www.bdd.rdplf.org Volume 2, n° 1, Avril 2019
https://doi.org/10.25796/bdd.v2i1.19113
ISSN 2607-9917

Le Bulletin de la Dialyse à Domicile

LONG NOCTURNAL HOME HEMODIALYSIS : AN OLD THERAPY BROUGHT UP TO DATE

L'HEMODIALYSE LONGUE NOCTURNE AU DOMICILE : UNE TECHNIQUE ANCIENNE REMISE AU GOÛT DU JOUR

Note : cette publication est en deux langues (version française disponible à la même adress URL : https://doi.org/10.25796/bdd.v2i1.19113

Eric Laruelle[1]

[1]AUB Santé, Rennes

Résumé

L'hémodialyse à domicile (HDD) se développe en France depuis 2011 en raison des progrès techniques apportés aux machines de dialyse, d'utilisation simplifiée, de la quantité limitée et de la qualité renforcée du dialysat. Réalisée le plus souvent sur un mode quotidien, en séances courtes, l'HDD apporte des résultats performants en terme de contrôle hydro sodé, d'épuration mais surtout en flexibilité et autonomie. Dans ce travail, nous décrivons l'organisation d'une technique alternative à l'hémodialyse quotidienne à bas débit (HDQBD), l'hémodialyse longue nocturne (HDLN) à bas débit de dialysat chez une patiente dialysée depuis 2006 après un échec de greffe. Nous discutons l'avantage de ce mode de dialyse, les premiers résultats, les freins possibles notamment la peur d'un événement adverse, les conditions de sécurité et l'avantage d'un système de télésurveillance/assistance développé pour cette occasion.

Mots clés : Hémodialyse longue nocturne, Hémodialyse à domicile, Hémodialyse à bas débit, Télésanté

Abstract

Home hemodialysis therapy orientation is rising since 2011 in France due to technical progress in dialysis machines, with a simplified use, an ultrapure and sparing dialysate delivery. The most frequent therapy is short daily dialysis sessions with performing results in terms of water and salt balance, depuration and mainly on autonomy and flexibility. In this article, we describe the organization of an alternative therapy with long nocturnal low flow hemodialysis in a dialyzed patient since 2006 after a graft failure. We discuss the benefits of this therapy, first results, eventual barriers to this method specially the occurrence of an adverse event, security and benefit of a telemonitoring and teleassistance that we develop for this occasion.

Keywords : Long nocturnal hemodialysis, Home Hemodialysis, Low dialysate flow rate, Telehealth

journal officiel du Registre de Dialyse Péritonéale de Langue Française RDPLF www.rdplf.org

www.bdd.rdplf.org Volume 2, n° 1, Avril 2019
https://doi.org/10.25796/bdd.v2i1.19113
ISSN 2607-9917

INTRODUCTION

Home hemodialysis (HHD) has been experiencing renewed interest in France since 2011 due to technical advances in dialysis devices and the provision of an ultrapure pre-conditioned dialysate (1-2).

The practice of long-nocturnal hemodialysis (LNHD) at home is as old as hemodialysis itself, as it was developed and described as early as 1963 by Shaldon in the United Kingdom (3). These first positive experiences subsequently led to long-night and often intensive hemodialysis programs, 5 to 6 nights/week at home by Canadian teams (4). Despite the spectacular results described by the Tassin team in the 1970s (5), LNHD performed three times eight hours a week had a very low development in France in care units (0.7% of dialysis has a duration > of 6 h, REIN 2016) and even less at home(6) .

The revival of HDD relies mostly on short and frequent dialysis regimen with recognized benefits: more physiological dialysis, better tolerated, better blood pressure control, improved nutritional parameters and patient-centered approach by providing greater flexibility and independence from treatment (7-9).

Performed at home, at the rate of three sessions per week, LNHD has similar clinical and biological benefits and improves the control of phosphatemia (10-11). It reduces the frequency of puncture of the vascular access and above all, completely releases daytime activity.

We describe our experience and the first results of low-flow dialysate home dialysis in a patient who had been dialysed since 2006 and had ten years of long-dialysis at night in selfdialysis unit care and 21 months of low flow daily hemodialysis (LFDH).
.

