



Management of arterial hypertension following the every-other day dialysis (EODD) versus two conventional regimens of 4-5 hours per session three times a week with 72 hours of week-end free dialysis

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SUMMARY

An increase in the frequency of hemodialysis sessions improves control of extracellular volume and blood hypertension and consequently reduces the mortality related to cardiovascular aetiology in hemodialysis patients.

We report the evolution of the blood hypertension depending on the need for antihypertensive drugs in a group of 38 prevalent patients that were included in a every-other-day dialysis schedule (EODD), and compare it with the results in two other groups of prevalent patients that were dialyzed in conventional, previously employed schedules without week-end sessions 4hoursx3xweek and 5hoursx3xweek. All three groups received hemodialysis treatment for more than 6 months.

A 68% (26/38) of the patients received antihypertensive treatment at the beginning the EODD schedule and, after 16 months, only 7.9% (3/38) of them required antihypertensive treatment ($p < 0.001$) with reduction in two of the three remanent patients; hypertension control in those 25 patients took an average of 100 ± 15 days. The final frequency of hypertension in EODD was lower ($p < 0.002$) than the frequency registered in the 84 prevalent patients in 4hx3xweek schedule, and also lower ($p = 0.065$) than the frequency of the 56 prevalent patients in 5hx3xweek schedule.

There is a significant difference ($p < 0,05$) between EODD and 4hx3xweek schedule as regards average figures of: increase in weight, decrease in dry-weight, blood pressure levels and hypotension incidence. EODD also produced better results than 5hx3xweek schedule in this regard although statistics did not reflect it.

The results using the every-other-day hemodialysis schedule support previous experiences (Lecce, Columbia) which achieved a good control of the dry-weight by means of suppressing the volume overload gained during the weekend and consequently obtaining adequate ultrafiltration rates and high reduction both of the hypertension and of the symptoms of intolerance to hemodialysis, which are so frequent in conventional schedules with 72 hours without hemodialysis sessions.

Key words: **EODD. Hypertension. Antihypertensive drugs. Hypotension. Dry weight.**

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CONTROL DE LA HIPERTENSIÓN ARTERIAL MEDIANTE EL ESQUEMA DE HEMODIÁLISIS EN DÍAS ALTERNOS (HDDA O «EODD»: «EVERY OTHER DAY DIALYSIS») VERSUS DOS ESQUEMAS CONVENCIONALES DE 4 Y 5 HORAS POR SESIÓN TRES VECES A LA SEMANA CON 72 HORAS DE FIN DE SEMANA SIN SESIONES

RESUMEN

El aumento de la frecuencia de las sesiones de hemodiálisis garantiza un mejor control del volumen extracelular y de la hipertensión arterial, hechos que pueden reducir la mortalidad relacionada con patología cardiovascular entre la población en hemodiálisis.

Describimos la evolución de la hipertensión arterial, en función de las necesidades de administración de fármacos antihipertensivos, en una población prevalente de 38 pacientes que iniciaron el esquema de hemodiálisis en días alternos sin descanso de 72 h de fin de semana, y la comparamos con 140 pacientes asimismo prevalentes que eran tratados en dos esquemas convencionales, previamente utilizados, con descanso de fin de semana y tres sesiones semanales de 4 y de 5 horas respectivamente; todos los pacientes habían permanecido durante más de 6 meses en hemodiálisis.

El 68,4% (26/38) de los pacientes del esquema alterno presentaba hipertensión arterial al inicio del esquema alterno y tras 16,1 meses de permanencia media en el esquema solo mantuvieron medicación el 7,9% de ellos (3/38) con reducción en dos de los tres pacientes restantes ($p < 0,001$). Los 25 pacientes que cesaron o redujeron la medicación antihipertensiva lo hicieron en una media de 100 ± 15 días. La frecuencia final de hipertensión en diálisis alterna fue inferior a la que presentaban los 84 pacientes prevalentes con esquema de 4 horas x 3 sesiones x semana (60,7%) ($p < 0,002$) y a la de los 56 pacientes prevalentes con esquema de 5 horas x 3 sesiones x semana (25%; $p = 0,065$).

