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Study of Acute Kidney Injury in Children Admitted In Pediatric ICU

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Abstract

Background: Acute Kidney Injury(AKI) has been traditionally defined as abrupt loss of kidney function leading to a rapid decline in the glomerular filtration leading to a rapid decline in the glomerular filtration rate(GFR), accumulation of waste products such as blood urea nitrogen(BUN) and creatinine, and dysregulation of extracellular volume and electrolyte homeostasis. AKI is defined as: Increase in serum creatinine by >=0.3 mg/dl from baseline within 48 hours; or increase in serum creatinine to >=1.5 times baseline within the prior 7 days; or urine output<=0.5 ml/kg/hr for 6 hours. **Aim:** To study the incidence of AKI in children admitted in PICU in civil hospital Ahmedabad, To various clinical features and complications of AKI in children, To study short term outcome of AKI in children. **Methods**: It is prospective observational study done over study period of 1/8/2019 to 5/2/2020. Total 50 patients admiited in PICU were enrolled in study after taking consent of their guardians and investigations for AKI were done and managed accordingly and outcomes was recorded.Patients having pre existing chronic renal diseases are excluded from study. **Results:** In present study, out of total patients admitted in PICU over a given study period, the incidence of AKI is 11%. And highest number of patients were noted in age group of 1 to 5 years. In this study, most common etiology of AKI is found to be Septicemia, which comprises 44% of total patients of AKI. In this study, oliguria is the commonest symptom seen in 94% patients of AKI, Hyperkalemia is the commonest electrolyte abnormality seen in 36% patients of AKI and Dyselectrolytemia is the most common complication seen in 64% patients of AKI in present study. Outcomes in form of discharge, Expiry and DAMA is noted as 66%,24%, and 10% respectively in this study. **Conclusions:** AKI affects a large proportion of critically ill children, especially the younger age group. Thus, all such patients should be monitored for development of AKI. Monitoring of electrolytes should be done as dyselectrolytemia is most common complication in AKI. Proper monitoring and early detection of AKI and timely treatment reduces the mortality of patients.

Keywords:- Acute Kideny Injury, Dyselectrolytemia.

INTRODUCTION

Acute Kidney Injury(AKI) has been traditionally defined as an abrupt loss of kidney function leading to a rapid decline in the glomerular filtration rate (GFR), accumulation of waste products such as blood urea nitrogen (BUN) and creatinine, and

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dysregulation of extracellular volume and electrolyte homeostasis.

AKI is defined as:

1. Increase in serum creatinine by >=0.3 mg/dL from baseline within 48 hr; or
2. Increase in serum creatinine to >=1.5 times baseline within the prior 7 days; or
3. Urine output <=0.5 ml/kg/hr for 6 hr

A classification system of AKI is proposed by the Kidney Disease Improving Global Outcomes(KDIGO).

KDIGO staging of AKI.[1,2,3,4,5,6]

Stage	Serum creatinine	Urine Output
1	1.5-1.9 times baseline, OR >=0.3 mg/dl increase	<0.5 ml/kg/hr for 6-12 hr
2	2.0-2.9 times baseline	<0.5 ml/kg/hr for >=12 hr
3	3.0 times baseline, OR S.Cr >=4.0 mg/dl, OR Initiation of renal replacement therapy, OR eGFR <35 ml/min/1.73 m2(<18 yr)	<0.3 ml/kg/hr for >=24 hr OR Anuria for >=12 hr

MATERIAL AND METHODS

Aims and Objectives

- To study the incidence of AKI in children admitted in PICU in civil hospital Ahmedabad.
- To study etiologies, various clinical features of AKI
- To study the complications of AKI in children
- To study the short term outcome of AKI in children and prognosis in various stages of AKI

➢ Study Design: Prospective observational type of study

➢ Participants: 50 pateints admitted in PICU in Civil Hospital Ahmedabad

➢ Study period: 1/8/2019 to 5/2/2020

➢ Consent: After taking informed consent from parents/gardians, patients were enrolled in study and investigations were done for AKI

All the patients were investigated and managed according to hospital based protocols and outcome was recorded.

