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*Clinical Study*

# Therapeutic Education's Role in the Management of Hypertension in Chronic Hemodialysis Patients

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The prevalence of hypertension remains high in hemodialysis (HD) patients, leading to a considerable morbimortality. The "dry weight method (DW)," established by Scribner, presents an undeniable interest in the management of hypertension in HD patients. *Aim*. The aim of our work was to determine the prevalence and risk factors (RFs) of hypertension in our chronic HD patients and try to reduce it by using a therapeutic education (TE) strategy based on Scribner's recommendations. *Patients and Methods*. We led an interventional prospective study in three phases. In phase 1, we determined the prevalence of hypertension. In phase 2, hypertensive patients benefited of a TE strategy. In phase 3, we evaluated the effects of our TE. *Results*. Hypertension was noted in 57 patients. RFs for hypertension included age, important interdialytic weight gain (IDWG), noncompliance to the dietary rules, and a rhythm of 2 sessions of dialysis per week. The use of a TE strategy enabled us to correct hypertension in some of our HD patients. *Conclusion*. A TE strategy improved the hypertension rate in our HD unit. This success could not be conceived without an educational effort supported by the whole medical team.

## 1. Introduction

The prevalence of hypertension remains high in hemodialysis (HD) patients, leading to a considerable morbimortality, and an unsatisfactory quality of life. The "dry weight method (DW)," established by Scribner, presents an undeniable interest in the management of hypertension in HD patients [1]. It is based on a gradual reduction of dry weight (DW), respect of sodium balance during the dialysis session, performance of sufficiently long dialysis sessions, a low sodium diet, and the gradual withdrawal of antihypertensive drugs [1].

Our study was conducted in three stages, each with distinct objectives. The aim in the first stage was to determine the prevalence of hypertension and its risk factors within our population of chronic hemodialysis patients. Then, in the second stage, we aimed to lower the blood pressure levels of our patients by adopting a therapeutic education (TE) strategy based on Scribner's recommendations. Finally, we evaluated the effects of our nonpharmacological treatment and our educational involvement.

## 2. Patients and Methods

Our interventional prospective study was carried out in three months, from October to December 2011, and in three stages. It enrolled 93 chronic hemodialysis patients from our hemodialysis unit.

The *first stage* consisted of an assessment of the epidemiological context, a determination of the prevalence of hypertension in our population using two approaches: on the first hand, hourly monitoring of BP during hemodialysis sessions, performed by all members of the medical and paramedical staff using appropriate manual blood pressure cuffs; on the other hand, we recommended to our patients that they perform ambDWG, efforts to restrict fluid ulatory monitoring of their blood pressure twice a day at rest, on their nondialysis days.

(i) We defined hypertension by BP values superior or equal to 140 mmHg for systolic blood pressure (SBP) and/or 90 mmHg for diastolic blood pressure (DBP)

found on at least two readings either in the dialysis center or at ambulatory monitoring.

(ii) We divided our patients into two groups:

(a) group 1: hypertensive patients ("Hypertension+" group);

(b) group 2: nonhypertensive patients ("control" group).

(iii) Then, by comparing the "Hypertension+" group to the "control" group with regard to anthropometric, clinical, biological, and dialytic parameters, we were able to identify risk factors for hypertension.

The statistical analysis was carried out using the SPSS 17.0 software program.

Quantitative variables with normal distribution were expressed as mean ± standard deviation, and quantitative variables with nonnormal distribution were expressed as median-(extremes). Their comparison was carried out using Student's $t$-test.

Qualitative variables were expressed as percentages. Their comparison was performed using the chi-square test.

The difference is considered statistically significant for $P < 0.05$.

