

## Original Research Article

# Frequency of etiologies of acute kidney injury in Faisalabad and surrounding districts

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## ABSTRACT

**Background:** To find out the causes of Acute Kidney Injury (AKI) in population.

**Methods:** A total of 150 patients were enrolled from medical, surgical, gynecology and obstetrics units of Allied Hospital and Madinah Teaching Hospital, Faisalabad, Pakistan. History, physical examination and investigations were recorded on specially designed proforma. Patients were evaluated to find out the etiologies of AKI. All patients were subjected to urine analysis, complete blood count, blood biochemistry (urea, creatinine, electrolytes, uric acid, calcium and phosphorus) and ultrasound scan of the abdomen and pelvis. Renal biopsy, immunological assays, such as hepatitis B surface antigen, anti-hepatitis C virus antibody, complements level, antinuclear antibody, anti-double-stranded DNA, anti-neutrophil cytoplasmic antibody and anti-glomerular basement membrane antibody were performed in selected cases.

**Results:** Male (36%) and female (64%). Pre-renal AKI was most common and was reported in 80 patients (53.33%). Intrinsic Renal azotemia in 56 patients (37.33%). Post renal azotemia in 14 patients (9.33%). Among 80 patients of prerenal AKI, hemorrhage in 45(56.25%), gastroenteritis in 16(20%), sepsis in 8(10%), cardiac diseases in 4(5%), hepatorenal syndrome in 3 (3.75%), peritonitis in 2 (2.50%) and burns in 2(2.50%) were the main causes of Pre-renal AKI. Among 56 patients of intrinsic renal AKI, 40(71.4%) had acute tubular necrosis (ATN), 12(21.4%) with multifactorial causes and 4(7.14%) were found to have glomerulonephritis. Among 14 patients of post renal AKI, 6(42.9%) were having calculi, 6(42.9%) were to have enlarged prostate and 2(4.3%) were having stricture urethra. In this study, contribution of obstetrical, medical and surgical etiologies were recorded as 40%, 36% and 20% respectively.

**Conclusions:** In contrast to study reported from neighbouring country, this study shows rather increase in pregnancy related AKI.

**Keywords:** Acute kidney injury, Intrinsic renal, Post renal, Prerenal

## INTRODUCTION

Acute kidney injury (AKI) is denoted by an abrupt decline in glomerular filtration rate (GFR) sufficient to decrease the elimination of nitrogenous waste products

and other uremic toxins.<sup>1</sup> This has traditionally been referred to as acute renal failure, but in recent years, this has been replaced with the term acute kidney injury.<sup>2</sup> The current diagnostic approach of AKI is based on an acute decrease of GFR, as reflected by an acute rise in serum

creatinine levels and/or a decline in urine output over a given time interval.<sup>3</sup> Classification of AKI includes pre-renal AKI, intrinsic renal AKI and post-renal (obstructive) AKI.

Acute kidney injury (AKI) is a clinical syndrome that complicates the course and worsens the outcome in a significant number of hospitalized patients.<sup>4</sup> The incidence of acute kidney injury (AKI) has increased over the past few decades and the reported incidence of AKI in different regions of the world is quite variable.<sup>5,6</sup> Large differences are observed in the incidence and the causes of AKI between developing and developed countries.<sup>7</sup> In developed countries, AKI is seldom a community-acquired disease, while in developing countries AKI is commonly caused by community-acquired diseases.<sup>8</sup> In developed countries the prevalence of AKI is increasing. In hospitalized patients it is estimated to occur up to 15% and is more common in critically ill patients, in whom its prevalence is estimated to be up to 60%.<sup>9,10</sup> In urban areas of developing countries, main causes of AKI are hospital acquired (renal ischemia, sepsis and nephrotoxic drugs) while in rural areas it is more commonly a consequence of community acquired disease (diarrhea, dehydration, infectious diseases, animal venoms etc.).<sup>11,12</sup> Under-reporting of AKI especially in developing countries is also a major problem that relates with the true knowledge of its impact and causes in many parts of the world.<sup>13</sup>

Thus, epidemiology and etiology of AKI differs from country to country and also varies from center to center within the same country.<sup>14</sup> Owing to the absence of a central registry, data on overall epidemiology and etiology of AKI are very limited for Pakistan. Being potentially reversible, it is very important to identify and treat the cause of acute kidney injury to prevent development of permanent damage to kidneys. The purpose of this study was to identify the causes of acute kidney injury to highlight the impact of different disorders causing AKI.

## METHODS

This study was conducted in the Allied Hospital and Madinah Teaching Hospital, Faisalabad, Pakistan. It was a Descriptive study. The study was conducted over a period of 2 years from March 2016-2018.

