Investigation of acute kidney injury and related factors in hospital patients; single center experience

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ABSTRACT

Objectives: Acute Kidney Injury (AKI) is a very common clinical problem. This picture is seen in 5-7% of hospitalized patients and in 25-30% of patients hospitalized in intensive care units. The aim of this study was to determine the incidence, etiology, clinical features, prognosis and complications in adult patients hospitalized with of AKI.

Methods: This study was organized as an observation study in which the files of the patients admitted to internal medicine and nephrology clinics between September 2012 and September 2017 were examined. All patients admitted to the internal medicine and nephrology clinics with the diagnosis of AKI were included in the study. But those under the age of 18, patients with chronic kidney damage, ex-patients after hospitalization, patients who were sent to the intensive care unit after hospitalization, patients who voluntarily refused treatment or left the service and who were hospitalized for more than 48 hours, but those who did not have biochemical analysis during their stay were excluded. RIFLE creatinine criteria were used for AKI identification.

Results: The study included 354 patients. 177 (50%) patients were male and 177 (50%) patients were female. The incidence of prerenal AKI in the internal medicine and nephrology clinics was 53.39%, renal AKI was 36.44% and postrenal AKI was 10.17%. When the causes of AKI were examined, 33.9% hypovolemia, 15.5% UTI and 13.5% gastroenteritis were detected. The dialysis rate was 23.7%.

Conclusion: Inconclusion, although the incidence of AKI is acceptable in our hospital. It is found to be compatible with the literature and it is possible to catch the early stage of injury by decreasing the frequency especially with better management of elderly patients and more closely monitoring renal functions in this group of patients

Key words: acute renal failure, hemodialysis, nephrology

Acute loss of kidney function with an increase in serum creatinine and/or a decrease in urine output was previously known as acute renal failure (ARF).[5-8] This clinical condition, which is now defined as acute kidney injury (AKI), has high morbidity and mortality and is a common condition in critically ill patients. Although there is significant progress in the diagnosis and treatment of AKI, the mortality rate increases considerably when AKI is sufficient to require renal replacement therapy in clinics and intensive care units.[16] Although RIFLE and AKIN have been proposed and approved definitions in AKI classification, in 2012 KDIGO needed a single definition both for its use in practice and research and for public health.[14, 19] Aim of this study, the etiology, clinical features, prognosis of hospitalized adult pa-

tients with the diagnosis of AKI in Internal Medicine and Nephrology clinics between September 1, 2012 and September 1, 2017. AKI is a disease that is very common in the community and has multiple causes. We wanted to point this out in our study. AKI can be followed by both internal medicine and nephrology clinics. We wanted to investigate whether there is a different situation from the literature in terms of incidence among these clinics. AKI is a disease that can go as far as dialysis when it cannot be intervened in place and on time. We wanted to indicate how many people received dialysis treatment in our study.

METHODS

This study was retrospectively organized by scanning the files of patients hospitalized with the diagnosis of AKI in the internal medicine and nephrology clinics between September 1, 2012 and September 1, 2017. Hemogram, blood biochemistry, blood gas values of 354 patients included in our study, clinic in which they were hospitalized, duration of hospitalization, whether they were on dialysis, comorbidities and conditions leading to AKI were examined electronically from hospital records by scanning epicrisis.

Statistical Analysis

354 patients were included in the study. Whether the numerical variables obtained from these patients were compatible with the normal distribution were checked with Kolmogrov Smirnov and Shapiro Wilk normality tests. Summary statistics (mean ± standard deviation) and minimum-maximum values of the variables consistent with the normal distribution are given. Numerical variables that are not compatible with the normal distribution are summarized with median-percentages and minimum-maximum. Descriptive statistics for categorical variables are given in numbers and percentages. While the comparisons of two independent groups were evaluated in terms of numerical variables, two independent groups t-test was used since the condition of normal distribution and homogeneity of variance was met. The homogeneity of variance was checked with Levene's test. The study protocol was approved by the institutional ethics committee (date/number:17.08.2018-016) and conducted in accordance with the principles of the Declaration of Helsinki and the Good Clinical Practice guidelines of the International Conference on Harmonization. There was no sponsor for the study. SPSS 22.0 (Statis-

tical Package for the Social Sciences) IBM Software program was used for statistical analysis.

