ACUTE KIDNEY INJURY IN MEDICAL ICU- AETIOLOGY PRESENTATION AND OUTCOME

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ABSTRACT

BACKGROUND

Acute Kidney Injury (AKI) is common in critically ill patients admitted to medical ICU and carries significant morbidity and mortality. Early diagnosis and effective treatment of the factors responsible carries better outcome, hence aetiological diagnosis and the presentation of AKI in different diseases gives confidence to the physician to prevent this untoward incidence.

MATERIALS AND METHODS

A descriptive study was done in the medical ICU of SCB Medical College, Cuttack and consecutive 100 adult patients of AKI were included in the study for the period from Sep 2014 to Sep 2016.

RESULTS

Among 100 patients of acute kidney injury, the most common aetiology was malaria followed by acute gastroenteritis, vasculotoxic snake bite and leptospirosis in contrary to sepsis which is the commonest cause in literature.

CONCLUSION

As the diseases are preventable by maintaining proper hygiene and vector control, the burden of acute kidney injury can be reduced.

KEYWORDS

Acute Kidney Injury; Malaria; Snake Bite; Haemodialysis; Intensive Care Unit.

HOW TO CITE THIS ARTICLE: Das SN, Thatoi PK, Kumar SS, et al. Acute kidney injury in medical ICU- aetiology presentation and outcome. J. Evolution Med. Dent. Sci. 2017;6(70):4979-4982, DOI: 10.14260/Jemds/2017/1081

BACKGROUND

Acute kidney injury (AKI) is a common clinical syndrome in intensive care units (ICUs) and is defined as "an abrupt (within 48 hours) reduction in kidney function that is an absolute increase in serum creatinine ≥ 0.3 mg/dL, a percentage increase in serum creatinine of more than 50% (1.5 fold from baseline) or a reduction in urine output (documented oliguria of < 0.5 mL/kg/hr for more than 6 hours).¹" Although, acute kidney injury can occur as a single organ phenomenon, it is frequently seen in the critical care environment as a part of multiple organ failure syndrome. In this setting, multiple factors must be taken into account when considering precipitating cause and appropriate management. Acute kidney injury may complicate up to 5% of hospital admissions and 30% of emergency admissions to ICUs.² AKI exerts a negative effect on the course of the disease and its outcome. It is triggered by extremely diverse group of aetiologies and clinicians must understand the aetiologies of acute kidney injury to prevent occurrence and to start treatment early.

Financial or Other, Competing Interest: None.

Submission 26-07-2017, Peer Review 20-08-2017,

Acceptance 26-08-2017, Published 31-08-2017.

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DOI: 10.14260/jemds/2017/1081

There have been few systematic studies in our state (Odisha) on the aetiology and clinical profile and changing trends and management on acute kidney injury, therefore the study was undertaken with following aims and objectives i.e. aetiology, presentation and outcome of acute kidney injury in medical ICU.

MATERIALS AND METHODS

After clearance from Institutional Ethics Committee (IEC), we have designed a descriptive study in the medical ICU of SCB Medical College, Cuttack and consecutive 100 patients of age more than 15 years of AKI were included in the study for the period from Sep 2014 to Sep 2016. Informed consent from all patients was obtained.

Patient Selection Criteria

Patients with serum creatinine more than 2 times normal or decrease in glomerular filtration rate (GFR) of $> 50\%$ or urine output < 0.5 mg/kg/hr for more than 6 hrs. were taken for the study.

Exclusion Criteria

Patients of chronic renal failure, post renal AKI and patients with past history of diabetes and hypertension were excluded from the study.

In every patient, detailed history and thorough clinical examination was done with special reference to history of fever, diarrhoea and snake bite. The following investigations were done: complete haemogram, erythrocyte sedimentation rate (ESR), malaria parasite (MP)-slide detection and

immunochromatographic test (ICT) and IgM antibody for leptospira in case of fever. Renal function test (serum urea and creatinine) was done at the time of admission and subsequently daily. Liver function test and coagulation profile (bleeding time, clotting time, prothrombin time, activated partial thromboplastin time, serum FDP) were done in every patient. Ultrasound of abdomen and pelvis was to be done in all patients to estimate the kidney size. Renal biopsy was done in selected patients, where there is unexplained acute kidney injury.

Glomerular filtration rate (GFR) was calculated at the time of admission and subsequently daily by using Cockcroft-Gault equation:

$$\text{Cr Cl (ml/min)} = \left\{ \frac{(140 - \text{age}) \times \text{weight (kg)}}{72 \times \text{serum Cr (mg/dl)}} \right\} \quad (\text{multiply factor } 0.85 \text{ in case of female})$$

Observation

Age	Male	Female	Total	Percentage
10-20	8	5	13	13%
20-30	9	11	20	20%
30-40	34	10	44	44%
40-50	12	5	17	17%
50-60	2	2	4	4%
60-70	1	1	2	2%
Total	66	34	100	

Table 1. Age and Sex (n= 100)

In our study, 66 patients were male and 34 patients were female. Majority of patients belonged to the age group of 30 - 40 yrs., i.e. 44 patients.

