e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2022; 14(9); 620-625

Original Research Article

Comparison of Biochemical Parameters Pre and Post-Hemodialysis among Patients of Acute and Chronic Renal Failure in Jamnagar, Gujarat.

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Received: 25-07-2022 / Revised: 25-08-2022 / Accepted: 20-09-2022

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Conflict of interest: Nil

Abstract

Background: Hemodialysis is one of the effective measures performed to correct hyperkalemia, uremia, and abnormal levels of serum sodium and creatinine in patients with renal failure. The present study determines the changes in biochemical parameters between the pre and post-renal stages of dialysis.

Materials and Methods: This cross-sectional study was conducted in the Department of Pathology, MP Shah Medical College, Jamnagar (Gujarat, India). Patients above 18 years of age were enrolled after informed consent. Biochemical parameters of fifty and hundred patients with acute renal injury and chronic renal failure respectively were collected. Biochemical parameters include serum sodium, potassium, urea, and creatinine. The comparison of biochemical parameters pre and post-dialysis was performed using paired student t-test with a 5% level of confidence.

Results: The patients suffering from acute renal failure showed a significant decrease in serum potassium [$t = 38.07$; $p < 0.0001$], serum urea [$t = 23.06$; $p < 0.0001$], and serum creatinine [$t = 23.47$; $p < 0.0001$] in post-dialysis patients compared to pre-dialysis levels. However, serum sodium did not differed significantly between the two groups [$t = 0.8$; $p = 0.42$]. In patients of chronic renal failure, a significant decrease in serum potassium [$t = 32.58$; $p < 0.0001$], serum urea [$t = 21.91$; $p < 0.0001$], and serum creatinine [$t = 31.99$; $p < 0.0001$] was present in post-dialysis patients compared to pre-dialysis levels. However, serum sodium did not differed significantly between the two groups [$t = 0.94$; $p = 0.35$].

Conclusion: Hemodialysis is a preferred technique to correct biochemical abnormalities in renal failure at the tertiary center, and it is cost-effective.

Keywords: biochemical parameters, creatinine, hemodialysis, , renal failure, serum sodium

Introduction

The term, “dialysis” is a greek word that means “through lysis”. It is used as an artificial replacement for a non-functional kidney or in the absence of a kidney. Dialysis may be used for those with an acute disturbance in kidney function or for those with progressive but chemically worsening kidney function a state known as chronic renal failure.[1] Dialysis is regarded as a "holding measure" until a renal transplant can be performed or sometimes as the only supportive measure in those for whom a transplant would not work.[2] Since kidneys maintain the balance of electrolytes in our body, estimation of major electrolytes like sodium and potassium is of major importance (Hyperkalemia is one of the complications of renal failure).[3] Hemodialysis is one of the effective means of treatment of hyperkalemia, and uremia, also to correct serum sodium and serum creatinine levels in renal failure.[4] Saurashtra region being notorious for kidney diseases and the dialysis machinery being available naturally gave a new field to probe. The present study determines the changes in serum sodium and serum potassium level in pre and post-renal dialysis patients.

Materials and Methods

This cross-sectional study was conducted in the Department of Pathology in collaboration with the Department of Biochemistry at M. P. Shah Medical College, Jamnagar (Gujarat, Rajasthan). The study evaluated patients with kidney injury, and compared changes in the biochemical profile in pre, and post-renal dialysis. Fifty patients with acute renal failure and one hundred patients with chronic renal failure were enrolled in the study. The data was collected in the dialysis unit of G.G. Hospital, Jamnagar, Gujarat. A pre-designed, semi-structured, pre-tested questionnaire was used for collecting identification data of patients and their medical history. All subjects were above 18 years of age. Verbal consent was taken from all patients.

Statistical analysis

The quantitative variables were expressed as mean and standard deviation, while categorical variables were expressed as percentages. The comparison of quantitative variables was done using the Student’s paired t-test. The significance level was considered at 5%. The JASP version 0.16.2.0 was used for statistical analysis.

