Original research

doi: http://dx.doi.org/10.22265/acnef.0.0.307

Spanish home hemodialysis experience

Experiencia en hemodiálisis domiciliaria en España

Alejandro Pérez Alba,[1,*] *Javier Reque Santiváñez,*[1]
Milagros Vázquez Gómez,[1] *Ramón Pons Prades,*[1]

[1]Service of Nephrology, Hospital Universitario General de Castellón, Castellón de la Plana, Spain

Abstract

Background: There is currently a growing interest, worldwide, for the possibilities offered by home hemodialysis, which is more widespread in northern European countries, Canada, the United Kingdom, the United States, Australia and New Zealand. In Spain, it has grown very slowly, except in certain regions such as the province of Castellón, where we have placed special interest in the expansion of home dialysis techniques.

Objective: To describe the experience in the Home Hemodialysis program of the Hospital General de Castellón.

Methodology: Descriptive study of the patients included in the home hemodialysis program of the Hospital General de Castellón, from its beginning in January 2008 to December 2017.

Results: As a whole, we trained 41 patients, of whom 36 came to hemodialysis at home (short-day regimen). Age 58.3±13.4 years, Charlson index 4.1±1.6, 62 % men, 25.6 % with diabetes mellitus, 15.4 % with diagnosis of heart failure, 32 % with hemodialysis fistula, 38.5 % of working-age patients were active. We obtained a technical survival considering the event death+technical failure, censoring transplant of 79.4 % a year, 75.2 % at 2 years and 42.1 % at 5 years, resulting determinants of the event in the univariate analysis: age, presence of diabetes mellitus and presence of heart failure, and only heart failure in the multivariate. The weekly reductions of phosphorus and beta-2-microglobulin were significantly greater with daily short hemodialysis with respect to on-line haemodiafiltration. Being the on-line hemodiafiltration superior in the weekly reduction from the 17800 daltons of myoglobin.

Conclusions: Home hemodialysis is a possible technique that offers the patient an adequate social-labor reintegration with good levels of weekly reduction of uraemic toxins and an acceptable technical survival over time.

Key words: Home hemodialysis, Spain, technical survival, uremic toxins.

doi: http://dx.doi.org/10.22265/acnef.0.0.307

Resumen

Antecedentes: existe actualmente un interés creciente, a nivel mundial, por las posibilidades que ofrece la hemodiálisis domiciliaria, la cual se encuentra más extendida en países del norte de Europa, Canadá, Reino Unido, Estados Unidos, Australia y Nueva Zelanda. En España, ha crecido de manera muy lenta, excepto en determinadas regiones como la provincia de Castellón, donde hemos puesto especial interés en la expansión de las técnicas dialíticas domiciliarias.

Objetivo: describir la experiencia en el programa de hemodiálisis domiciliaria del Hospital General de Castellón.

Metodología: estudio descriptivo de los pacientes incluidos en el programa de hemodiálisis domiciliaria del Hospital General de Castellón, desde su inicio en enero del 2008 hasta diciembre del 2017.

Resultados: en su conjunto, entrenamos a 41 pacientes, de los que 36 llegaron a hemodializarse en casa (régimen corto-diario). La edad de los pacientes era 58,3±13,4 años; y el índice de Charlson, 4,1±1,6. 62 % de los pacientes eran hombres, 25,6 % padecían diabetes mellitus; 15,4 % tenían diagnóstico de insuficiencia cardíaca y 32 % eran portadores de fístula de hemodiálisis. El 38,5 % de los pacientes en edad laboral estaba activo. Obtuvimos una supervivencia técnica considerando el evento muerte+fallo técnico, censurando el trasplante, del 79,4 % al año, 75,2 % a los 2 años y 42,1 % a los 5 años. En el análisis univariante, resultaron determinantes la edad, la presencia de diabetes mellitus y la presencia de insuficiencia cardíaca. En el análisis multivariante, solo se mantuvo la insuficiencia cardíaca. Las reducciones semanales de fósforo y beta-2-microglobulina fueron significativamente mayores con hemodiálisis corta diaria, en comparación con la hemodiafiltración on-line. La hemodiafiltración on-line fue superior en la reducción semanal a partir de los 17 800 daltons para la mioglobina.

