ACUTE KIDNEY INJURY DUE TO MEDICAL DISORDERS
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ABSTRACT: In this study 100 Acute Kidney Injury patients were analyse there was 57 male and 43 female, the medium age were 41.4. Oliguria AKI predominate (88%). Acute diarrhoeal diseases was the leading cause of AKI in this study (44%). Malarial AKI is (8%). Leptospirosis (4%). Snake bite with AKI (5%). Glomerulonephrities (5%). Drugs contributes (2%), Post renal (surgical) causes contributes (2%).

AIMS AND OBJECTIVES:
1. To study about the etiological profile of acute kidney injury.
2. To apply the RIFLE criteria in acute kidney injury patients admitted to the medical wards and to confirm the significance.
3. To study about the prognosis and outcomes of acute kidney injury.

INTRODUCTION: Acute kidney injury (AKI) is a protean syndrome of varied severity. It is characterized by a rapid (hours to weeks) decline in the glomerular filtration rate (GFR) and retention of nitrogenous waste products such as blood urea nitrogen (BUN) and creatinine.¹, ² In recent years, it has been recognized that the time – honored term Acute Renal Failure fails to adequately describe what is a dynamic process extending across initiation, maintenance and recovery phases, each of which may be of variable duration and severity. The term Acute Renal Failure suggests that the syndrome is dichotomous and places an undue emphasis on whether or not renal function has overtly failed. This believes the now well - established fact that even mild decrements in glomerular filtration may be associated with adverse clinical outcomes.³, ⁴ The alternative proposed term acute kidney injury has much to recommend it, perhaps better captures the diverse nature of this syndrome and has entered into wide spread clinical use.

AKI may occur in someone either with previously normal renal function or as an acute and anticipated deterioration in function in the setting of previously established chronic kidney disease. The etiology and outcomes of AKI is heavily influenced by the circumstances in which it occurs, such as whether it develops in the community or in the hospital. It is similarly important to distinguish whether the kidney injures occurs as an isolated process, which is more common in community acquired AKI, or if it occurs as part as a more extensive multi organ syndrome.⁵

In 2004, Acute Dialysis Quality Initiative (ADQI) group, International Society of Nephrology (ISN), National Kidney Foundation (NKF) and American Society of Nephrology (ASN) met and proposed the term ‘Acute Kidney Injury. AKI generally defined as: ‘An abrupt and sustained decrease in kidney function’

Acute Dialysis Quality Improvement Initiative (ADQI) has proposed a new definition of AKI, that has been widely endorsed and is increasingly being used in keeping with the spectrum
of changes seen in AKI, the diagnostic classification scheme was developed, this scheme is referred to by the acronym RIFLE, and includes three levels of renal dysfunction of increasing severity, namely. Risk of renal dysfunction, injury to the kidney and failure of kidney functions, and two outcome categories: Loss of function. And End stage kidney disease. Renal dysfunction is defined in terms of a rise in creatinine or a reduction in urine output, the more severe of the two criteria being selected. When achieved designation results from urine output criteria a subscript "o" is added e.g. RIFLE-Fo. Similarly, a subscript of "c" is used to denote the presence of preexisting renal disease.(6)

| GFR criteria                      | Urine output criteria                      |   |
|-----------------------------------|-------------------------------------------|---|
| Risk                              | Increased Serum Creatinine x 1.5           |   |
|                                   | GFR decrease>25%                          |   |
| Injury                            | Increased Serum Creatinine x 2 or         |   |
|                                   | GFR decrease>50%                          |   |
| Failure                           | Increased Serum Creatinine x 3            |   |
|                                   | GFR decrease>75%                          |   |
|                                   | or Serum Creatinine <4mg/ dl              |   |
|                                   | Acute rise>.5 mg/dl                       |   |
| Loss                              | Persistent AKI = complete loss of         |   |
|                                   | Kidney function > 4 weeks                 |   |
| ESKD                              | End Stage Kidney Disease                  |   |
|                                   | (> 3 months)                              |   |

