



“CLINICAL PROFILE AND OUTCOME OF CHILDREN AGED 1 MONTH TO 12 YEARS WITH ELECTROLYTE DISTURBANCES ADMITTED IN PAEDIATRIC INTENSIVE CARE UNIT OF A TERTIARY CARE HOSPITAL, KAKINADA.”

Dr. Monica Ram Korpu

M. S. Raju

Dr. D. Manikyamba

Dr. G. Poornima* *Corresponding Author

ABSTRACT **Background:** Most common electrolyte disturbances in ICU setting in children are mainly of sodium, potassium, calcium and bicarbonate. Hyponatremia is associated with SIADH with wide range of effects on CNS based on the chronicity of sodium disturbance. Hypokalemia is associated with serious effects like muscle paralysis (including respiratory muscles), paralytic ileus and cardiac arrhythmias. Hyperkalemia causes neuromuscular effects and arrhythmias. Hypocalcemia can cause tetany, seizures, stridor due to laryngospasm and apnea. Metabolic acidosis with pH < 7.2 can cause impaired cardiac contractility and arrhythmias. **Objectives:** To know the incidence, age distribution, underlying illness and mortality rate of dyselectrolytemia of children aged 1month- 12 years admitted in paediatric intensive care unit of a tertiary care hospital **Results:** Dyselectrolytemia was found in 59 children. Hyponatremia was the most common abnormality found in 24 children followed by metabolic acidosis and hypokalemia. 25% of the children had mixed electrolyte abnormalities. Majority of children with dyselectrolytemia (42 children) presented with CNS infection. Septicemia and multisystem involvement were seen in 22% each. Mortality rate among children with hyponatremia and hypernatremia was 41.6% and 75% respectively where as mortality in children with normonatremia was 18%. The mortality among those with other electrolyte abnormalities was also higher compared to those without dyselectrolytemia. **Conclusion:** The present study shows that the incidence of electrolyte abnormalities is high (59%), the commonest being hyponatremia. Dyselectrolytemia in critically ill children is an important prognostic indicator irrespective of primary disease. Hence it is mandatory to routinely monitor for electrolyte abnormalities in all ICU admitted children which can help in reducing mortality.

KEYWORDS :

INTRODUCTION

Electrolyte abnormalities are common in children admitted in ICU which may remain unrecognized in majority and result in mortalities and morbidities. Most common electrolyte disturbances in ICU setting in children are mainly of sodium, potassium, calcium, bicarbonate and chloride. Prompt recognition and early management of these disturbances prevent further dreadful complications. High index of suspicion is necessary to ensure correction of these disturbances.

Sodium and potassium disturbances are common in hospitalized children. Hyponatremia is associated with SIADH with wide range of effects on CNS based on the chronicity of sodium disturbance¹. Hypokalemia is associated with serious effects like muscle paralysis (including respiratory muscles), paralytic ileus and cardiac arrhythmias². Hyperkalemia causes neuromuscular effects and arrhythmias³. Hypocalcemia can cause tetany, seizures, stridor due to laryngospasm and apnea. Metabolic acidosis with pH < 7.2 can cause impaired cardiac contractility and arrhythmias³.

Large number of studies were done on this topic but studies in this area are scarce hence this study is taken up to evaluate the electrolyte imbalances especially of serum sodium, potassium, calcium and bicarbonate in children admitted in ICU.