Conclusiones: la hemodiálisis domiciliaria es una técnica posible que ofrece al paciente una adecuada reinserción sociolaboral, buenos niveles de reducción semanal de toxinas urémicas y una aceptable supervivencia técnica en el tiempo. **Palabras clave:** hemodiálisis domiciliaria, España, supervivencia técnica, toxinas urémicas.

doi: http://dx.doi.org/10.22265/acnef.0.0.307

Citación: Pérez-Alaba A, Reque-Santiváñez J, Vázquez-Gómez M, Pons-Prades R. Experiencia en hemodiálisis domiciliaria en España. Rev. Colomb. Nefrol. 2018;5(2):127-136. doi: http://dx.doi.org/10.22265/acnef.0.0.307

Correspondence: Alejandro Pérez Alba, aperezalba@gmail.com

Received: 11.04.18 • **Accepted**: 11.07.18 • **Published online**: 09.08.18

http://dx.doi.org/10.22265/acnef.0.0.307

Introduction

Since the beginning of this century, there has been a progressively increasing interest in home hemodialysis (HHD) as a method of renal replacement therapy. It has arisen in an attempt to improve the medical outcomes obtained with the conventional hemodialysis (HD), performed three times a week, through the promotion of more frequent, and therefore, more physiological regimes. With its use, strict schedules of HD in the healthcare centers are avoided.

Since the beginning of this century, there has been a progressively increasing interest in home hemodialysis (HHD) as a method of renal replacement therapy. It has arisen in an attempt to improve the medical outcomes obtained with the conventional hemodialysis (HD), performed three times a week, through the promotion of more frequent, and therefore, more physiological regimes. With its use, strict schedules of HD in the healthcare centers are avoided.

The development of the HHD has been uneven in the world, being greater in Australia and New Zealand (where it has always presented high prevalences), as well as in countries of Northern Europe, the United Kingdom, Canada and the United States.[1] In Spain, the growth of the technique has been slow and its development is still incipient. An exception is the General Hospital of Castellón, where we have achieved an important growth of the HHD, unlike what happened in the rest of the country. It is for this reason that we thought it appropriate to present our experience.

Materials and methods

Patients included in the HHD unit of the Hospital General de Castellón, from its creation in January 2008, until December 2017.

Results

In these 9 years, we have trained 41 patients, with an annual incidence in progressive increase. (Figure 1) Of these patients, we have managed to take 36 to their home (2 are still in the training phase