Investigations required in study,

- Renal function tests(blood urea, serum creatinine,serum sodium, serum potassium) and others(serum calcium,serum phosphate)
- Blood gas analysis
- Complete blood counts with peripheral smear
- USG KUB
- Urine routine and microscopy, Urine culture

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Inclusion Criteria

- Age more than 28 days upto 12 years and does not come in exclusion criteria

Exclusion Criteria

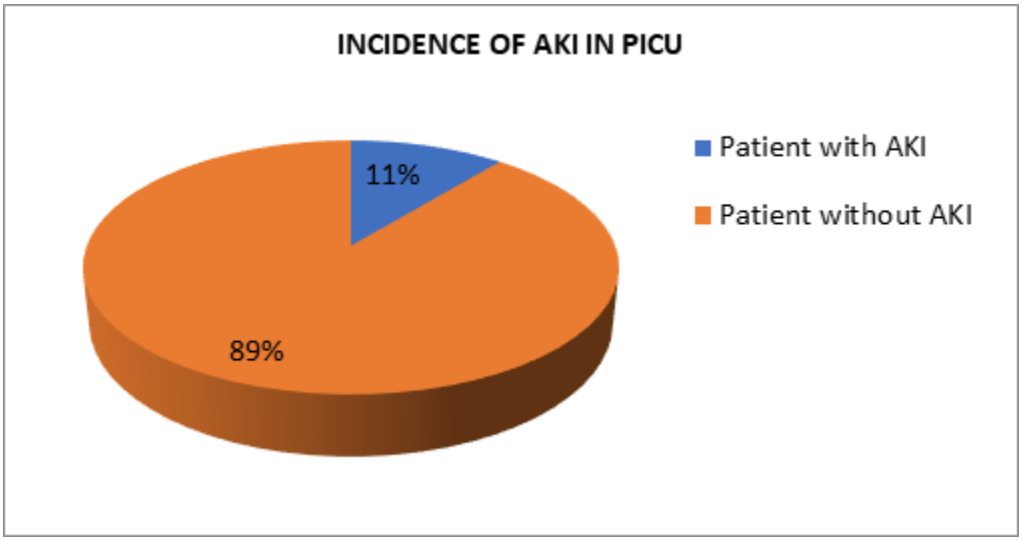
- All the neonates were excluded from this study
- All patients with pre existing chronic renal disease, chronic renal failure or congenital malformation excluded.
- Patients whose parents did not consent to the study were excluded.

RESULTS

In present study, out of 454 patients admitted over a period of 6 months, 50 patients had AKI. The incidence of AKI in patient admitted in PICU is 11%.

Incidence of AKI in Pediatric ICU (PICU)

Total patients admitted in PICU	Patients having AKI	Patients not having AKI	Incidence in other study
454	50 (Incidence 11%)	404	4.5% [in Bailey et al],[7] 36.1% [in Mehta et al][8]



Moghal NE et al,[9] reported yearly incidence of 0.8 per 1,00,000 paediatric population.

Age wise Comparison

No.	Age Group	No. Of patients of AKI(%)
1	>1 month- 12 months	16 (32%)
2	>1-5 years	20 (40%)
3	>5-10 years	8 (16%)
4	>10-12 years	6 (12%)