During *the second stage*, patients in group 1 ("Hypertension+" group) benefited from treatment based on Scribner's recommendations [1], as well as on the results of our statistical study. This approach was inspired by our determination to implement the principles of therapeutic education (TE). Thus, our first step was to increase the number of individual consultations in view of establishing an educational diagnosis for each patient. This involves determining the patients' level of knowledge and awareness of their disease, their degree of adherence to treatment regimens and hygienic-dietary recommendations, and the possible obstacles to be overcome. We then prepared a program based on the "constructivist model" of therapeutic education, which meant having small groups of patients engaged in learning with the help of trial and error activities and the setting up of challenges [2].

In order to unify the management of our patients, we integrated TE logbooks with the standard logbooks for the monitoring of chronic HD. These TE logbooks, included information on the clinical, psychological, and biological states of the patients and their treatment. They, therefore, allowed the tracking of the learning progress as well as the communication of instructions between the health care staff.

During the *third stage*, we evaluated the effects of these nonpharmacological measures on interdialytic weight gain (IDWG) and blood pressure readings.

## 3. Results

Our total population comprised 93 chronic hemodialysis patients whose mean age was 50.8 ± 15.5 years. Elderly subjects (patients with age ≥65 years) represented 20.43% of the total population ($n = 19$). The M/F sex ratio was 0.978 (46 M/47 F) and the mean time on hemodialysis was 88 ± 54.03 months. 58 of our patients followed a dialysis rhythm of 2 sessions of 5 hours each per week, while the other 35 patients underwent dialysis 3 times per week in 4-hour sessions. The etiologies of the end-stage renal disease (ESRD) in these patients are summarized in Table 1.

Table 1: Causal nephropathies in our hemodialysis patients.

| Causal nephropathy | $n = 93$ | % |
|---|---|---|
| Undetermined | 44 | *47.31* |
| Polycystic kidney disease | 15 | *16.12* |
| Diabetic | 12 | *12.9* |
| Vascular | 9 | *9.67* |
| Chronic tubulointerstitial nephritis | 8 | *8.6* |
| Chronic glomerulopathy | 5 | *5.37* |

In *stage 1*, we monitored the BP of all our patients hourly during connection, then on disconnection for a period of two weeks. In addition, the patients followed our instructions to measure their blood pressure twice a day on the nondialysis days, also for two weeks. This amounts to a total of closely monitored 442 dialysis sessions and 1720 blood pressure measurements (10 readings per week outside the center for patients dialyzed twice a week, and 8 for those dialyzed three times a week).

An arterial BP exceeding the stipulated thresholds was found in 231 dialysis sessions (Table 2), which corresponds to 57 patients, that is, a mean of 4.05 ± 0.95 [3–6] sessions with Hypertension+/patient in two weeks. Only 9 of these patients (15.7%), of whom 7 were dialyzed 2 times/week and 2 dialyzed 3 times/week regularly left the dialysis session with a normal BP. All the other patients remained hypertensive off dialysis.

This hypertension was systolic, systolic-diastolic, or isolated diastolic in 80.34%, 12.6% and 6.98% of cases, respectively. The mean SBP was 172.75 ± 17.69 (145 – 220) mmHg.

As for the blood pressure measurements taken outside the center, of the 1088 taken by the 57 hypertensive patients, only 74 were normal (i.e., 6.8%): these were from the 9 patients who were normotensive at the end of their sessions and included at least one reading taken the day after dialysis.

Thus, the hypertension prevalence in our population of chronic hemodialysis patients was on the order of 61.3%.

The characteristics of the 57 patients diagnosed as hypertensive were as follows: a mean age of 58.35 ± 11.6 (31 – 83) years; 19 patients (33.3%) were over the age of 65 years; sex ratio of 1.19 (31 M/26 F), a hemodialysis rhythm of 2 and 3 sessions per week for, respectively, 44 and 13 of these patients; a mean IDWG of 3.50 ± 0.51 (2.1 – 4.98) kgs; 70.1% of them ($n = 40$) stated that they scrupulously complied with the hygienic-dietary recommendations (HDR).