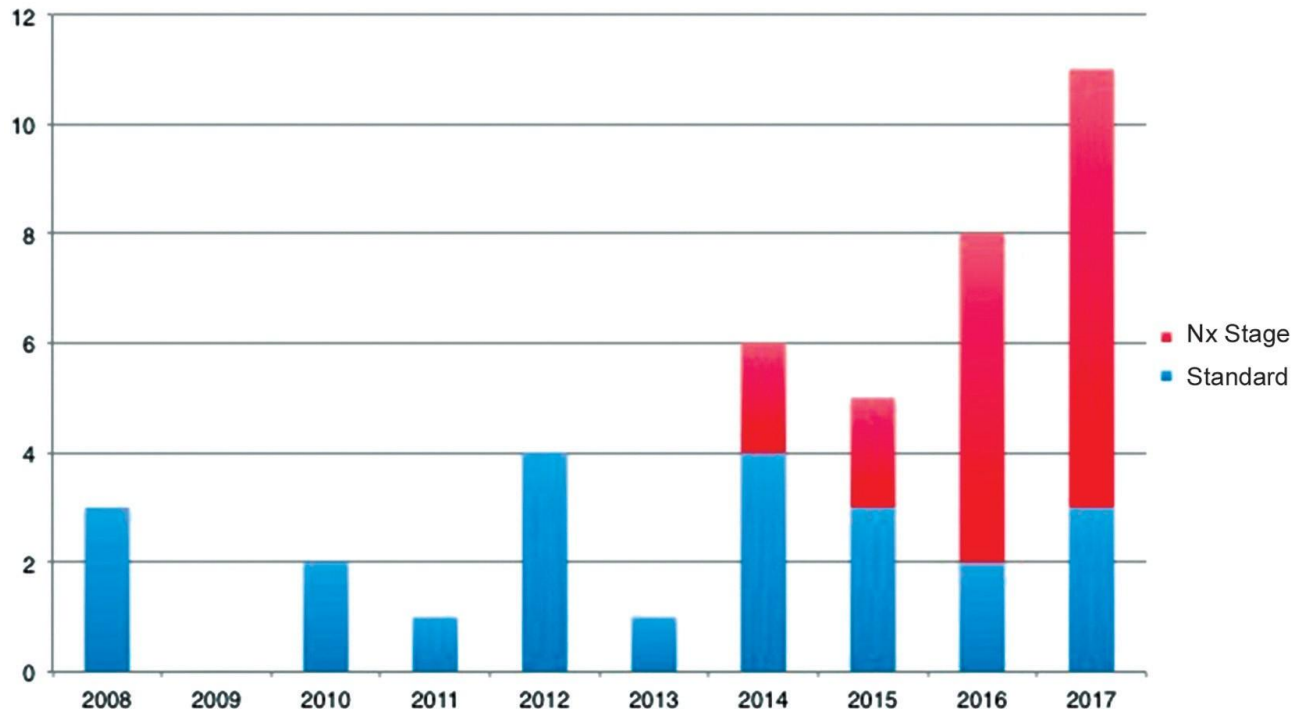

Figure 1. Incidence of patients in HHD (number/year)

http://dx.doi.org/10.22265/acnef.0.0.307

and 3 had training failures; of which 1 was by medical prescription, 1 due to loss of interest and 1 due to loss of confidence of the patient).

As of December 2017, 20 patients persist at home. Of the remaining 16, 4 were *exitus*, 7 had transplants and 5 left the program for different reasons (2 due to issues related to the caregiver, 2 by medical prescription and 1 due to problems related to the vascular access).

The training had an average of 34.8 ± 12.7 sessions, with a range between 12 and 61 sessions, and the training scheme most commonly used was that of 4 weekly sessions. The age below 65 years, the availability of the NxStage monitor and the experience accumulated by the center were determining factors in order that the training had a lower number of sessions ($p<0.05$). Having a catheter-related fistula or the level of studies of the patient were not determinative.

The mean age of the patients was 58.3 ± 13.4 years, with a median of 60 years and a range between 21 and 81 years. 28 % were over 65 years of age. 38 % were women and 62 % were men, 59 % had basic studies and only 15 % had higher studies. 38.5 % of working-age patients were active.

The patients had a Charlson index without age of 4.1 ± 1.6 (range = 2-8). 25.6 % had diabetes mellitus and 15.4 % were diagnosed with some degree of heart failure.

Regarding the origin of the patients, 41 % came from a specific consultation of advanced chronic kidney disease (ACKD); 36 %, from peritoneal dialysis (PD); 15 %, from in-center HD; and 8 %, from kidney transplant.

The distance of the patient's home regarding the hospital had a median of 15 km and a range between 2 and 131 km. 59 % of patients were at less than 20 km of distance.

We present the data of permanence in the technique (Figures 2 and 3)