Las diferencias entre las ganancias medias de peso entre sesiones con y sin fin de semana, los descensos medios del peso seco, las medias de tensión arterial y la frecuencia de hipotensiones, entre los pacientes en el esquema alterno y los del esquema con fin de semana y 3 sesiones de 4 horas durante la misma, alcanzaron diferencia significativa ($p < 0,05$). Estos mismos datos comparados con el mismo esquema pero con sesiones de 5 horas fueron mejores pero sin alcanzar significación estadística. El gasto farmacéutico en medicación antihipertensiva se redujo en un 87%.

Nuestros resultados, empleando el esquema de hemodiálisis en días alternos sin descanso de 72 horas, apoyan experiencias previas (Lecce, Columbia) que consiguen controlar el peso seco tras hacer desaparecer el exceso de volumen acumulado en el fin de semana posibilitando unas tasas adecuadas de ultrafiltración, minimizando la aparición de hipertensión y de los síntomas de intolerancia en hemodiálisis, tan frecuentes en el esquema convencional.

Palabras clave: *Hemodiálisis días alternos. Hipertensión arterial. Fármacos antihipertensivos. Hipotensión. Peso seco.*

INTRODUCTION

Arterial hypertension (AHT) appears in 73% of the patients with chronic renal failure at pre-dialysis in our country¹, and in hemodialysis (HD)-treated populations its incidence still is high, both in our setting (54%)² and in other regions of the world, reaching 72% of HD-treated patients in the USA³. This fact relates with universal spreading of the today called conventional HD regimen consisting in three sessions per week, 3-4 h per sessions, and 72 h hemodialysis-free week-end, which was developed from the theory of m^2/hour^4 , and the minimal urea Kt/v^5 ; with previous longer HD dialysis regimens, AHT was seldom seen⁶.

Maintaining AHT in HD largely depends on the excess of extracellular volume (ECV) so that other HD regimens increasing dialysis time and sessions frequency favor AHT management⁷.

We describe a reduction of the need for AHT medication in HD patients included in an every-other-day 4-hours-per-session regimen with no 72-h resting period during the weekends (EODD), with an associated strategy of withdrawing hypotensive medication and daily supervision of lean weight estimation. The results are compared with those from conventional HD regimens with week-end breaks: three weekly sessions, 4 hours per session (4HDC) and three weekly sessions, five hours per session (5hDC).

PATIENTS AND METHODS

Retrospective and prevalence study with three groups of patients with Stage IV chronic renal disease and on renal replacement therapy with HD.

- Patients on EODD: prevalent population at 06/30/2005, with minimal staying of 6 months at the EODD regimen: 38 patients 18 men and 20 women with mean age of 67.2 ± 12.2 years. Thirteen patients started EODD as their first dialysis technique with a mean stay of 16.1 ± 6.1 months and 25 patients started on EODD after switching from a previous conventional regimen with three weekly sessions of 5 hours per session and 72-h dialysis-free week-ends (5HDC), with a mean stay on HD of 48.8 ± 41.5 months. Forty-seven percent of all patients were diabetics.

Selection criteria to be included into that regimen were: personal history of arterial hypertension and/or heart failure and/or coronary heart disease and/or vascular access through funneled permanent catheter.

EODD technique: 4-h sessions every other day with no 72-h weekend breaks (Mon-Wed-Fri-Su-Tu-Th-Sat-Mon). Dialyzers with high permeability synthetic membranes of 1.6-2,1 m² of surface area, bicarbonate concentrate, constant Na⁺ profile of 140 mEq/L, with monitors controlling ultrafiltration rate; Qb: 300-350 mL·min; Qd: 500 mL·min; constant and linear ultrafiltration profile. Biocompatibility: single use extracorporeal circuit non-ethylene oxide sterilized (≤ 1 mS) for the dialysis bath by double-flow reverse osmosis; ultrafilter before the dialyzer of dialysis fluid.