MATERIAL AND METHODS

Context

As everywhere in France, HDD activity in Brittany declined in the 1990s where it only affected five patients in 2011 (Figure 1). In Rennes area, since 2013, 11 patients have been introduced in HDQBD.

The decline of HDD has been accompanied by the development of self-dialysis unit cares, with the particularity since 2003 in Brittany of development of long nocturnal dialysis units , including the Montgermont unit. Four patients transferred to home in recent years are patients who had experienced long-night self dialysis and have made the home choice as a second step.

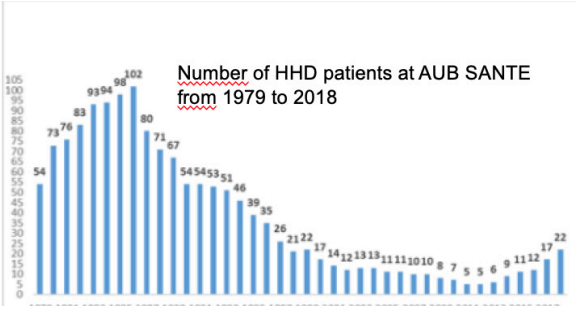

Fig. 1 : number of patients in HHD 1979-2018 at AUB

Clinical case

We present Mrs. P.'s medical data in addition to her testimony in this issue on the impact of the treatments she has experienced. (BDD 2019; 2 (1) 33-36)

Mrs. P. has Chronic Kidney Failure on type 1 diabetes discovered at the age of 14. Proteinuric kidney disease will worsen after pregnancy and at the age of 34, she will be preemptively grafted of a kidney and pancreas. Unfortunately, the survival of the pancreatic graft lasted only 12 months due to a mycotic aneurysm of the pancreatic artery and renal survival, 48 months. There is still hyperimmunization and thrombosis of the external iliac artery which is the site of pancreatic arterial anastomosis that will limit her access to a future transplant.

Long-nocturnal hemodialysis

Mrs. P. is an archaeologist and 80% of her work consists in the management of Breton archaeology teams. Divorced, she raises her son alone with the help of her mother. In 2007, she began treatment with conventional hemodialysis in a unit of self dialysis, but was quickly treated with long-night dialysis in our care unit. These dialysis sessions were well tolerated on a hemodynamic level. She was receiving antihypertensive treatment (Aprovel ® 150 mg) which was stopped after two years of long dialysis, her blood pressure being normal. Her diabetes has been treated since 2008 with an insulin pump whose flow is reduced by 20% during dialysis sessions. The vascular access is a superficialized humero-basilica arteriovenous fistula (AVF) During this period, her treatment was Apidra®, Kayexalate 1 spoonful measures the days without dialysis, Tahor® 20 mg per

www.bdd.rdplf.org Volume 2, n° 1, Avril 2019
https://doi.org/10.25796/bdd.v2i1.19113
ISSN 2607-9917

day, Uvedose ® 1 bulb per month, Speciafoldine ® 5 mg 1 cp three times a week. She did not need erythropoietin (ASE).

Daily hemodialysis

In March 2017, she began sessions in a daily mode (6 x 2:30).She was trained to the self puncture of her fistula and to the use of the Nxstage® cycler. From a hemodynamic point of view, her blood pressure remained normal without treatment. The target dose of purification was delivered without difficulty with an average Kt/V single pool at 0.64±0.02 and an average total standard Kt/V at 2.57±0.05. The changes induced by LFDH were as follows: the iron reserve decreased because blood loss increased with daily dialysis. She now required ASE treatment (Mircera® 120 mcg/month). Phosphorus was less well controlled despite the reintroduction of phosphorus chelators (sucroferric oxyhydroxide, Sevelamer®) and dietary advice to reduce dietary intake. Treatment with Cinacalcet® began in October 2017 with levels of PTH regularly above 10N (Table 1).

In March 2018, a cardiac check-up was performed: cardiac ultrasound showed normal left ventricular systolic function, normal valve function and normal left ventricular mass. Coronarography was normal. The abdominal scan showed the known occlusion of the right iliac artery post pancreatic transplantation. The iliac axes were free of calcifications.

