Brief Communication

Patterns of AKI Patients Requiring Sustained Low Efficiency Dialysis (SLED) Admitted in an ICU of Bangladesh

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Abstract

Background: Acute kidney injury (AKI) is a common and serious complication among patients admitted in intensive care units (ICUs). The incidence, cause, severity and outcome of AKI in Bangladeshi ICUs is largely unknown. The aim of this study was to find out the cause of AKI among the hemodynamically unstable patients requiring SLED admitted to the ICU of BIRDEM Hospital, Dhaka, Bangladesh.

Methods: All critically ill patients of AKI admitted to the 10 bed mixed adult ICU over a period of a year were studied prospectively if they needed SLED. Standard demographic, physiologic and clinical data were collected. Severity of illness was assessed using acute physiology and chronic health evaluation (APACHE) II score. Diagnosis of AKI was based on Acute Kidney Injury Network (AKIN) criteria.

Results: 43 hemodynamically unstable patients with AKI were studied. Mean age of the patients were 60.12 ± 14.57 with 67.4% male patients. 35% patients had de novo AKI where as 65% had acute on chronic renal failure. There was high prevalence of DM (72.1%) and HTN (60.5%) among study patients. Septic shock (48.83%) and cardiac cause including acute myocardial infarction and/or cardiogenic shock (46.51%) were the two commonest causes of AKI in our ICU.

Conclusion: Higher age, pre-existing chronic renal impairment, DM and HTN were associated with AKI with hemodynamic instability requiring SLED. Sepsis is the commonest cause of AKI followed by cardiac causes. As expected, sicker patients with high APACHE II score were more likely to develop AKI. However, a larger scale study should be done including all hemodynamically unstable AKI patients admitted in different ICUs of Bangladesh.

Key words: AKI, ICU, SLED

Introduction

Acute Kidney Injury (AKI) is a common clinical syndrome with a broad etiological profile. It complicates about 5% of hospital admissions & 30% of admissions to Intensive Care Units.[1] The variability of incidence of AKI and mortality depends on the type of ICU, study population, the period during which the study is conducted, and the criteria used to define AKI.[2] There have been many studies about the epidemiology and risk factors of AKI in critically ill patients in the different regions of the world. However, data on the aetiology, management practices and outcome in patients with hemodynamically unstable AKI admitted to ICUs in Bangladesh has not been studied in depth.

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The aim of the present study was to assess the patterns of critically ill patients who developed AKI and required SLED as renal replacement therapy (RRT) in an ICU of an academic hospital of the capital of Bangladesh.

Materials and Methods

This was a prospective observational study in 10 bed adult ICU of BIRDEM General Hospital, Dhaka, Bangladesh over one year period from 1st June 2012 to 31st May 2013 . Study protocol had been approved by the ethical review committee of the hospital. Before study, informed written consent was obtained from individual patient or his/her legal guardian. All patients with AKI admitted to this ICU were screened for inclusion criteria. AKI was defined as an abrupt (within 48 hours) reduction in kidney function (absolute increase in serum creatinine of ≥0.3 mg/dl, percentage increase in serum creatinine of ≥50%, or urine output <0.5 ml/kg/hr for >6 hours).[3] Patients were included if they required SLED as RRT due to hemodynamic instability. We excluded patients if they had a) pre-admission end stage renal disease (ESRD), or chronic kidney disease (CKD) stage IV or V according to Kidney Disease Outcome Quality Initiative (KDOQI)[4], b) renal transplant where chronic allograft rejection could not be excluded, c) consent denial.

On admission into ICU the baseline data of patients (e.g.; age, gender, basic disease and previous documented serum creatinine level), Glasgow coma score (GCS) and vitals were recorded on a data collection form. The data sheet also documented complete blood count (CBC), hematocrit (Hct),

ECG, Chest X-ray, Troponin I, prothrombin time (PT), activated partial thromboplastin time (aPTT), Urine R/M/E, blood urea, serum creatinine, serum electrolytes, arterial blood gas (ABG), and other imaging studies as needed .

