



Reconsidering the Trends In Sepsis Induced Acute Kidney Injury In An Indian Tertiary Care Hospital

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Background: Sepsis is due to inflammatory response to infection which is characterized by end-organ injury distant which is away from the primary site of infection as in case of Acute Kidney Injury (AKI).

Materials and Methods: A prospective observational study was done in the Departments of Medicine in a north Indian tertiary care hospital between 1st February, 2013 and 31st January, 2014 in patient admitted to Intensive Care Unit (ICU), with diagnosed sepsis. Sequential Organ Failure Assessment (SOFA) score and RIFLE (Risk, Injury, Failure, Loss of kidney function, and End-stage kidney disease) was calculated in all patients at the time of ICU admission. The data collected on kidney function included blood urea, serum creatinine and urine output.

Results: Presenting symptoms was fever in 156 (65%), dyspnoea in 128 (53.3%) and cough in 75 (31.3%). Suspected case on infection were 117 (48.8%) respiratory, 40 (16.6%) GIT, 13 (5.4%) skin & soft tissue, 10 (4.2%) urogenital system and 4 (1.7%) CNS. Based on SOFA score, 64.4%, 95.2% and 100% developed AKI between the score of 0 to 9, 10 to 15 and > 15 respectively. Based on RIFLE classification, 29 (16.7%), 38 (21.8%) and 107 (61.5%) were in the 'Risk', 'Injury' and 'Failure' category respectively. In this study, 1(3.4%), 9 (23.7%) and 28 (26.1%) out of 29, 28 and 107 were in the class of 'Risk', 'Injury' and 'Failure' respectively. In this study, 6 (20.7%), 14 (36.8%) and 35 (32.7%) out 29, 38 and 35 belong to AKI of 'Risk', 'Injury' and 'Failure' group.

Conclusion: This study, conducted on critically ill Indian patients at a tertiary care referral hospital demonstrates a high incidence of septic AKI. Higher SOFA scores on admission were associated with an increased risk of developing AKI.

Keywords: Current Trend, Sepsis, Acute Kidney Injury, Tertiary Care Hospital

Introduction

Sepsis is a major health problem affecting millions of individuals around the world each year. Over the last twenty years, the incidence of sepsis has increased greatly. In the United States alone, the number of cases of sepsis exceeds 700000 patients annually (1). Mortality due to sepsis is more than 200,000 deaths each year in the United States alone (2). Indian

studies have found the incidence of Systemic Inflammatory Response Syndrome (SIRS) without organ dysfunction to be 51.6% and SIRS with organ dysfunction to be 17.1%, of which 76.5% were due to sepsis (3).

The kidneys are commonly affected organs in sepsis. Up to 32.4% of all patients with sepsis have been shown to develop septic Acute Kidney Injury (AKI)

(4). Sepsis may lead to intra renal hemodynamic changes, endothelial dysfunction, infiltration of inflammatory cells into the renal parenchyma and intra glomerular thrombosis and obstruction of tubules with necrotic cells and debris, all of which contribute to the development of AKI (5). Septic AKI is associated with a significantly higher mortality, increased patient morbidity, multi-organ dysfunction and an increased length of stay in the intensive care unit (5,6).

The RIFLE classification, (Risk of renal failure, Injury to the kidney, Failure of kidney function, Loss of kidney function and End-stage kidney disease), an international consensus classification for acute kidney injury is a simple, readily available tool to classify AKI and is a good outcome predictor, with progressive increase in mortality with worsening RIFLE class (6).

In the Indian population, although AKI had been studied, few studies have focussed on septic AKI particularly. Our study sought to identify and classify septic AKI among critically ill patients and to assess the morbidity and mortality associated with the same,

Materials And Methods

This study was a prospective observational study done in the Department of Medicine at Christian Medical College and Hospital (CMCH) Ludhiana. Institutional Ethics Committee approval was obtained before conducting the study with reference number CMC/3092 dated 5th August 2020. Informed consent was obtained from the patients.

All patients admitted to the Intensive Care Unit (ICU) over a period of 1 year, with a diagnosis of sepsis were included in the study. The standard demographic, clinical and physiological data was collected. The presenting symptoms, comorbid conditions and relevant investigations including cultures and imaging to determine the source of sepsis were noted. Severity of illness was assessed using the Sequential Organ Failure Assessment (SOFA) score, which was calculated in all patients at the time of ICU admission.

Sepsis was diagnosed when, in a patient with suspected infection, two systemic inflammatory response syndrome (SIRS) criteria (temperature >38.3 or $<35.6^{\circ}\text{C}$, heart rate >90 beats per minute,

respiratory rate >20 per minute, or white blood cell count $>12.0 \times 10^3$ or $<4.0 \times 10^3$) were present.