- Patients on 4HDC: Prevalent population at 06/30/2002 with no selection criteria prior to beginning of the 4HDC technique, and corresponding to the last year this technique was still applied at out Unit and with minimal stay of 6 months: 84 patients, 46 men and 38 women, mean age 64 ± 13 years, mean time on HD 82.6 ± 75.2 months. Twenty-three percent of the patients were diabetics.

HD regimen with three weekly 4-h sessions, with 72-h dialysis-free week-ends (4HDC); dialyzers with modified cellulose membranes of 1.6-1.8 m² surface area, bicarbonate concentrate, constant Na⁺ profile at 140 mEq·L; monitors with ultrafiltration rate control; Qb: 300-350 mL·min; Qd: 500 mL·min; constant and linear ultrafiltration profile. Biocompatibility: single use extracorporeal circuit sterilized with ethylene oxide, radiation or heat; pure water supply (> 1 mS) for the dialysis bath by reverse osmosis flow.

- 5HDC: Prevalent population at 06/30/2004 with no selection criteria prior to beginning of the 5HDC technique, and corresponding to the last year this technique was still applied at out Unit and with minimal stay of 6 months: 56 patients, 27 men and 29 women, mean age 69.2 ± 11 years; mean time on HD 64.6 ± 56.3 months. Thirty-two percent of the patients were diabetics.

HD regimen with three weekly 4-h sessions, with 72-h dialysis-free week-ends (5HDC); dialyzers with high permeability synthetic membranes of 1.6-2,1 m², bicarbonate concentrate, constant Na⁺ profile at 140 mEq·L; monitors with ultrafiltration rate control; Qb: 300-350 mL·min; Qd: 500 mL·min; constant and linear ultrafiltration profile. Biocompatibility: single use extracorporeal circuit sterilized with ethylene oxide, radiation or heat; pure water supply (> 1 mS) for the dialysis bath by reverse osmosis flow.

Since the start of our hemodialysis units (1974), the following data, as well as other incidents, are included into the HD sessions registry: patient's weight before and after the session; blood pressure (BP) measurements: BP before puncturing the vascular access, BP after connecting the extracorporeal circuit (within the first hour of HD), BP at the 2^d, 3^d, 4th, and 5th hour of dialysis, and BP after disconnecting from the system; hypotension episodes and requirement of normal saline to manage them.

From 1997, the registries are transferred to the HD Units Database (Mec Rec, Gambro®).

The following data from the patient's history were gathered for the 3 groups:

1. Prescriptions of hypotensive medication (1, 2, 3 or more drugs) at the time of cross-sectional prevalence in the three populations, as well as previous medications before starting EODD.
2. Progression of antihypertensive therapy requirements during the stay at the EODD.
3. Weight at start of HD, and the lowest weight ever during permanence on the HD regimen.
4. Pre-HD BP registries, BP at the 1st, 2^d, 3^d, 4th, and 5th hour of dialysis, and post-HD BP for twelve weeks before the cut-off date.
5. Lean body weight gains prescribed in-between weekly sessions and after the weekend, for twelve weeks before the cut-off date.
6. Number of symptomatic hypotension episodes, measured by the need of normal saline to normalize the BP, within 6 months before the cut-off date.
7. Kt/V determinations (2^d gen. Daug.) for 6 months before the cut-off date.

Treatment strategy for patients with AHT on HD consisted in progressive discontinuation of anti-hypertensive medications associated to prescription of the required linear ultrafiltration rates during the HD session to achieve 0.5-1 kg body weight reductions as compared to previously calculated lean weight, without generally exceeding reductions greater than 3% of the body weight at the beginning of the HD session; all this was done considering BP progression during the previous HD session and during the current session in order to avoid intra-dialysis or post-dialysis intolerance episodes. Drugs of the day with HD session were discontinued in the first place, and then those of the day without HD.

