J Prev Epidemiol. 2020;5(1):e09 Original Article

doi 10.34172/jpe.2020.09 Journal of Preventive Epidemiology http jprevepi.com

Changing epidemiology of acute renal failure at a tertiary care hospital in North India

Raju Kumar*, Ramesh Kumar, Sapna Manhas, Poonam Sharma

Department of Nephrology, Batra Hospital and Medical Research Centre, New Delhi, India

Correspondence to:
Raju Kumar,
Email: raj.skims@gmail.com

Received: 7 May 2020
Accepted: 7 Aug. 2020
ePublished: 18 Sep. 2020

Keywords: Epidemiology, Hospital-acquired AKI, Mortality, Acute kidney injury

Abstract

Introduction: Acute kidney injury (AKI) is one of the most common clinical condition with a significant economic burden worldwide.
Objective: This study was conducted to determine the aetiology, clinical presentation and outcome of AKI from 2012-2014 and compared these findings with historical controls (2007-2011).
Patients and Methods: This was an observational prospective comparative study with two groups - historical control group (group 1; 2007-2011) and prospective group (group 2; 2012-2014). Patients of either gender or aged between 18 and 70 years with AKI were included in the study. Demographic details, clinical signs and symptoms, and laboratory evaluations were noted. Outcomes evaluated were etiological parameters of renal failure, the outcome of renal failure and histology.
Results: A total of 100 patients were included in the study (group 1, n=50; group 2, n=50). Overall, demographics were comparable between the two groups. Oliguria or anuria was the commonest presentation. Proteinuria was found in 12% and 6% of patients in group 1 and group 2, respectively. The mean (SD) serum creatinine at presentation was 5.39 (2.49) and 4.93 (2.99) in two groups, respectively. The medical causes were the most common etiological parameters of AKI (76% versus 94% in groups 1 and 2, respectively). Post-surgical and obstetrics causes were less prevalent in group 2. Acute interstitial Nephritis was common histology pattern in both group 1 and 2. The frequency of haemodialysis increased in group 2 and the mortality was decreased in both groups.
Conclusion: Results showed that some etiological factors were slowly becoming less prevalent, while others were becoming more important factors in the genesis of AKI.

Citation: Kumar R, Kumar R, Manhas S, Sharma P. Changing epidemiology of acute renal failure at a tertiary care hospital in North India. J Prev Epidemiol. 2020;5(1):e09. doi:10.34172/jpe.2020.09.

Introduction

Acute kidney injury (AKI) is one of the most common clinical conditions with a significant economic burden worldwide. However, owing to climatic conditions, overcrowding and poor socioeconomic factors, AKI in India differs from the world. The International Society of Nephrology (ISN) declared a human rights case statement of 0 by 25, which means, by 2025 no one should be dying due to untreated AKI in low-resource regions (1).

A recent meta-analysis which evaluated the global burden of AKI, the pooled incidence of AKI in the hospitalized population was around 19.4%, 7.5%, 31.0%, 9.0% and 16.7% in Eastern Asia, Southern Asia, Southeastern Asia, Central Asia, and Western Asia, respectively; and pooled mortality was 36.9%, 13.8%, and 23.6% in Eastern Asia, Southern Asia, and Western Asia, respectively (2). In India, AKI due to medical, obstetric and surgical causes accounts for 87.5%, 8.7% and 3.4% of cases respectively (3).

Key point

This prospective observational comparative study with two groups - historical control group (Group 1; 2007-2011) and prospective group (group 2; 2012-2014) included a total of 100 AKI patients (group 1, n=50; group 2, n=50) of either gender and aged between 18 and 70 years. Overall, demographics were comparable between the two groups. Oliguria or anuria was the commonest presentation. Proteinuria was found in 12% and 6% of patients in group 1 and group 2, respectively. The mean (SD) serum creatinine at presentation was 5.39 (2.49) and 4.93 (2.99) in two groups, respectively. The medical causes were the most common etiological parameters of AKI (76% versus 94% in groups 1 and 2, respectively). These results showed that some etiological factors were slowly becoming less prevalent, while others were becoming more important factors in the genesis of AKI.

Objectives

This paper reports the results of a study that to determine the aetiology, clinical presentation and outcome of AKI from 2012-2014 and compared these findings with historical controls (2007-2011).