RIFLE classification scheme for Acute Kidney Injury(6)

- RIFLE is also useful at predicting outcome data including recovery of renal function, length of hospital stay, renal replacement requirement and in-hospital mortality.
- In 2004, Acute Kidney Injury Network (AKIN) formed. AKIN proposed a diagnostic criteria for the definition AKI: "An abrupt (within 48 hours) reduction in kidney function currently defined as an absolute increase in serum creatinine of more than or equal to 0.3 mg/dl (≥26.4 μmol/l), a percentage increase in serum creatinine of more than or equal to 50% (1.5-fold from baseline), or a reduction in urine output (documented oliguria of less than 0.5 ml/kg per hour for more than six hours).”
- Data has emerged recently that suggests smaller increases in Serum Creatinine than those considered in RIFLE criteria may be associated with adverse outcomes. So AKIN proposed a new classification/staging system.
- Classification/staging system for acute kidney injury.
A major challenge in the investigation and management of AKI is timely recognition of the syndrome. It remains difficult to easily and reliably measure rapid changes in the GFR. Although the severity in decline in GFR correlates with the onset of oliguria, the latter is insensitive marker of the syndrome because many subjects with severe renal failure remain non oliguric. In AKI, there is a poor agreement between serum creatinine and GFR, at least until a serum creatinine steady state is reached and even then, the absolute rise in serum creatinine must take into account differences in creatinine generation rates.⁷

**MATERIALS AND METHODS:**

**Inclusion Criteria:**
- Age above 18yrs is included in my study.
- An increase in serum creatinine of more than or equal to 1.5 mg/dl from baseline

**Exclusion Criteria:**
- Patients with chronic kidney disease.
- Patients with abnormal kidney size and abnormal cortico medullary differentiation (USG ABDOMEN).
- Patient with hypertension & diabetes.

**LAB INVESTIGATIONS:**
- Complete blood picture.
- Complete urine examination.
- Random blood sugar.
- Blood urea.
- Serum creatinine.
- Serum electrolytes.
- Serum uric acid.
- Urinary sodium & creatinine.
- Liver function test.
- Ultrasound abdomen.
- ECG.
- Chest x-ray.
- M.P strip test & smear for M. P.

**Observations and Results:**

| Age in years | No. of Patients (N) | Percentage (%) |
|--------------|---------------------|----------------|
| <20          | 03                  | 3.75           |
| 21-30        | 32                  | 40.00          |
| 31-40        | 12                  | 15.00          |
| 41-50        | 20                  | 25.00          |
| 51-60        | 10                  | 12.50          |
| >60          | 03                  | 3.75           |

Table 1: Age Distribution (N=80)

Out of 80 patients studied, majority were between the age group of 21-30 (40%).

| Gender   | No. of Patients | Percentage (%) |
|----------|-----------------|----------------|
| Males    | 48              | 60.00          |
| Females  | 32              | 40.00          |

Table 2: Sex Distribution (N=80)

Out of 80 patients studied 48 are males. Male: Female = 1.5:1.
Table 3: Age and Sex Distribution (N=80)

| Age in years | Males N (%) | Females N (%) |
|--------------|-------------|---------------|
| <20          | 02 (4.16)   | 01 (3.20)     |
| 21-30        | 22 (45.80)  | 10 (31.24)    |
| 31-40        | 06 (12.50)  | 06 (18.68)    |
| 41-50        | 12 (25.00)  | 08 (25.00)    |
| 51-60        | 04 (8.38)   | 06 (18.68)    |
| >60          | 02 (4.16)   | 01 (3.20)     |
| **Total**    | **48 (100.00)** | **32 (100.00)** |

Out of 48 male patients, 22 patients are in the age group of 21-30 years (45.80%). Out of 32 female patients, 10 patients are in the age group of 21-30 years (31.24%).
Out of 80 patients, 60 (75%) patients presented with oliguria. 36 patients were male and 24 were female.