Progression of body weights, BP registries, and incidents with the dialysis technique were reviewed daily by the physicians in charge who prescribed UF and changes in anti-hypertensive therapy as needed.

All patients with a history of CV disease and/or AHT were put on a salt-restriction diet to the maximal level of achievement without producing loss of appetite.

The need for prescription of anti-hypertensive therapy was established if the average determination of pre- and post-HD BP was above 150/85 mmHg⁸ with no response or intolerance to further reductions of lean weight.

The calculation of the cost for anti-hypertensive medication was based on reference prices established in Annex 3 of the Andalusian Health Service and on active principles most frequently used in our patients: enalapril, amlodipine, nifedipine, atenolol, and doxazosin; from the determination of the cost per patient and per month, the product for each HD treatment regimen was calculated and the percentages by groups with 1, 2, or 3 drugs by projecting the comparative cost for 100 patients on HD per year.

Statistical Method: descriptive statistics: central tendency and dispersion measurements (mean and sd) for quantitative variables and proportions for qualitative variables.

Inferential statistics: bi-variate analysis for comparing means (Student's t test) and proportions (Chi squared). The level of significance chosen was the one corresponding to a level of alpha significance of $p < 0.05$, independently of the analysis considered and the character of the variable being analyzed; when that level was not reached it was considered as not significant (NS).

RESULTS

Mean stay of prevalent population on EODD was 16.1 ± 6.1 months. Table I shows the frequency of EODD-treated AHT at the beginning and at the end of follow-up ($p < 0.001$).

In addition to a global reduction in the number of patients requiring antihypertensive medication, in the 3 patients that were kept on medication the number of drugs used could be reduced from 3 to 1 drug in two cases.

In the 25 patients discontinuing or reducing antihypertensive therapy, the average time to reach the objective was 100 days; the remaining patient was kept on the 3 initial drugs.

Table I. Progression of AHT with EODD

	Num.	%
Total AHT pre-HD	26/38*	68.42
3 or more drugs	11	42.3
2 drugs	8	30.7
1 drug	7	26.9
Total AHT post-HD	3/38*	7.9
3 or more drugs	1	2.6
2 drugs	0	0
1 drug	2	5.3
Days (mean) with AHT from start of EODD	100.5 \pm 15.8	
Months (mean) with AHT from start of EODD	3.3 \pm 0.1	

* $p < 0.001$.

Table II. Incidence of AHT and hemodialysis regimen

		4HDC	5HDC	EODD
Num. prevalent > 6 Months		84	56	38
AHT:	Num.(%)	51 (60.7)	14 (25)	3 (7.9)
3 or more drugs:	Num.(%)	7 (8.3)	5 (8.9)	1 (2.6)
2 drugs:	Num.(%)	20 (23.8)	5 (8.9)	0
1 drug:	Num.(%)	24 (28.6)	4 (7.1)	2 (5.3)
No AHT:	Num.(%)	33 (39.3)	42 (75)	35 (92.1)
AHT%		4HDC vs 5HDC $p < 0.001$		
AHT%		4HDC vs EODD $p = 0.002$		
AHT%		5HDC vs EODD $p = 0.065$		

Table II shows the need for antihypertensive medication with the three HD regimens.

The decrease in AHT frequency with EODD and 5HDC regimens in relation to the 4HDC regimen reached a statistically significant difference, and although EODD considerably improved AHT control over the 5HDC regimen, this difference did not reach statistical significance.

Table III shows the differences in time and frequency between the three HD regimens, the differences between initial weight and the lowest lean weight achieved, gains in body weight assigned during the week and during the week-end, as well as BP values between patients with AHT at the beginning of EODD that could reduce or discontinue antihypertensive medication and those prevalent patients with AHT and 4HDC or 5HDC regimens at the time of prevalence cut-offs.

Differences in the parameters analyzed between patients on EODD and 4HDC reached statistical significance but it was not so between EODD and 5HDC.

