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INCIDENCE AND OUTCOME OF HOSPITAL ACQUIRED ACUTE KIDNEY (HAAKI) INJURY IN A TERTIARY CARE HOSPITAL

Nephrology

Rajath Govind* Asst Prof, General Medicne, AFMC, Pune – Primary *Corresponding Author

Sourya Sourabh Mohakuda Asst Prof, General Medicne, AFMC, Pune

T Murari Assoc Prof, General Medicne, AFMC, Pune

ABSTRACT

INTRODUCTION: Acute kidney injury (AKI) is common in patients admitted to a hospital. Various studies report the incidence of hospital acquired acute kidney injury (HAAKI) from 2-7 %. The reported mortality rate ranges from 25 % to 70 %. This study aimed to study the incidence and outcome of HAAKI in a tertiary care hospital in north India.

MATERIALS & METHODS: This prospective single centre based hospital observational study was conducted for 18 months at a tertiary care centre. HAAKI was defined as the development of AKI any time after 24 h of hospitalization, in a patient who was admitted with normal renal function. Serum creatinine (SCr) and urine output were monitored daily and at the end of 30 days. Renal replacement therapy (RRT) was instituted according to standard clinical indications. The outcome of the patients as well as renal outcome was ascertained at 30 days after optimal management. Appropriate statistical methods were used to analyze the data.

RESULTS: A total 8159 new patients were admitted in acute wards and ICU during the study period, out of which 102 patients were diagnosed with HAAKI with incidence of 1.25 %. Oliguria in 20 patients (19.6%)was less common than non-oliguric subset. However, they were found to have worse AKIN stage than non-oliguric patients with 15 out of 20 patients in AKIN stage 3. Mortality rates were also higher in this subset with 16 out of 20 patients having fatal outcome. Further, the patients who had oliguria were more likely to need RRT when compared to non-oliguric patients. (19 out of 20, p< 0.001). Sepsis was the most common cause accounting for 52.43% of patients with HAAKI.Complete renal recovery at 30 days was found in 42 (41.17%) patients, Partial renal recovery in 44 (43.13%) and no renal recovery in 11 (10.7%). Among the 102 patients with HAAKI, 23 required RRT (22.5%).The mortality rate for HAAKI in our study was39.21%. (40/102).

CONCLUSIONS HOSPITAL: acquired acute kidney injury is a relatively common and serious occurrence that is associated with increased mortality and resource consumption. Oliguric AKI is less common than non-oliguric AKI, but is significantly associated with increased severity of AKI, increased requirement of RRT during the course of illness and poor patient as well as renal outcome.

KEYWORDS

INTRODUCTION

Acute kidney injury (AKI)is common in patients admitted to a hospital with various critical medical and surgical illnesses. To date, there is a paucity of data on the incidence of AKI, whether it be community or hospital-acquired. Various studies report the incidence of HAAKI from 2-7%.As new era with renal safe drugs and reagents are becoming available along with expert care, there is a need to study current pattern of important causes and their relative role in acquisition of AKI in hospitalised patients. This prospective observational study aimed to study the incidence and outcome of hospital acquired acute kidney injury (HAAKI) in a tertiary care hospital in north India.

MATERIALS & METHODS

Thiswas a prospective single centre based hospital observational study. The study period was from 01 Oct 2013 to 31 Mar 2015. All patients above the age of 18 yrs and having normal creatinine on admission(defined as<1.3 mg/dl (Lab reference range) and urine output >0.5 ml/kg/h were included in the study.Chronic kidney disease(CKD) with stable renal function (compared to earlier value) on admission were also included.HAAKI was defined as the development of AKI any time after 24 h of hospitalization, in a patient who was admitted with normal renal function. It was presumed that the patient had normal renal function on admission if the serum creatinine (SCr) at admission was <1.3 mg/dl or urine output was >0.5 ml/kg/h.

Age < 18 yrs, CKD patients on dialysis, Community acquired AKI: defined as renal failure developing outside the hospital and diagnosed within 24 hrs of hospital admission and post renal transplant recepients were excluded from the study.

To classify patients into one of the RIFLE criteria and AKIN criteria, peak and baseline (at the time of admission) creatinine values were noted from the patient case sheet. The peak creatinine was defined as the highest serum creatinine level during hospital admission.The patients were evaluated for the immediate cause/ causes of AKI, and were then divided into RIFLE R, I and F categories as well as Acute kidney injury network(AKIN) stage 1, 2 and 3.All patients were subjected to detailed clinical history and examination. The investigations included baseline and in-hospital Serum Creatinine and urine output levels. The Serum Creatinine values of patients admitted to ICU and acute wards were monitored daily and once in three days respectively. The patients were classified into appropriate RIFLE and AKIN classes at the time of diagnosis. Patients were followed-up daily up to30 days either in the hospital or after discharge. Serial records of urine output and serum creatinine were maintained.

