of 1.92 admissions/patient/year and an average of 7.6 days of HS (lower than that in the general population but this is likely due to the low number of patients in this age group). In the USA, the average HS for these patients is 15.5 days, and 17.7 days if they are diabetic.[11] Table II shows the comparison by cause. This group expends 9.6% of their remaining life in the hospital[12], highlighting hospitalizations due to social causes (usually that live alone with no financial or dwelling resources) and trauma. With the old population increase, bone fractures in HD patients are increasing in general, and in particular, in those older than 75 years and women.[11] From another perspective, the mean expenditure in dialysis and hospitalization in the United Kingdom is 99 euros/day, although for a patient older than 80 years it is 106 euros/day. If there is associated vascular disease, this cost increases up to 111.27 euros/day.[4]

Cardiovascular pathology is the first cause for admission and HS. In our case, 1 in five admissions were due to cardiac cause (approximately evenly divided into ischemia, arrhythmia, and cardiac decompensation) and represent almost 1/5 of days of HS. This is evident since cardiovascular damage, which onsets when glomerular filtration rate is lower than 60 ml/min,[2] has to be added to increasing age and diabetes, the latter being the first cause of hospital admission in HD patients. Chronic renal failure adds to modifiable factors of cardiovascular disease, such as arterial calcifications due to high calcium-phosphorus product and endothelial dysfunction promoted by inflammatory mediators and nitric oxide deficit.[2] Anemia is associated to remodeling, heart failure and decrease in survival rates.[13] The risk for death from cardiovascular origin is 5 fold increased in HD patients older than 75 years, but in patients aged 25-35 years it is increased by 375 fold.[2] One in six admissions in our patients were due to peripheral vascular disease, representing almost 1/3 of days of HS, and accounting for our main cause of HS. The work by Koch[14] is very representative of the morbidity due to peripheral vascular disease, which found that the 5-year survival rate of non-diabetic HD patients was 74%, for diabetics 73%, those with coronary disease 50%, and with lower limb ischemia only 10%. The main risk factors were age, male gender, diabetes, and cigarette smoking.[14] For hospital stays longer than 30 days, 95% end up with major or minor amputation, and 27% had multi-resistant infections.[14] Two thirds of our amputated patients died during their hospitalization longer than 30 days from multi-resistant infections, and not being able to be discharged alive from the hospital. Admissions due to LLI or its complications (amputations or infected ulcerations) were 12.8% of the whole but represent 25.3% of total days of HS, and 85% of the patients with this condi-

tion were diabetics. In our country, Sánchez Perales found an incidence of 1.1 amputated patients/100 patients/year, 55.0% of amputated patients being diabetics.[15] The one-year mortality rate for amputations was 60%, and 60% of them were of cardiovascular origin.[14]

Infections were the second cause for hospital admission and age, diabetes, comorbidity, hypoalbuminemia, and the use of a TC have been identified as risk factors for infections.[16] In our case, they represented 16.8% of all admissions, and 22% in the HEMO study, 57.7% of them with poor outcome (death, admission to the ICU, or hospital stays longer than 7 days).[16] Age and low plasma albumin were predictive of a poor outcome, and the frequency of a poor outcome depends on the infection origin: 95% for those of cardiac origin and 43.8% for those of vascular access origin.[16] Vascular access infections would represent 1/3 of all infections and more than half of bacteremias in HD patients.[17] In our case, there only was one bacteriemia case which origin was a PFC, which speaks on favor a good catheter care. We only had one case of AVF infection that required to be undone, although we should remind that admissions for AVF infections have doubled within the last 10 years in the USA.[11] Our main admission reason for an infectious origin was respiratory infection (43.3%), which is in agreement with other registries, since this cause has raised by 19% within the last 10 years.[11] Next were infections of an unknown origin (20.0%) and infections of lower limb ulcerations (16.7%), the latter having higher means of HS (10.0 days).