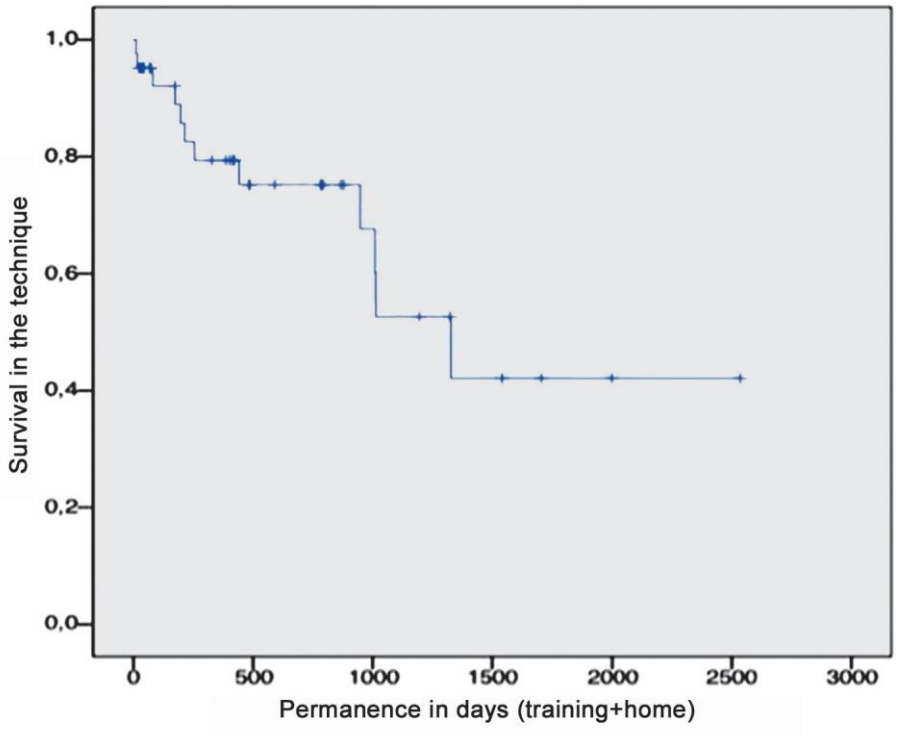

Figure 2. Technical survival. Event (death + abandonment of the program), censored (transplant).

http://dx.doi.org/10.22265/acnef.0.0.307

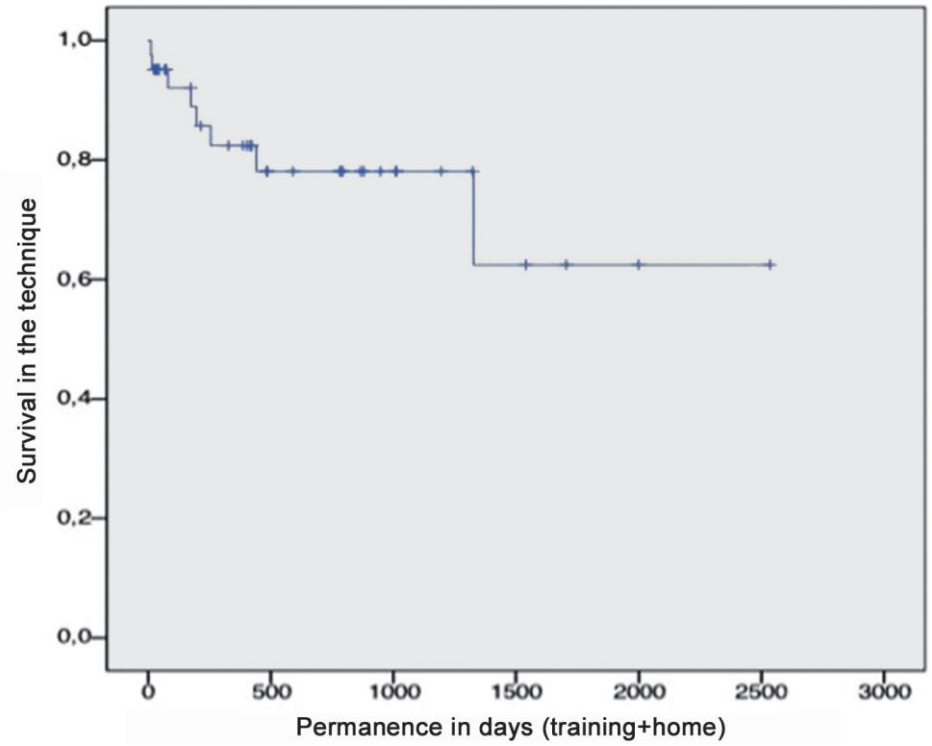

Figure 3. Technical survival. Event (abandonment of the program), censored (death + transplant).

Taking into account the training period and stay in home with the event death + technical failure (censoring egress due to transplant), in the univariate analysis, the determining factors (by Cox regression) for abandoning the program were: age, presence of diabetes mellitus and presence of heart failure; the Charlson index, the gender, the distance to the center, the presence of a dialysis fistula, the type of monitor used and the level of studies of the patient were not determining. In the multivariate analysis, age and diabetes mellitus lost significance, only the presence of heart failure remained significant.

32% of patients had dialysis fistulas; and the rest, tunneled catheters. In all cases, except in 1, we performed buttonhole puncture, with 0 infectious events related to native fistula and 0.12 infections-patient-follow-up year in the case of a catheter. In this way, the admissions due to vascular access related infections accounted for 12.2 % of the total. Regarding the specific problems of function of the access, recorded by the patient in hemodialysis graph, they were 1.59/1000 HD in the case of a catheter and 8.95/1000 HD in the case of native fistulas, without registering any episode of thrombosis thereof.

