

Effect of Hemodialysis On Plasma Osmolarity In Patients With Chronic Renal Failure

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Summary:

Back ground: The study was conducted on fifty patients (27 males and 20 females) with chronic renal failure (CRF) undergoing maintenance hemodialysis (HD), at artificial Kidney unit, Al- Hakeem Hospital / Najaf, during the period from April to June 2008.

Patients & methods: Plasma osmolarity (P_{osm}), plasma creatinine (P_{cr}) plasma urea (P_{urea}) > plasma sodium (P_{Na}) and plasma potassium (P_k) were measured for all patients before and after dialysis.

Results: The paired t -test was used to compare the pre-dialysis values with the post dialysis values and simple linear correlation to study the relation between (P_{Na}), and (P_{osm}), p values less than 0.05 considered not significant. The result of study showed a significant decrease in the means of P_{Na} , P_k , P_{cr} , P_{urea} and P_{osm} after dialysis in comparison with the pre-dialysis values ($p < 0.0001$). There was also a significant positive correlation between P_{Na} and P_{osm} ($r = 0.30, p < 0.05$)

Conclusions: HD had a significant regulatory effect on body fluids and electrolytes ratio, P_{osm} and removal of uremic toxins in patients with CRF, the study also revealed that P_{osm} may be another useful indicator of body fluids and electrolytes status among these patients

Key words : Plasms Osmolarity, Chronic Renal failure

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Introduction:

Osmolality is a measure of the concentration of osmotically active particles or solutes in a solution, sodium ion and related anions like chloride are by far the major constituent of P_{osm} and changes in serum sodium level is usually reflected as an alteration in P_{osm} ⁽¹⁾. Hypoosmolality is considered to be an indicator of the severity of many underlying illness. Moreover, severe hypoosmolality, although relatively uncommon, is associated with substantial morbidity and mortality^(2>3,4). Chronic renal failure remain one of the most common, costly disabling and deadly medical conditions that challenge the health professional and community⁽⁵⁾. The syndrome of CRF arises as a consequence of irreversible loss of endogenous renal function, to a degree sufficient to render patients permanently dependent upon replacement therapy.

Although the trend of renal transplant tend to gain great attention in the last decades, HD remain the most common therapeutic modality for CRF⁽⁶⁾. Hemodialysis based on movement of the metabolic waste product down a concentration gradient from circulation into the dialysate as the blood pass through the dialyzer. There are two geometric configuration for dialyzer : hollow fiber and flat plate where blood is separated from the dialysate by semi-permeable membrane⁽⁷⁾. The kidneys play important role in maintaining internal environment homeostasis, accordingly derangement of renal function found to be associated with various degree of alteration in P_{osm} . The present study is an attempt to asses the state of body fluids and electrolytes ratio in patients with CRF and to evaluate the role of HD in maintaining P_{osm} among these patients.

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Patients and Methods:

The study was conducted on 47 patients (27 males and 20 females) with CRF, with a mean age of 38.7+ 17.2 years who were randomly selected from patients admitted to the Artificial Kidney Unit of Al-Hakeem Hospital in Najaf city during the period from April to June 2008. All patients were dialysed two times every week with a dialysis session time of 2-3 hours. Five ml of blood was collected from every participant just before and immediately after dialysis. The collected blood samples were placed in tubes containing lithium heparin. The plasma was separated within 30 minutes of blood collection by centrifugation at 3000 rpm for 10 minutes using Hettich centrifuge (Karl Kolb Scientific Technical Supplies, Frankfurt, Germany). The plasma samples were kept in capped plastic tubes in the deep freeze (-20 C) until analysis. Plasma sodium and P_K concentrations were measured using an emission flame photometer (Corning 400 , England). Plasma creatinine was measured manually by Jaffe end point method using kit from Biosyr (with deproteinization). In an alkaline medium, creatinine combines with picric acid to form a red Janovsky complex whose intensity is measured at 520 nm⁽⁸⁾.