MATERIALS AND METHODS

Study setting, population, and sampling techniques

This is a hospital based Prospective observational study done in Paediatric Intensive Care Unit, Government General Hospital, Kakinada. 100 children in the age group 1 month to 12 years who were admitted in PICU during the study period from June 2021 to November 2022 were included in the study

Study was approved by institutional ethics committee. Prior written informed consent was taken from parents or caregivers of children included in study

After initial stabilization, the cases were monitored for serum electrolytes and other investigations were done on clinical necessity. Electrolyte disturbances involving Sodium, Potassium, Calcium and Bicarbonates were identified and treated appropriately as per hospital

protocol. The data was collected in a predesigned proforma. Details of child like age, sex, clinical features and underlying illness were noted. Duration of hospital stay and outcome were recorded

Case definitions

Hyponatremia < 135 mEq/L
Hypernatremia > 145 mEq/L
Hypokalemia < 3.5 mEq/L
Hyperkalemia > 5.0 mEq/L (>1 year) > 6.0 mEq/L (<1 year)
Hypocalcemia < 8.8 mg/dl (total) < 1.12 mmol/L (ionized)
Hypercalcemia > 10.8 mg/dl (total) > 1.23 mmol/L (ionized)
Metabolic acidosis - serum HCO₃ < 20 mEq/L

RESULT

A total of 100 children admitted in pediatric ICU, GGH, KKD were included in the study. Majority of them were in the age group of 1month to 1year. 64 were males and 36 were females. The male to female ratio was 1.7 :1. Dyselectrolytemia was found in 59 children. Hyponatremia was the most common abnormality found in 24 children followed by metabolic acidosis and hypokalemia. 25% of the children had mixed electrolyte abnormalities. (Refer Table 1)

Majority of children with dyselectrolytemia (42 children) presented with CNS infection. Septicemia and multisystem involvement were seen in 22% each. (Refer Table 2)

Table 1: Incidence of Dyselectrolytemia among study subjects (n=100)

Dyselectrolytemia	Frequency	Percentage
Hyponatremia	24	24%
Hypernatremia	4	4%
Metabolic Acidosis	21	21%
Hypokalemia	18	18%
Hyperkalemia	8	8%
Hypocalcemia	6	6%
Hypercalcemia	3	3%
Mixed abnormalities	25	25%

In our study, 59% were having any form of dyselektrolytemia. Out of all 24% were having Hyponatremia followed by metabolic acidosis in 21%, Hypokalemia in 18%, hyperkalemia in 8%, Hypocalcemia in 6%, Hypernatremia in 4% and Hypercalcemia in 3%

TABLE 2 : Underlying illness in children with Dyselektrolytemia (n=59)

Underlying illness	No. of cases
Central nervous system infections	42 (71%)
Respiratory diseases	9 (15%)
Renal diseases	4 (7%)
Septicemia	13 (22%)
Gastro intestinal diseases	4 (7%)
Multi system involvement	13 (22%)

In our study, CNS illness (71%) was the most common system associated with dyselektrolytemia followed by Sepsis(22 %), Respiratory system(15%), Renal (7%), GIT (7%), Multi system involvement(22%)

TABLE 3: The Age distribution of children with dyselektrolytemia

Age	1m- 1yr	1yrs- 5yrs	5yr-10yr	>10yrs	TOTAL
Hyponatremia	14	4	3	3	24
Hypernatremia	2	2	0	0	4
Hypokalemia	10	4	2	2	18
Hyperkalemia	4	2	1	1	8
Hypocalcemia	3	1	1	1	6
Hypercalcemia	2	1	0	0	3
Metabolic acidosis	16	3	1	1	21

TABLE 4: Outcome of children with Dyselektrolytemia

Dyselektrolytemia	Survival	Deceased	P value
Hyponatremia	14 (58.4%)	10 (41.6%)	0.02
Hypernatremia	1(25%)	3 (75%)	<0.001
Normonatremia	59 (82%)	13 (18%)	
Hypokalemia	11 (61%)	7 (39%)	0.02
Hyperkalemia	3 (37.5%)	5 (62.5%)	0.01
Normokalemia	60 (81%)	14 (19%)	
Hypocalcemia	3 (50%)	3 (50%)	<0.022
Hypercalcemia	3 (100%)	0	
Normocalcemia	68 (75%)	23 (25%)	
Metabolic acidosis	13 (62%)	8 (38%)	<0.001

Mortality rate among children with hyponatremia and hypernatremia was 41.6% and 75% respectively where as mortality in children with normonatremia was 18%. This difference is statistically significant with P value <0.05. The mortality among those with other electrolyte imbalances like hypokalemia or hyperkalemia, hypocalcemia or hypercalcemia and metabolic acidosis was higher compared to those without dyselektrolytemia.