Exclusıon Criteria

1. Those under 18 years old
2. Those with a history of chronic kidney damage
3. Those who exited before the end of their treatment after hospitalization
4. Patients sent to the intensive care unit after hospitalization
5. Patients who refuse treatment or leave the service voluntarily
6. Those who did not undergo biochemical analysis during the hospitalization period, even if they were hospitalized for more than 48 hours

RESULTS

The patients whichs included in the study, 177 (50%) were male and 177 (50%) were female and of the 354 patients included in the study, 150 (42.4%) were hospitalized in the internal medicine service and 204 (57.6%) were hospitalized in the nephrology service (Table 1). The mean age of the 354 patients included in the study was 67.24 ± 17.10 years (18-104). The mean age of the patients who were divided into 3 groups for prerenal, renal and postrenal reasons are given in (Table 2). There was a statistically significant difference between the groups in terms of age ($p < 0.001$). The difference is seen between those hospitalized for renal (61.74 ± 18.46) and prerenal (70.83 ± 15.47) causes. (Table 2). According to their diagnosis, 189 (53.39%) patients were hospitalized for prerenal reasons, 129 (36.44%) for renal reasons, and 36 (10.17%) for postrenal reasons. (Table 3). The hospitalization period of the patients was 8.29 ± 6.088 days (2-53 days) in the prerenal group, 10.13 ± 7.394 days

Table 1. Number and Percentage Distribution of Patients by Service and Gender

Clinic	n (%)
Internal Medicine	150 (42.37)
Nefrology	204 (57.63)
Gender	
Female	177 (50)
Male	177 (50)
Total	**354 (100)**

Table 2. Average Age Values in Diagnostic Groups

Variable	Diagnosis	N	Mean ± Std. Deviation	Min-Max	*P*
Age	Prerenal	189	70.83 ± 15.47	18-104	< 0.001
	Renal	129	61.74 ± 18.46	19-89	
	Postrenal	36	68.11 ± 15.29	33-89	
	Total	354	67.24 ± 17.10	18-104	

(2-51 days) in the renal group, and 11.53 ± 6.926 days (2-37 days) in the postrenal group. (Table 4). During the follow-up, 84 (23.7%) of the patients received renal replacement therapy in the form of hemodialysis (Table 5). When we look at the most common causes of AKI in our study; we see that 33.9% of the patients have hypovolemia, 15.5% have urinary tract infection (UTI) and 13.6% have gastroenteritis. Apart from this, respectively; We can see NSAID use, acute tubular necrosis, contrast nephropathy, malignancy, benign

Table 3. Distribution of the patients according to their diagnoses

Diagnosis	n (%)
Prerenal	189 (53.39)
Renal	129 (36.44)
Postrenal	36 (10.17)
Total	354 (100)

prostatic hypertrophy, multiple myeloma, rhabdomyolysis, glomerulonephritis and kidney stones (Table 6).

DISCUSSION

AKI is a clinical picture that progresses with deterioration of kidney functions and decrease in glomerular filtration rate within days or even hours.[10-13] According to the RIFLE and AKIN criteria recently used in the diagnosis of AKI, an increase of 0.3 mg/dl in creatinine, a 1.5-fold increase in basal creatinine, or a urine output of less than 0.5 ml/kg/hour in the last 6 hours makes the diagnosis of AKI.[1-4] Oliguria and creatinine values above 3 mg/dL at the time of diagnosis have been reported as poor prognostic indicators.[9] Mortality is high in elderly patients with multiorgan failure and accompanying sepsis. It is known that mortality is over 50% in patients who are followed in the intensive care unit and need mechanical ventilation.[3] Rabbani *et al*.[19] examined 898 patients diagnosed with AKI between 1991 and 2000 and reported that 551 (61%) patients were male and the mean patient age was 53 ± 17.6 (15-91). Wang *et al*.[20] examined 209 patients who were treated with the diagnosis of AKI in Beijing University Hospital between 1994-2003 and reported that the patient's age peaked in two periods (34-45 and 60-80 years). Selcuk *et al*.[22] examined 339 patients with AKI and found two or more etiological factors causing AKI in 46 (13.5%) of the patients. Prerenal and renal causes together in 26 (56%) of these patients, prerenal, renal and postrenal causes together in 12 patients (26%), renal and postrenal causes together in 4 (9%) patients, and prerenal and postrenal causes in 4 (9%) patients. Postrenal causes were identified together. Diarrhea and vomiting are the most common prerenal causes, gentamicin is the most common renal cause and prostatic hypertrophy is the most common postrenal cause. It was determined that 32 (70%) of the patients with more than one etiological factor were oliguric, 8 patients (17%) were anuric, and 6 (13%) were nonoli