Table 4: Presenting features of AKI

| Urine output | Male | Female | Total N (80) |
|--------------|------|--------|-------------|
| Oliguric     | 36   | 24     | 60 (75.00)  |
| Nonoliguric  | 12   | 8      | 20 (25.00)  |

Out of 80 patients, 37 patients presented with acute diarrheal disease (ADD) (46.25%).

Table 5: Etiological profile of AKI

| Etiology                  | Male | Female | Total N(80) |
|---------------------------|------|--------|-------------|
| Acute diarrheal disease(ADD) | 24   | 13     | 37 (46.25)  |
| Sepsis                    | 08   | 06     | 14 (17.50)  |
| Malaria                   | 04   | 03     | 07 (8.75)   |
| Leptospirosis             | 02   | 00     | 02 (2.50)   |
| O P Poisoning             | 02   | 02     | 04 (5.00)   |
| Snake bite                | 08   | 08     | 16 (20.00)  |
Table 6: AKI-Rifle Distribution

| Etiology                          | No. of Cases | Risk | Injury | Failure |
|----------------------------------|--------------|------|--------|---------|
| Acute diarrheal disease(ADD)     | 37           | 25   | 10     | 02      |
| Sepsis                           | 14           | 06   | 04     | 04      |
| Malaria                          | 07           | 04   | 03     | 00      |
| Leptospirosis                    | 02           | 02   | 00     | 00      |
| O P Poisoning                    | 04           | 02   | 02     | 00      |
| Snake bite                       | 16           | 08   | 04     | 04      |
| **Total**                        | **80**       | **47** | **23** | **10**  |

According to Rifle criteria, 47 patients were in Risk, 23 patients were in Injury and 10 patients were in Failure.
Table 7: Acute kidney injury - Treatment

### Table 7: Acute kidney injury - Treatment

| No. Of Cases | Conservative | Hemodialysis |
|---------------|--------------|--------------|
| Risk          | 47           | 00           |
| Injury        | 23           | 05           |
| Failure       | 10           | 08           |

All the patients at RISK were treated conservatively.

Figure 7

Table 8: Acute kidney injury-outcome

| No. of Cases | Survived | Expired |
|--------------|----------|---------|
| Risk         | 46       | 0       |
| Injury       | 26       | 1       |
| Failure      | 28       | 12      |

ACUTE KIDNEY INJURY OUTCOME

![Graph showing acute kidney injury outcome]
Mean age±SD

| Present study | Dr. Muthusethupati M. A. et al (8) | Pedro chimezie Emem-chioma et al (9) |
|---------------|-----------------------------------|-------------------------------------|
| N=80          | N=100                             | N=62                                |
| 26±8.5        | 28±7.5                            | 41.3±18.5                           |

Table 9: Age distribution Comparative study

In present study mean age distribution is 26±8.5 which is coinciding with Dr. Muthusethupati M. A et al (8) study which was 28±7.5, Where as in Pedro chimezie Emem-chioma et al (9) showed 41.3±18.5.

| Present study | No. of patients N= 80(%) | Dr. Muthusethupati M. A. et al (8) N=100(%) | Pedro chimezie Emem-chioma et al (9) N=62 (%) |
|---------------|--------------------------|---------------------------------------------|----------------------------------------------|
| Males         | 48(60%)                  | 65(65%)                                     | 38(62%)                                      |
| Females       | 32(40%)                  | 35(35%)                                     | 24(38%)                                      |

Table 10: Sex distribution comparative study (8)

In present study, males are 60% and females are 40% which is correlating with Dr. Muthusethupati M. A. et al (8) which was 65% and 35% and Pedro chimezie Emem-chioma et al (9) which was 62% and 38%

| Present study N=80 (%) | Dr. Muthusethupati M. A. et al (8) N=100 | Oliguria |
|------------------------|------------------------------------------|----------|
| Oliguria               | 60(75%)                                  | 80(80%)  |

Table 11: Presenting features of AKI (8)