Clinical Feature	Number of Patients	Percentage
Anaemia	74	74%
Fever	51	51%
Hypotension	19	19%
Jaundice	20	20%
Acute gastroenteritis	21	21%
History of snake bite	19	19%
Cerebral symptoms	15	15%
Oedema	26	26%
Haematuria	2	2%
ARDS	4	4%

Table 2. Clinical Presentation (n= 100)

In our study, majority of patients presented with anaemia (74%) followed by fever (51%) and other symptoms such as hypotension (19%), jaundice (20%), acute gastroenteritis (21%), history of snake bite (19%), cerebral symptoms (15%), oedema (26%), haematuria (2%) and ARDS (4%).

	No. of Cases	Percentage
Malaria	41	41%
Acute gastroenteritis	21	21%
Vasculotoxic snake bite	19	19%
Sepsis	4	4%
Leptospirosis	5	5%
Unknown	10	10%

Table 3. Aetiology (n= 100)

In our study, out of 100 patients of acute kidney injury, 41 patients were of malaria, 21 patients were of acute gastroenteritis, 19 patients were of vasculotoxic snake bite, 10 patients were of unknown aetiology, sepsis patients were 4 and leptospirosis patients were 5 in number.

	Number	Percentage
Plasmodium falciparum (pf +ve)	27	66%
Plasmodium falciparum and vivax (pf/pv +ve)	14	34%

Table 4. Malaria and AKI (n= 41)

Out of 41 patients of malaria causing AKI 27 patients were positive for only plasmodium falciparum, while 14 patients were found to be positive for both plasmodium falciparum and vivax (mixed infection).

Oliguric AKI	Non-oliguric AKI
65 patients	35 patients
65%	35%

Table 5. Oliguric and Non-oliguric AKI (n= 100)

Out of 100 patients, 65 patients had oliguric acute kidney injury, while 35 patients had non-oliguric kidney injury.

Aetiology	Oliguric (n=65)	Non-oliguric (n=35)
Malaria	18 (27%)	23 (66%)
Acute gastroenteritis	16 (24%)	5 (14%)
Vasculotoxic snake bite	13 (20%)	6 (17%)
Unknown	10 (15%)	
Leptospirosis	4 (6%)	1 (3%)
Sepsis	4 (6%)	

Table 6. Aetiology of Oliguric and Non-oliguric AKI

Out of 65 patients of oliguric acute kidney injury 18 patients were due to malaria, 16 patients were due to acute gastroenteritis, 13 patients were due to vasculotoxic snake bite, 10 patients were due to unknown aetiology and 4 patients were each due to sepsis and leptospirosis.

Out of 35 patients of non-oliguric acute kidney injury 23 patients were due to malaria, 5 patients were due to acute gastroenteritis, 6 and 1 patients were due to vasculotoxic snake bite and leptospirosis respectively.

Total Cases	No. of Cases with increased Serum FDP	No. of Cases with decreased Platelet Count
100 cases	32	32
	32%	32%

GFR (mL/min)	No. of Cases
< 10	3
10 - 20	34
20 - 30	41
30 - 40	16
40 - 50	6

Table 7. GFR (Glomerular Filtration Rate) (n= 100)

Maximum no. of patients at the time of admission had GFR between 20 - 30 mL/min with mean GFR of 23.19 mL/min.

GFR (mL/min)	Malaria	Acute Gastro.	Snake Bite	Unknown Aetiology	Leptospirosis	Sepsis
< 10	2 (4.8%)				1 (20%)	
10 – 20	8 (19.5%)	9 (43%)	7 (37%)	5 (50%)	1 (20%)	4 (100%)
20 – 30	13 (31.7%)	12 (57%)	11 (58%)	5 (50%)		
30 – 40	12 (29.2%)		1 (5%)		3 (60%)	
40 – 50	6 (14.6%)					
	41	21	19	10	5	4

Table 8. Correlation of GFR (mL/min) with Aetiology of AKI (n= 100)

Out of 100 patients of acute kidney injury; 41 patients were of malaria out of which 13 cases (31.7%) had GFR between 20 - 30 mL/min, 12 patients (29.2%) had GFR between 40 - 50 mL/min, 8 patients (19.5%) had between 10 - 20 mL/min, 6 patients (14.6%) had between 40 - 50 mL/min and 2 patients had GFR < 10 mL/min. Out of 21 patients of acute gastroenteritis, 12 patients (57%) had GFR between 20 - 30 mL/min and 9 patients (43%) had GFR between 10 - 20 mL/min. Out of 19 patients of vasculotoxic snake bite 11 patients (58%) had GFR between 20 - 30 mL/min, 7 patients (37%) between 10 - 20 mL/min and 1 patient (5%) between 30 - 40 mL/min. Out of 10 patients of unknown aetiology, 5 patients had GFR between 10 - 20 mL/min and other 5 between 20 - 30 mL/min. Out of 5 patients of leptospirosis 3 patients had GFR between 30 - 40 mL/min and one each between 10 - 20 and < 10 mL/min. All the 4 patients of sepsis had GFR between 10 - 20 mL/min.