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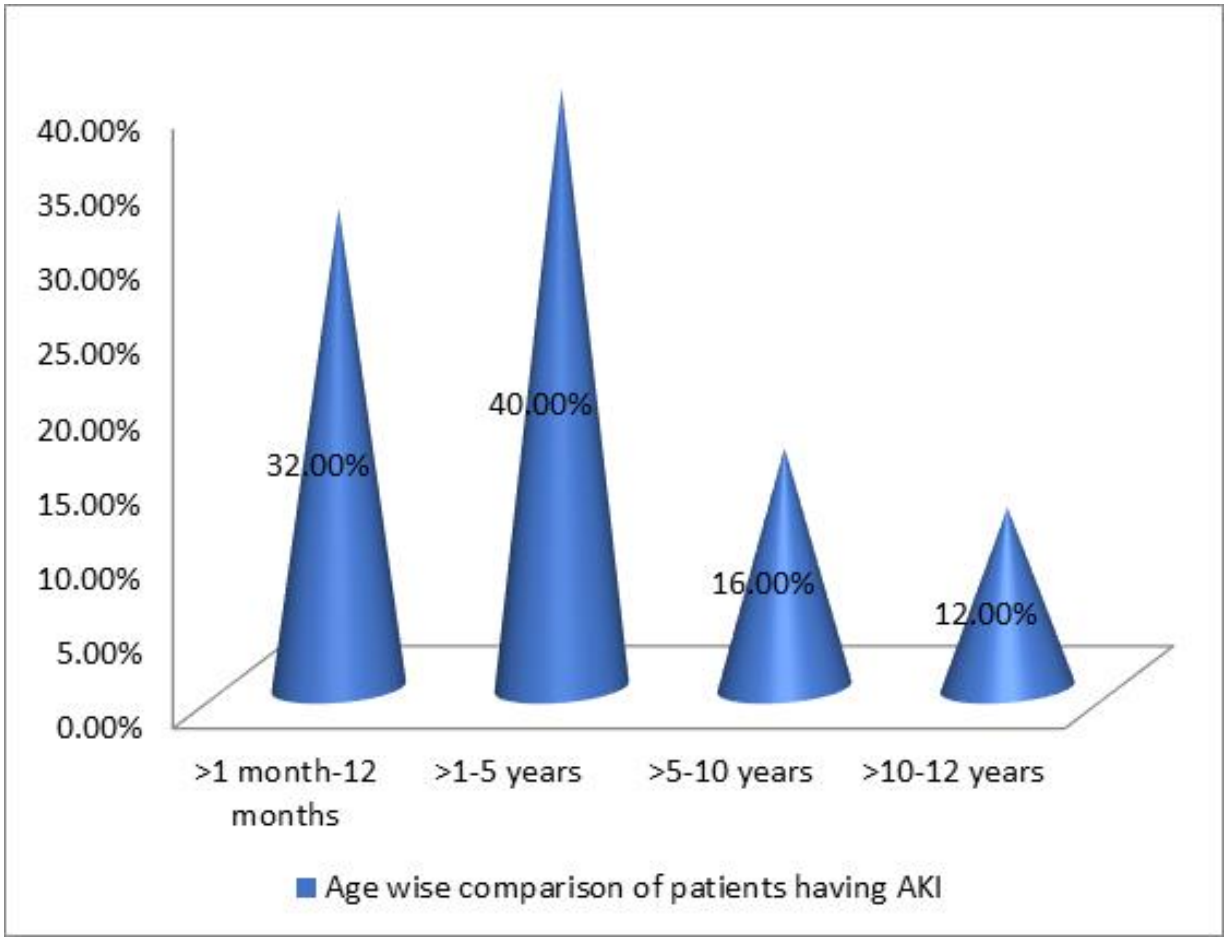
In present study, highest number of patients were noted in age group >1-5 years (40%). Srivastava RN et al found in their study that 49% between 1-4 year and 23% of patients were below 1 year.[10] Jamal A et al found in their study on AKI that the mean age of presentation was 4.5 years with 56.7% of patients under the age of 5 years.[11]



Sex Wise Comparison

No	Sex	No. of Patients of AKI (%)
1	Males	26 (52%)
2	Females	24 (48%)

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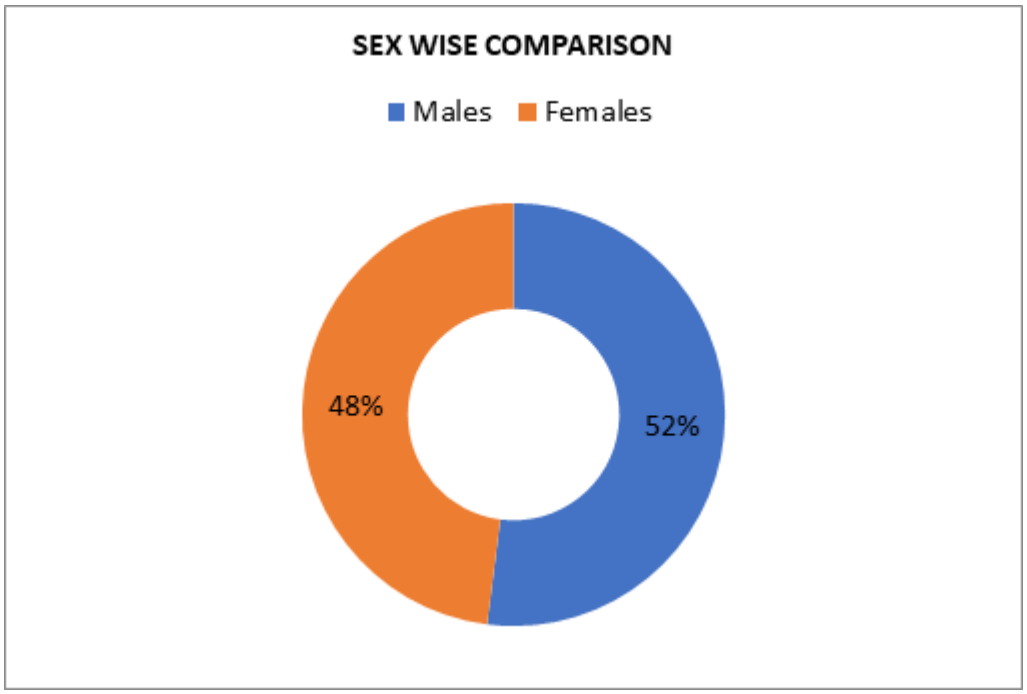