Results:

The patients suffering from acute renal failure showed a significant decrease in serum potassium [$t = 38.07$; $p < 0.0001$], serum urea [$t = 23.06$; $p < 0.0001$], and serum creatinine [$t = 23.47$; $p < 0.0001$] in post-dialysis patients compared to pre-dialysis levels. However, serum sodium did not differed significantly between the two groups [$t = 0.8$; $p = 0.42$] (Table 1).

Table 1: Comparison of biochemical parameters between pre-hemodialysis and post-hemodialysis in acute renal failure patients.

Biochemical parameters	Pre-hemodialysis Mean ±SD	Post-hemodialysis Mean ±SD	t-value	p-value
Serum sodium (mEq/L)	142±7.2	141±5.0	0.8	0.42
Serum potassium	6.5±0.5	3.6±0.2	38.07	<0.0001

(mEq/L)				
Serum urea (mg%)	174.3±28.3	76.6±9.8	23.06	<0.0001
Serum creatinine (mg%)	11.68±1.77	5.14±0.84	23.47	<0.001

In case of patients suffering from chronic renal failure, a significant decrease in serum potassium [t = 32.58; p < 0.0001], serum urea [t = 21.91; p < 0.0001], and serum creatinine [t = 31.99; p < 0.0001] was present in post-dialysis patients compared to pre-dialysis levels. However, serum sodium did not differed significantly between the two groups [t = 0.94; p = 0.35] (Table 2).

Table 2: Comparison of biochemical parameters between pre-hemodialysis and post-hemodialysis in chronic renal failure patients.

Biochemical parameters	Pre-hemodialysis Mean± SD	Post-hemodialysis Mean ±SD	t-value	p-value
Serum sodium (mEq/L)	140.3±5.9	139.6±4.6	0.936	0.35
Serum potassium (mEq/L)	5.4±0.5	3.5±0.3	32.58	<0.0001
Serum urea (mg%)	77.1±14.2	37.2±11.4	21.91	<0.0001
Serum creatinine (mg%)	6.14±0.71	3.19±0.55	31.99	<0.0001

Table 3: Studies show the comparison of biochemical parameters between pre-hemodialysis and post-hemodialysis in acute renal failure patients.

Study	Serum sodium (mEq/L)		Serum potassium (mEq/L)		Serum urea (mg %)		Serum creatinine (mg %)	
	PreHD	PostHD	PreHD	PostHD	PreHD	PostHD	PreHD	PostHD
Valentine Lobo et al.(2004)[5]	137.7± 11.8	140.8±4 .1	4.7±0. 9	4.2±0.9	132±4 2.2	79±34.2	-	-
PJ Shelgikar etal.(2005)[6]	-	-	-	-	-	-	8.6±1.5,	3.5±2.7
Present study	142±7. 2	141±5.0	6.5±0. 5	3.6±0.2	146±2 0	77±9.8	11.7±1. 77	5.1±0.8 4

PreHD: Pre-hemodialysis; PostHD: Post-hemodialysis

Table 4: Studies show the comparison of biochemical parameters between pre-hemodialysis and post-hemodialysis in chronic renal failure patients.

Study	Serum sodium (mEq/L)		Serum potassium (mEq/L)		Serum urea (mg %)		Serum creatinine (mg %)	
	PreHD	PostHD	PreHD	PostHD	PreHD	PostHD	PreHD	PostHD
Agraharkar et al.(2003)[11]					72.1 ± 11.1	30.7 ± 4.5	5.2 ± 0.6	2.9 ± 0.5
Tarif N, Yamani H et al.(2008)[12]	132.7 ± 2.3	134.2 ± 2.6	5.2 ± 0.9	3.3 ± 0.8				
Ahmad Z (2010)[13]			6.4 ± 0.4	3.5 ± 0.4				
A. Blumberg, H.			5.7 ±	3.6 ±				