Moreover, 32 patients (56.1%) followed an antihypertensive treatment comprising one, two, or three pharmacological classes in, respectively, 59.3% ($n = 19$), 34.4% ($n = 11$), and 6.2% ($n = 2$) of cases.

Table 2: Hemodialysis sessions profile in group 1 "Hypertension+" patients ($n = 57$).

| Number of hemodialysis sessions per week | 2 sessions/week | | 3 sessions/week |
|---|---|---|---|
| *Number of patients with hypertension* | *44* | | *13* |
| Number of supervised sessions/week | 88 | | 39 |
| Number of supervised sessions/2 weeks | 176 | | 78 |
| *Total of supervised sessions* | | *254* | |
| Number of patients that presented 3 episodes of intradialytic hypertension in 2 weeks | 16 | | — |
| Number of patients that presented 4 episodes of intradialytic hypertension in 2 weeks | 28 | | 2 |
| Number of patients that presented 5 episodes of intradialytic hypertension in 2 weeks | — | | 3 |
| Number of patients that presented 6 episodes of intradialytic hypertension in 2 weeks | — | | 8 |
| *Number of sessions with hypertension in 2 weeks* | *160* | | *71* |
| *Total of sessions with hypertension* | | *231* | |

Table 3: Causal nephropathies in group 1 "Hypertension+" patients ($n = 57$).

| Causal nephropathy | $n = 57$ | % |
|---|---|---|
| Undetermined | 30 | *52.6* |
| Polycystic kidney disease | 8 | *14.03* |
| Diabetic | 6 | *10.52* |
| Vascular | 6 | *10.52* |
| Chronic tubulointerstitial | 4 | *7.01* |
| Chronic glomerulopathy | 3 | *5.26* |

The distribution of the nephropathies causing their ESRD is shown in Table 3.

By comparing group 1 "Hypertension+" to the "control" group, statistical analysis allowed us to retain the following risk factors: age ($P < 0.0001$), significant IDWG ($P < 0.0001$), nonrespect of hygienic-dietary recommendations ($P = 0.014$), and the rhythm of two dialysis sessions per week ($P < 0.0001$) (Table 4).

In *stage 2*, we tried to apply Scribner's recommendations with the aim of achieving a reduction of hypertension by non-pharmacological means in the 57 hypertensive patients.

Consequently, we undertook an educational effort among the patients and their families which involved explaining, designing, and monitoring adherence to a low-sodium diet, defined as a consumption of less than or equal to 6 g of NaCl per day. We also illustrated our explanations with concrete examples of the salt content of the foods most commonly consumed in Moroccan households.

This work was the fruit of an intense and sustained effort by all 16 members of the medical and paramedical staff and was based on the fundamental principles of TE [2].

In fact, a rigorous educational diagnosis revealed that 87.7% ($n = 50$) of the patients were of low socioeconomic level, that 80.7% ($n = 46$) had an inadequate educational level, but that all had access to at least one close adult who was both educated and involved in the organization of their everyday hygiene.

We then organized biweekly learning sessions for small groups of 4 to 5 patients, "neighbors" during dialysis sessions. In colloquial Moroccan Arabic, we explained with illustrations, proposed playful trial and error exercises, set up collective reasoning challenges with imaginary situations, and answered everybody's questions. We took account of each individual's needs, sensitivities, susceptibilities, and level of understanding with the aim of optimizing knowledge acquisition.

The subjects we dealt with included not only ESRD in dialysis as an entity in itself with its specificities, its daily constraints, its complications, its psychoaffective repercussions, but especially the guiding principles for the life style of a patient in dialysis in terms of diet, physical activity, and use of medications.

The majority of these methods correspond to the "constructivist model" of TE, based on group work using activity modules, and which we chose for the team spirit and the notion of mutual help that it develops, associated with an allosteric learning model, meaning one that takes account of patients' acquired knowledge and works with their beliefs while trying to inculcate knowledge "with," but also "in opposition to" their conceptions [2]. In addition, a TE diary was created for each patient allowing him/her to keep track of the TE program to ensure the traceability of the TPE program for each individual.