The characteristic of the dialysis used in all patients was the short-daily regime. 56.1% used conventional monitor and high permeability filter; and 43.9% used the NxStage system (low-flow dialysis bath). The sessions had a duration of 150.4 ± 17.8 minutes, 5.3 ± 0.6 sessions per week. It was obtained a Kt/Vstd of 2.7 ± 0.5. The mean ultrafiltration was 6.9 ± 1.7 ml/kg/hour. We present the weekly reductions of toxins of the systems used in HHD (standard monitor and NxStage) 2.5 hours (5 sessions/week), comparing them with data of on-line hemodiafiltration (on-line HDF) of our hospital HD unit 4 hours (3 sessions/week), with a mean convective volume of 24 liters and high permeability filter of 2.1 m^2 of surface. (Figure 4)

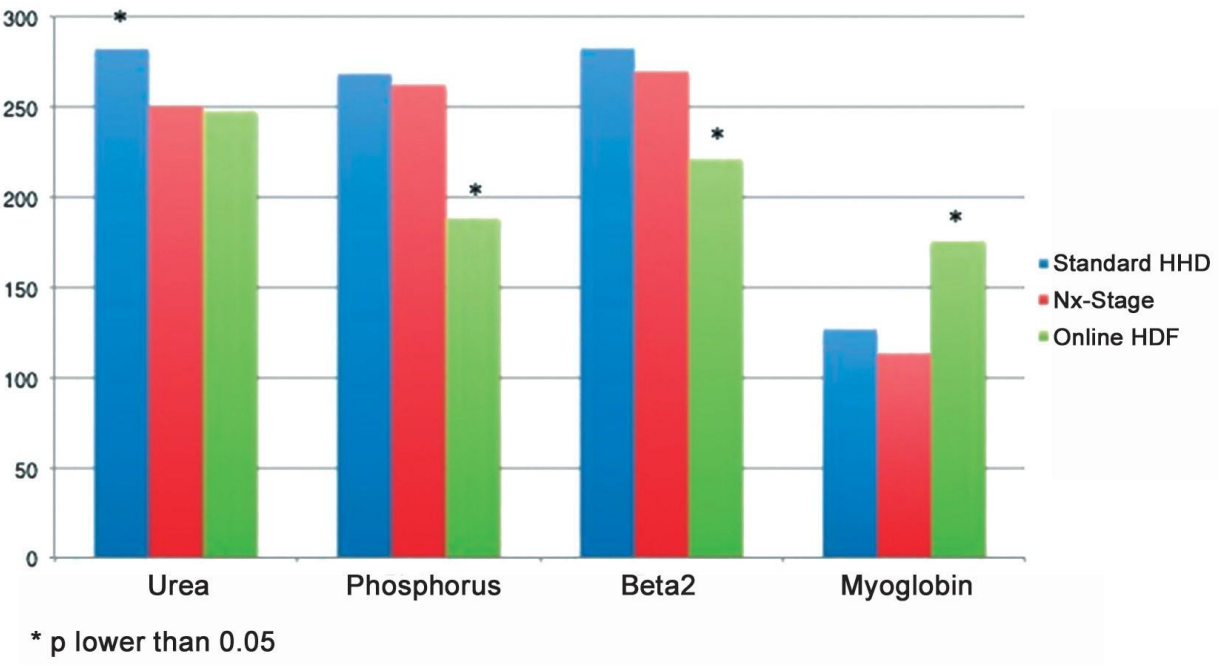

Figure 4. % of weekly reduction based on molecular weight.

Discussion

During these nine years of experience, we have been gradually growing in the number of patients under home hemodialysis, to become one of the centers with the largest number of patients in Spain, currently reaching a prevalence of 34.5 pmp. This means that the HHD represents, in the Province of Castellón, the 3.4 % of the total of dialysis, far above the 0.4 % that the technique represents in all over Spain.[2]

The growth has been much greater in the last 4 years, mainly due to the use of specific monitors for home hemodialysis and the optimization of the transfer of patients from PD. We consider the PD as the dialysis technique of choice over the HHD, due to its simplicity and the economy of the vascular access. PD is considered internationally as one of the sources of patients that must be optimized to foster growth in HHD.[3]

It has also been essential in the development of this technique the existence of an ACKD consultation,[4] where patients are informed about the options of renal replacement therapy and without doubt, the existence of a nephrological team which, as a whole, believes in the advantages of the domiciliary techniques. In contrast to the rest of Spain, where the majority of patients come from in-center HD in 46 %, and only 22 % from PD and 25 % from ACKD consultation;[5] in our case, the patients came mostly from PD and ACKD consultation. In no case, PD and HHD have been competitive, but rather complementary. In any case, there has been a growth of both techniques, as occurs in other countries, by promoting home dialysis as a whole.[6]

Regarding the characteristics of our patients, they were older and had more comorbidities than in the series of other European groups such as the one of Jayanty,[7] which showed a mean age of 48.3 years, a Charlson index of 3 and a percentage of diabetes mellitus and congestive heart failure of 9.1 and 4.2 %, respectively.