LNHD

After 18 months of completing the daily sessions, she aspired to resume her profes-sional activity. The question was then to resume nocturnal dialysis without having to give up the autonomy acquired with regard to treatment. The sessions began in Octo-ber 2018. The patient first performed them, independently in the long night dialysis unit prior to home installation. The third person in the domicile was her 19-year-old son, but he did not
take part in the treatment. The unit then offered a back-up solution in the event of an electrical failure, cycler failure, vascular first puncture problem and allowed for a res-pite option when needed. The cycler allowed the performance of eight-hour long dialy-sis with 8 bags of 5 liters or a dialysis flow at 80 ml/mn versus the usual flows of 150 to 200 ml/mn. Blood flow was 250 ml/mn, which is a ratio of 30% optimizing the saturation of the dialysate. Ultrafiltration averaged 8.2 ml/h/kg in LNHD versus 8.6 ml/h/kg in QBDHD. In our patient, the necessary volume needed to obtain a total standard Kt/V of 2,1 is estimated at 40 liters for three sessions of 8 hours per week and 30 liters for one session every other day. The initial requirement was 35 liters per session, plus 40 sec-ondary liters to improve phosphorus clearance.

Comparative results on the main biochemical parameters measured over periods of 3 to 6 months with the three techniques are presented in Table 1.

Tableau 1 : Table 1 : biological results on HDLN, HDBQD et HDLN at low dialysate flux ;

Parameters	LN HD 3x240 l	LFDH (6X20 l)	HLNHD (3x40 l)
Kt/V sp	2,55+/-0,12	0,64+/-0,02	1,24+/-0,07
Kt/V standard total (Gotch)	2,95+/-0,05	2,57+/-0,05	2,17+/-0,07
Hemoglobin (g/dL)	12,1+/-0,69	10,5+/-0,7	11,6+/-0,8
Ferritin (ng/ml)	214+/-77	152+/-124	127+/-22
Potassium (mmol/l)	5,2+/-1,22	4,7+/-0,7	5,1+/-1,1
Bicarbonate (mmol/l)	22,2+/-2	22+/-1,4	24+/-2
Calcium (mmol/l)	2,33+/-0,13	2,27+/-0,11	2,12+/-0,07
Phosphorus (mmol/l)	2,11+/-0,4	2,32+/-0,3	2,09+/-0,4
Albumin (g/l)	43,5+/-2	44,5+/-1	44,4+/-1
PTH (1-84 bio intacte, pg/ml)	228+/-240 (4N)	488+/-131 (8.5N)	308+/-200 (5N)

LNHD 3x240 l (between September 2016 and February 2017),
BQDHD 6x20l (between March 2018 and August 2018)
Home LNHD low-flox 3 x35 then 3x40 l (between November 2018 and January 2019):

Anaemia was corrected and iron recharging allowed to lower the Mircera® dose to 100 mcg/month.

In daily dialysis, short sessions do not require anticoagulation, but in long dialysis, it is necessary. After several tests, a dose of Fraxiparine® of 0.4 ml per session was injected at the beginning of the session directly into the fistula needle. Bleeding from the arterial point was noted during the first sessions due to excessive anticoagulation and the reshuffling of a button hole point that had been abandoned. The puncture technique was mixed with a

www.bdd.rdplf.org Volume 2, n° 1, Avril 2019
https://doi.org/10.25796/bdd.v2i1.19113
ISSN 2607-9917

blunt 16G needle on the arterial point and rope scale on the venous point punctured with a sharp needle(17G). Extracorporal circuit pressure alarms were set to -250 mm Hg for the arterial pressure, with a range of variation of 60/-40 around the venous pressure once it has stabilized. The average values were -77 mmHg for the arterial pressure, 190 mmHg for the venous pressure. Alarms were rare during the session. The attachment of the needles was maximized with the help of several adhesive strips placed in a tie and then covered with a tubular net allowing maintenance without compression. A blood leak detection tab is attached close to the needle to detect early needle desinsertion. It is connected to an audible alarm in the room and provides teletransmission of the alarm in the Montgermont night dialysis unit. A Wi-Fi remote control also allows the patient an emergency phone call in free hand mode (SOS key) and get immediate audio contact with the nurses through the speaker (photo 1and 2).

Photo 1 : blood leak detection system,

Photo 2 : remote control with an emergency call button

The cycler is placed on a tray to detect a leak of fluid (dialysis, blood) and connected to an audible alarm. The cycler's audible alarm is amplified using external speakers (photo 3). The connections of extra-corporal circuit are secure: a hand tubular bridge holds the venous line to the venous needle, the screwing of the cap on the heparin line is checked and the line is clamped. The return line is clamped. In case of hypotension, a dialysis bolus is pre-programmed.