Study	Male Female Ratio
Present study	1.08:1
Krishnamurthy et al,[12]	1.18:1
Salih et al,[13]	1.7:1

In present study, highest number of patients were noted in age group >1-5 years(40%) with Male: Female ratio of 1.08:1. However, in other studies, done by Arora P et al, Jamal A et al and Salih et al, male preponderance was found in children with AKI.[11,12,13,14]

Various Etiologies of AKI

Etiologies of AKI	Number Of Patients (%)
Septicemia	22 (44%) [including acute gastroenteritis with dehydration (22%), meningitis (12%), pneumonia (8%), multiple organ dysfunction syndrome (2%)]
Dengue Shock Syndrome	9 (18%)
Hemolytic Uremia Syndrome	7 (14%)
Myocarditis	5 (10%)
Complicated Urinary Tract Infection	4 (8%)
Nephrotic syndrome	3 (6%)

In present study, most common etiology of AKI is Septicemia (22 patients {44%} out of 50 patients of AKI (2%), which is in form of acute gastroenteritis with dehydration (22%), meningitis (12%), pneumonia (8%) and multiple organ dysfunction syndrome. Other causes of AKI are Dengue Shock

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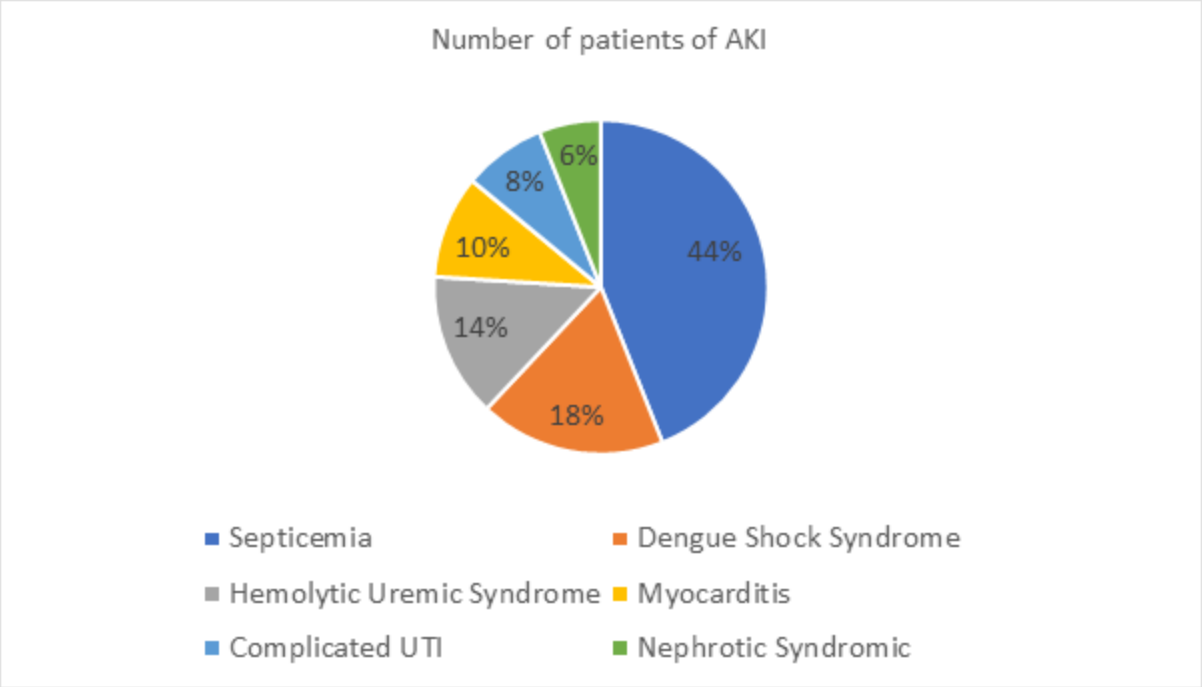
Syndrome (18%), Haemolytic Uremic Syndrome (14%), Myocarditis (10%), complicated Urinary Tract Infection (8%) and Nephrotic syndrome (6%).