### Sample collection

A total of 150 patients were enrolled from medical, surgical, gynecology and obstetrics units of Allied Hospital and Madinah Teaching Hospital, Faisalabad. The diagnosis of AKI was based on standard criteria. History, physical examination and investigations were recorded on specially designed proforma. Patients were evaluated to find out the etiologies of AKI. All patients were subjected to urine analysis, complete blood count, blood biochemistry (urea, creatinine, electrolytes, uric acid, calcium and phosphorus) and ultrasound scan of the

abdomen and pelvis. Renal biopsy was done in selected cases with unexplained AKI and in those with features suggestive of systemic and glomerular diseases. Immunological assays, such as hepatitis B surface antigen, anti-hepatitis C virus antibody, complements level, antinuclear antibody, anti-double-stranded DNA, anti-neutrophil cytoplasmic antibody and anti-glomerular basement membrane antibody were performed in selected cases.

Acute Kidney Injury (AKI) is defined as an increase in serum creatinine of 0.3 mg/dl or more within 48 hours of observation or 1.5 times baseline or greater, which is known or presumed to have occurred within 7 days, or a reduction in urine volume below 0.5 ml/kg/h for 6 hours.<sup>1</sup>

### Inclusion criteria

- Patients of either gender
- Age more than 18 years
- Hospitalized patients fulfilling criteria of acute kidney injury

### Exclusion Criteria

- Age less than 18 years
- Patients with known chronic kidney disease
- Patients of kidney transplant
- Patients on maintenance hemodialysis

### Statistical Analysis

- All analyses were performed using SPSS software, version 12.0.
- The study was approved by the Ethics Committee of the hospital.

## RESULTS

Total no of patients enrolled were 150. Out of which 54 (36%) were male and 96 (64%) were female.

Prerenal azotemia was reported in 80 patients (53.33%). Intrinsic renal azotemia was involved in 56 patients (37.33%). Post renal azotemia was found in 14 patients (9.33%).

Prerenal azotemia was reported to be the dominant cause of AKI, involving 80 patients (53.33%). Relative contribution of various etiologies included: Hemorrhage (traumatic, obstetrical and surgical) in 56.25%, gastroenteritis in 20%, sepsis in 10%, cardiac diseases in 5%, hepatorenal syndrome in 3.75%, peritonitis in 2.50% and burns in 2.50%.

Intrinsic renal azotemia was reported to be the second most common cause of AKI. It involved 56 patients out of which 40 (71.4%) had ATN, 12 (21.4%) had multifactorial causes and 4 (7.14%) were found to have glomerulonephritis. Out of 40 patients with ATN, 32

(80%) had ischemic ATN (hypovolemic 62.5%, sepsis 15% and cardiac diseases 2.5%), 04 (10%) had nephrotoxic ATN and 04 (10%) were having multifactorial causes.

Post renal azotemia was found to be the third and least common cause of AKI, involving 14 patients. Out of these 6 (42.9%) were having calculi, 6 (42.9%) were found to have enlarged prostate and 2 (4.3%) were having stricture urethra.

In this study, obstetrical causes were 44%, medical 36%, and surgical 20%.

## DISCUSSION

The spectrum of causes of AKI is markedly different in developing and developed countries. The past four decades have, therefore, seen changes in the pattern of disorders causing AKI in both developed and developing countries.<sup>15</sup> These changes reflect an increase in the average age of the affected patients, the evolution of intensive care medicine and lowering of thresholds for surgical intervention.

In this study prerenal AKI was reported as the most common cause of AKI contributing 53.33% (80 out of 150 patients). This is comparable to international literature e.g.40% (Hou SH, et al.) study.<sup>16</sup>

Hemorrhage (traumatic, operative or obstetrical) was the leading cause of prerenal AKI and was reported in 45 patients. In this study, hemorrhage, sepsis and gastroenteritis were the leading causes of prerenal AKI, involved 69 cases (86.25% of prerenal azotemia). This was only due to lack of facilities, improper management and lack of qualified staff at peripheral or inside city areas, where patients had to go first time for medical aid.

Hepatorenal syndrome was reported in 3 patients (3.75% of prerenal azotemia) of this study; these were the patients who were having cirrhosis and ascites and developed AKI. The result was comparable with the study conducted by Hou et al, and Turney et al.<sup>16,17</sup>

Intrinsic renal azotemia was the second most common cause of AKI and involved 56 patients (37.33%) out of 150 cases in this study. In this study, ATN was reported as the most common cause of intrinsic renal azotemia. ATN was reported in 40 patients out of 56 patients (71.4%) of intrinsic renal azotemia. Out of these 40 cases, 32 patients (80%) were having ischemic ATN, 4 patients (10%) were having nephrotoxic ATN and remaining 04 patients (10%) of ATN were reported to have multifactorial causes. Moreover glomerulonephritis was present in 4 cases (7.14%) and multifactorial causes were present in 12 cases (21.4%).

In a study done by Thadhani, out of 100 cases of intrinsic renal azotemia, 85% of the cases were having ATN (50%

ischemic ATN and 35% toxic ATN), 10% of the cases were having interstitial nephritis and 5% of the causes having acute glomerulonephritis.<sup>18</sup>

In this study ischemic ATN was produced due to hypovolemia in 25 cases (44.64% of intrinsic AKI), out of which 4 cases were because of hemorrhage during general surgery, 18 cases were of obstetrical hemorrhage and 3 cases were of gastroenteritis. In study by Hou et al, hypovolemia produced ATN in 22 patients (17.1%) out of total 129 patients of AKI.