At home, the clinical parameters are monitored and can be checked at distance: weight, blood pressure, temperature using the Serviline ® system.

Photo 3 :blood leak detection tray. External speakers.

DISCUSSION

We report our long-night dialysis experience at home on the Nxstage® cycler. It is an alternative pattern of home treatment that differs from daily treatment and adapts with new cyclers a method frequently used in the early days of HHD (1-3).

Conventional four hours hemodialysis performed three times per week is associated over the long term with a high rate of cardiovascular complications and a low quality of life. Transplantation remains the best survival and rehabilitation treatment. Our observation illustrates the need to further develop alternatives to conventional treatment for patients who do not have easy access to a transplant.

The clinical and biological positive effects of increasing time or frequency of dialysis have been widely

https://doi.org/10.25796/bdd.v2i1.19113
ISSN 2607-9917

described (7-11). Some cohort studies have concluded that survival is comparable to kidney transplant patients (12). Although this has not been demonstrated in randomized studies, benefits on surrogate criteria including control of blood pressure and improvement in nutrition have been observed. This is the case for our patient who has normal blood pressure without any treatment, without left ventricular hypertrophy, lack of vascular calcifications, very good control of acidosis and nutritional parameters.

The decrease in ultrafiltration rate is associated with lower cardiovascular mortality and a better tolerance of dialysis (13). We observed a comparable average UF during the QBDHD and LNHD periods respectively 8.6 ml/H/kg and 8.2 ml/h/kg, much less than the usual conventional hemodialysis ultrafiltration.

Regarding the phosphorus-calcium balance, although the phosphorus chelators had been stopped for a fairly long period of time, the control of phosphatemia was insufficient during the last months of high flow long dialysis which caused the rise in the parathormone levels. QBDHD did not change this and phosphatemia rose despite the reintroduction of chelators and cinacalcet. It is too early to judge the effect of long-night dialysis, even though serum phosphorus appears to have decreased slightly. In long dialysis with 3x 40 litres of dialysis, the amount of phosphate eliminated was estimated at 155 mmol/week compared to 130 mmol/week for 6 x 20 litres of dialysis, a 20% higher level for long treatment.

Although our patient choosed to perform three-weekly sessions rather than one night every otherday, HDD by its flexibility is perfectly suited to this pattern that avoids the two-day interval without dialysis with potentially harmful metabolic and volemic effects.

The Nxstage® cycler is suitable for long night sessions, the only limit being the need to amplify the sound level of the warnings. We encountered few alarms and few adverse events other than fistula bleeding on the first sessions. In our experience, long night dialysis is safe and needle disconnections are very rare. In the literature, in a population of 202 patients dialyzing on traditional generators for twelve years, Tennankore et al. described only 22 serious events including 18 fistula needle disconnections and 6 embolic events for 757 patient-years or 0.009 disconnection per patient-year (14).

Despite this low rate of complications, one of the main barrier to adopting HDD is the feeling of insecurity and fear of a serious event. This is also an important barrier for teams who fear to put patients at risk. Needle disconnection is easily prevented by a rigorous procedure with a reinforced attachment and by setting the cycler's venous pressure alarm ranges. The leakage of blood at the circuit level must be prevented especially at the heparin line. Appropriate patient training should emphasize compliance with these protocols and insist on procedures in case of bleeding.

The device we have implemented carries a blood detector alarm into a remote health unit. This device helps to reassure both patient and healthcare teams and should replace the third-person obligation. A majority of patients do not want to place responsibility for home treatment on their closed ones. This is the case for our patient who is perfectly aware of her treatment. It is not possible to have a close one provide a follow-up during the hours of sleep even if it is a companion and the safety profile of the technique does not justify it. This type of treatment supported by new technologies allows to do without the third person and offers more possibility to the single person.

Monitoring treatment follow-up parameters (clinical parameters and cycler data) could positively affect technical survival (15).