In present study, oliguric patients are 60(75%) which correlates with Dr. Muthusethupati M. A. et al 67 study which was 80%.

| Etiology                        | Present study N=80(%) | Cengiz Utas et al (10) N=75(%) | Pedro chimezie Emem-chioma et al (9) N=62(%) |
|---------------------------------|-----------------------|--------------------------------|-----------------------------------------------|
| Acute diarrheal disease(ADD)    | 37(46.25%)            | 36(48%)                        | 9(14.51%)                                     |
| Sepsis                          | 14(17.50%)            | 12(16%)                        | 20(32.25%)                                    |
| Malaria                         | 07(8.75%)             | 4(5.4%)                        | 11(17.74%)                                    |
| Leptospirosis                   | 02(2.50%)             | 2(2.66%)                       | 00                                             |
In present study 37(46.25%) patients presented with Acute diarrheal disease (ADD), Snake bite 16(20%), Sepsis 14(17.5%), Malaria 7(8.75%), O P Poisoning 4(5%) and Leptospirosis 2(2.5%) which is correlating with Cengiz utas et al study. Where as in Pedro chimezie Emem-chioma et al sepsis 20(32.25%) was the most common presentation.

|                          | Present study N =80(%) | Ostermann M. et al N=75(%) | José António Lopes et al N=68(%) |
|--------------------------|------------------------|---------------------------|---------------------------------|
| RISK                     | 47(58.75%)             | 44(58.6%)                 | 25(36.7%)                       |
| INJURY                   | 23(28.75%)             | 20(26.6%)                 | 36(52.9%)                       |
| FAILURE                  | 10(12.50%)             | 11(14.6%)                 | 7(10.29%)                       |

In present study, 47(58.75%) were in RISK and 23(28.75%) INJURY and 10(12.50%) were in FAILURE which was correlating with Ostermann M et al study. Where as in José António Lopes et al maximum number of cases were in sepsis so according to RIFLE criteria they were in INJURY.

DISCUSSION: Acute kidney injury is a potentially fatal, but reversible renal disease. The etiology, course, outcome, differ in various parts of India due to its climatic and geographic diversity and the varying standards of medical care. In our study 100 patients were analysed, there were 57 males and 43 females. The median age was 41.4. Maximum number of cases occurred in the second and fourth decade. Acute diarrhoeal disease was the leading cause of AKI in our study. Of 44(44%) patients 5(11.3%) patients were treated with dialysis (Peritoneal Dialysis=2, Hemodialysis =3), 39(88.6%) cases treated conservatively. One patient died due to arrythmia. The mortality observed during the study was 2.2%, which is less. Awareness of early rehydration therapy and early referral to higher centers contribute to decline in mortality.

Malarial AKI was observed in 8(8%) cases. In Dr. M. A. Muthusethupathi et al study no cases were reported. A study by Prakash J et al from eastern India reported 4.2% cases were reported. Out of 8 cases 4 cases were treated with hemodialysis and 4 cases were treated conservatively. The mortality observed in our study was 25% in contrast with 42.5% in Zinna S et al. Two patients presented with cerebral malaria with renal failure. One patient had metabolic acidosis, One patient had arrhythmias, One patient had hypotension. Mortality decreased mainly due to earlier diagnosis and earlier use of hemodialysis.

We have 4(4%) patients of leptospirosis with AKI as compared to Dr. M. A. Muthusethupathi et al study in which the incidence of leptospirosis was 41%. we confirmed the
cases based on modified faine’s criteria. Of 4 patients 3 patients were treated conservatively, one patient was treated with hemodialysis. There was no mortality in our study.

