PULMONOLOGY

Serum Sodium Imbalance in Pediatric Community-Acquired Pneumonia and Its Association with Disease Severity

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Abstract

Community acquired pneumonia if not timey treated is associated with many problems one of which is hyponatremia. It develops less frequently in pneumonia children who are hospitalized. Disease outcome can be greatly reduced if it is recognised timely and treated with isotonic saline in due time.

METHODOLOGY: One hundred children fulfilling our criteria and admitted in Department of Pediatrics, Services Hospital, Lahore were included in the study. Five cc venous blood was drawn from each children of community acquired pneumonia and sent to hospital laboratory for evaluation of blood sodium levels.

RESULTS: one hundred cases of CAP were included in the study. When mean +SD of age was calculated, mean age of the study population was found to be 1.55±0.52 years. In addition, 55 %(n=55) were male while 45 %(n=45) were females. 27 %(n=27) children effected with CAP were found to be having low sodium levels whereas 73 %(n=73) had normal sodium levels.

CONCLUSION:

After conducting research, we have come to the conclusion that community acquired pneumonia is very frequent among children in the age group between 1-1.5 years. If it is promptly treated, children can be saved from life threatening pathologies.

KEYWORDS: ***Children, community acquired pneumonia, hyponatremia***

Introduction

Community-acquired pneumonia (CAP) is a major problem all over the world but its incidence is much higher in the underdeveloped world. More than one million children die from pneumonia every year. Major cause of pneumonia is viral in origin. Respiratory syncytial virus, influenza A, and parainfluenza types 1 through 3 are the most common viral agents.it is followed by infection with bacteria's like streptococcus pneumonia.[3],[4]

Most of the cases of CAP, resolves on its own but if left untreated it is associated with many complications including that of renal system The measurement of serum electrolytes may be helpful in assessing the degree of dehydration in children with limited fluid intake and whether hyponatremia is present.[5]many studies have produced a positive relationship between respiratory tract infections and hyponatremia .[6] A study reported an incidence of 27.9% hyponatremic children who had CAP. Similarly, Don M and colleagues have found 45% incidence of hyponatremia in children of CAP. HN is easy to diagnose and rarely dangerous, but sometimes its origin may be difficult to settle, and inappropriate fluid therapy

may lead to complications.[7] hyponatremia results from water retention or shift of sodium from intracellular to extracellular fluid or vice versa.[8] The syndrome of inappropriate antidiuretic hormone (SIADH) which is common in many paediatric illnesses of pulmonary, cerebral or malignant origin is responsible for water retention and thus causes hyponatremia.[9]

The rationale of the study is that no local literature is available to address this issue while international studies are showing a significant difference which needs another study to be conducted in our local population so that the actual frequency of the morbidity may be determined which will be helpful for the paediatricians for timely prevention of complications of hyponatremia e.g. increased hospitalization stay, cerebral edema, seizures, coma and death in community acquired pneumonia.

Materials and method

A Cross sectional Study was carried out in the Department of Pediatrics, Services, Hospital, Lahore. Children of age up to 2 years who are diagnosed as cases of CAP in the last 72 hours. However, already diagnosed cases of hyponatremia (on history and medical record), Children having previous history of hyponatremia (on history and medical record) and children who were not willing to pariciapte were excluded from the study.Informed consent of the parents of children was obtained to include their data in the study. The demographic profile of every children was recorded. 5cc blood sample of children who were diagnosed with CAP was taken and sent to hospital lab. The data was analyzed through IBM SPSS version 22. Mean ± SD were calculated for age. Stratification for age, gender, duration of CAP, nutritional status (i.e. malnourished/nourished) and socio-economic status were done to control the effect modifiers. Post stratification chi-square test was applied to know the significance. p value $\leq$0.05 was considered as significant.

RESULTS

A total of 100 cases fulfilling the inclusion/exclusion criteria were enrolled. Subjects were than stratified according to their age. Mean $\pm$ SD age was calculated as 1.55$\pm$0.52 years. In addition, it showed that 45% (n=45) had upto 1 year of age while 55% (n=55) were between 1-2 years of age. Gender distribution shows that 55 %(n=55) were male while 45 %(n=45) were females. Frequency of hyponatremia in children with community acquired pneumonia was recorded in 27% (n=27) whereas 73 %(n=73) had no findings of the morbidity. (Table no. 1) Frequency of hyponatremia with regards to age showed that 7 out of 45 cases up to 1 year of age and 17 out of 55 cases between 1-2 years of age had hyponatremia. p value was 0.07. (Table No. 2). Stratification for frequency of hyponatremia with regards to gender shows that 12 out of 55 male and 12 out of 45 female cases had hyponatremia, p value was 0.42. Frequency of hyponatremia with regards to duration of CAP shows that 18 out of 67 1-2 weeks duration of CAP and 6 out of 33 >2 weeks duration of CAP had hyponatremia, p value was 0.33. (Table No. 2)