Patients and Methods

Patients

This was an observational prospective comparative study with historical control. The study included two groups – historical control group (group 1; 2007-2011) and prospective group (group 2; 2012-2014). Patients of either sex and aged between 18 and 70 years with AKI and RIFLE demonstrated by either serum creatinine level >1.5 mg/dL or oliguria (defined as urine output <400 mL/d) or anuria (defined as urine output <100 mL/d) were included in the study. Patients with chronic kidney disease were excluded from the study.

All patients attending the department of nephrology were screened and included if eligible in group 2 (prospective group). Group 1 or the historical control group consisting of 50 patients seen in the preceding 5 years, and with a similar demographic profile as group 2. Following details were collected: demographic details, clinical signs and symptoms, and laboratory evaluations (including CBC, blood urea, serum creatinine, sodium, and potassium, and urine routine). A 24-hour urinary protein was done in six patients in Group 1 and three patients in group 2. Immunological markers (ANA/ANCA[C&P]/ANTI DsDNA) were done when necessary. A total of 26 (52%) patients in group 1 and 23 (46%) from group 2 underwent renal biopsy.

Outcomes evaluated were etiological parameters of renal failure, the outcome of renal failure (recovery, progression or death), and histology (cortical necrosis, tubular necrosis and glomerulonephritis).

Ethical issues

The study was approved by the Ethics Committee at each hospital site (Batra Hospital and Medical Research Centre, New Delhi). Individual written consent was obtained from each patient. The study was conducted in line with the Declarations of Helsinki.

Statistical analysis

Statistical analyses were conducted using SPSS (version 17.0). Continuous variables are presented as the mean and standard deviation, and categorical variables are presented as absolute numbers and percentage. The comparison of normally distributed continuous variables between the groups (groups 1 and 2) was performed using Student's t test. Nominal categorical data between the groups were compared using the chi-square test or Fisher's exact test as appropriate. $P<0.05$ was considered statistically significant.

Results

A total of 100 patients were included in the study (group 1, n = 50; group 2, n = 50). Overall, demographics were comparable between the two groups. The mean age at presentation was 39.60 (11.13) years and 39.80 (11.62) years in group 1 and group 2, respectively; and the male: female ratio was 1.77 and 1.17, respectively. Oliguria or anuria was the commonest presentation. Thirty-two percent of patients from group 1 and 22% of patients from group 2 had signs of dehydration, vasculitis and arthritis. Active sediments in urine were mainly secondary to vasculitis, lupus and IgA nephropathy, and in some patients due to analgesic nephropathy. Proteinuria was found in 12% and 6% of patients in group 1 and group 2, respectively (Table 1).

The mean (SD) serum creatinine at presentation was 5.39 (2.49) and 4.93 (2.99) in two groups, respectively. Figure 1 shows a progressive decline in serum creatinine over days in the majority of patients.

Etiological parameters of AKI in two groups are presented in Table 2. The medical causes were most common in the majority of patients, 76% and 94% in groups 1 and 2, respectively. Drugs, infections and malaria showed an increasing trend, while diarrhoea shows the decreasing trend, but the differences were not significant. Multiple myeloma and vasculitis are emerging as newer etiological parameters since last one decade. Surgical causes have shown a significant decline in group 2. Overall, the incidence of obstetric-related AKI has decreased significantly since the last decade. The obstetric causes include 6% and 2% of patients in groups 1 and 2, respectively.

Table 3 summarizes the renal biopsy. Overall, there was no significant difference between the two groups. Acute interstitial nephritis was reported in 14% and 12% of patients in group 1 and 2, respectively. Table 4 summarizes haemodialysis and outcomes among included patients. The frequency of haemodialysis increased in group 2. The mortality has also decreased in both groups and constitutes 4% and 2% in group 1 and 2, respectively.

Discussion

This was an observational prospective study which evaluated the trend of aetiology, clinical presentation and outcome of AKI in an Indian setting. Overall, results demonstrated that though there were no major differences between the groups, the clinical presentation and few aetiological parameters showed changes over time.

Though, AKI is common worldwide and seen in all age groups, the prevalence of AKI is more in elderly in developed countries; however, it is seen more in younger patients in developing countries (4). In the present study, the mean age was around 39 years in both groups. This was consistent with previous reports. In a study by Jayakumar et al, the average age of patients with AKI is 37 years (3). A study from Nigeria showed that 46% of their patients with AKI were aged less than 40 years (5). In the present study, males were higher in number than females, this could be due to easy access to treatment centre by males than females.