Plasma urea concentration was determined enzymatically, using kit Purchased from Eicon (Germany), in an alkaline medium, the ammonium ions react with the phenol and hypochlorite to form a green colored indophenol⁽⁹⁾.

Plasma osmolality was measured by freezing point depression technique, using Slamed Osmometer (Bibby Sterilin, France)⁽¹⁰⁾.

Student's t-test (paired) was used for studying the differences in the means of different parameters within patients before and after dialysis and simple linear correlation to study the relation between P_{Na} and P_{Osm} , p values less than 0.05 considered not significant, all values were expressed as Mean ± SD.

RESULTS

The mean ± SD and P values of different studied parameters before and after dialysis are shown in table 1, the result of this study showed a significant decrease in the means of P_{Na} , P_K , P_{cr}, P_{ur} and P_{Osm} after dialysis in comparison with the pre-dialysis values (p<0.0001). There was a significant positive correlation between P_{Na} and P_{osm} (r =0.30 , p< 0.05).

Table 1: mean ± SD and P values of P_{Na}, P_K, P_{cr},P_{ur} and P_{osm} in patients with CRF before and after dialysis .

Parameters	Mean ± SD		P values
	Before dialysis	After dialysis	
P _{Na} mmol/L	140.1±5.9	135.7±4.6	<0.0001
P _K mmol/L	5.1±1.1	3.5±0.7	<0.0001
P _{Cr} umol/L	876.3± 259.9	511.2±217.6	<0.0001
P _{Ur} mmol/L	31.4±8.8	19.1±5.7	<0.0001
P _{Osm} mosm/kg	300.6 ±20.3	282.7±18.7	<0.0001

DISCUSSION

Analysis of body fluids and electrolytes abnormalities in patients with CRF is not easy due to alteration of regulatory mechanisms involved in the maintenance of plasma electrolytes homeostasis and the effect of therapeutic measures employed, such as drugs and composition of dialysate.

The pre-dialysis mean of P_a^{\wedge} was significantly ($p < 0.0001$) higher than that of post-dialysis values. Nine (19%) out of the 47 patients with CRF included in this study were found to have hyponatremia before dialysis, while the remaining patients had P_{Na} values within normal range.

Although, the incidence of hyponatremia not increased, but the severity of already existing hyponatremia tend to increase after dialysis. Hyponatremia reflects an abnormal ratio of sodium to water, it may be due to abnormal excess water retention or due to excess sodium loss. Diuretics are commonly used therapeutic modalities among patients with CRF, these agents specially the thiazide and loop diuretics have a profound effect on plasma electrolytes concentrations through alteration of renal tubular reabsorption⁽¹¹⁾. This observation appear to be logical, since almost all patients with CRF included in this study were maintained in loop diuretics. Several mechanisms have been postulated for diuretic induced hyponatremia including nonosmotic-stimulated Antidiuretic hormone release, interference with urinary dilution in the cortical diluting segment, and thirst⁽¹²⁻¹³⁾. The mean P_{osm} of patients with CRF showed a significant decrease ($p < 0.001$) after dialysis, twenty eight (58.8 %) out of 47 patients with CRF included in this study had hyperosmolality ($P_{osm} > 295$ mosm/kg), this is probably due to excess accumulation of osmotically active particles like urea and other toxic substances in the blood due to failure of the kidneys to excrete these toxic substances. Twenty five (42.5%) patients had hyperkalemia, chronic renal failure provides a perfect milieu for the development of electrolytes disturbances, renal dysfunction, elevation of neurohormonal substances, activation of the Renin angiotensin aldosterone system, and diuretic therapy which represent the major contributory factors⁽¹⁴⁾. The mean P_K was significantly ($p < 0.001$) decreased after dialysis and even it falls to hypokalemic level in 4 patients. This finding indicates that HD had important role in correction of hyperkalemia encountered in patients with CRF. The result of this study showed a positive correlation ($r = 0.3$, $p < 0.05$) between P_{Na} and P_{osm} , accordingly a simple and rapid test like P_{osm} may be another useful indicator of body fluids and electrolytes status in patients with CRF.

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