Dietary salt restriction and reduction of dialysate sodium to control hypertension in maintenance haemodialysis patients

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The management of hypertension in patients with end stage renal disease on maintenance haemodialysis has changed completely in the past three decades. In the early 1960s it was possible to control even the severest hypertension without drugs by the use of a low sodium dialysate (130 mmol/l) and a restricted salt intake (<5 g/day). The diet was simple. It required home cooking without added salt and the avoidance of obviously salted foods. Excellent results using this regime were reported from several centres [1,2] and bilateral nephrectomy—a procedure which was considered unnecessary by those who practiced this regime [3]. Associated with success were long hours (8 h) of overnight dialysis on a Kiil dialyser with a cuprophan membrane. Successful control of hypertension by this technique occurred independently of the buffer used in the dialysate. It was first described with bicarbonate as a buffer [1,2] and later also reproduced with acetate-buffered dialysate [3].

In the late 1970s dialysis times were shortened from three times for 6–8 h a week to three times 3–5 h. High efficiency haemodialysis was introduced, with high blood flow and dialysate flow rates in combination with large surface area dialysers. This regime frequently caused cardiovascular instability during dialysis, muscle cramps and post-dialysis hypotension. As a consequence, in order to avoid patient misery with shorter and more efficient haemodialysis, dialysate sodium was raised to 140 mmol/l or more and dietary sodium restriction was abandoned. Today, hypertension is an increasing problem in dialysis patients despite of a much larger choice of potent antihypertensive drugs [4]. In addition, cardiovascular diseases remain the most frequent cause of death and life expectancy of the dialysis patient has worsened [5].

One centre in the world has remained faithful to the original formula of long hours of dialysis, a relatively low sodium dialysate (138 mmol/l) and dietary salt restriction (4–5 g/day) [6]. Tassin in France repeatedly reports the best survival and lowest gross and standardized mortality on maintenance haemodialysis in the world. Excellent blood pressure control is achieved without drugs with mean arterial pressures below 99 mmHg. A total of 98.4% of patients of the dialysis population in Tassin do not require blood pressure medication. However, recently they have not stressed the importance of salt restriction as a requirement for their successful regime. This may account for the partial failure to reproduce the favourable results when only the dialysis time has been lengthened and no attention has been paid to salt restriction [7,8].

Recently, we and others [9,10] have demonstrated that it is possible to lower blood pressure and reduce or even discontinue antihypertensive medication without prolongation of dialysis time (4–5 h per session) and without altering dry body weight.

In our study, eight hypertensive haemodialysis patients were assigned to a regime of gradual lowering of the dialysate sodium concentration from 140 to 135 mmol/l at a rate of 1 mmol/l every 3–4 weeks in combination with an attempt to lower salt intake by advising the patients to eat a moderately NaCl-restricted diet of no more than 6 g/day with no added salt and avoidance of canned and salty tasting food. Dialysis time was kept constant. Predialysis systolic and diastolic pressures showed a clear trend to fall (systolic pressure 147 ± 9.3 vs 136 ± 17 mmHg, diastolic pressure 88 ± 5.5 vs 80 ± 9.6 mmHg) without a change of dry weight. The reduction of the mean arterial pressure reached a level of significance (108 ± 4.4 vs 98 ± 10.9; P = 0.02, Wilcoxon test). The antihypertensive medication could be reduced significantly as well. In four out of eight patients blood pressure pills could be stopped completely. However, in only half of the patients a decrease of interdialytic weight gain could be observed indicating only partial compliance with the salt restriction. In some patients lowering the salt load had the effect of restoring taste acuity for salt which may have facilitated their compliance with the low salt diet. Overall, there was a slight increase in the frequency of muscle cramps during haemodialysis.

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It was only observed in the non-compliant group of patients.

The results of the study performed by Donohoe P et al. [9] suggest that reducing the dialysate sodium and a low salt diet lead to a decrease in peripheral resistance. The same finding was reported in the patients on long hour dialysis from Tassin [11]. It has been speculated that a possible accumulation of vasoconstrictor substances in uremic patients may cause an increased vascular resistance. Substances like endothelin-1 are increased in uremic plasma. A reduced clearance of endogenous inhibitors of nitric oxide, like asymmetric dimethyl arginine (1-ADMA) could further play a role. Long hour dialysis would increase the clearance of these substances [12]. How reducing sodium intake (less than 6 g/day) and lowering dialysate sodium (135 mmol/l) reduces peripheral resistance is not well understood. Clinically, the mechanism seems to be at least partly volume independent. One possible mechanism could be that an increased sodium load leads to an inhibition of the Na+/K+-ATPase via an endogenous digitalis-like substance, the result of which would be an increase of the intracellular sodium and calcium concentration with an increased tone of vascular smooth muscle cells. Reducing the sodium load would revert this mechanism [13]. A link between sympathetic overactivity as it is found in haemodialysis patients [14] and sodium load could be an alternative hypothesis.

It is concluded that abandoning dietary salt restriction and increasing dialysate sodium helped to improve cardiovascular stability and well-being of the patient during the dialysis session, especially with decreasing dialysis time and higher ultrafiltration rates. The price, however, which has to be paid by the patients is a high prevalence of arterial hypertension often insufficiently controlled by antihypertensive medication. A recent study suggests that blood pressure control can be achieved by moderate salt restriction and cautiously lowering the dialysate sodium concentration. If these preliminary data can be confirmed it may be possible to achieve the results of Tassin without resorting to long hours of dialysis. Meanwhile, it would be helpful if Tassin stressed more clearly the need of salt restriction as the last time it was mentioned by them in their abstracts was 1983 [15].

References