At the end of the study, we reached 92.9% compliance with hygienic-dietary recommendations (HDR) ($n = 53$), although this percentage remains subjective since there is no way to verify the veracity of our patients' statements.

The second measure introduced was a change of rhythm to three dialysis sessions per week. For logistical reasons, this concerned 13 of our patients, which brought the number of patients dialyzed 3 times per week to 26, versus 31 dialyzed 2 times per week This decision was made for the most hypertensive among them, that is, those whose SBP was higher or equal to 180 mmHg.

Finally, we attempted to achieve a reduction of dry weight (DW) in the 48 patients whose hypertension persisted at the end of the sessions, at a rhythm of 1/2 Kg/15 days within the limits of hemodynamic tolerance. Consequently, DW remained unchanged in 9 patients, decreased by 0.5 kg in 15 patients, 1 Kg in 21 patients, 1.5 Kgs in 10 patients and 2 Kgs in 2 patients. This corresponds to a mean decrease of $0.98 \pm 0.42$ Kg.

Table 4: Statistical analysis of hypertension risk factors in our hemodialysis patients.

| Parameter | Hypertension+: $n = 57$ | Hypertension−: $n = 36$ | $P$ |
|---|---|---|---|
| Age (years) | 60.8 ± 13.76 | 39.11 ± 13.37 | **0.000** |
| Sex ($n$) | 31 H/26 F | 15 H/21 F | NS |
| Causal nephropathy ($n$) | | | |
| Undetermined | 30 | 14 | NS |
| Diabetic | 6 | 6 | NS |
| Vascular | 6 | 3 | NS |
| Polycystic kidney disease | 3 | 5 | NS |
| Glomerular | 8 | 7 | NS |
| Chronic tubulointerstitial | 4 | 1 | NS |
| Hemodialysis duration (years) | 96.22 ± 53.31 | 77.11 ± 53.82 | NS |
| Intradialytic weight gain (Kgs) | 3.52 ± 0.51 | 2.68 ± 0.68 | **0.000** |
| Compliance with dietary rules: $n$ (%) | 40 (*70.1*) | 33 (*91.6*) | **0.014** |
| 2 dialysis sessions/week: $n$ (%) | 44 (*77.2*) | 12 (*33.3*) | **0.000** |

During *the third stage*, we evaluated the effects of our treatment on blood pressure measurements using the same methodology and rigor as in stage 1, as well as its effects on IDWG.

(i) We found that 8 patients moved into the "normotensive" category according to their BP figures, which were normal at all readings for 6 of them, and above normal at only one reading for the other two patients concerned.

The prevalence of hypertension in our population, thus, decreased to 52.7%.

In the "Hypertension+" group, at that point composed of 49 patients, there were also changes in the blood pressure profile. The mean arterial pressure decreased from a value exceeding or equal to 20 mmHg in 24.5% of patients, from a value of less than 20 mmHg in 26.3% of patients, and remained unchanged in 49.2% of cases.

The mean of the SBP thus changed to 166.12 ± 17.05 (140 – 200) mmHg.

(ii) With regard to IDWG, efforts to restrict fluid and salt intake allowed its reduction in 80.7% of cases ($n = 46$ patients) distributed as follows: a decrease of less than or equal to 0.5 Kg in 13 patients, between 0.5 and 1 kg in 17 patients, between 1 and 1.5 kgs in 14 patients, and definitely exceeding 1.5 kgs in two patients. This amounts to a mean decrease of 0.98 ± 0.42 Kgs. On the contrary, there was no decrease of IDWG in 11 patients (19.2%).

## 4. Discussion

Our study demonstrated a 62.3% prevalence of hypertension in our population of chronic hemodialysis patients. Our TPE program made it possible to reduce this rate to 52.7%.

