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Outcome of patients admitted with dehydration in a Paediatric Intensive Care Unit in correlation with Severe Serum Electrolyte Panel Disturbances.

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I. Introduction.

The serum electrolyte panel (SEP) is a frequently ordered laboratory test, but there is paucity of data on the impact of severe SEP disturbances on outcome of cases presenting with dehydration in PICU.

Dehydration disturbs the delicate balance of electrolytes in the individuals; children are especially vulnerable to dehydration due to their small size and fast metabolism.

Electrolyte abnormalities can adversely affect the outcome; the serum levels of electrolytes should be closely monitored with serial measurements and treated properly.[1]

Dyselectrolytemias, especially hyponatremia is one of the most common electrolyte disorders encountered in hospitals, occurring in approximately 11% - 30% of hospitalized children.[1-4] Serum sodium plays a significant role in plasma osmolality and tonicity.[3] Hyponatremia results from deficit of sodium or surplus of water. Impaired water excretion, inappropriate release of vasopressin, use of hypotonic fluids, redistribution of sodium and water, several drugs and primary illness all contribute to hyponatremia. ICU-acquired hyponatremia and hypernatremia are common in critically ill patients and are associated with increased risk of hospital mortality.[4] Incidence of hypernatremia in children admitted to PICU varies from 4% - 7%.[4,5] Predisposing factors include the administration of sodium bicarbonate solutions to correct metabolic acidosis, renal water loss through a concentrating defect from renal disease, gastrointestinal fluid losses through nasogastric suction, lactulose administration and water losses through fever.[5] Potassium plays a key role in maintaining the resting membrane potential of the cell through the activity of Na+/K+-ATPase. Hypokalaemia and hyperkalaemia in ICU has been observed at an incidence of 12% - 15%.[5,6] and 2% - 6%[7] respectively. Potassium is necessary for the electrical responsiveness of nerve and muscle cells and for the contractility of cardiac, skeletal and smooth muscle.

There is a lot of published adult data addressing this problem but paediatric data has just begun to generate especially over the last decade with the growth of paediatric critical care medicine subspecialty. This study was conducted to identify the magnitude of electrolyte changes and their outcome.[8]

Our objective of the study was to determine the correlation of SEP changes on the resulting outcome of patients receiving treatment in PICU.

II. Methods.

A retrospective study in children from 1 month to 12 years of age who were admitted because of dehydration in a pediatric intensive care unit (PICU) fromthe duration of Sept 2020 to March 2022.Data was retrieved from Medical records of PICU.Demographic, comorbidities, need of mechanical ventilation and SEP results were recorded. Outcome measurements included severe changes in SEP and their effect on patient outcome as discharge, discharge against medical advice or death. Serum electrolyte disturbances were categorized according to their severity, serum potassium into mild 5.5–6.5 mEq/L, moderate 6.5–7.5 mEq/L and severe >7.5 mEq/L hyperkalemia; and serum potassium level of 3.0 – 3.5 mEq/L. Moderate hypokalemia is a serum level of 2.5-3.0 mEq/L, and severe hypokalemia is a level of less than 2.5 mEq/L. Hypernatremia as mild 146-149 mmol/L; moderate 150-169 mmol/L; severe ≥170 mmol/L and Hyponatremia as mild 130-134 mmol/L. moderate: 125-129 mmol/L, severe: < 125 mmol/L. Patients were categorised based on whether severe electrolyte disturbances (severe hypernatremia or severe hyponatremia or severe hyperkalemia or severe hypokalemia) were present on admission, following their effect on outcome of the patient.

The data was entered in Microsoft Excel 2016. Statistical analysis was done on IBM SPSS STATISTICS VERSION 20.
Categorical variables were taken in the form of frequencies and percentages. Distribution was represented by pie charts or bar graphs. Continuous variables were expressed in the descriptive statistics tables as means, standard deviation and range.
The Categorical variables in the two groups were compared using cross tabulation design and Chi square T test. The continuous variables were compared by considering mean and standard deviation and using independent sample T test.
Bivariate Correlations between variables were calculated using Pearson's correlation coefficient.
P value < 0.05 was considered significant and p value < 0.01 was considered highly significant.

Tables:

Table 1: Electrolyte Normal Range

1	Sodium	135-145 mEq/L
2	Potassium	3.5-4.5 mEq/L

Table 2: Descriptive Statistics of Electrolyte parameters

Parameters	N	Range	Minimum	Maximum	Mean	Std. Deviation
Sr Sodium	59	78	107	185	146	-0.81
Sr Potassium	59	7	2.4	9.4	5.9	13.61