No. of Cases	Biopsy Report
5 cases	Normal
2 cases	Rapidly progressive glomerulonephritis (RPGN)
2 cases	Post infectious glomerulonephritis
1 case	Membranoproliferative glomerulonephritis (MPGN)

Table 9. Renal Biopsy (n= 10)

Renal biopsy was done on 10 cases of acute kidney injury, where aetiology of acute kidney injury was uncertain. Out of 10 cases 2 cases had rapidly progressive glomerulonephritis, 2 had post infectious glomerulonephritis and 1 case had membranoproliferative glomerulonephritis.

	No. of Patients	Haemodialysis	%
Malaria	41	32	78%
Acute gastroenteritis	21	8	38%
Vasculotoxic snake bite	19	6	31%

Table 10. Patients Undergone Haemodialysis (n= 46)

In our study, out of 100 patients of AKI 46 patients needed renal replacement therapy in the form of haemodialysis.

All the patients survived and got discharged.

DISCUSSION

We have included 100 patients of acute kidney injury admitted to medical ICU in our study; 66 patients were males and 34 patients were females [Table 1]. Majority of patients were in the age group of 30 - 40 years. Similar findings were observed in the study done by Prakash et al in Patna, 1995 out of 426 patients of ARF, the majority of patients were males in the age group of 30 - 40 years.³

In our study majority of patients presented with anaemia 74%, fever 51% and jaundice 20%. Twenty-one patients (21%) presented with diarrhoea, history of snake bite 19% and 15% presented with cerebral symptoms [Table 2], while in the study by Mehta et al in Mumbai, 2001 on Malaria and ARF, the presenting clinical features were fever in 22 (91.6%) out of 24 patients, altered sensorium in 10 patients (41.6%) and diarrhoea in 3 patients (12.5%).⁴ Therefore, the disparity in clinical presentation is due to difference in the aetiology of acute kidney injury.

In our study, out of 100 patients of acute kidney injury, majority of patients were due to malaria (41%) followed by acute gastroenteritis (21%), vasculotoxic snake bite (19%) [Table 3]. In the study done by Prakash et al in Patna 1995, out of 426 patients of acute renal failure the most common cause of AKI was found to be acute gastroenteritis (35.2%) followed by acute glomerulonephritis (10.3%), post abortal sepsis (10.5%) and falciparum malaria (4.2%).³

As Odisha is an endemic state for malaria, we found malaria is the commonest cause of AKI in contrary to sepsis in literature.⁵ The second common cause of AKI in our study is acute gastroenteritis followed by vasculotoxic snake bite, as vast majority of people residing in rural and forest areas and lots of people are engaged in farming and agricultural activities.

In our study, out of 41 patients of malaria causing AKI 27 (66%) were due to plasmodium falciparum infection alone, while 14 cases (34%) were due to plasmodium falciparum and vivax mixed infection [Table 4] and 32 (78%) of them needed haemodialysis. Similar findings were found by Mehta et al in their study on malaria and AKI in 2001, which showed that out of 24 patients 12 patients were plasmodium falciparum positive and 4 showed mixed infection with both plasmodium falciparum and vivax.⁴ The incidence of acute kidney injury is less in mixed infection (Pf/Pv).

In our study, 65 patients had oliguric AKI and 35 patients had non-oliguric AKI [Table 5]. Malaria was found to be most common cause of non-oliguric AKI, while acute gastroenteritis was found to be most common cause of oliguric AKI. In the study on malaria and AKI in 1998 by Panda et al in Odisha showed that 18% had non-oliguric acute renal failure, while 75% patients had oliguric renal failure.⁶

In our study, the mean GFR at the time of admission was 23.19 mL/min. 41% of patients had their GFR within 20 - 30 mL/min followed by 34% of patients within 10 - 20 mL/min [Table 7].

Renal biopsy was done in 10 cases, where the aetiology of AKI could not be determined after doing all the basic investigations. Out of 10 biopsies 5 showed normal report, 2 cases showed rapidly progressive glomerulonephritis, 2 cases showed post infectious glomerulonephritis and 1 case showed membranoproliferative glomerulonephritis [Table 9].

CONCLUSION

AKI in the ICU results from multiple factors. The incidence of AKI reported in critically ill patients varies substantially.⁷ Therefore, early identification and appropriate majors for the patients at the risk of developing AKI prevents subsequent renal failure and ultimately impact overall ICU morbidity and mortality. Among 100 cases of acute kidney injury, the most common aetiology was Malaria followed by acute gastroenteritis, vasculotoxic snake bite and leptospirosis. As these diseases are preventable by maintaining proper hygiene and vector control, the burden of acute kidney injury can be reduced. Whatever may be the aetiology, prompt diagnosis, specific therapy and proper fluid management and use of dialysis as and when required can reduce mortality and morbidity in patients with acute kidney injury.

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