DISCUSSION

In the present study 100 children in the age group of 1 month to 12 years admitted in pediatric ICU with various diseases were randomly detected and enrolled to study the electrolyte abnormalities. 59% of the patients were found to have electrolyte abnormalities. The incidence of electrolyte abnormalities in ICU admitted children ranged from 37.4% to 84% in the studies done by Jaykumar et al⁴ and Naseem F et al⁵ respectively. In many other studies, incidence was 83.7% (Keerthidarshini et al⁶), 60% (Nehagarwal et al⁷), 57.3% (Haider et al⁸), 53.7% (Chary dc et al⁹), 44.3% (Panda et al¹⁰).

Type Of Abnormality

In this study, Hyponatremia (24%) was the most common abnormality followed by metabolic acidosis (21%). 25 children found to have mixed abnormalities. Hypercalcemia was the least common abnormality.

Underlying Condition

In this study, majority of the children with electrolyte abnormalities had CNS disease followed by septicemia. 13 children (22%) had multisystem involvement.

Children with CNS infection are known to have SIADH which causes hyponatremia. The features like altered sensorium, seizures and raised

ICT due to hyponatremia are often masked by underlying CNS disease. Fluid restriction and periodic monitoring of serum sodium are essential in these patients.

Age Group Involved

In this study it is found that all the electrolyte abnormalities were significantly more common in the age group of 1 month to 1 year. The incidence of hyponatremia in this study was 24%. It ranged from 16% to 40.8% in various studies done by Haider et al⁸ and Chary dc et al⁹ respectively. Other studies done by Jaykumar et al⁴, Panda et al¹⁰, Sachdeva et al¹¹, A Reddy et al¹² showed incidence of 35.2%, 27.4%, 19.6%, 16.8% respectively.

Mortality In Children With Dyselektrolytemia

In the present study mortality among children with hyponatremia and hypernatremia was 40% and 75% respectively and in those with normonatremia was 18%. This difference is statistically significant with P value <0.05. The studies done by Panda et al¹⁰ and Haider et al⁸ also reported higher mortality in children with hyponatremia and hypernatremia.

Hypokalemia was most commonly observed in children with CNS illness. Studies done by A Reddy et al¹² also reported similar results. Low oral intake, presence of vomitings, stress induced catecholamine release and use of medications like mannitol and steroids contribute to the incidence of hypokalemia in these children. Mortality in patients with hypokalemia and hyperkalemia was found to be significantly higher (P value < 0.05). Studies done by Haider et al⁸ and Panda et al¹⁰ also reported the same results.

Metabolic acidosis is commonly observed in children with CNS illness especially in children less than 1 year. Immaturity of kidney in handling the acid base abnormalities may be responsible for higher incidence in this age group. Mortality among children with metabolic acidosis was significantly high (52.3%). Studies done by Muraleetharan et al⁶ (52.8%), Ishaque et al¹³ (25%) and Ulain et al¹⁴ (26%) also reported higher mortality in critically ill children with metabolic acidosis.

The mortality in children with dyselektrolytemia is significantly higher than in those without dyselektrolytemia. As the manifestations of dyselektrolytemia are overlapping and often masked by the clinical features of underlying conditions, high index of suspicion and monitoring of all ICU admitted children for electrolyte abnormalities helps in early identification and timely management. This improves the outcome of these children.

CONCLUSION

The present study shows that the incidence of electrolyte abnormalities is high (59%), the commonest being hyponatremia. Dyselektrolytemia in critically ill children is an important prognostic indicator irrespective of primary disease. Hence it is mandatory to routinely monitor for electrolyte abnormalities in all ICU admitted children which can help in reducing mortality.

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