Renal replacement therapy(RRT) was instituted according to standard clinical indications. The outcome of the patients as well as renal outcome was ascertained at 30 days after optimal management. The control population consisted of 40 patients with normal renal functions admitted to the ICU and acute wards during the period of study.

The SPSS-16 software was used to statistically analyze the results. Pearson's Chi Square Test was used to compare the statistical significance of the outcome due to each major etiology with the other group. Multivariate logistic regression was used to determine the combination of factors deciding the outcome of HAAKI.

RESULTS

Out of the total 102 patients, 78 were males and 24 were females.77.4% patients of HAAKI received RRT.

Oliguria and AKIN classification

		Count			
		AKIN			Total
		AKIN1	AKIN2	AKIN3	
Oliguria	Non oliguric	76	2	4	82
	Oliguric	2	3	15	20
Total		78	5	19	102

Pearson Chi-square value = 61.99, p-value <0.001

OLIGURIA AND AKIN CLASSIFICATION

Oliguric patients were more likely to have a worse AKIN or RIFLE classification as compared to patients who were non oliguric. This correlation was found to be statistically significant (P value < 0.001 for both RIFLE as well as AKIN)

Oliguria and Patient outcome				
		Count		
		Patient outcome		Total
		Survived	Death	
Oliguria	Non oliguric	53	24	77
	Oliguric	4	16	20
Total		57	40	97

Pearson Chi-square value = 15.62 , p-value <0.001

OLIGURIA AND PATIENT OUTCOME

Out of the 20 patients who had oliguria, 16 succumbed to their illness. Oliguric patients had a poor overall outcome when compared with patients who did not have oliguria. This correlation was statistically significant (P value < 0.001).

Oliguria and Renal outcome						
		Renal outcome				Total
		Complete recovery	Partial recovery	No recovery	Lost to follow up	
Oliguria	Non oliguric	42	34	1	5	82
	Oliguric	0	10	10	0	20
Total		42	44	11	5	102

Pearson Chi-square value = 47.21 , p-value <0.001

OLIGURIA AND RENAL OUTCOME

Oliguric patients were likely to have a poor recovery of renal function. In this study, none of the oliguric patients had complete renal recovery. This relationship was statistically significant (P value < 0.001)

Etiology and AKIN Classification					
		AKIN			Total
		AKIN1	AKIN2	AKIN3	
Etiology	Pre-renal	8	0	0	8
	Sepsis	40	3	12	55
	Contrast nephropathy	15	0	5	20
	Drug induced	15	2	2	19
Total		78	5	19	102

Table 26: **Pearson Chi-square value = 6.23 , p-value = 0.398**

ETIOLOGY AND AKIN CLASSIFICATION

It was observed that sepsis was the most common cause of AKI amongst our patients accounting for 52.43% of patients who had AKI as per RIFLE criteria and 53.92% in patients who had AKI as per AKIN criteria. Statistically,no particular etiology individually predisposed the patient to a higher RIFLE or AKIN classification (p value = 0.45 and 0.39 for RIFLE and AKIN respectively).

		Group		Total	Pearson Chi-Square	P-value
		Case	Control			
Sex	Female	24	10	34	0.034	0.853
	Male	78	30	108		
Total		102	40	142		
Age	19-45 Yrs	5	3	8	3.24	0.518
	46-55 Yrs	24	8	32		
	56-65 Yrs	28	7	35		
	66-75 Yrs	30	17	47		
	>75 Yrs	15	5	20		
Total		102	40	142		
Patient outcome	Survived	57	30	87	5.32	0.69
	Death	40	10	50		
	Lost to follow up	5	0	5		
Total		102	40	142		

Case control comparison when matched with Age sex,comorb idities and outcome.

DISCUSSION

This was a prospective single centre hospital based observational study. A cohort of 8159 new patients was admitted in the acute wards and ICU during the study period of 18 months from 01 Oct 2013 to 31 Mar 2015. One hundred and two patients were diagnosed with AKI as per the inclusion criteria and definition of AKI and HAAKI.

The incidence of HAAKI in our patients was found to be 1.25 % of all admissions in ICU and acute wards during the study period. Various other studies report the incidence of HAAKI from 2-7%[1]. Data from the Intensive Care National Audit Research Centre (ICNARC) UK suggests that AKI accounts for nearly 10% of all ICU bed days. The wide variation in the incidence of HAAKI across various centers may be due to the different definitions of AKI/HAAKI.

A total of 20 patients (19.6%) amongst all our patients were oliguric, defined by AKIN and RIFLE criteria. After the patients were classified into AKIN and RIFLE categories, it was observed that oliguric patients were more likely to have a worse AKIN or RIFLE stage as compared to patients who were non-oliguric. This correlation was found to be statistically significant (p< 0.001 for both RIFLE as well as AKIN). Further, the patients who had oliguria were more likely to need RRT when compared to non-oliguric patients. (p< 0.001).

