Renal Failure

ISSN: 0886-022X (Print) 1525-6049 (Online) Journal homepage: informahealthcare.com/journals/irnf20

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To cite this article: Belda Dursun, Sukran Unal, Halil Ibrahim Varan & Gultekin Suleymanlar (2004) Can a Different Priming Process of the Dialyzer Affect Dialysis Adequacy in Chronic Hemodialysis Patients?, Renal Failure, 26:2, 155-157, DOI: 10.1081/JDI-120038498

To link to this article: https://doi.org/10.1081/JDI-120038498

Published online: 07 Jul 2009.

RENAL FAILURE
Vol. 26, No. 2, pp. 155–157, 2004

CLINICAL STUDY

Can a Different Priming Process of the Dialyzer Affect Dialysis Adequacy in Chronic Hemodialysis Patients?

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ABSTRACT

In this study, we investigated whether a different priming process of the dialyzer could affect the dialysis adequacy in chronic hemodialysis (HD) patients. 20 HD patients (M/F:12/8) with a median age of 40 (20–74) were included in this study. All the patients were clinically stable and were on bicarbonate-based hemodialysis program 3 times in a week. During the study period of 6 months, we tried to keep the vascular accesses, types and surfaces of the membranes and also the blood and dialysate flow rates almost the same for all patients. For the first 3 months of the study we performed our routine priming process by flushing 1 L of saline from the bloodline without any dialysate passing through the dialyzer. For the next 3 months, we carried out a different priming process. While we passed 1 L of saline through the blood compartment of the dialyzer, we also started the dialysate pump to get a flow rate of 500 mL/min for 30 minutes. After a 3 month period of different priming process, significant increases were observed in Kt/V (1.19 ± 0.14 to 1.35 ± 0.14, $p = 0.000$), URR (%) (62.3 ± 1.1 to 66.9 ± 1.25, $p = 0.000$) and nPCR (1.09 ± 0.04 to 1.25 ± 0.04, $p = 0.002$) parameters. Our findings show that a priming process of the dialyzer by passing both saline and dialysate from the dialyzer for half an hour before starting every dialysis session can improve dialysis adequacy parameters. We suggest that this procedure, by increasing dialysis adequacy, can provide great clinical benefits.

Key Words: Priming process; Dialysis adequacy; Chronic hemodialysis.

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DOI: 10.1081/JDI-120038498
0886-022X (Print); 1525-6049 (Online)

INTRODUCTION

Increasing the adequacy of dialysis parameters is one of the most important goals of the hemodialysis centers, resulting in a decrease of uremia-associated complications. Several factors, including type, surface area and KoA of the dialyzer, vascular access type, length of dialysis session, blood and dialysate flow rates, may all play role in achieving an efficient dialysis.[1] Dialysis adequacy can be evaluated by using the parameters of Kt/V, (%) URR (urea reduction rate) and nPCR (normalized protein catabolism ratio).[1]

In this study, we investigated whether a different priming process of the dialyzer could affect the dialysis adequacy parameters in chronic hemodialysis (HD) patients. Priming is a pre-dialysis wash-through phenomenon of dialyzer with a volume of 60–120 mL according to membrane surface area and it improves the characteristics of the membrane.[2] Particle spallation has been shown for most dialyzers, but proper priming minimizes it.[3] However, the efficacy of priming process on dialysis adequacy has not been investigated so far.

MATERIAL-METHODS

Twenty HD patients (M/F: 12/8) with a median age of 40 (20–74) and hemodialysis duration of at least 6 months were included in the study. All the patients were clinically stable and were on a bicarbonate based, four hour, thrice-weekly hemodialysis regimen. During the study period of 6 months, we kept the vascular access, type and surface of the membrane and also the blood and dialysate flow rates peculiar to each patient the same. In our center, we routinely used to make the priming process by flushing 1 L of saline from the blood compartment without any dialysate passing through the dialyzer. We performed our usual priming procedure for the first 3 months of the study. Then, for the next 3 months, we carried out a different priming process. We connected the arterial and venous lines of the dialyzer to a 1 L saline bag and started the blood pump. The dialysate pump was also started at the same time at a flow rate of 500 mL/min. We applied this different type of priming process for half an hour before every hemodialysis session for three months. Then paired t-test statistical method was performed to compare the mean values of Kt/V, URR (%) and nPCR obtained from two different types of priming processes.

RESULTS

Application of a different priming process, flushing the dialyzer with both saline and dialysate for half an hour before every dialysis session, for next 3 months (period 2) has shown significant increases in Kt/V, URR (%) and nPCR compared to the parameters obtained from our routine priming process applied in the first 3 months (period 1). Results obtained from two different priming processes are depicted in Table 1.

DISCUSSION

Our findings show that a different priming process of the dialyzer by passing both saline and dialysate through the dialyzer for half an hour before starting every dialysis session can improve dialysis adequacy parameters as expressed by KtV, URR (%) and nPCR. The reason for this beneficial effect may be explained by convection type of heat transfer from the dialysate (36°C) to the microtubules of the dialyzer (room temperature=21°C). Because of a difference between the temperatures, heat transfer occurs from the dialysate to the microtubules of the dialyzer until a steady state is reached.[4] As a result of thermal expansion, surface area of the microtubules of the

Table 1. Hemodialysis adequacy data obtained in the first (period 1) and next 3 months (period 2) of the study.

Parameters	Period 1	Period 2	*P* value
Kt/V	1.19±0.14	1.35±0.14	0.000
URR (%)	62.3±1.1	66.9±1.25	0.000
nPCR	1.09±0.04	1.25±0.04	0.002

Data are expressed as mean values ± mean of standard error.
Values of $p<0.05$ were considered significant.

dialyzer increases. This can be explained by the following formulas:

$$\delta = \alpha \cdot \Delta T \cdot d_{initial}$$

$$d_{final} = \delta + d_{initial}$$

$$S_{microtubule} = \pi \cdot d_{final} \cdot L$$

Where, δ=change in diameter of a microtubule; α=thermal expansion coefficient of microtubule; ΔT=change in temperature; $d_{initial}$=initial diameter of microtubule; d_{final}=final diameter of microtubule; $S_{microtubule}$=surface area of dialyzer; L=length of microtubule.[5] As it can be derived from the formulas, heat transfer by causing thermal expansion may increase the surface area of the microtubules of the dialyzer, resulting in a more amount of blood pass through the dialyzer in unit time and an increase in diffusion rate.[4] However, no heat transfer occurs in our routine priming process since there is no difference between the temperatures of dialysate and blood compartments both of which are kept at the same temperature (36°C).

Our study suggests that a different priming process of the dialyzer by passing both saline and dialysate through the dialyzer for half an hour before starting every dialysis session can improve dialysis adequacy parameters and can provide clinical benefits. However, further in vitro studies are needed to enlighten this clinical observation.

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