Admissions due to vascular access vary from 18.4% to 44.0% (Table II.). These represent dramatic episodes for the patient since many times they imply aggressive therapies, catheter placement and/or creation of a new AVF. Age, female gender, diabetes, and duration of hemodialysis therapy are the main determinant factors of the type of vascular access and functioning time.[18] Thirty-four point four percent of our patients had, at some point of time, a catheter for dialysis. Although our admission rate for access failure is one of the lowest reported (this may be due to patients' age and to an increasing trend to abandon complicated AVF without trying to repair them and replacing them by a PFC; this may prevent patient's admission), we should remind that access failure motivated 3 in 10 consultations to the ED, 4 in 10 admissions within the first 6 months of treatment, and 2 in 10 overall admissions.

The peak incidence of hospital admissions occurs within 3 months of HD onset, and this is mainly due to creation of a vascular access, which admission rate is almost three fold that for other reasons.[19] Patients that have been taken care of by a nephrologist before entering dialysis present 10 times less admissions than those not managed so,[20] likely because of a lower rate of central catheter placement and better management of the different metabolisms.[20,21] In Spain, uncontrolled patients have a risk of hospital admissions, mainly related with problems with the vascular access or infection, 5.6 times higher, HS is 4 times longer within the first year, and health-related costs within the first 6 months of dialysis are 2-5 times higher than pre-dialysis controlled patients; these higher costs are due to higher hospitalization and morbidity.[22] If we analyze only those patients that started HD during the study period, 70.6% of all admissions and 42.7% of total days of HS occurred within the first 6 months of therapy. The main causes were creation of their first AVF (22.5%) and AVF complications (15.0%), followed by cardiac causes (22.5%) (likely due to comorbidity and anemia) LLI (12.5%), and infections (7.5%). In the USA, only 34% of the patients had a functional AVF at start of HD, and in our country this rate is about 50%.[22] Almost 70% of the patients were referred to our Center with an already created AVF, although more than half of them were not in working conditions from the beginning.

We believe that, for the time being, early management of patients with chronic renal failure in order to start renal replacement therapy in good condition, together with an adequate vascular access from the be-

**Table III.** Reason for consultation to the Emergency Department in percentages, percentage of hospital admissions from total consultations to the ED, and average of hospital stay (in days) for admitted patients

| | Access | CV | APE | Digestive | Infectious | Trauma | % Admissions | AvHS |
|---|---|---|---|---|---|---|---|---|
| Ponfedial | 28.9 | 10.3 | 9.3 | 10.3 | 9.3 | 8.4 | 62.6 | 9.9 |
| Gruss | 11.9 | 11.0 | 1.7 | 15.3 | 19.5 | 15.3 | 30.5 | 10.2 |
| Loran | 16.0 | 15.0 | 17.0 | 12.0 | 18.0 | | 60.0 | 7.8 |

It is observed that in our patients the main reason for consultation is complications of the vascular access, which shows the difficulty in obtaining and maintaining good accesses. The important percentage of APE shows the difficulty in performing ultrafiltration to those patients with heart disease, but it mainly represents in many patients the poor adherences to a diet. The percentage of admissions reflects the percentage of consultations that end up in hospitalization, and also observed is the average hospital stay. Access: vascular access; CV: cardiovascular; APE: acute pulmonary edema; trauma: trauma.

ginning, seem to be the only valid measures to decrease the admission rate and HS.

We observe that our diabetic population had slightly more admissions than non-diabetics, although they comprised 51.6% of the whole days of HS with an average of days of HS slightly higher (5.0 ± 19.3). This implies that half of the time of HS corresponded to admitted diabetic patients. They accounted for 75.0% of admissions due to neoplasm, 58.3% for gastrointestinal causes, 53.3% for infectious causes (80.0% of all infected ulcerations), and 41.8% of cardiovascular causes (69.2% of all LLI and 80.0% of all amputations).

We have figured out an estimation that, considering a prevalent population of 50 HD patients, there are almost 10 consultations/month to the ED, that slightly over half of them proceed to hospital admission, they require 3-7 beds/month to be taken care of during their admission, and half of the time these beds will be occupied by a patient with a cardiovascular condition or a diabetic patient. Among patients starting HD, more than 2/3 of their admissions will occurred within the first 6 months, mainly to create a vascular access. The main causes for admission and HS were cardiovascular, vascular accesses, and infections. The factor "center" has to be taking into account for our results, although they may be of practical usefulness to plan appropriate resources in the future. The increase in the number, age, and comorbidity of these patients will make necessary to increase the resources so that they may be taken care of.

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