Table 3: Descriptive Statistics of presence of electrolyte changes

Electrolyte Disturbances	44
Severe electrolyte disturbances	12

Table 4: Descriptive Statistics of demographics

	Male	Female
Less than 5 years	30	14
Greater than 5 years	9	6

Table 5: Descriptive Statistics of Requirement of Ventilation

Ventilated pts	12
Non ventilated pts	47

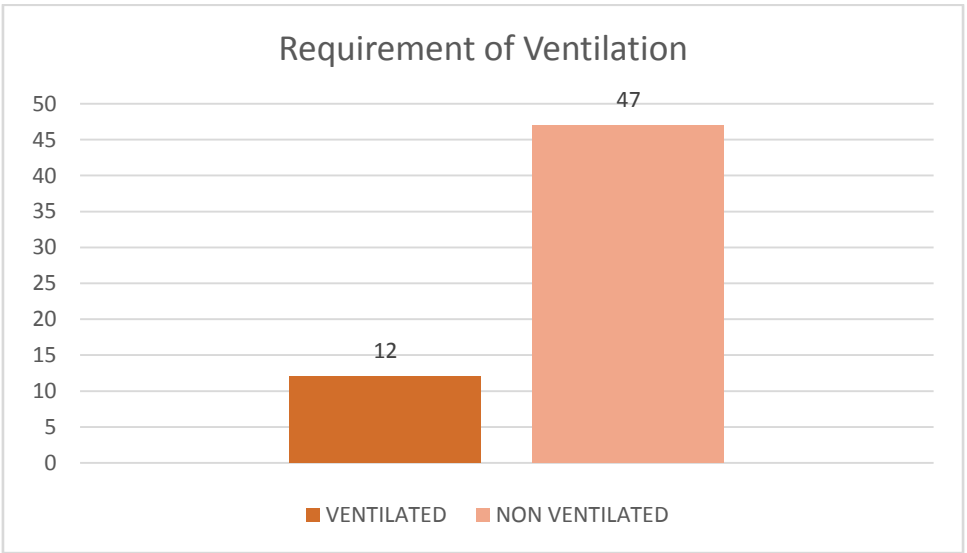
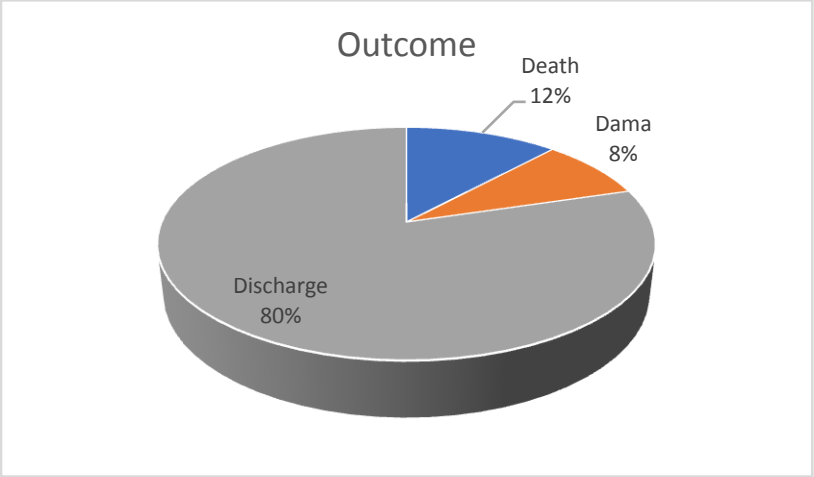


Table 6: Distribution of patients with severe serum electrolyte panel changes		
N.	%	
Mortality	3	25
Survival	9	75
Total	12	100

Table 7: Correlation of severe SEP disturbances with Outcome of the patients		
		Severe electrolyte disturbances
Mortality	Pearson Correlation (R)	0.37
	P	0.00392
	N	3
	%	25
	P	0.00001
Survival	N	9
	%	75

Table 8: FINAL OUTCOME DISTRIBUTION

OUTCOME	No	%
DEATH	7.00	11.86
DISCHARGED	47.00	79.66
DAMA	5.00	8.47



III. Results.

59 patients presenting with dehydration and admitted to PICU were studied. Obtaining a SEP can provide useful information for the treatment of children with dehydration.Among these children, 39 (66.10%) were male and 20 (33.89%) were female.

Electrolyte imbalance was noted in 44 (74.57%) children.

Severe electrolyte changes were noted in 12 (20.33%) children.

Mechanical ventilation was required in 12 (20.33%) children.

Out of the total expiries during the study period, 4had electrolyte imbalance, 3 had severe electrolyte disturbance making it a significant risk factor for mortality. (0.003922). A significant number of discharges were seen in cases without electrolyte imbalance, 43 cases did not have severe SEP were discharged. (0.0001)

Regarding the outcome,59 admissions, total discharges from PICU were 52, (including LAMA) and there were 7 expiries.

IV. Discussion.

Dyselectrolytemias are not uncommon in critically ill paediatric patients. [5] When present; they can significantly affect the outcome of patients. Critical care provision through paediatric intensive care units (PICU) is aimed at maintaining 'homeostasis' in the body which is vital for the organ's support and optimal function. This involves not only fluids but also electrolytes balance.[6]

Major electrolytes important in this regard are sodium and potassium.[7] Their imbalance in either direction i.e. lower or higher than normal values can affect cellular processes, which can significantly affect morbidity and mortality.[9] These imbalances also result in longer stay in hospital [10], thus adding significantly to the costs of management. Thus early recognition and intervention to correct these imbalances is essential to avoid poor outcome that is mortality in concordance with studies by Stelfox HT et al., 2008 [2, 11]

There was a significant impact of COVID 19 on the study as patients were not willing to stay due to social reasons leading to greater number of leaves against medical advice.

V. Conclusion.

Presence of electrolyte imbalance at the time of admission is an important prognostic indicator in critically ill children. The precise information about exact level of essential electrolyte at the time of admission has great significance in outcome of patients.

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