In contrast with other studies our study had significant number of patients with the combination of leptospirosis, malaria, enteric fever. Of 12(12%) patients, 10(80%) were treated conservatively, two patients were treated with hemodialysis. We also had significant number of sepsis (10%) as a cause of AKI. Of 10 patients 4(40%) patients were treated conservatively, 6(60%) patients were treated with hemodialysis. The mortality was higher (70%). It may be due to association with comorbid illnesses (e.g. Diabetes), and higher incidence of multi organ dysfunction syndrome in these patients. AKI due to cupper sulphate poisoning contributes about 3(3%). All 3 patients were treated with Hemodialysis and recovered. One patient developed metabolic acidosis and was, treated with dialysis successfully. Another 2 patients developed AKI after dichromate poisoning, both patients were treated with hemodialysis. Both patients developed metabolic acidosis and one patient died. Another 2 patients developed AKI after unknown poisoning, one patient was treated with hemodialysis. Both patients developed metabolic acidosis and one patient died. One patient developed AKI after paracetamol poisoning and was treated with hemodialysis. There was not many studies on dichromate and paracetamol poisoning with acute kidney injury.

The 5 patients had snake bite as a cause of AKI. 4(80%) patients were treated with hemodialysis. The mortality was 20%. In Dr. M. A. Muthusethupathi et al study the incidence was 4.7% and the mortality was 34.7%. In Prakash J et al study no case of snake bite was reported. In our series mortality is mainly due to delay in seeking early treatment as most of the patients were from rural areas.

In our study, 5(5%) patients had glomerulonephritis. All patients were treated conservatively and recovered. AKI due to glomerulonephritis was 8.5%.

AKI due to drugs contribute 2(2%) of patients. One patient was hypertensive and developed acute kidney injury, when he was started on ACEI, however his renal Doppler was normal, and he recovered. One patient was diagnosed to have rheumatoid arthritis, and developed acute kidney injury with NSAIDS and recovered with conservative management.

AKI due to Postrenal (surgical) causes contribute 2(2%) of patients. One patient had bilateral I staghorn calculi treated surgically, and he recovered. One patient had BPH of grade 3 and was treated surgically. He recovered.

Of total 100 cases 46 patients came under RISK based on “RIFLE” criteria. In that 100% patients were treated successfully with conservative management. The mortality of RISK in our study was nil. About 26 patients came under INJUR. In that 15(57.6%) patients treated conservatively, 11(42.3%) patients were treated with dialysis. The mortality in INJURY was 3.8%. About 28 patients came under FAILURE.

In that 10(35.7%) patients were treated conservatively, 18(64.2%) patients were treated with dialysis. The mortality in FAILURE was 46.1%. Ostermann M, Chang RW: CCM 2007 detected the following RIFLE class F have a mortality of 57%, RIFLE class I 45% RIFLE class R 21%. There was an association between acute kidney injury and hospital outcome, but associated organ failure, had a greater impact on prognosis than severity of acute kidney injury.
CONCLUSIONS: The presentation of AKI is predominantly oliguric. But non-oliguric AKI should be born in mind. Acute diarrhoeal disease still remains the most common cause of acute kidney injury. Mortality observed during the study is very low when compared the previous studies. Awareness of early rehydration therapy and early referral to higher centers contribute to decline in mortality.

Infections occupies significant place in the etiology of AKI, which includes malaria (including complicated), leptospirosis, enteric fever, and combination of above infections. Regarding sepsis we have to prevent the multi organ failure or we have to treat the multi organ failure very aggressively to reduce the higher mortality associated with sepsis. Majority of our patients were managed conservatively when dialysis is indicated for clinical or biochemical reasons, HD is the preferred mode of dialytic support. PD is begun only when HD is not available or is contraindicated.

Main issues obtained were,
1. About two-third of patients with AKI can be managed by conservative measures alone.
2. About one-third of patients needed dialysis,
   Delayed diagnosis and treatment, pulmonary and other infections, the frequent presence of complicating features and the multi organ dysfunction syndrome are the chief reasons for the mortality rate in our study.
   The frequency of peritoneal dialysis is decreased so drastically because of availability of hemodialysis and higher efficiency of hemodialysis.
   The RIFLE classification was suitable for the definition of acute kidney injury in all type of medical settings. There was an association between acute kidney injury and hospital outcome, but associated organ failure, had a greater impact on prognosis than severity of acute kidney injury.

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