The presence of AKI was assessed for within the first 24 hours after admission and thereafter on a daily basis. AKI was classified according to the RIFLE classification. Baseline serum creatinine values were estimated using the Modification of Diet in Renal Disease (MDRD) equation, as recommended by the Acute Dialysis Quality Initiative (ADQI) Working Group. The lowest creatinine value among the all the hospital admission creatinine values was taken as the baseline value. At the onset of AKI, patients were assigned to their worst RIFLE category according to either serum creatinine or urine output criteria. These patients were followed up till discharge and their clinical course and outcome followed as in the protocol. The need for haemodialysis and final outcome was also noted.

Statistical analysis: The data collected was entered on an excel spread sheet and analysed using the students T test and the Chi Square test. Categorical variables are described as percentage.

Results

A total of 240 patients were admitted with a diagnosis of sepsis during the study period. The baseline demographic characteristics of the study population were as seen in Table 1. The common presenting symptoms were fever in 156 (65%) patients, dyspnoea in 128 (53.3%) patients and cough in 75 (31.3%) patients (Table 2). SOFA score on admission was > 15 in 1 patient and scores between 10 to 15 were seen in 62 patients (Table 3).

The primary suspected source of infection was the respiratory system in 117 (48.8%) patients, GIT in 40 (16.6%) patients, skin & soft tissue in 13 (5.4%) patients, the urogenital system in 10 (4.2%) patients and CNS in 4 (1.7%) patients (Figure 1). The overall incidence of Acute kidney injury (AKI) amongst the 240 patients, as defined by the RIFLE criteria was 72.5% ie 174 patients. The incidence of AKI was 80.5% (95/118 patients) in the 51-75 year age group; 66.2% (49/74 patients) in the 26-50 year age group, 64% (16/25 patients) in the > 75 year age group and 60.8% (14/23 patients) in the < 25 year age group (Table 4). According to gender, the incidence of AKI was 70.3% (111/158 patients) among males and 74.4% (61/82 patients) among females. Amongst

patients with SOFA score between 0 to 9, 64.4% developed AKI. Amongst those with a score between 10 to 15, 95.2% developed AKI and amongst those with a score > 15, all 100% developed AKI (Table 5).

According to the RIFLE classification; 29 (16.7%) patients were in the 'Risk' category, 38 (21.8%) patients in the 'Injury' category and 107 (61.5%) patients in the 'Failure' category. The requirement

for renal replacement therapy in the form of haemodialysis was seen in 1/29 (3.4%) patients in the 'Risk' class, 9/38 (23.7%) patients in the 'Injury' class and 28/107 (26.1%) patients in the 'Failure' class. Mortality was 20.7% (6/29 patients) in the AKI-Risk class, 36.8% i.e. 14/38 (36.8%) patients in the AKI-Injury group and 32.7% i.e. 35/107 in the AKI- Failure group (Table 6).

TABLE 1: Demographic characteristics

Age (years)	Number of patients	%
0-25	23	9.6
26-50	74	30.8
51-75	118	49.2
>75	25	10.4
Gender		
Males	158	65.8
Females	82	34.2
Co morbidities		
Ischaemic heart disease	23	9.6
Type 2 Diabetes mellitus	54	22.5
Systemic hypertension	56	23.3
COPD	18	7.5
Alcohol Consumption	27	11.3
Smoking	17	7.1
Others*	31	12.9

*Others include Hypothyroidism, Rheumatoid Arthritis, Vasculitis, Interstitial Lung Disease, Chronic Rheumatic Valvular Heart Disease, Bronchial Asthma, Hepatitis B and C Infections.

TABLE 2: Common presenting symptoms

Symptom	Number of patients	%
Fever	156	65.0
Dyspnoea	128	53.3
Cough	75	31.3
Diarrhoea	15	6.3
Dysuria	11	4.6
Abdominal Pain	54	22.5

Altered Sensorium	45	18.8
Others *	23	9.6

*Others include hemiparesis, paraparesis, headache, back pain, haematuria, pyuria and jaundice.