Table 4. Length of stay of the patients according to the etiology of AKI

Diagnosis		N	Minimum	Maximum	Mean	Std. Deviation
Prerenal	Length of stay	189	2	53	8.29	6.088
Renal		129	2	51	10.13	7.394
Postrenal		36	2	37	11.53	6.926

Table 5. Renal replacement therapy (hemodialysis) status of the patients

Dialysis	n (%)
Yes	84 (23.7)
No	270 (76.3)
Total	354 (100)

guric. It was stated that 19 (41%) patients were given medical therapy alone, and 27 (59%) patients were given dialysis together with medical treatment. It was reported that 5 (10.8%) patients died. El- Reshaid *et al.*[17] reported the most common causes of AKI etiology as drugs, sepsis and hypovolemia. In our study, of 354 patients followed up with AKI, 177 (50%) were male and 177 (50%) were female (Table 2). The mean age of the patients was 67.24 ± 17.10 (18-104) years. Considering the age distribution according to the etiology of AKI, the mean age of the prerenal group was 70.83 ± 15.47 (18-104), the mean age of the renal group was 61.74 ± 18.46 (19-89), and the mean age of the postrenal group was 68.11 ± 15 years (33-89) years (Table 2). There is a statistically significant difference in age among patients according to the cause of renal failure. The difference is seen between patients who came to the hospital for renal (61.74 ± 18.46) and prerenal (70.83 ± 15.47) reasons. ($p < 0.001$). Considering the clinics in which the patients were admitted in our study, 150 (42.37%) were hospitalized in internal

medicine and 204 (57.63%) were hospitalized in nephrology (Table 1). Considering the etiology of AKI, 189 (53.39%) patients were in the prerenal group, 129 (36.44%) were in the renal group, and 36 (10.17%) were in the postrenal group (Table 3). When the causes of AKI are examined according to etiology; Out of 354 causes of renal AKI, 120 (33.9%) of AKI's were due to dehydration (hypovolemia), 55 (15.5%) were due to urinary tract infection, 48 (13.5%) were due to gastroenteritis, and 10 (2.8 %) was due to benign prostatic hyperplasia (BPH) (Table 6). Considering the causes of AKI due to toxic nephropathy, 16 patients were followed up as AKI due to NSAID use, 7 patients as AKI due to glomerulonephritis, 9 patients as AKI due to contrast nephropathy, 9 patients as AKI due to multiple myeloma, and 8 patients as AKI due to rhabdomyolysis (Table 6). Considering the causes of postrenal renal failure, there were BPH in 10 patients, mass compression due to malignancy in 11 patients, prostate ca in 2 patients, bladder ca in 2 patients, kidney stone disease in 5 patients, and idiopathic hydronephrosis in one patient. Hemodialysis is not routinely applied in AKI, but is performed in the presence of emergency dialysis indications such as uremic encephalopathy, pericarditis, oliguria-anuria. Selcuk *et al.*[15, 22] examined a total of 339 patients with AKI and reported that 59% of the patients needed dialysis. Zhang *et al.*[23] reported that 39 (37.5%) of the 104 patients they followed up with the diagnosis of AKI required dialysis. Mahajan *et al.*[24] found the