Mean body weight gain at the prevalence cut-off date, as compared to the lowest weight normalizing BP, for patient with AHT at the beginning of EODD was $1.3 \text{ kg} \pm 1.9$ (+1.8%).

Table IV shows the differential analysis of symptomatic hypotension episodes between the HD regimens.

The percentage of sessions with hypotension was significantly lower (SD) for EODD as compared to 4HDC and 5HDC.

Antihypertensive treatment cost (100 patients/year) was 15,552 € for 4HDC, 9,384 € (-40%) for 5HDC, and 2,016 € for EODD (-87% vs 4HDC) (-78% vs 5HDC).

Monthly Kt/v (Kt/V of the session \times Num. of sessions per month) for 4HDC was 16.6 ± 1.4 ; for 5HDC: 20.9 ± 4.2 , and for EODD 20.1 ± 3.3 .

The hemodialysis product (HDP):⁹ Num. of session hours \times (weekly sessions)² was 49 for EODD, 36 for 4HDC, and 45 for 5HDC.

DISCUSSION

The presence of AHT in HD patients favors the development of left heart hypertrophy and CVD¹⁰, which represents

Table III.

	4HDC	vs HDDA	5HDC	vs HDDA	EODD
Num. sessions x month	13		13		15
Hours x session	4		5		4
Hours x month	54		65		60
Máximum num. of hours without session	72		72		48
Difference kg mean \pm SD (%)	-1.1 \pm 4.1 (-1.52%)	p = 0.01	-1.4 \pm 6.5 (-2.3%)	p = 0.35	-3.2 \pm 3 (-4.3%)
Gaing kg WE* mean \pm SD	+3.3 \pm 0.7	p < 0.001	+2.5 \pm 0.9	p = 0.21	+2.1 \pm 1
Gain kg no WE mean \pm SD	+2.8 \pm 0.6	p = 0.001	+2.3 \pm 0.9	p = 0.40	+2.1 \pm 1
systolic BP mmHg mean \pm SD	145 \pm 16	p < 0.001	135 \pm 17	p = 0.41	131 \pm 14
diastolic BP mmHg mean \pm SD	79 \pm 14	p = 0.003	75 \pm 15	p = 0.20	69 \pm 12

*WE: weekend.

the most important death cause among HD patients in all populations^{11,12}; deaths from CVD mainly occur within the 72-hours period free of dialysis session, corresponding to the week-end, a condition that is not observed among patients on peritoneal dialysis¹³, which reflects the importance of ECV volume expansion for maintaining BP in HD patients, although other humoral factors present within the uremic milieu or related to chronic ECV excess⁷ may also contribute in maintaining BP.

The development of HD regimens that increase the time and/or frequency of the sessions and other convective technical variations¹⁴ has shown to improve metabolic parameters of the uremic syndrome, the incidence of AHT, and its heart repercussions¹⁵. Tassin's HD with three 8-hour weekly sessions reduces the need for hypotensive medications to just 3% of his patients¹⁶, and daily short-dialysis regimens¹⁷ and prolonged nocturnal daily HD¹⁸ normalize the BP in those patients. All these regimens facilitate the maintenance of lean weight by strictly controlling the ECV and allowing for a better balance between ultrafiltration and vascular refilling from the interstitium¹⁹.

In a previous publication²⁰, we described the cardiovascular state improvement in 9 patients that did not manage to reach the lean weight and still having overhydration

symptoms; their HD regimen was switched from a conventional one (5HDC) with 72 hours session-free to an EODD regimen developed by Mastrangelo et al.²¹ (Lecce Dialysis) for those patients from their series with lower body surface area as an alternative to the regimen of four weekly sessions that although assuring the absence of a 72-hour period without dialysis is not exactly an every-other-day regimen.

This proceeding has been applied in the USA (Columbia, Missouri) with the English acronym EODD: Every other day dialysis²², showing good management of AHT.