In the present study, the most common presenting symptoms in each group were oligoanuria (70% and 70%),

Table 1. Patient demographics and clinical characteristics

Parameters	Group 1 (2007–2011), n=50	Group 2 (2012-2014), n=50	*P* value
Age (years), mean (SD)	39.60 (11.13)	39.80 (11.62)	0.930
Age group (years)			
20-30	13 (26)	12 (24)	
31-40	13 (26)	9 (18)	0.687
41-50	15 (30)	20 (40)	
>50	9 (18)	9 (18)	
Gender			
Men	18 (36)	23 (46)	0.309
Women	32 (64)	27 (54)	
Current signs and symptoms			
Oliguria or anuria	35 (70)	35 (70)	1.000
Vomiting or diarrhoea	8 (16)	4 (8)	0.663
Loin pain	8 (16)	8 (16)	1.000
Drug intake/Toxin,	9 (18)	12 (24)	0.640
Rash, Arthritis	16 (32)	14 (28)	0.663
Other complaints	28 (56)	30 (60)	0.547
Sign of dehydration, vasculitis or arthritis	16 (32)	11 (22)	0.260
Active sediments in routine urine examination	11 (22)	10 (20)	0.545
24-h urinary protein			0.524
No	44 (88)	47 (94)	
Nephrotic	5 (10)	3 (6)	
Sub-nephrotic	1 (2)	0	
Positive immunological markers (ANA/ANCA[C&P]/ANTI DsDNA)	5 (10)	6 (12)	0.749
Serum creatinine			
Mean (SD)	5.39 (2.49)	4.93 (2.99)	0.343
Range	2.70 - 15.30	2.30 - 15.50	

Data presented as n (%), unless otherwise specified.

arthralgia (32% and 28%), vomiting or diarrhoea (16% and 8%) and drug intake (18% and 24%) in group 1 and 2, respectively. Loin pain, puffiness of face and malaise were also seen but less commonly. The predominant clinical presentation was oligoanuria which was consistent with most of the published data (6). In the present study, the serum creatinine a showed slight decrease over time. Immunological markers have high sensitivity and specificity in diagnosing vasculitis (small vessel and lupus nephritis).

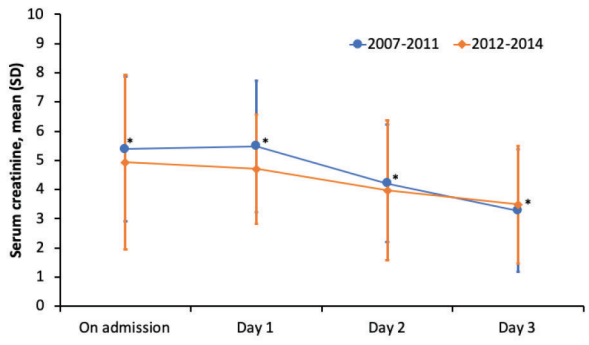

Figure 1. Comparison of serum creatinine.

Though there is no direct comparative study of AKI in obstetric complications, based on the available literature it appears that there is a decrease in the incidence of AKI in obstetric complications. The percentage of patients getting renal cortical necrosis appears to be highest in obstetric complications than in complications due to medical and surgical diseases and procedures. The incidence of acute cortical necrosis has decreased significantly from 5.8% to 1.3% (7).

In the present study, the aetiology in both groups has shown an increase in medical causes and decline in surgical and obstetric causes. The medical, surgical and obstetric causes accounted for 76%, 18% and 6% in group 1 and 94%, 4% and 2% in 2012-2014, respectively. Our study findings were supported by Jayakumar et al where they reported the medical, surgical, and obstetric causes accounted for 87.6%, 3.4%, and 8.9% of ARF, respectively (3). In the present study, the AKI related to infection and malaria has increased from (12% to 20%) and (8% to 12%) and diarrhoea related AKI has decreased from 16% to 8% in group 1 and 2, respectively. Prakash et al who evaluated patients from 1996 to 2008 reported a decrease in diarrhoea-related AKI and increase in AKI related to malaria, sepsis and liver disease (7).