In this study ischemic ATN due to obstetrical hemorrhage was reported in 18 cases (32 % of intrinsic AKI). This incidence was higher than the study conducted by Turney et al, which showed 142 (10.6%) out of 1342 cases of intrinsic AKI who developed AKI due to obstetrical causes.

In this study, sepsis was another cause of ischemic ATN reported in 6 patients (15%) of ATN. Studies by Hou et al, and Turney et al, showed that sepsis lead to ATN in 7.8% and 18% of AKI patients respectively.

In this study, nephrotoxic ATN was reported in 04 (7.14% of ATN) out of 56 patients. 2 patients received radiocontrast media causing AKI, 01 of rhabdomyolysis, 01 of other multidrug induced AKI.

Another study conducted by Kleinknecht documented that incidence of AKI in-hospital due to drugs is estimated as 20%.<sup>19</sup>

In present study amongst the intrinsic causes AKI glomerulonephritis was reported in 4 cases (7.14%). In a study conducted by Turney et al, described the incidence of AKI due to glomerulonephritis to be 3.5%.

Multifactorial causes leading to AKI were reported in 12 patients of intrinsic AKI. This was due to multiple causes, e.g., hypovolemia, sepsis, drugs, hypertension etc.

In this study postrenal azotemia was the third major group amongst causes of AKI. 14(9.33%) patients were having AKI due to postrenal obstruction.

Out of 14 patients, 6 (42.9% of postrenal azotemia) were having stones, bilateral in pelvicalyceal system, 6 (42.9%) of postrenal azotemia) were reported to have enlarged prostate and in 2 (14.5% of postrenal azotemia) stricture urethra was the cause. Other multicenter studies have shown that AKI due to postrenal azotemia was reported in 5% (H.R. Brady 1998) and 2.3% (Gray G. Singer 1996) of the cases of AKI.

Previous reviews of the causes of AKI suggest that approximately 60 percent were related to surgery and extensive trauma, 30% occurred in a medical setting and about 10% were related to the complications of pregnancy.<sup>20,21</sup>

Acute kidney injury (AKI), in association with pregnancy invariably occurs as a result of potentially preventable causes.<sup>22</sup> Availability of health care facilities varies widely in different parts of world, even in same region, neighboring countries or different parts of same country can present range of statistics in this regard.<sup>23</sup> In developed countries, the incidence of pregnancy associated AKI decreased from 22% in 1950's to 1% in 1990s, whereas India has reported a decrease from 15%-22% in 1970s to 9%-13% in 2013. From Pakistan published reports reveal 11%-36% of total AKI resulted from complicated obstetrics except one weird joint report from two centers in same city, which has reported pregnancy related AKI 0.55% of total AKI over a period of ten years.<sup>24,25</sup>

Study by Mehta RL et al, highlights meta-analysis of worldwide epidemiology of AKI; still some countries with considerably high morbidity with AKI are missing in this report, mainly because of non-publishing the results from such centers.<sup>26</sup> AKI complicating pregnancy has almost disappeared from some parts of world while still poses remarkable health issue in other.<sup>27,28</sup>

A study published from Morocco in 2013 reveals incidence of pregnancy related AKI 0.66% (out of 5600 deliveries, 37 developed AKI).<sup>29</sup> Whereas study published from Nigeria in 2012 revealed 33% of AKI resulted from pregnancy related complications. A recently published study from Canadian population has shown an increase in pregnancy related AKI from 1.66 to 2.68 per 10,000 deliveries between 2003-04 and 2009-10 (61% increase, 95 confidence interval 24% to 110%).<sup>30</sup>

In this study of 150 cases of AKI obstetrical causes are 44%, medical causes 36% and surgical causes 20%. In contrast to studies reported from neighboring country, author have observed rather increase in pregnancy related AKI over last ten years.

AKI occurs in this society due to mismanaged obstetrical/gynecological or surgical problems, infection, drug abuse, or inadequate or delayed treatment of medical problems, (CCF, IHD/Diabetes, hypertension, chronic liver diseases, sepsis etc).

In this country due to poor health infra-structure and lack of adequate primary health care facilities, many people develop AKI due to preventable causes and these can be dealt with by careful assessment of volume status, simple fluid replacement and control of infection and avoidance of nephrotoxic agents. Lack of awareness and low index of recognition of the etiological factors lead to late presentation of the patients to tertiary care hospitals and such cases often end in permanent kidney failure.<sup>31</sup> The incidence of AKI in developing world can be reduced by improving health facilities and increasing awareness through media campaign.

## CONCLUSION

In contrast to studies reported from neighboring country, author have observed rather increase in pregnancy related AKI over last ten years. This is alarming and requires serious measures to be taken at national level for improvement of health facilities and increasing awareness.

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