The expansion of the criteria for selection of patients, as advocated by the International Society

of Hemodialysis,[8] is another factor that has allowed us to grow in HHD. Thus, it can be seen in the different international registers, such as the Scottish or the Australian (ANZD ATA), a progressive increase in the proportion of patients over 65 years of age, which has changed from the year 2000 to 2015 from 5% to 26% in Scotland , from 12 to 24% in Australia and from 9 to 18% in New Zealand. In the United States, this proportion has always been high: in 2000, it was at 34%; and in 2015, at 31%, according to data from the American registry (USRDS).[1]

The distance is a facilitating factor for the development of HHD. Although the fact of being near to the reference center is not an impediment for it, in our case most of the patients were within a radius of less than 20 km of distance from the hospital, data that agrees with large series, such as the American by Prakash,[9] where the median with respect to the reference center was 10.6 km, and 68 % of patients were at less than 14 km.

In our experience stands out the labor rehabilitation of the patient under HHD. 38.5 % of working-age patients (mean = 51.4 years) were active. When compared with other techniques of renal replacement therapy in Spain,[10] in-center HD had an occupation percentage of 21.7 % of the working age patients (mean age = 47.8 years). For the PD, this percentage was 35.2 % (mean age = 48.5 years); and for the kidney transplant, 39 % (mean age = 46.4 years). Thus, our occupation data are close to the percentages of Spain on renal transplant, taking into account that our patients were older. This is, undoubtedly, an excellent data that goes in the direction of the economic advantages that HHD can entail.

As for the maintenance of the patient in the technique, stands out that the training period was shown as a crucial moment, since more than one third of the abandonments of the program occurred at this time. This was due to reasons dependent on the patient (lack of confidence and motivation); and, during the period of stay at home, it was originated for reasons dependent on the medical team (excessive acquired comorbidity conditioned by the performance of the HHD) and the caregiver.

The data of permanence in HHD that we obtained are comparable to data of ANZDATA and studies reported by European groups,[7,11] that show an excellent technical survival of HHD over time, superior to that of PD.[12] However, in our experience were shown as predictors of the decrease in the permanence of the patient in HHD the age, the diabetes mellitus and the heart failure, similarly to that was reported in other studies.[7] It should be noted that our training period was similar to what is shown in the Frequent Hemodialysis Network,[13] where the average number of sessions needed to train the patient was 27,[7] being determining factors the age and the mental status of the patient, but not the type of vascular access.

Regarding the vascular access, we recognize some bad data in our group in terms of the percentage of native fistulas. We have been progressively correcting this figure, although it is hindered by the bad situation of the vascular access in the province. In any case, the appropriate access should be always a native fistula,[14] which, in addition, ensures (as demonstrated by Perl[15] on 1869 Canadian patients incident in HHD), less probability (hazard ratio) of the composite event death-technical failure (0.78 [0.64-0.94]), of the event death (0.63 [0.43-0.91]) and of the event technical failure (0.84 [0.67-1.05]), although in this last case without statistical significance.

It is true that the protective effect that HHD has against cardiovascular risk can be attenuated by the increase in infection risk, especially on the vascular access,[16,17] due more to the buttonhole canalization rather than to the more frequent puncture.[18] Thus, it has been described that the buttonhole technique can triple the infection risk over native fistulas.[19] In any case, this type of puncture is a facilitating factor of the HHD, and what has to be done is to refine the infectious risk during training. In addition, periodic supervisions of the aseptic technique should be carried out, since

when it comes to reinfections, the risk decreases,[16] probably because the patients acquires greater awareness of what HHD entails. In our case, despite the use of buttonhole almost constantly, we did not record any infectious episode over the fistula, which caused more problems for the patient in the connection: up to 5-fold more than with the catheter.