TABLE 3: SOFA Score

SOFA Score	Number of patients	%
0-9	177	73.6
10-15	62	25.8
>15	1	0.4

TABLE 4: Overall incidence of Acute kidney injury

Age	Number of patients with sepsis	Number of patients with sepsis and AKI	%
0-25 years	23	14	60.8
26- 50 years	74	49	66.2
51- 75 years	118	95	80.5
>75 years	25	16	64

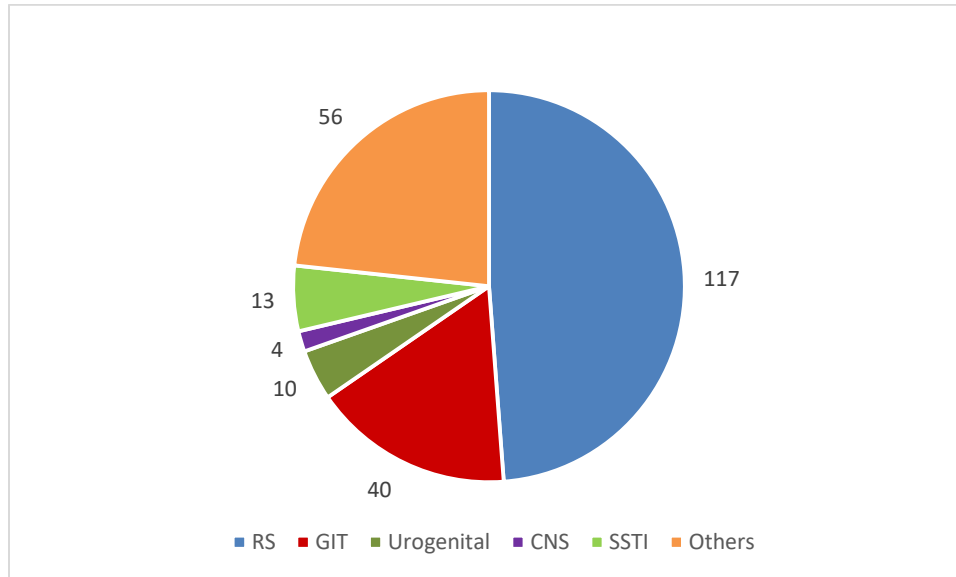
TABLE 5: SOFA score & Incidence of AKI

SOFA Score	Number of patients.	Number of patients with AKI.	%
0-9	177	114	64.4
10- 15	62	59	95.2
> 15	1	1	100

TABLE 6: Classification of AKI according to RIFLE class

	Number of patients	Dialyzed	Mortality
AKI (Includes all RIFLE classes)	174 (72.5%)	38 (21.8%)	55 (31.6%)
Risk	29 (16.7%)	1 (3.4%)	6 (20.7%)
Injury	38 (21.8%)	9 (23.7%)	14 (36.8%)
Failure	107 (61.5%)	28 (26.2%)	35 (32.7%)

FIGURE 1: Primary suspected source of infection



Discussion

Sepsis and its complications are common causes of concern among all critically ill patients and ICU patients the world over. The Beginning and Ending Supportive Therapy (BEST) kidney investigators highlighted in their study that sepsis was the most common cause of AKI in critically ill patients, with 47.5% of the septic patients developing AKI (7).

An Indian study by Sural et al, showed a high incidence of septic AKI with 80% of the critically ill septic patients developing AKI (8). In our study, the incidence of Acute kidney injury (AKI) was 72.5% I.e. 174 patients (9).

Baghshaw et al observed that among the patients with septic AKI, 38.5% of patients belonged to the Risk group, 38.8% to the Injury group and 22.7% to the Failure group (10). In an Indian study by Gurjar *et.al*, it was noted that among the patients with septic AKI, 24% were in Risk, 34% in Injury and 42% were in Failure (9). Our study had 16.7% patients in the ‘Risk’ category, 21.8% in the ‘Injury’ category and 61.5% in the ‘Failure’ category. The need for hemodialysis was noted in 38/174 (21.8%) patients with AKI, one patient i.e. 1/29 (3.4%) from the Risk group, 9/38 (23.7%) patients from the Injury group and 28/107 (26.1%) from the Failure group. The overall mortality was 30.6%. Mortality was 20.7% in the Risk group, 36.8% in the Injury group and 32.7% in the Failure group

The need for haemodialysis and the mortality was noted to be higher in the RIFLE Injury and Failure classes as compared to those in the Risk class. However, between the Injury and Failure classes there was no significant difference in mortality or morbidity; as measured by the need for dialysis. However, our study does not have any follow up data on patients after discharge from the ICU especially with respect to long term improvements in renal function or dialysis dependency.

This study, conducted on critically ill Indian patients at a tertiary care referral hospital demonstrates a high incidence of septic AKI. Higher SOFA scores on admission were associated with an increased risk of developing AKI. Identification of patients in early Risk class of AKI can help in maintaining good vigil towards preventing further worsening of renal failure. Once the patient has gone into the Injury class, the prognosis and mortality is similar to the Failure class patients. Hence it is quintessential to identify these patients while they are at ‘Risk’, in order to try and prevent the progression to ‘Injury’ and ‘Failure’ classes.

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