Study	Most common Etiology
Present study	Septicemia (44%)
Krishnamurthy et al12	Septicemia (23.5%)
Mehta et al8	Septicemia (32%)

Symptoms in Patients of AKI

Symptoms	No. Of patients (%)
Decreased urine output	47 (94%)
Fever	39 (78%)
Edema	30 (60%)
Breathlessness	30 (60%)
Vomiting	21 (42%)
Altered sensorium	18 (36%)
Diarrhoea	16 (32%)
Refusal to feed	16 (32%)
Convulsion	10 (20%)
Irritability	9 (18%)
Burning micturition	5 (10%)
Difficulty in swallowing	5 (10%)
Black coloured stool	3 (6%)
Hematuria	1 (2%)

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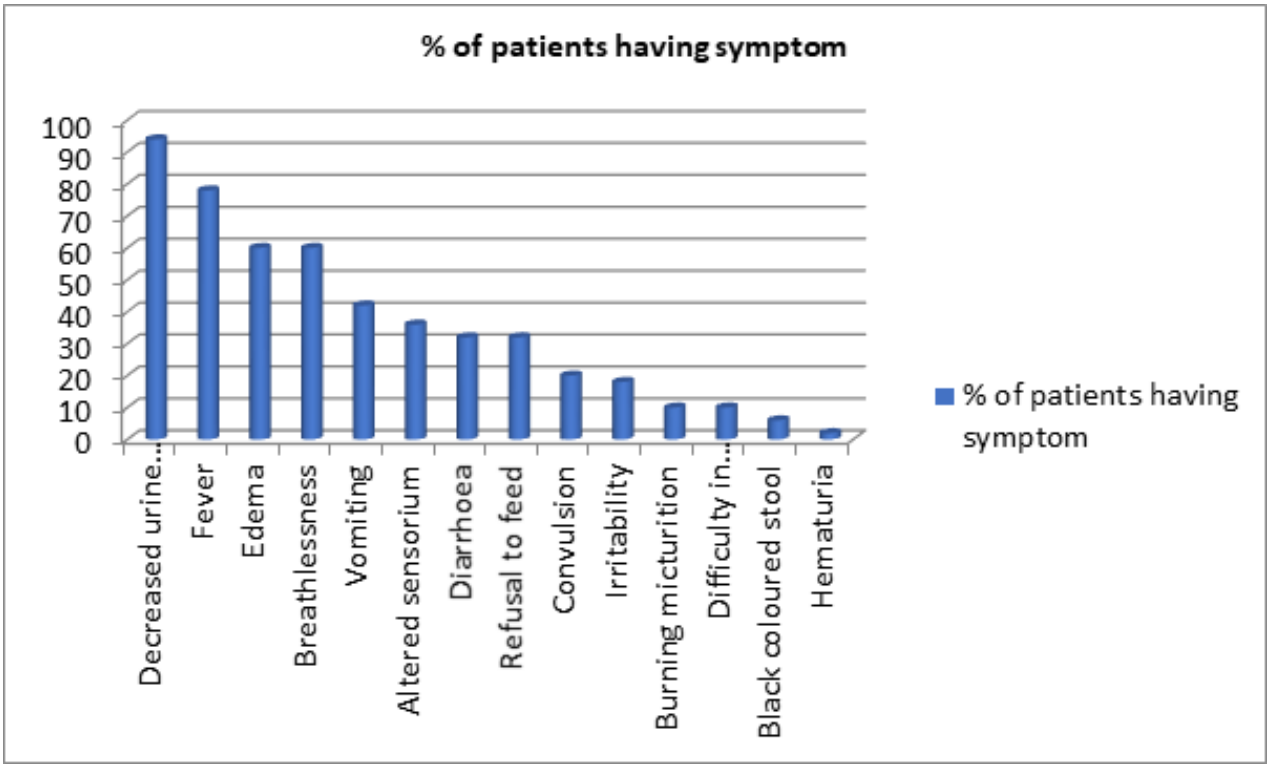
In present study, oliguria was commonest symptom (94%) followed by fever (78%), oedema (60%), breathlessness (60%), vomiting (42%), altered sensorium (36%), diarrhoea (32%) and convulsion (20%).