Epidemiological surveys conducted during this last decade all found an elevated prevalence of hypertension in HD, ranging from 55 to 85% according to the different studies [3–5]. Moreover, since the 1990s, it has appeared that blood pressure control by dialysis has become insufficient, and two main reasons for that may be suggested.

First of all, the patients reaching the stage of dialysis are increasingly aged [6]. In our series, elderly subjects represented one fifth of our hemodyalized population and one third of our group 1 "Hypertension+." Thus, all of our elderly patients were hypertensive.

The second explanation is that vascular nephropathies currently constitute between 35 and 40% of nephropathies causing ESRD, while they represented only 5% of the latter in the 1970s [6]. In fact, known risk factors for these vascular nephropathies are diabetes and hypertension. Thus, the patients concerned have a history of diabetes with endothelial vascular lesions and/or of hypertension preceding the renal failure. Consequently, the blood pressure values of these patients do not improve even after they start dialysis. In our work, vascular and diabetic nephropathies made up 21% of causative nephropathies.

Nevertheless, the epidemiological data reported in the literature must be put into perspective, since the different authors do not use the same definition of hypertension. Some refer to the mean arterial pressure (MAP), others to predialytic systolic arterial blood pressure, setting the threshold value either at 140 mmHg, or at 150 mmHg. Similarly, the definition of hypertension depends on the age and the comorbidities of the study population. Thus, in the absence of cardiovascular complications, normotension corresponds to a resting predialytic SBP below 130/80 mmHg according to the recommendations of JNC7. In contrast, the recommended target for an elderly person with atherosclerosis is instead, 140–150 mmHg [7, 8].

Concerning the blood pressure measurement method, there is currently no study of a cohort of dialyzed patients that would allow determination of the prevalence of hypertension in relation to ABPM [9]. In our study, the use of ABPM with all our patients was difficult for logistical reasons, so we opted for hourly measurement of BP during dialysis sessions. We

completed the assessment of the BP profile of our patients by twice-daily readings taken by the patients on nondialysis days.

Hypertension in chronic renal failure, but also in HD is characterized by an elevated SBP, while the DBP usually remains normal, even low. This leads to an increase in the differential, or pulse pressure, which is an independent risk factor for cardiovascular disease [10–14]. In our series, hypertension was systolic in more than 80% of cases.

Whether cause or consequence of nephropathies, Hypertension in dialysis remains strongly linked to hydrosodium volumes, with salt now being considered as a true "uremic toxin" for the renal failure patient [15]. Also, from a physiopathogenic point of view, expansion of the extracellular volume (ECV) and the resulting increase of peripheral vascular resistance (PVR) are the main hypertension mechanisms at the different stages of chronic renal failure [16–20].

Scribner [1], however, was one of the first clinicians to base his conclusions on the involvement of ECV and PVR in the hypertension of the hemodialyzed patient and thereby laid the two cornerstones of nonpharmacological treatment of hypertension. He, thus, recommended the correction of ECV by ultrafiltration and a low-sodium diet. He first tried this method with the patient Clyde Schields, who survived his ESRD for 11 years. The term "dry weight" (DW) would appear only later, thanks to Thomson et al. [21] in 1967, and since then, the term "DW method" has been used.

The necessary associated measures are respect of the sodium balance during the session, adequate length of the dialysis session, and the progressive withdrawal of antihypertensive drugs once the measures are implemented. On the other hand, with regard to HDR, the very common habit of recommending water intake restrictions is ineffective and illusory if not combined with the recommendation to restrict sodium intake [22].

That being said, our study, like others in the literature, finds that the correction of ECV does not automatically lead to BP normalization. In fact, there is a gap between the two, known as the "lag phenomenon," which creates a situation lasting approximately six months that is often complicated to manage [23]. Consequently, after three months, we were only able to lower the prevalence of hypertension in our series by 10%. The exact physiopathological mechanism of the "lag phenomenon" has not yet been clarified, but two weighty hypotheses have been retained: the first is that the DW varies according to intercurrent catabolic and anabolic events; the second is that the correction of ECV and its hemodynamic disturbances engender only a very gradual correction of vascular remodeling and therefore of PVR [24, 25].