CONCLUSION

Our observation shows that long-night hemodialysis three times a week can be offered at home with a low flow dialysis monitor. This therapy is adapted to the needs of patients by clinical benefits (on the blood pressure, nutritional benefit, tolerance of dialysis) and by the impact on the quality of life. New health technologies and remote monitoring are tools that can help to act positively on the fear of complications at home.

CONFLICTS OF INTEREST

les auteurs déclarent ne pas avoir de conflit d'intérêt pour cet article.

THANKS

I would like to thank Dr. Natalie Borman of the Wessex Kidney Centre, Porstmouth, who, through the presentation of her experience at the SNSFD in June 2018 in Caen, motivated and guided this first low-speed LNHD installation at home.

REFERENCES

1/ Meyrier A. Naissance, croissance, decadence et renaissance de l'hemodialyse à domicile. Bulletin de la dialyse à domicile. (2018) Vol 1, n°3. https://doi.org/10.25796/bdd.v1i3.56

2/ Benabed A, Henri P, Lobbedez T., Goffin E., Baluta S., Benziane A et al.Hémodialyse quotidienne à bas débit de dialysat à domicile : résultats cliniques et biologiques des 62 premiers patients traités en France et en Belgique » Néphrologie et thé-

https://doi.org/10.25796/bdd.v2i1.19113
ISSN 2607-9917

rapeutiques 13 (2017) 18-25.

3/ Shaldon S. First use of nocturnal hemodialysis. Kidney int 2009 ; 76 :230

4/ Pierratos A., Ouwendyk M., Francoeur R., Vas D., Dominic S., Ecclestone A. M. et al Nocturnal Hemodialysis: three year experience. Journal ot the American Society. 9 (5) 859-868.

5/ G. Laurent and B.Charra The results of an 8h thrice weekly haemodialysis schedule. Nephrol Dial Transplant 1998, 125-131.

6/ Rapport Rein 2016 https://www.agence-biomedecine.fr/rapport-annuel-REIN-2016, consulté le 03/02/2019

7/Cherukuri S., Bajo M., Clussi G., Corciulo R., Fessi H., Ficheux M. et al. Home hemodialysis treatment and outcomes: retrospective analysis of the Knowledge to Improve Home Dialysis Network in Europe (KIHDNEy) cohort. BMC Nephrology (2018) 19 :262

8/Chazot C.,Ok E., Lacson E., Kerr P.G., Jean G., Misra M. Thrice weekly nocturnal haemodialysis : the overlooked alternative to improve patient outcomes. Nephrol Dial Transplant (2013) 28.2447-2455

9/Eloot S. Van Biesen W., Dhondt A., Van de Wynkele H., Glorieux G., Verdonck. P. et al Impact of hemodialysis duration on the removal of uremic retention solutes. Kidney International (2008) 73, 765-70

10/ Rocco MV, Lockridge RS, Beck GJ, Eggers PW, Gassmann JJ, Greene The effects of frequent nocturnal home hemodialysis : the Frequent Hemodialysis Network noccturnal trial . Kidney Int 2011: 80 :1080-1091

11/Basile C., Libutti P., Lucia Di Toro A ;, Casino F.G., Vernaglione L. Tundo S et al .Removal of uraemic retention solutes in standard bicarbonate haemodialysis and long hour slow flow bicarbonate haemodialysis Nephrol Dial Transplant (2011)26 :1296-1303

12/Pauly R.P., Gill J.S., Caren L. R., Asad R., Chery A.Pierratos A. et al Survival among home haemodialysis patients compared to kidney transplant recipients

13/ R. Saran, JL Bragg-Gresham, NW Levin, ZJ Twardowski, V Wizemann et al Longer treatment time and slower ultrafiltration in hemodialysis : Associations with reduced mortality in DOPPS, Kidney Int,(2006) 69,1222-28

13/Cafazzo J. A., Leonard K., Easty A. Rossos P.G. Chan C Patient-perceived barriers to the adoption of nocturnal home hemodialysis. CJASN (2009)

14/ Tennankore KK, D.Gama C., Faratro R, Fung S., Wong E., Chan CT Adverse technical events in home hemodialysis, Am J Kidney Disease, 2015 65 (1) : 116-21

15/E. Weinhandl, A.J.Collins Relative risk of home hemodialysis attrition in patients using a telehealth platform. Hemodialysis International 2018 22:318-327

Received 19/02/04, accepted after revision19/02/17
publishe 19/04/10