From those results, we applied this treatment regimen in those patients already included into a 5HDC regimen and with incident HD following the inclusion criteria previously described in *methods*.

After 16 months of follow-up on EODD, only 3 out of 38 prevalent patients (7.9%) with more than 6 months on this regimen still needed medication to control BP values (2 out of 3 patients went down from 3 to 1 drug), as compared to the beginning of the EODD regimen when 68% of the patients (26/38) required antihypertensive therapy (SD); AHT control was achieved within an average time of 100 days from the beginning of EODD.

The frequency of AHT among our patients at the beginning of EODD is similar to that reported in Spain and Europe; the frequency of AHT among patients that remained on EODD for longer than 6 months is, however, much lower than that among conventional HD in Andalusia where more than half of prevalent patients require antihypertensive medication². The Lecce group, with four weekly sessions (either alternate or not), achieved to control AHT in 85% of the patients that were hypertensive at the beginning of HD, although at the end of the follow-up period, 39% required medication to control AHT even with HD.

We have compared our results with those obtained in prevalent populations with a stay on HD longer than 6 months with two regimens previously used in our Unit, both with a 72-h dialysis-free period and with no previous inclusion criteria: with the 4HDC regimen, the frequency

Table IV. Hypotension episodes in AHT patients

	4HDC	5HDC	EODD
Num. patients	51*	14*	26*
Total sessions within 6 months	3,978	1,092	2,340
Total episodes	1,049	263	394**
Sessions with an episode (%)	26%	24%	17%

*Comparison between prevalent patients with AHT > 6 months on HDC vs incident EODD patients with AHT.

**P < 0.001 vs 4HDC and 5HDC.

of AHT was 60%, in agreement with European registries; the presence of AHT was lowered to 25% in prevalent patients, although still two thirds of the patients required more than 2 drugs. Reductions in AHT frequencies with the 5-h conventional regimen and with the EODD regimen, as compared with the 4-h conventional regimen, reached significant differences, but although the difference between EODD and 5HDC was considerable, it did not reach a statistical difference, although it expresses the influence and the impact of dialysis session duration²³ on AHT management²⁴.

In order to avoid biases due to seasonal BP variations described with HD²⁵, the prevalence cut-off dates for the three HD populations have been set at the same annual seasonal date set for the population ascribed to EODD.

Cardiovascular comorbidity factors that most of HD patients have lead to a defective response of the mechanisms that compensate UF (cardiac output, peripheral resistances, vascular refilling capacity from the interstitial space); if the UF rate needed to achieve the lean weight exceeds the refilling capacity, then hypotension occurs, which needs volume reposition and reduction of the UF rate to resolve, closing a vicious circle that maintains expansion of the ECV.

Hourly UF rates described as tolerable vary from 0.5% to 1.5 % of the body weight, depending on the particular patient²⁶; with total UF rates higher than 3%, the patient enters into a risk zone for hypotension²⁷ and the coexistence of hypotensive medication is an additional difficulty for reaching the lean weight²⁸.

With ECV increase of just 2% of the lean weight, AHT may develop²⁹ with no other overhydration symptoms³⁰ and this fact in a 70-kg individual may represent an ECV in excess of just 1.4 kg.

EODD patients that managed to control their AHT had an average weight gain during the 48-h inter-session period of 2.1 kg; for an average usual body weight of 70 kg in our population, the total safe UF rate of 3% of the body weight per session corresponds to the average weight gain with EODD; however, the average weight gain during the 72-h dialysis-free period for patients with AHT on a 4HDC regimen was 3.3 kg. (+37% vs EODD), so that during the first HD of the week it is difficult to achieve an appropriate UF rate that is well tolerated without complications, and by not reaching the lean weight during that first session, the excess in ECV and AHT are maintained through time.

As a result, the mean decrease in lean weight (-4.3%) obtained in our initially hypertensive patients on EODD that managed to control their AHT was significantly higher than that achieved (-1.52%) by prevalent patients on 4HDC that still need therapy to control their AHT.