Finally, the regime of HHD used was the short daily HD, which is the only one that is currently performed in Spain. Mean ultrafiltrations lower than 10 ml/kg/h that reduce the cardiovascular risk in the patient under HD were achieved,[20] with excellent weekly reductions of urea, phosphorus and beta-2-microglobulin, both with HD with bath flows of 500 ml/min, and with the NxStage system.

When we compared the reduction of uremic toxins by molecular weight of the short daily regime of 5 sessions per week, with the obtained with an on-line HDF of 4 hours and three sessions per week with mean convective volumes of 24 liters (being the blood flows of 330 ml/min in all cases), we found that, for the urea, the reduction was greater in the short daily regime, with HD with standard bath flow ($p<0.05$) with respect to that obtained with the NxStage system in the same regime, and with respect to the on-line HDF of 3 times per week.

The weekly reductions of phosphorus and beta-2-microglobulin were greater ($p <0.05$) in both short-daily regimens, with respect to the on-line HDF. Nevertheless, when the molecular weight of myoglobin was increased to 17800 daltons, the statistical significance fell in favor of on-line HDF. It is from 15000 daltons of molecular weight where the high permeability filters have their limit[21] and the convective clearance provides its importance.

To improve the clearance of toxins of higher molecular weight, we would find as possibilities the nocturnal frequent regimes, the home HDF, and without the need to increase the complexity of the technique, the option of expanded HD,[22] through the so called "high retention onset filters", which offer a promising possibility.

Conclusions

In our experience, HHD is a dialysis option that offers the patient time freedom and a good capacity for social and labor rehabilitation. It is possible to perform it with few additional resources, it allows the patient to continue at home when the peritoneum is no longer useful for dialysis and offers excellent uremic toxin clearance levels, with low hourly ultrafiltration ratios. Thus, it allows to obtain long periods of permanence in the technique, with promising medical outcomes. It is for this reason that, from the Hospital General de Castellón, we are committed to the development of this modest form of dialysis, which, without a doubt, has much to offer the patient.

Conflict of interest

There was no funding for the preparation of this article.

Funding

There was no funding for the preparation of this article.

Ethical responsibilities

Protection of people and animals

The authors declare that no experiments were performed on human beings or animals for this research.

Data confidentiality

The authors declare that they have followed the protocols of their workplace on the publication of patient data.

Right to privacy and informed consent

The authors declare that patient data do not appear in this article

http://dx.doi.org/10.22265/acnef.0.0.307

Contribution of the authors

Alejandro Pérez Alba: Main author

Javier Reque Santivañez: Writing and data analysis assistant.

Milagros Vázquez Gómez: Relation and data collection assistant.

Ramón Pons Prades: Helped in writing.

