



ORIGINAL RESEARCH PAPER

Nephrology

INTRAVASCULAR VOLUME STATUS IN CHILDHOOD NEPHROTIC SYNDROME

KEY WORDS: nephrotic syndrome, intravascular volume status, FeNa , Fractional urinary excretion of potassium, IVC collapsibility index

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ABSTRACT

Aim and Objectives: To assess the intravascular volume status in children presenting with Nephrotic Syndrome
Design : Prospective observational study
Setting: Tertiary care teaching hospital
Method : All children presenting with 1st episode of nephrotic syndrome based on inclusion and exclusion criteria in the general pediatric wards in Institute of child health. Tests for FeNa, Fractional urinary excretion of potassium, Echo to look for IVC collapsibility index were done for all of those children.
Results : In our study, We included 42 participants 16(38.1%) were females and 26(61.9%) were males. 20(47.6%) patients were found to have a FeNa of < 1, whereas 22(52.4%) patients were found to have a value of FeNa >1. 16(38.1%) patients were found to have a fractional urinary excretion of potassium of > 60 %, whereas 26 (61.9%) patients in this study had a fractional urinary excretion of potassium of <60 %. A total of 16(38.1%) patients were found to have an IVCCI < 50 %. 26(61.9%) patients were found to have an IVCCI > 50 %. Intravascular volume status was found to be decreased/hypovolemic in 38% of the patients in this study whereas 62 % of the patients had hypervolemic or normovolemic intravascular status. Since a significant number of patients were found to be hypovolemic, intravascular volume status must be assessed in patients with nephrotic syndrome before the institution of diuretic therapy for treating edema.

INTRODUCTION :

Nephrotic syndrome is one of the commonest diseases involving the glomerulus in Childhood . This caused by factors which increase the permeability of the glomerular filtration barrier. Most common age group of presentation of nephrotic syndrome is 3-6yrs. Around 2/3rds present before 6 yrs of age. The ratio among boys to girls is 2:1. But by late adolescence both sexes are equally affected. About 90% of the patients are in the most common form known as Idiopathic Nephrotic syndrome. Rest of the 10 % may be divided into multiple forms. Incidence is about 2-3 cases per 100000 children in developed countries with higher incidence in developing countries.

SUBJECTS AND METHODS :

Study group comprised of all children presenting with 1st episode of nephrotic syndrome based on inclusion and exclusion criteria in the general pediatric wards in ICH between January-September 2015 were enrolled into the study. Detailed history and clinical examination were done for these patients. Tests for FeNa, Fractional urinary excretion of potassium, Echo to look for IVC collapsibility index was done for all of those patients on admission. Children with Proteinuria >50 mg/kg/day or spot PCR >2 or urine dipstick 2+ or more Serum albumin < 2.5 g/dl Serum cholesterol >200 mg/dl were included and those with Previous episodes of nephrotic syndrome and Prior use of diuretics for edema during the present episode were excluded from study .Results were entered in an excel sheet and data was analyzed using open epi version 2.3.1 for statistics.

RESULTS:

A total of 42 patients were included in the study who satisfied the inclusion criteria. Among the 42 children, 12 (28.6%) were in the age group between 1 to 3years. There were 24(57.1%) children in the age group between 3 and 6 years which forms the largest age group in this study.

There were 6(14.3%) children of age more than 6 years and less than 10 years. 16 (38.1 %) were found to be females and 26 (61.9 %) of the total 42 participants were found to be males. 6(14.2%) of the patients in the study were Christians ,3 (7 %) were Muslims and the rest 33(79%) were from Hinduism religion. There is no statistically significant association of various religious cultures with incidence of nephrotic syndrome or its intravascular volume status.

20(47.6%) patients were found to have a FeNa of less than 1. 22(52.4%) out of the 42 patients were found to have a value of

FeNa more than 1 .

16(38.1%) of the 42 patients were found to have a fractional urinary excretion of potassium of more than 60 % with a 95 % confidence intervals lying between 25 and 53 percentage points. 26 (61.9%) of the 42 patients in this study had a fractional urinary excretion of potassium of less than 60 % with 95% confidence interval lying between 46 and 75 percentage points .

A total of 16(38.1%) out of 42 patients were found to have an IVCCI < 50 % with a 95 % confidence intervals lying between 25 and 53 percentage points. 26(61.9%) of the total patients were found to have an IVCCI > 50 % with 95% confidence interval lying between 46 and 75 percentage points.