*4.1. Contribution of Therapeutic Education (TE) Applied to the DW Method in Our Series.* The DW method cannot be envisioned nowadays without the establishment of a TE strategy. In fact, we can consider as undeniable for therapeutic efficacy the value of patients' acquisition of knowledge concerning the subtleties of their disease, particularly when it is chronic [26]. For our patients, despite all our available therapeutic arsenal and our ability to juggle their dialytic parameters, achieving our blood pressure objectives could not be managed without the patients' willing efforts and involvement, which go hand in hand with their having adequate knowledge and awareness of the different aspects of their illness.

There was a time when the paradigm of TE was biomedical. The patient was considered to have an organic substrate that the doctor was supposed to eliminate through treatment: the "good patient" was the "good complier" [2]. We, now, know that TE is not just yet another tool in the treating physician's arsenal, but is rather a new assessment of the doctor-patient relationship. Thus, it is no longer a matter of adopting a "paternalistic" attitude towards patients, but rather to incite their awareness and involve them in decision-making by providing them with access to a maximum of knowledge. "The goal of therapeutic education is for patients (and their families) to understand their disease and treatment, collaborate with the health care team and take responsibility for their treatment as means of maintaining and improving their quality of life" [27–31].

There are different schools of thought about TE. The "constructivist" approach, built on the philosophical works of Leibnitz and Kant, emphasizes construction: the learner progressively constructs knowledge by working with others. Group work calls for expressions and activities of trial and error, working on learning from errors, investigation, and the setting up of challenges [2]. The learner must "attach new information to schemas that he/she already knows," and set up "cognitive bridges rendering the information significant in relation to a preexisting structure" [32–34].

(i) A well-conducted TE program includes several steps.

(a) First of all, an educational diagnosis in parallel with the clinical diagnosis. This consists of identifying the patient's needs, the skills to acquire or mobilize, and potential obstacles [2]. In our case, we used prolonged sessions of dialogue with our patients with the aim of establishing a climate of trust and attaining the objectives of the educational diagnosis.

(b) Next, with the collaboration of the patient, a personalized TE program must be prepared, envisaging the types of situations to be set up [2]. With our patients, we chose the constructivist model of TE because it seemed to us better adapted to their life style in taking account of their constraints.

(c) The next requirement is to organize individual and/or group TE sessions and finally, there must be an evaluation of the patient, that is, a taking stock of what he/she has understood, learned, knows how to do and how he/she copes with the disease on a daily basis [2]. In our work, we organized discussion groups made up of 4 to 5 patients who were neighbors during dialysis sessions. During these discussions, we dealt with ESRD in dialysis as a separate entity, with its specificities, its daily constraints, and its complications, but especially the principles of life style for a dialysis patient in terms of diet, physical activity, and use of medications.

(ii) We based our work on the constructivist method because of the advantages of group work and cross-stimulation that it offers. While it encourages motivation through experience, it remains quite limited when the knowledge to be acquired is in contradiction with the conceptions mobilized by the patient. Consequently, the further the situations are from previously mastered knowledge and skills, the more the patient will use primitive reasoning strategies. It is for this reason that we enriched our work with one of the new generation of educational methods, that is, the "allosteric" learning model, in which the patient is taught to reason, but especially *in opposition to* his/her acquired knowledge and beliefs [35].

## 5. Conclusion

The "DW method" sustainably corrects hypertension in HD in the majority of cases, but this success is not conceivable without a sustained educational effort by the whole health care team, and hence the advantage of planning a TE program.

However, this effort tends to be more or less neglected in favor of pharmacological treatment, which moreover, is not very effective.

Thus, the scientific community should take up the challenge of renewing the use of this nonpharmacological method, especially among young and future nephrologists.

## Conflict of Interests

The authors declare that they have no conflict of interests.

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