Table 2. Summary of causes

Cause	Group 1 (2007-2011) N=50	Group 2 (2012-2014) N=50	*P* value
Medical	38 (76)	47 (94)	0.023
Analgesic nephropathy	8 (16)	12 (24)	0.317
Infection/sepsis	6 (12)	10 (20)	0.275
Malaria	4 (8)	6 (12)	0.741
Gastroenteritis	8 (16)	4 (8)	0.357
Small vessel vasculitis	4 (8)	3 (6)	1.000
Multiple myeloma	3 (6)	2 (4)	1.000
Lupus nephritis	1 (2)	3 (6)	0.617
Contrast induced nephropathy	1 (2)	0	1.000
Coxsackie virus myositis	1 (2)	0	1.000
Dengue	1 (2)	1 (2)	1.000
Hepatorenal syndrome	1 (2)	0	1.000
Sarcoidosis	0	1 (2)	1.000
IgA nephropathy	0	1 (2)	1.000
Leptospirosis	0	1 (2)	1.000
Snake bite	0	1 (2)	1.000
Poisoning	0	1 (2)	1.000
Vit-D-Intoxication	0	1 (2)	1.000
Obstetric	3 (6)	1 (2)	0.617
Intrauterine death	0	1 (2)	1.000
Intrapartum sepsis	1 (2)	0	1.000
Pre-eclampsia	2 (4)	0	0.450
Surgical	9 (18)	2 (4)	0.051
Post-surgical	4 (8)	1 (2)	0.362
Post-traumatic	3 (6)	1 (2)	0.617
Post-obstructive	2 (4)	0	0.450

Prakash et al studied the changes in the epidemiology of community-acquired AKI over a time span of 26 years in two study periods (1983-95 and 1996-2008) where they evaluated 2405 (1375 male and 1030 female) cases of AKI (7). Authors found that the obstetrical AKI was decreased because of the declining number of postabortal AKI. Surgical AKI decreased from 13.8% to 9.17% in the study period, the malaria increased significantly from 4.7% to 17% and the diarrhoea associated AKI had significantly decreased from 36.8% to 19% (7). In another study, ARF (acute renal failure) was studied in hospitalized patients between 1988 and 2002 in the United States, where 5 563 381 discharges with ARF and 598 768 with ARF that required dialysis (ARF-D) were identified (4). Results showed that between 1988 and 2002, the incidence of ARF rose from 61 to 288 per 100 000 population and the incidence of ARF-D increased from 4 to 27 per 100 000 population. In-hospital mortality also decreased over the period of time from 40.4% to 20.3% in ARF patients and from 41.3% to 28.1% among ARF-D (4).

In another study by Prakash et al analysed the incidence, causes and clinical course of ARF due to primary intrarenal disease other than acute tubular necrosis in 1122 ARF patients over a period of 16 years (1984 to 1999) (8). Results showed that intrinsic renal diseases were responsible for ARF in 891 (79.4%) of cases. ARF was related to acute glomerulonephritis in 9.3%, acute interstitial nephritis in 7%, and renal cortical necrosis in 4.6% of patients. Obstetrical complications were the main causes (61%) of cortical necrosis in adults with ARF (8).

In the study by Utaş et al, 439 patients with ARF (116 were admitted in 1983–1990 and 323 in 1991–1997) were evaluated (9). In this study the age of presentation increased from 49.8 years in the first period to 58.8 years in the second; however, the frequency of surgical cases decreased from 28.4% to 23.8%; similarly, obstetric cases were also decreased from 18.9% and 14.8% (9). The mortality was higher for surgical (45.5%) than for obstetric (27.8%) and medical ARF (24.3%) (9). Overall, these results show that the trend of aetiological parameters changes over time and our results were consistent with previous results. The slight differences could be due to the improved post-operative care in our hospital.

Vasculitis and multiple myeloma were considered as emerging new etiological parameters of renal failure since last decade. The present study revealed that vasculitis included 10% and 12% of patient and multiple myeloma

Table 3. Summary of renal biopsy

Parameter	Group 1 (2007–2011), n=50	Group 2 (2012-2014), n=50	*P* value
Acute interstitial nephritis	7 (14)	6 (12)	0.674
Acute tubular necrosis	5 (10)	5 (10)	1.000
Acute glomerulonephritis			
Crescentic glomerulonephritis	4 (8)	3 (6)	1.000
Membranoproliferative glomerulonephritis	2 (4)	5 (10)	0.436
Diffuse proliferative glomerulonephritis	2 (4)	1 (2)	1.000
Post-infectious glomerulonephritis	1 (2)	0	1.000
Myeloma cast nephropathy	2 (4)	1 (2)	1.000
Thrombotic microangiopathy (HUS/TTP)	1 (2)	1 (2)	1.000
Renal cortical necrosis	2 (4)	1 (2)	1.000

Data presented as n (%). HUS, haemolytic uremic syndrome; TTP, thrombotic thrombocytopenic purpura.