References

1. United States Renal Data System. 2017 USRDS annual data report: Epidemiology of kidney disease in the United States. Bethesda, MD National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases; 2017.
2. Sociedad Española de Nefrología. Grupo de trabajo de apoyo y promoción de la hemodiálisis domiciliaria en España. [Internet] 2018. Available in: http://www.senefro.org/modules.php?name= grupos&d_op=viewgroup&idgroup=12766
3. Mc Cormick BB, Chan CY, ORN Home Dialyisis Research Group. Striving to Achieve an Integrated Home Dialysis System: A Report from the Ontario Renal Network Home Dialysis Attrition Task Force. Clin J Am Soc Nephrol. 2018;13(3):468-470. https://doi.org/10.2215/CJN.06900617
4. Walker RC, Blagg CR, Mendelssohn DC. Systems to cultivate suitable patients for home dialysis. Hemodial Int. 2015;19 Suppl 1:52-58. https://doi.org/10.1111/hdi.12203
5. Pérez Alba A, Slon Roblero F, Castellano Gasch S, Bajo Rubio MA. Barriers for the development of home haemodialysis in Spain. Spanish nephrologists survey. Nefrología. 2017;37(6):665-668. https://doi.org/10.1016/j.nefroe. 2017.10.006
6. Shah N, Quinn RR, Thompson S, Pauly RP. Can home hemodialysis and peritoneal dialysis programs coexist and grow together?. Perit Dial Int. 2017;37(6):591-594. https://doi.org/10.3747/pdi.2017.00101
7. Jayanti A, Nikam M, Ebah L, Dutton G, Morris J, Mitra S. Technique survival in home haemodialysis: a composite success rate and its risk predictors in a prospective longitudinal cohort from a tertiary renal network programme. Nephrol Dial Transplant. 2013;28(10):2612-2620. https://doi.org/10.1093/ndt/gft294
8. Rioux JP, Marshall MR, Faratro R, Hakim R, Simmonds R, Chan CT. Patient selection and training for home hemodialysis. Hemodial Int. 2015;19 Suppl 1:71-79. https://doi.org/10.1111/hdi.12254
9. Prakash S, Coffin R, Schold J, Lewis SA, Gunzler D, Stark S, et al. Travel distance and home dialysis rates in the United States. Perit Dial Int. 2014;34(1):24-32. https://doi.org/10.3747/pdi.2012.00234
10. Julián-Mauro JC, Cuervo J, Rebollo P, Callejo D. Situación laboral y costes indirectos en pacientes con insuficiencia renal: diferencias entre distintas modalidades de tratamiento renal sustitutivo. Nefrología 2013;33(3):333-341. https://doi.org/10.3265/Nefrologia.pre2012.Dec.11767
11. Cornelis T, Tennankore KK, Goffin E, Rauta V, Honkanen E, ?zyilmaz A, et al. An international feasibility study of home haemodialysis in older patients. Nephrol Dial Transplant. 2014;29(12);2327-2333. https://doi.org/10.1093/ndt/gfu260
12. Nadeau-Fredette AC, Hawley CM, Pascoe EM, Chan CT, Clayton PA, Polkinghorne KR, et al. An Incident Cohort Study Comparing Survival on Home Hemodialysis and Peritoneal Dialysis (Australia and New Zealand Dialysis and Transplantation Registry). Clin J Am Soc Nephrol. 2015;10(8):1397-1407. https://doi.org/10.2215/CJN.00840115
13. Pipkin M, Eggers PW, Larive B, Rocco MV, Stokes JB, Suri R, et al. Recruitment and training for home hemodialysis experience and lessons from the Nocturnal Dialysis Trial. Clin J Am Soc Nephrol. 2010;5(9):1614-1620. https://doi.org/10.2215/CJN.02440310
14. Faratro R, Jeffries J, Nesrallah GE, MacRae JM. The care and keeping of vascular access for home hemodialysispatients. Hemodial Int. 2015;19 Suppl 1:80-92. https://doi.org/10.1111/hdi.12242
15. Perl J, Nessim SJ, Moist LM, Wald R, Na Y Tennankore KK, et al. Vascular Access Type and Patient and Technique Survival inHome Hemodialysis Patients: The Canadian Organ Replacement Register. Am J Kidney Dis. 2016;67(2):251-259. https://doi.org/10.1053/j.ajkd.2015.07.032.
16. Weinhandl ED, Nieman KM, Gilbertson DT, Collins AJ. Hospitalization in daily home hemodialysis and matched thrice-weekly in-center hemodialysis patients. Am J Kidney Dis. 2015;65(1):98-108. https://doi.org/10.1053/j.ajkd.2014. 06.015.
17. Suri RS, Li L, Nesrallah GE. The risk of hospitalization and modality failure with home dialysis. Kidney Int. 2015;88(2):360-368. https://doi.org/10.1038/ki.2015.68
18. Lok CE, Sontrop JM, Faratro R, Chan CT, Zimmerman DL. Frequent hemodialysis fistula infectious complications. Nephron extra. 2014;4(3):159-167.

19. Muir CA, Kotwal SS, Hawley CM, Polkinghorne K, Gallagher MP, Snelling P, et al. Buttonhole cannulation and clinical outcomes in a home hemodialysis cohort and systematic review. Clin J AM Soc Nephrol. 2014;9(1):110-119. https://doi.org/10.2215/CJN.03930413

20. Flythe JE, Kimmel SE, Brunelli SM. Rapid fluid removal during dialysis is associated with cardiovascular morbility and mortality. Kidney Int. 2011;79(2):250-257. https://doi.org/10.1038/ki.2010.383

21. Maduell F. Eficacia depurativa de medianas y grandes moléculas en diferentes modalidades de hemodiálisis. Nefrología. 2005;25 Supl 2:15-18.

22. Ronco C. The rise of expanded hemodialyisis. Blood Purif. 2017;44(2):I-VIII. https://doi.org/10.1159/000476012