Table 6 Table of Causes of AKI

Causes of AKI	N	%
Hypovolemia	120	33.9
Uriner Tract Infection	55	15.5
Gastroenteritis	48	13.6
Use of NSAİD	16	4.5
Acute tubuler necrosis	13	3.7
Contrast Nefropaty	11	3.1
Malignancy	11	3.1
BPH	10	2.8
Multiple Myeloma	9	2.6
Rhabdomyolysis	8	2.3
Upper GI Bleeding	8	2.3
Glomerulonephritis	7	2.0
Kidney Stone	5	1.7
Others	33	9.3
Total	**354**	**100**

rate of need for renal replacement therapy (RRT) to be 33.5%. In the study of Uyanik *et al.*[25] reported that 74 (29%) of 256 AKI patients needed hemodialysis. In our study, the rate of patients in need of dialysis was found to be 23.7% with 84 patients. It was remarkable that the rate of patients requiring dialysis was similar to other studies. The dialysis indications of our patients were anuria, hypervolemia, uremic encephalopathy, uremic hiccups, preoperative dialysis in terms of uremic bleeding, tumor lysis syndrome and hyperuricemia. While 33 (17.5%) of the prerenal patients were taken to hemodialysis, 37 (28.7%) of the renal AKI's and 14 (38.9%) of the postrenal AKI's were taken to hemodialysis (Table 5).

CONCLUSION

As a result, although the etiology of AKI includes a wide variety of factors that was grouped according to prerenal, renal and postrenal causes as main groups and both the etiologies of patients hospitalized with AKI and the symptoms of AKI in our hospital, internal medicine and nephrology clinics, show a great similarity in the literature. Although AKI patients receive more effective treatment with the widespread use of dialysis today. It is still an important cause of morbidity and mortality in hospitalized patients.[26] Likewise, the rates of patients undergoing hemodialysis or peritoneal dialysis are similar. This shows that the patients hospitalized in the internal medicine and nephrology clinic of our hospital are correctly diagnosed and treated appropriately.

Authors' Contribution

Study Conception: MB,; Study Design: MB,; Supervision: FB,; Materials: MB,; Data Collection and/ or Processing: FB,; Statistical Analysis and/or Data Interpretation: FB,; Literature Review: MB,; Manuscript Preparation: MB and Critical Review: FB.

