Original Research Article

Nephrogenic ascites: prevalence and effect of daily nocturnal high flux hemodialysis

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Abstract

Background: Nephrogenic ascites (NA) is the end stage renal disease. A study was conducted to find the prevalence of NA in chronic kidney disease (CKD) maintenance hemodialysis (MHD) patients and also to find the effect of daily nocturnal high flux hemodialysis (NHFH) as treatment modality in these study members. **Methods:** It was a prospective observational study, conducted in the department of nephrology, GSL Medical College. Individuals aged ≥18years, on CKD V on MHD, diagnosed with NA and treated with daily NHFH for one month were included. Various factors such as variation in body weight, heart rate, blood pressure (BP), abdominal girth, serum parameters such as albumin, calcium, phosphorous, PTH, Hb%, Kt/v, portal vein diameter, ejection fraction, left ventricular mass index (LVMI), AV access failure before and after initiation of nocturnal hemodialysis (NH) were analysed. Student's t-test was used to find the mean difference. **Results:** Total 12 (100%) participants were included male female ratio was 3. Statistically there was significant difference in mean systolic and diastolic BP, serum calcium, Phosphrous and PTH before and after NHD. But there was no significant difference in serum albumin levels. **Conclusion:** Decrease in NA with daily NH using high flux dialyzer. In addition, improvement in clinical parameters such as reduction of BP, HR, body weight, improvement in various serum parameters and decrease in LV mass index, improvement in LVEF. However, studies with large sample size is strongly recommended.

Keywords: serum, levels, statistics, mean

Strength and limitations

- Rare study and first of its kind in these setup is the strength of this.
- Small sample size, short duration of therapy are the limitations.
- In addition, the cause for NA is multifactorial which leads to difficulty to establish temporal relation is another significant limitation.

Introduction

Nephrogenic ascites (NA) is refractory ascites, with end stage renal disease[1], which was first described in 1970,[2]. The reported incidence varies between 0.7 to 26%, with wide age range between 11 and 71 years and male but there was no race predilection[3-5].

The pathophysiology of NA is poorly understood, many theories were reported but no single mechanism has been retained,[6]. Increased abdominal girth, anorexia, early satiety and cachexia characterize the clinical presentation,[7], while massive ascites with minimal lower extremity edema is found on physical examination. The diagnosis is usually established by exclusion of other known causes of ascites[8], such as congestive heart failure, pericardial effusion or constrictive pericarditis, hepatic cirrhosis, Budd-Chiari syndrome, inferior vena cava syndrome, hypothyroidism, pancreatitis, tuberculosis peritonitis, and malignancy. Appropriate fluid management and salt restriction are the common treatment modalities. Severe salt restriction, frequent ultrafiltration and HD significantly improved the ascites[9].

With these, a study was conducted to find the prevalence of NA in chronic kidney disease (CKD) maintenance hemodialysis (MHD) patients and also to find the effect of daily nocturnal high flux hemodialysis (NHFH) as treatment modality in these study members.

Materials and methods

It was a prospective observational study, conducted in the department of nephrology, GSL Medical College, Rajahmundry from July 2018 to December 2019. Study protocol was approved by the institutional ethics committee.

An informed written consent was taken from all the study members. The individuals of both gender, aged ≥18years, on CKD V on MHD, diagnosed with NA and treated with daily NHFH for one month duration were included in the study. Those with demonstrable causes of ascites, pregnancy, retrovirus infected and those who didn't submit the informed consent were not included in the study. All the patients who satisfied the inclusion criteria were included in this research.

Standard protocol was followed for the diagnosis of NA and all were treated by daily NHFD. Eligible patients were analysed for association between various factors such as variation in body weight, heart rate, blood pressure (BP), abdominal girth, serum parameters such as albumin, calcium, phosphorous, parathyroid hormone (PTH), Hb%, Kt/v, portal vein diameter, ejection fraction, left ventricular mass index (LVMI), AV access failure before and after initiation of NH, [10].

Patient and Public Involvement

Patients fulfil the inclusion criteria were included in the study. As the MHD progress, the study participant were resolved from the NA.

Statistical analysis

The data values were entered into Microsoft Excel and statistical analysis was done by using IBM SPSS Version 22.0. For categorical variables, the values are expressed as number and percentages and for continuous variables the values are represented as mean ± standard deviation. Student's t-test was used to find the mean difference between two groups, $P \leq 0.05$ was considered to be statistically significant.

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Results

Total 12 (100%) participants were included in this research, among these 75% were male and the male female ratio was 3. The mean parameters were 36.75 ± 10.12 years, 14.67 ± 4.56 months and4.92 ± 1.93 months, respectively, the age, duration of MHD and duration to develop NA.

The mean systolic BP were 147.50 ± 17.73 mmHg and 141.17 ± 13.50 mmHg, before and after NHD, respectively; statistically there was significant difference (P < 0.01). In diastolic BP also statistically there was significant difference before and after NHD, the mean were 89.17 mmHg and 85.08 mmHg, respectively.

The mean difference in serum albumin among the study participants was 0.12 g/dL; statistical there was no significance difference between the groups. Statistically there was significant difference between the groups when serum Calcium levels analysed and the mean difference was 0.41 mg/dl. The mean difference in serum phosphorous was 2.39 mg/dl; statistically there was significant difference. When serum PTH was considered among the groups, the mean change was 75.83 pg/ml; statistically there was significant difference (Table 1).