In the study done by Salih et al, 77.5% of the patients had oliguria, 44% had dehydration and 7.5% had hypertension. Arora P et al reported that oliguria was present in 46.4% of the patients while 53.6% had anuria.[13,14] Shah BV et al also found that most common presenting feature was oligo-anuria (94.1%).[15]



Electrolytes and acid base disturbances

Disturbances	No. of Patients of AKI (%)	Krishnamurthy et al12 (%)	Salih et al13 (%)
Hypernatremia	16 (32%)	6.5%	28%
Hyponatremia	10 (20%)	16.3%	13%
Hyperkalemia	18 (36%)	14.5%	30%
Hypokalemia	15 (30%)		12%
Hypocalcemia	6 (12%)		45.8%
Hyperphosphatemia	2 (4%)		
Metabolic acidosis	16 (32%)	26.5%	97%

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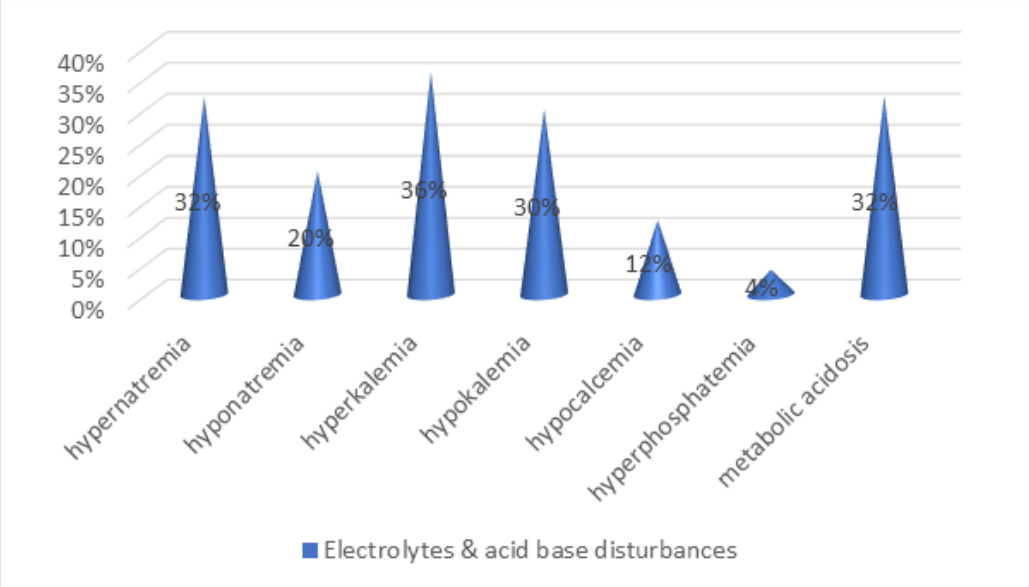
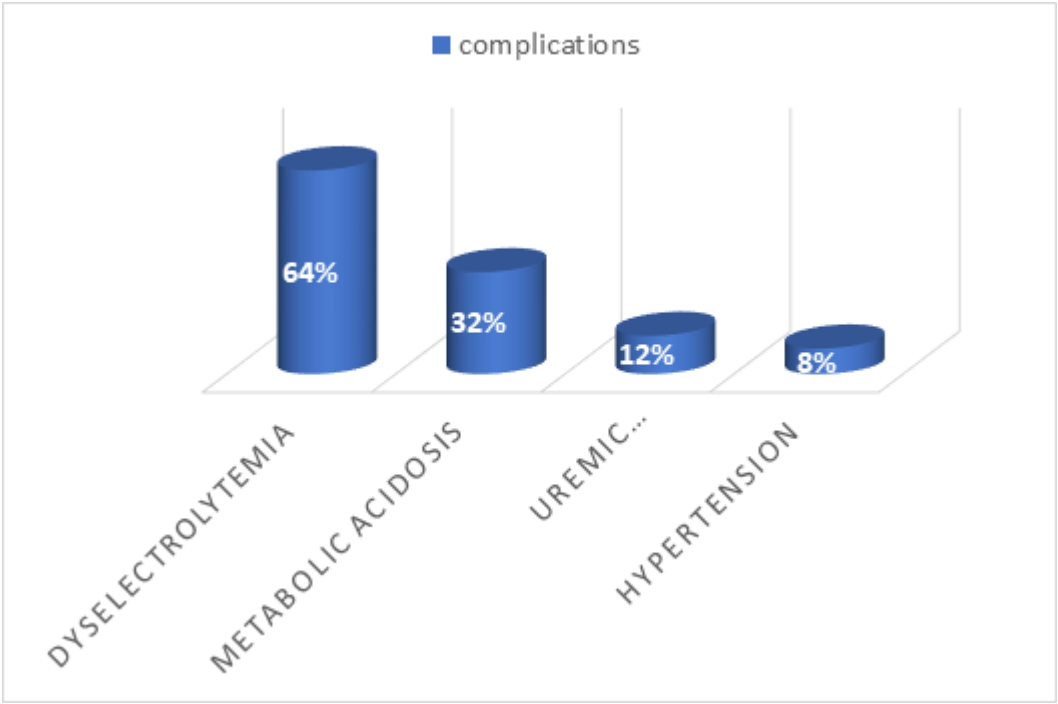