REFERENCES

1. Lameire N, Van Biesen W, Vanholder R. Acute renal failure. Lancet 365; 2005:417-430.
2. Bellomo R, Ronco C, Kellum JA, Mehta RL, Palevsky P; Acute Dialysis Quality Initiative workgroup. Acute renal failure—definition, outcome measures, animal models, fluid therapy and information technology needs: the Second International Consensus Conference of the Acute Dialysis Quality Initiative (ADQI) Group. Crit Care 2004; 8:204-12.
3. Kellum JA, Bellomo R, Ronco C. Classification of acute kidney injury using RIFLE: What's the purpose? Crit Care Med 2007; 35:1983-4.
4. Akcan-Arikan A, Zappitelli M, Loftis LL, Washburn KK, Jefferson LS, Goldstein SL. Modified RIFLE criteria in critically ill children with acute kidney injury. Kidney Int 2007; 71:1028-35.
5. Hoste EA, Clermont G, Kersten A, Venkataraman R, Angus DC, De Bacquer D, Kellum JA. RIFLE criteria for acute kidney injury are associated with hospital mortality in critically ill aptients: A cohort analysis. Crit Care 2006; 10:R73
6. Mehta RL, Kellum JA, Shah SV, Molitoris BA, Ronco C, Warnock DG, Levin A. Acute Kidney Injury Network Acute Kidney Injury Network.: report of an initiative to improve outcomes in acute kidney injury. Crit Care 2007; 11:R31
7. Lopes JA, Fernandes P, Jorge S, Gonçalves S, Alvarez A, Costa e Silva Z, França C, Prata MM. Acute kidney injury in intensive care unit patients: a comparison between the RIFLE and the Acute Kidney Injury Network classifications. Crit Care 2008; 12(4): R110
8. Mehta RL, Pascual MT, Soroko S, Savage BR, Himmelfarb J, Ikizler TA, Paganini EP, Chertow GM. Spectrum of acute renal failure in the intensive care unit: the PICARD experience. Kidney Int. 2004; 66:1613-21
9. Lamiere N, Biesen WV, Vanholder R: Acute renal failure. Lancet 2005; 365:417- 30.
10. Gill N, Nally Jr JV, Fatica RA. Renal failure secondary to acute tubuler necrosis: epidemiology, diagnosis, and management. Chest 2005; 128:2847-63.
11. Ympa YP, Sakr Y, Reinhart K, Vincent JL. Has mortality from acute renal failure decreased? Asystematic review of the literature. Am J Med 2005; 118:827-32.
12. Liu KD, Chertow GM. Acute Renal Failure In: Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, Loscalzo J (eds). Harrıson's Principles of Internal Medicine.. USA. Mc Graw Hill Medical 2008:1752-61.
13. Jafferson JA, Thurman JM, Schrier RW. Pathophysiology and etiology of acute kidney injury. In: Floege J, Jonhson RJ, Feehally J (eds). Comprehensive Clinical Nephrology.. St. Louis, Misouri, USA. Elsevier 2010: 797-813
14. Singri N, Ahja SN, Levin ML. Acute renal failure. JAMA 2003; 289:747-51.
15. Selcuk NY, Odabaş AR, Cetinkaya R ,Tonbul HZ, San A. Frequency and outcome of patients with acute renal failure have more causes than one in etiology. Ren Fail 2000; 22:459-64.
16. Macedo E, Bouchard J, Mehta RL. Prevention and nondialytic management of acute kidney injury. In: Floege J, Jonhson RJ, Feehally J (eds). Comprehensive Clinical Nephrology.. St. Louis, Misouri, USA. Elsevier 2010: 830-43.
17. El-Reshaid K, Kapoor M, Johny KV, Sugathan TN. Acute renal failure in Kuwait- aprospective study. J Trop Med Hyg. 1993; 96:323-9.
18. Kohli HS, Bhaskaran MC, Muthukumar T, Thennarasu K, Sud K, Jha V, Gupta KL,Sakhuja V. Treatment-related acute renal failure in the elderly: a hospital-based prospective study. Nephrol Dial Transplant. 2000 ;15:212-7.
19. Rabbani MA, Habib HB, Siddiqui BK, Tahir MH, Ahmad B, Murtaza G, Maria Q,Ahmad A. Etiology of acute renal failure in a tertiary center. Saudi J Kidney DisTranspl. 2008 ;19:1009-14.
20. Wang Y, Cui Z, Fan M. Retrospective analysis on Chinese patients diagnosed with acute renal failure hospitalized during the last decade (1994-2003). Am J Nephrol. 2005 ;25:514-9.

21. Biesenbach G, Janko O, Schmekal B. Etiology and prognosis of "internal medicine" acute renal failure in 1981-1990 and 1991-2000-an analysis of 510 cases in a single centerWien Med Wochenschr. 2003; 15

22. Selçuk NY, Odabas AR, Cetinkaya R, Tonbul HZ, San A. Frequency and outcome of patients with acute renal failure have more causes than one in etiology. Ren Fail. 2000; 22:459-64.

23. Zhang L, Wang M, Wang H. Acute renal failure in chronic kidney disease-clinical and pathological analysis of 104 cases. Clin Nephrol. 2005; 63:346-50.

24. Mahajan S, Tiwari S, Bhowmik D, Agarwal SK, Tiwari SC, Dash SC. Factors affecting the outcome of acute renal failure among the elderly population in India: a hospital based study. Int Urol Nephrol. 2006; 38:391-6.

25. Uyanık A. Akut Böbrek Yetmezliğinde Prognoza Etki Eden Faktörlerin Araştırılması. Uzmanlık Tezi. Atatürk Üniversitesi Tıp Fakültesi, Ġç Hastalıkları Anabilim Dalı, Nefroloji Bilim Dalı, 2010.