TABLE No. 1FREQUENCY OF HYPONATREMIA IN CHILDREN WITH COMMUNITY ACQUIRED PNEUMONIA (n=100)

Hyponatremia	No. of patients	%
Yes	27	27

No	73	73
Total	100	100

Table no. 2: Stratification for Frequency of Hyponatremia with Regards to Age, Gender and Duration of Community Acquired Pneumonia (n=100).

		Hyponatremia		p-value
		Yes	No	
Age	Up to 1 year	7	38	0.07
	1-2 year	17	38	
Gender	Male	12	43	0.42
	Female	12	33	
Duration of CAP	1-2 weeks	18	49	0.33
	>2 weeks	6	27	

DISCUSSION

Hyponatremia is the most common finding in children of community acquired pneumonia. The current study was planned with the view that no local literature is available to address this issue while international studies are showing a significant difference. Hyponatremia leads to severe life threatening complications like cerebral edema, epileptic fits, coma and even death. The rationale of the study is to find out the frequency of hyponatremia in our population so that physicians can be guided accordingly.

In our study, we found out that frequency of hyponatremia in children with community acquired pneumonia was 24 %. A study done by Wrotek A and others recorded hyponatremia in 33.3% cases of CAP.[6] Another study recorded these findings (i.e. hyponatremia) in 27.9% of the cases(with community acquired pneumonia).[7] The findings of our study are in agreement with the above studies, while another study recorded it in 45.4% of children with community acquired pneumonia.[10] These findings are higher than our results and can be explained by the fact that they have included patients having all type of respiratory infections whereas we have included only those patients who are suffering from lower respiratory tract infection i.e., pneumonia.

When hyponatremia was stratified with age, gender and duration of disease, it should positive statistical significant result with age only. These results were in line with a study conducted by Mandal and colleagues. [12]

Hyponatremia is usually mild in children with CAP[11]. The basic pathophysiologic mechanism behind this can be explained by considering the role of two hormones which are antidiuretic hormone (ADH) and atrial natriuretic peptide (ANP). [10]Atrial natriuretic peptide is produced from atrial muscles. It is a natriuretic peptides. It regulates arterial pressure by regulating diuresis and natriuresis. [13] Fever or dehydration reset the osmostat for ADH secretion,in addition it increase atrial natriuretic peptide secretion.. Over-secretion of ANP is correlated with hypoxia, which leads to pulmonary vasoconstriction, pulmonary hypertension, and right-heart overload.[11, 12] Garrahay et al. [13]found that 68% of hyponatremia in community acquired pneumonia had characteristics typical of SIADH.

Severe hyponatremia is rare in children with CAP. This can be explained by the observations of Haviv et al which reported that ANP helps to maintain sodium level within normal limits through its diuretic and natriuretic effect.[14] In addition, Gerigk et al.,[15] found that ADH may cause HN that may originate by a non-osmotic, cardiovascular mechanism in acutely ill children, including children with pneumonia.

Hyponatremia, the most common frequent electrolyte derangement identified among hospitalized patients[16] and is associated with worsened clinical and economic outcomes and indicates a poor prognosis.[17] It is important to emphasize that the presence of HN is associated with not only prolongation of hospitalization ,but also with an increase in hospital mortality.[18]In our study, children with HN at admission had longer hospitalization times and a prolonged duration of fever, although their final outcome was favorable, including cases that developed pleural effusion.[17]

The point to ponder is whether hyponatremia in most patients is simply a powerful marker of severity of the underlying disease or a direct contributor to the adverse outcomes observed. But whatever it may be, hyponatremia is a compelling independent marker of adverse outcome.[19] The danger of fluid overload in children with bacterial meningitis is widely appreciated [20], but it has not been valued how commonly fluid restriction is indicated in pneumonia in childhood. [17]An Indian study concluded that fluid therapy in pneumonia should be modified. Those having hyponatremia with hyper osmolality need liberal fluids while those with hypo osmolality need fluid restriction and hypotonic fluids.[21] In the end, we think that more studies with greater sample size and prolonged duration of research are needed to explore the mechanism and association of hyponatremia with severity of illness.

CONCLUSION

We came to a conclusion that hyponatremia is common among children affected by pneumonia and should be kept in mind while treating for pneumonia. But it needs more prolonged studies to find whether hyponatremia levels are associated with severity of disease or not.

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