Table 1: Various serum parameters before and after NHD among the study participants

Parameter	Before	After	Statistical analysis
Albumin	3.56 ± 0.54	3.68 ± 0.45	t=-1.29; P=0.22
Calcium	8.06 ± 0.44	8.47 ± 0.58	t=-2.16; P=0.05
Phosphorous	6.21 ± 1.58	3.82 ± 0.68	t=5.75; P=0.00
PTH	264.33 ±126.06	188.50 ± 50.10	t=2.87; P=0.02

The mean portal vein diameter before and after NHD was 0.46 ± 1.56 mm and 9.96 ± 1.47 mm, respectively; statistically there was significant difference (P < 0.03). The mean difference among the study members in the ejection fraction was 5.42%; statistically there was significant difference between the groups (P < 0.00). The mean difference in LVMI among the groups was 14.83 gm/m^2; statistically there was significant difference (P < 0.00).

Discussion

Total 170 patients attending MHD to this institution were considered and 12 were diagnosed to be NA. The prevalence of NA in this report was 7%. In the available studies, the prevalence was reported to be 0.7% to 20%[4,11].

Gender wise, 9 (75%) were male participants and the male female ratio was 3. preponderance in the study population. Almost similar gender ratio was reported; 2 by Hammond et al.[4], 1.2 by Arismendi et al[12]. and 1.3 by Holm et al[13].

The mean duration of MHD among the study members was 14.67 ± 4.56 months and 4.92 ± 1.93 months was the mean time period to develop NA. In a study by Steven Huy B.Han et al[1], the mean duration of hemodialysis was reported to be 20 months which is similar to our report. Whereas the mean duration of 32 ± 15 months duration was reported by Ali Ihsan Gunal et al[9], the mean duration to develop NA was mentioned to be 19 weeks by Huy B.Han et al[1], and 6.5± 2.4 months by Ali Ihsan Gunal et al,[9].

There was 4.95Kgs mean weight loss among the study members after 1 month of NHD, was statistically significant. These study findings were less compared to Ali Ihsan Gunal et al. report[9]. Strict control in salt intake is the main cause in the reduction of weight loss in this report.

The mean difference in systolic BP was 6.33 mmHg which was statistically significant. The magnitude in decrease in BP was higher in the study done by Ali Ihsan Gunal et al[9], which was due to high ultrafiltration rates and severe salt restriction. Chan CT et al, [14] also reported reduction systolic BP which was statistically significant.

There was decrease in heart rate in this study, which was statistically significant. Similar findings were reported in the literature[9]. The reasons for the decrease in heart rate could be decreased nocturnal hypoxemia[16], reduced levels of catecholamines and improved endothelial function[17]. Abdominal girth was used as a parameter to assess the decrease in ascites in this research, the mean difference was 7.67 cms which was statistically significant.

Hemodialysis is a catabolic event so it was hypothesized that there would be decrease in serum albumin due to NH but this study disproved the hypothesis. schulman et al[18], also reported similar findings. Shorter duration NH may be the cause for this. Moreover, no comparative studies are available in this comparison.

The participants in this research did not receive elemental calcium or vitamin D_3 supplementation due to poor socio economic status. In spite of this there was rise in serum calcium levels after NHD which was statistically significant. Bruce F Culleton et al[19], also reported rise in serum calcium.

There was decease in serum phosphorous after NHD and the mean difference was 3.82 ± 0.68 mg/dl, statistically significant. A remarkable and unprecedented feature of NHD was reported by Simonsen O et al[20], which results in removal of > 160 mmol of phosphate each week which was more than double the removal seen in conventional hemodialysis. The findings of Bruce F.Culleton et al[19], were at par with this research. Due to socioeconomic status, the study population did not receive phosphate binders. The mean difference in serum PTH between the groups was 75.83 pg/ml, which was statistically significant. Similar findings were reported by Bruce F.Culleton et al.[19], the mean difference was 47 pg/ml and this was also statistically significant. Most of our study members had had secondary hyperparathyroidism which may be the cause for the increase PTH in this report.

There was rise in ejection fraction in this study as well as in the literature also[9]; the mean difference was 5.42% and 14.2%, respectively. This was mainly attributed to the high ultrafiltration rates. The cause for NA in Ali Ihsan Gunal et al[9], report was mostly poor salt control as well as high fluid intake which causes lower ultrafiltration rates. Whereas, in this study the cause for NA was multifactorial.

The mean hemoglobin concentration before and after NHD was 8.56 ± 1.22 g/dl and 8.55 ± 1.29 g/dl, respectively; statistically this difference was not significant (P<0.92). In spite of daily NHD, due increased appetite and oral supplementation of iron, erythropoietin, there was no fall in HB levels.

In the general population, LV mass is an independent predictor of Cardio vascular disease events and mortality[21]. Regression of LV mass decreases the risk of major cardiovascular events such as BP control and reported as a valid surrogate end point for the occurrence of cardiovascular events, at least in individuals not undergoing dialysis[22]. In ESRD patients, LV hypertrophy is common, affecting up to 75% of patients with incident ESRD[23], and has been shown to be an independent predictor of cardiovascular disease events and survival[24, 25]. Although progression of LV hypertrophy appears to be the norm in dialysis patients[26], regression of LV mass can occur and is associated with improved outcomes[27, 28]. In the study by Bruce F.Culleton et al[19], the mean difference in LVMI was -7.1±12.4 g/m^2, the difference was significant. In the conventional hemodialysis group the mean difference of LVMI was +1.0±14.1 g/m^2.In the NHD group the mean difference was -7.1±12.4 g/m^2. This was similar to the results in our study. The mean difference in this study was -14.83 gm/m^2 which was also statistically significant.

Conclusion

In this study we found that decrease in NA with daily NH using high flux dialyzer. In addition, improvement in clinical parameters such as reduction of BP, HR, body weight, improvement in various serum parameters and decrease in LV mass index, improvement in LVEF. However, studies with large sample size is strongly recommended.

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