W. Roser et al. (1997)[14]			0.2	0.1				
Malhis M et al.(2010)[15]	136 ± 3.4	138 ± 5.2	5.7 ± 0.7	3.9 ± 0.8			10.6 ± 2.4	7.5 ± 3.5
Istavan Lorincz et al.(1999)[16]								
M House et al.(2002)[17]			5.0 ± 1.4	3.5 ± 0.9				
Present Study	140.3 ± 5.9	139.6 ± 4.6	5.4 ± 0.5	3.5 ± 0.3	77.1 ± 14.2	37.2 ± 11.4	6.1 ± 0.7	3.2 ± 0.6

PreHD: Pre-hemodialysis; PostHD: Post-hemodialysis

Discussion:

Fewer studies have been conducted on the effects of intermittent hemodialysis (IHD) in acute renal failure (ARF) patients, as peritoneal dialysis (PD) was used earlier, especially in those with hemodynamic instability or bleeding risk. In addition, widespread use of peritoneal dialysis was due to the non-requirement of highly trained personnel, expensive and complex apparatus, and systemic anticoagulation.

The present study has been conducted to determine the effects of intermittent hemodialysis on biochemical parameters in patients with renal failure. Lobo et al. and Shelgikar et al. showed a decrease in serum potassium, serum urea, and creatinine in patients with acute renal failure after intermittent hemodialysis.[5,6] Researchers showed that the average reduction in post-dialysis levels of serum sodium, potassium, and urea were 1 mEq/L, 1.9 mEq/L, and 69 mg% compared to 3.1 mEq/L, 1.9 mEq/L, and 53 mg% respectively compared to the study conducted by Lobo et al.[5] Similarly, the average reduction in creatinine levels in the present study was 6.6 mg% compared to 5.1 mg% as seen the study conducted by Shelgikar et al.[6]

Phu et al. observed that intermittent hemodialysis is more effective than peritoneal dialysis in correcting biochemical abnormalities.[7] Researchers concluded that hemodialysis was more effective in resolving acidosis and lowering plasma creatinine levels, which corresponded to an increase in survival rate. Recently newer techniques such as continuous renal replacement therapy (CRRT) have become the treatment of choice in critically ill patients over the past two decades, but studies conducted by Mehta et al. (1996)[8], Paganini et al. (1996)[9], and Bommel EF(1997)[10] demonstrated no significant reduction in mortality and improvement in biochemical parameters with CRRT compared to intermittent hemodialysis.[11]

In patients with chronic renal failure, the present study showed that the average reduction in post-dialysis serum sodium was 0.7mEq/L comparable with studies conducted by Yamani et al. (2008) [12] and Malhis et al. (2010) [15] in which the average reduction was 1.5mEq/L and 2mEq/L respectively. In the present study serum potassium reduced by 1.9 mEq/L post- hemodialysis, comparable to studies conducted by Yamani et al.(2008) [12], Blumberg et al. [14], Malhis et al.(2010) [15], House et al.(2002) [17]. However, in a study conducted by Ahmad et al. [13], the serum potassium post-dialysis was reduced by 2.9 mEq/L, about 1.0 mEq/L higher than the present study, because the spectrum of study was narrow since the study was carried out with hyperkalemic patients only. [16] The average reduction in post-dialysis serum urea level in the present study is 39.9 mg% comparable with 41.4 mg% seen in the study conducted by Agraharkar et al. (2003)

[11]. The mean reduction in serum creatinine in the post-dialysis sample in present study is 2.9 mg%, comparable to 2.3 mg% and 3.1 mg% seen in studies conducted Agraharkar et al.(2003) [11] and Malhis M et al.(2010) [15], respectively. Hemodialysis can be used as a method to correct biochemical abnormalities in renal dysfunction. [18]

Conclusion: Hemodialysis is a preferable technique to correct biochemical abnormalities in patients of renal failure at tertiary center and it is cost effective.

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