In our study, AKI was diagnosed in 20 patients (19.2%) using the urine output criteria. This means, that the rest of the patients developing AKI by serum creatinine criteria were non-oliguric. Studies on AKI by Cruz et al and Macedo et al have shown, that addition of the urine output criteria (oliguria ≥6 hours) to serum creatinine criteria can improve the ability to predict mortality -, but that urine output criteria alone show a lower predictive ability than serum creatinine . Our findings are broadly in agreement with this observation.

Thus, it is evident that although GFR in AKI may be significantly lower, oliguria may not manifest. Therefore, a decline in GFR translating to sustained oliguria is a late and not early indicator of AKI. Moreover, this relation may be frequently distorted by the administration of large amounts of intravenous fluids, diuretics, vasopressor drugs, or any combination of these. Conversely, oliguria can reflect salt and water retention as a normal renal response to a mild or moderate degree of hypovolemia or hypotension.

Our study had categorised the patients into four predefined etiological factors (Sepsis, prerenal, nephrotoxic drugs and radio-contrast agent induced AKI) based on prevalent causes and for the ease of analysis. Clinical judgment was used in placing each patient to the most probable etiology. Uchino et al have used such predefined classification in the BEST (Beginning and Ending Supportive Therapy for the Kidney) study.

Sepsis was the most common cause of AKI amongst our patients accounting for 52.43% of patients who had AKI as per RIFLE criteria and 53.92% in patients who had AKI as per AKIN criteria. However, it was observed that the etiology did not significantly predispose the patient to a higher RIFLE or AKIN classification (p = 0.45 and 0.39 for RIFLE and AKIN respectively) neither did it influence the requirement of RRT (p= 0.149). Sepsis accounted for majority of fatalities amongst our patients (27 out of 97 patients). This relation was not statistically significant (p = 0.145)using the Pearson's chi square test, but the multivariate logistic regression model which compared age, gender, number of comorbidities and etiology with patient outcome, found that age and etiologyare the main factors, which contribute to patient outcome significantly.

A number of studies have attempted to determine the etiology of AKI in hospital wards. A large prospective study by Nash *et al*. is one of the few studies where the researchers found that the most common causes and mechanisms of AKI, in decreasing order of frequency, were decreased renal perfusion (including volume depletion, hypotension, and/or congestive heart failure), medications, radiographic contrast media, postoperative factors, sepsis, transplantation-related factors (liver and heart), obstruction, and hepatorenal syndrome. In 2003, Tariq Ali *et al* studied that for AKI, sepsis was the most frequent precipitating factor (47%) followed by hypovolemia (32%) .

With respect to renal recovery, as assessed at the end of 30 days, complete recovery was found in 42 out of 102 patients (41.17%), Partial recovery in 44 out of 102 patients (43.13%) and no recovery in 11 out of 102 patients (10.7%). 23 out of 102(2.5%) of our patients diagnosed with HAAKI required RRT.The Acute Dialysis Quality Initiative (ADQI) Working Group proposed an operational definition

for classification of kidney recovery associated with AKI based largely on persisting changes to SCr or ongoing need for RRT. A minimum follow-up period of 90 days has been suggested to ascertain kidney outcomes following an episode of AKI . Whether this is the most stable definition remains uncertain.Our study has used similar definitions, but has chosen 30 days as time frame for assessment of renal recovery for the ease of follow up.For those survivors still receiving dialysis at 90 days, the probability of further recovery allowing them to wean from dialysis is less likely. The challenge still remains in developing an acceptable definition and timeframe for determining partial recovery. At some point, these patients will transition between a state of "recovering" to being classified as having CKD.

The mortality rate for HAAKI in our study was39.21%. (n=40). The reported rate of mortality of HAAKI ranges from 25% to 70% . Our resultsreaffirm the association of acute kidney injury with increased hospital mortality. As our hospital is a tertiary center, we admit more sick patients who may have contributed to the highermortality rate, which is comparable to the figures by other workers reported in literature.

Strengths of our analysis include the use of a large, diverse, and mixed patient population with a wide range of comorbidities, complete outcome ascertainment and sufficient time period of study. Limitationof the study was that many patients had more than one factor causing HAAKI, but they were placed into various pre defined sub groups, which may have altered their contribution as a risk factor to HAAKI.

CONCLUSIONS

Hospital-acquired acute kidney injury is a relatively common and serious occurrence that is associated with increased mortality and resource consumption. In our study we found an incidence of 1.25% of HAAKI among new admissions to ICU and acute wards during the study period of eighteen months.Patients who developed AKI during the course of their illness have a higher mortality as compared to age, gender and etiology matched patients who do not have AKI.Oliguric AKI is less common than non-oliguric AKI, but is significantly associated with increased severity of AKI, increased requirement of RRT during the course of illness and poor patient as well as renal outcome.

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