16 (38.1%) patients had hypovolemia satisfying the above criteria with a 95 % confidence interval lying between 25 – 53.2 percentage points. 22(52.4%) patients had FeNa >1 and fractional urinary potassium excretion <60 % and IVCCI < 50 % with a 95 % confidence interval lying between 37 – 67 percentage points. Hence these patients were classified as hypervolemic.

4(9.5%) patients had a FeNa <1 but fractional urinary potassium excretion <60 % and IVCCI <50 % with a 95 % confidence interval lying between 3 – 21 percentage points. Since these patients did not satisfy the criteria for hypovolemia fully, there were classified as having hypervolemic or normovolemic intravascular volume status.

Hence a total of 16(38.1%) patients were classified as having hypovolemia whereas the rest of the 26(61.9%) were classified as having hypervolemia or normovolemia(not having hypovolemia) with a 95% confidence interval lying between 37.4 to 67 percentage points.

DISCUSSION :

The objective of this study was to measure the intravascular volume status of the patients presenting with first episode of nephrotic syndrome. Clinically intravascular status is very difficult to monitor because it is associated with many nonspecific signs and symptoms like giddiness, abdominal pain, diarrhea, hypertension etc. which can be very difficult to detect in children. Since diuretics are a major class of drugs used to treat edema in nephrotic syndrome, it was very vital to measure the intravascular volume status in patients for the treatment of edema.

In this study a total of 42 patients with first episode of nephrotic syndrome who were satisfying the inclusion criteria were included. Among the 42 patients, FeNa was found to be <1 in 20 patients denoting hypovolemia whereas it was >1 in 22 patients denoting hypervolemia. Fractional excretion of potassium was found to be $>60\%$ in 16 patients making them hypovolemic whereas it was found to be less than 60% in 26 patients making them hypervolemic. IVC CI was found out to be $>50\%$ in 16 patients making them hypovolemic and in 26 patients it was less than 50% making them hypervolemic.

A combination of FeNa <1 , fractional excretion $>60\%$ and $IVCCI >50\%$ was taken as having a hypovolemic intravascular status. 16 patients in this study were found satisfying the above criteria and were classified as having a hypovolemic intravascular status. The patients classified as having hypovolemic intravascular status didn't show any different symptoms or signs than the other subset of patients. 4 patients had a FeNa <1 but fractional excretion of potassium $<60\%$ and an $IVCCI <50\%$. Since these patients did not satisfy the criteria for hypovolemia they were classified as hypervolemia or normovolemia (not hypovolemia). 22 patients in this study had a FeNa >1 and fractional excretion of potassium $<60\%$ and an $IVCCI <50\%$. These patients were classified as having hypervolemic intravascular status.

Hence in this study it was found out that 16 patients out of 42 (38.1%) had a hypovolemic intravascular status and 26 patients out of 42 (61.9%) had an intravascular status which was not hypovolemic (hypervolemic or normovolemic). Since the patients with hypovolemia presented with almost the same symptoms as the ones with hypervolemia and diuretics are the drugs used to treat edema as first line, intravascular volume status must be assessed using laboratory parameters before the institution of diuretics to treat edema to prevent aggravation of a decreased intravascular volume status. In a study published by Sahay et al in sep 2011 had concluded some patients with nephrotic syndrome are hypovolemic and urinary indices are very useful in the evaluation of intravascular volume status in nephrotic syndrome. In a study published in March 2001 Osman domnez et al showed the usefulness of echocardiogram in measuring $IVCCI$, LAD in measuring the intravascular volume status in nephrotic syndrome. In a recent study published in Turkish journal of medicine in Jan 2015 which was also done using FeNa, Fractional urine potassium and echocardiography, 25% of the patients were found to be hypovolemic (FeNa <1 , frac urine potassium excretion $>60\%$ and $ivcci >50$, increased LAD) whereas the rest 75% were found to be hypervolemic or normovolemic (FeNa >1 , frac urine potassium excretion $<60\%$ and $IVCCI <50$, decreased LAD), the results of which are almost similar to our study.

CONCLUSION:

The objective of this study was to determine the intravascular volume status in first episode of nephrotic syndrome. This was important because diuretics are the first line drugs used to treat edema in patients with nephrotic syndrome and if used in patients with hypovolemia, may precipitate further volume depletion which can lead to dangerous complications like renal vein, pulmonary vein, cerebral vessel thrombosis and acute tubular necrosis in the kidney. In this study it was noted that 38% patients were hypovolemic which is a significant percentage. Hypovolemia in nephrotic syndrome can be clinically silent but can be detected by simple tests like FeNa, fractional urinary potassium and echocardiography to measure $IVCCI$ which are commonly available in many centers and are relatively inexpensive.

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