Table 4. Summary of haemodialysis and outcomes

Parameters	Group 1 (2007-2011), n=50	Group 2 (2012-2014), n=50	*P* value
Haemodialysis	19 (38)	27 (54)	0.632
Outcomes			
Resolved	40 (80)	44 (88)	0.42
Chronic kidney disease	8 (16)	5 (10)	0.372
Died	2 (4)	1 (2)	1.000

Data presented as n (%).

include 4% and 6% of patients, respectively, in groups 1 and 2; however, in previous study by Prakash et al these were 0.28% and 1.13%, respectively (7). We anticipate the increase in diagnosis of this disease because of our elaborative clinical assessment and diagnostic procedures.

Conclusion

In conclusion, results showed that some etiological factors were slowly becoming less prevalent, while others were becoming more important factors in the genesis of AKI. The newer infections, vasculitis and multiple myeloma and use of NSAIDs emerged as etiological parameters of AKI. Improvements in the healthcare system have possibly reduced the morbidity and mortality over the past one decade.

Limitations of the study

First, this was a single centre study. Second, the sample size of this study was comparatively, hence care must be taken in generalizing the results.

Authors' contribution

Both authors were the principal investigators of the study and were included in preparing the concept, design, manuscript and critically evaluated the intellectual contents. Both authors participated in preparing the final draft of the manuscript, revised the manuscript and critically evaluated the intellectual contents. Both authors have read and approved the content of the manuscript and confirmed the accuracy or integrity of any part of the work.

Conflicts of interest

The authors declare that they have no competing interests.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

Funding/Support

None.

References

1. Mehta RL, Cerdá J, Burdmann EA, Tonelli M, Garcia-Garcia G, Jha V, et al. International Society of Nephrology's 0by25 initiative for acute kidney injury (zero preventable deaths by 2025): a human rights case for nephrology. Lancet 2015; 385: 2616-43. doi: 10.1016/S0140-6736(15)60126-X.
2. Susantitaphong P, Cruz DN, Cerda J, Abulfaraj M, Alqahtani F, Koulouridis I, et al. World incidence of AKI: a meta-analysis. Clin J Am Soc Nephrol. 2013;8:1482-93. doi: 10.2215/CJN.00710113.
3. Jayakumar M, Prabahar MR, Fernando EM, Manorajan R, Venkatraman, Balaramanv. Epidemiologic trend changes in Acute Renal Failure- a tertiary centre experience from south India. Ren Fail 2006;28:405-10. doi: 10.1080/08860220600689034.
4. Waikar SS, Curhan GC, Wald R, McCarthy EP, Chertow GM. Declining mortality in patients with acute renal failure, 1988 to 2002. J Am Soc Nephrol. 2006;17:1143-50. doi: 10.1681/ASN.2005091017.
5. Arije A, Kadiri S, Akinkugbe OO. The vability of hemodialysis as treatment option for renal failure in a developing economy. Afr J Med Sci. 2000;29:311-4.
6. Sharfuddin AA, Weisbord SD, Palevsky PM, Molitoris BA. Acute Kidney Injury. In: Taal MW, ed. Brenner and Rector's The Kidney. Vol 1. 9th ed. Philadelphia, PA: Saunders Elsevier; 2011:1044-5.
7. Prakash J, Singh TB, Ghosh B, Malhotra V, Rathore SS, Vohra R, et al. Changing epidemiology of community-acquired acute kidney injury in developing countries: analysis of 2405 cases in 26 years from eastern India. Clin Kidney J. 2013;6:150-5. doi: 10.1093/ckj/sfs178.
8. Prakash J, Sen D, Kumar NS, Kumar H, Tripathi LK, Saxena RK. Acute renal failure due to intrinsic renal diseases: review of 1122 cases. Ren Fail. 2003;25:225-33. doi: 10.1081/jdi-120018723.
9. Utaş C, Yalçindağ C, Taşkapan H, Güven M, Oymak O, Yücesoy M. Acute renal failure in Central Anatolia. Nephrol Dial Transplant. 2000;15:152-5. doi: 10.1093/ndt/15.2.152.