Complications of AKI

Complication	No. of patients of AKI	Krishnamurthy et al12	Salih et al13
Complication	32 (64%)	38.1%	23%
Metabolic acidosis	16 (32%)	26.5%	97%
Uremic encephalopathy	6 (12%)	17.4%	7.5%
Hypertension	4 (8%)	16.8%	-



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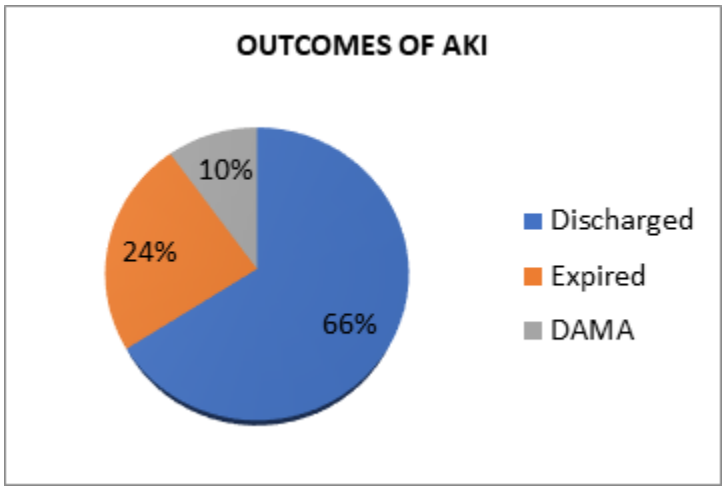
In present study, Hyperkalaemia was commonest electrolyte abnormality in 36% patients followed by hypernatremia in 32% patients and metabolic acidosis in 32% patients followed by hypokalaemia in 30% patients.

In present study, Dyselectrolytemia was the most common complication seen in 64% patients followed by metabolic acidosis in 32% patients followed by uremic encephalopathy in 12% patients and hypertension in 8% patients.

Outcomes

Discharges	**Expired**	**DAMA**
33(66%)	12 (24%)	5 (10%)



Study	**Mortality**
Present study	24%
Krishnamurthy et al12	17.5%
Salih et al13	10%

In present study, out of 50 patients, 24% patients expired, 10% patients took DAMA and rest all 66% patients were discharged.

CONCLUSION

- AKI affects a large proportion of critically ill children, especially the younger age group. Thus, all such patients should be monitored for development of AKI.
- Most common complication occurs in AKI patients is dyselectrolytemia. So, monitoring of electrolytes should be done and timely intervened.
- AKI presents with multiple symptoms and common symptoms are oliguria, fever, oedema, breathlessness, vomiting, altered sensorium, diarrhoea ,convulsion. So these symptoms should not be neglected and proper intervention should be taken.

- Proper monitoring and Early detection of AKI and timely treatment reduces the mortality of patients.

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