The 20% increase in dialysis session duration with the 5HDC regimen as compared to the 4HDC regimen improves the lean weight reduction averages (-2.3%) and also the inter-dialysis weight gain among prevalent patients with AHT, although these results are poorer than those obtained in patients with initial AHT on EODD.

The 23 patients that normalized their BP with the EODD regimen later on had a 1.8% increase over the lowest lean weight ever achieved while keeping a controlled BP, a phe-

nomenon already described and that adds to the «lag phenomenon»²⁹.

BP levels achieved by patients with AHT that started on EODD and that manage to discontinue their anti-hypertensive medication during the follow-up period were lower to those presented by patients with AHT treated with a 4HDC (SD) and 5HDC (NS) regimens; this is coherent with the maintenance of a physiologic extracellular volume without major variations during the week-end.

Besides the absence of the 72-h dialysis-free period, two other factors have been paramount for our results:

The first one is progressive withdrawal of antihypertensive medication in order to achieve sufficient UF rates without the development of complications³¹; hypotension, as well as AHT, is also related with the mortality increase with HD^{32,33}, it frequently develops (25%) during conventional HD sessions³⁴, and it accounts for patient discomfort and getting away from their appropriate lean weight making them need the infusion of normal saline to maintain BP³³.

EODD significantly decreased the rate of hypotension episodes down to 17% of the sessions as compared to 26% and 24% observed with the 4HDC and 5HDC regimens, respectively (SD); the decrease in the frequency of hypotension episodes with EODD may be due to the lack of antihypertensive medication and to the elimination of the 72-h dialysis-free period, which helps maintaining acceptable weight gains manageable with tolerable UF rates. Body mass variations related to appetite increase linked to improvement of the uremic syndrome after starting on EODD create some difficulty for accurate adjustments of the target weight after the session and contribute to persistence of a certain rate of hypotension episodes, although less frequent^{19,36}.

Although Lecce's series presented a lower percentage of sessions with hypotension (8.7%), the mean age of that population was 20 years younger than that of our patients on EODD; besides, and due to inclusion criteria in the EODD regimen, our patients presented greater cardiovascular comorbidity and thus greater susceptibility.

The second factor is the close follow-up of each patient and of each HD session³⁵ assessing the course and incidents to establish the target UF rate and weight for the next session³⁶. This schedule proved to be successful in the Tassin's study. The discontinuation of the need for antihypertensive therapy in most of our patients on EODD also implicates a greater tolerance to UF, the disappearance of side effects, and the increase of patient's quality of life; besides, it also implies a considerable reduction of pharmaceutical costs: for the 5HDC group, it was estimated that pharmaceutical cost for prevalent AHT patients was reduced by 40% as compared to 40% the 4HDC regimen; cost reduction for EODD was 87% and 78% as compared to 4HDC and 5HDC, respectively. This cost reduction for antihypertensive medication may help compensate the cost increase due to two additional sessions per month per patient in relation to conventional regimen.

EODD involves a 16.7% increase of HD duration as compared to 4HDC so that the average monthly Kt/V improves (20.1 vs 16.6) and comes close to the one obtained with the 5HDC regimen (20.9); besides, the increase in the frequency of EODD sessions involves an increase in stdKt/v of 17.4% as compared to 4HDC, taking as the reference the

same Kt/v equivalent to 1.3³⁷. The hemodialysis product (HDP) for EODD (49) is even higher than that obtained with the 5HDC regimen (45); the collateral effect of increasing the dialysis dose by increasing time is the decrease of AHT³⁸.

HD regimens increasing the time and/or the frequency of the sessions show as beneficial effects control of AHT, although they are not easily applicable to the whole patient population due to problems with resources, logistics, or accessibility.

The adequate control of AHT achieved with EODD makes of this regimen the most efficient alternative^{22,39} since it allows maintaining the organizational aspects of three shifts of patients per HD monitoring device, as it occurs with 4HDC but not with the 5HDC regimen.

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