Patients were treated with SLED with hemodialysis machine (Dialog+ manufactured by B. Braun Avitum AG) with blood flow 100-150 ml/min and dialysate flow 300 ml/min for 6 to 8 hours in every alternate day.

All data were collected using a structured datasheet from the patients' preadmission and current ICU records. Collected data were presented as mean values ± SD, or percentage (%).

Results

Total 43 hemodynamically unstable patients of ICU with AKI were treated with SLED. Table I demonstrates the baseline variables of the study patients. Most of the patients (90.69%) were above 40 years of age (Fig 1).

Table I: Baseline variables of the study population

Variable	Value	Range
Age (years)	60.12 ± 14.57	22 to 90
Male gender (%)	29 (67.4%)	---
APACHE II	26.88 ± 6.25	13 to 38
Mean arterial pressure (mmHg)	80.58 ± 10.92	---
Vasopressor/inotrope support (%)	30 (69.8%)	---
Mechanical ventilator support (%)	25 (58.1%)	---

Number of patients
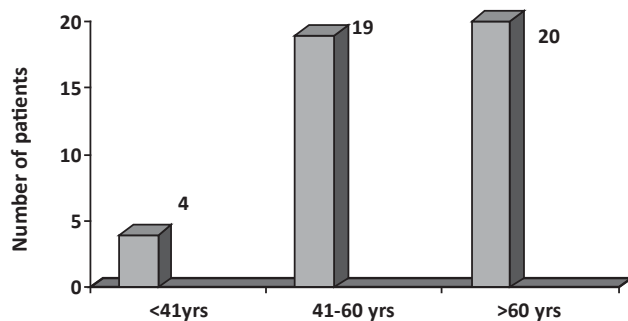
Fig 1: Bar chart showing age distribution of the patients

Fifteen (35%) patients did not have any history of previous renal disease, whereas twenty eight (65%) had chronic kidney disease (CKD stage 1 to 3). 31(72.1%) out of 43 patients were suffering from Diabetes Mellitus (DM). 26 (60.5%) patients had H/O hypertension (HTN) before ICU admission and were on anti-hypertensive medications. 11 (25.6%) patients had diagnoses of ischemic heart disease (IHD) prior to hospital admission as evidenced by their medication history or documentation in their old records.

Most patients had more than one diagnosis during their admission in ICU. The most common diagnosis was pneumonia followed by AMI. Though all patients had been

suffering from AKI, only 7 patients were diagnosed AKI alone on admission. Table II shows the primary diagnosis of the study patients at the time of admission. Other causes♦ included CLD, SLE, Leptospirosis, Severe Hyponatremia and Septic Arthritis.

Table II: Primary diagnoses during admission in ICU*

Diagnosis	Number of patients
Pneumonia	20
Acute myocardial infarction (AMI)	18
AKI	7
Cerebrovascular disease (CVD)	3
Others♦	5

*Multiple responses were elicited

21 (48.83%) patients had septic shock, 20 (46.51%) patients had cardiac causes (AMI and/or cardiogenic shock), and 2 (4.65%) patients had hypotension (neither septic nor cardiac) as cause of AKI in the hemodynamically unstable study patients. Pneumonia was the source of septic shock as 20 out of 21 septic patients were suffering from it. The remaining patient had septic arthritis which was the source of septic shock. Of the two patients who suffered from hypotension, one was found to have hypovolemia; and the other had hepato-renal syndrome as cause of hypotension.

Discussions:

AKI is a common and a serious complication among patients admitted to ICUs. The incidence of AKI in the ICU has increased worldwide during the past decade due to increased recognition.[5] Early epidemiology studies were confounded by erratic definition of AKI until recent consensus guidelines (RIFLE and AKIN) which standardized its definition.[3] Clinical studies[5] assessing the exact incidence of AKI in the ICU proved sparse and were often complicated by differing criteria for the diagnosis of AKI. This paper discussed the patterns of AKI in the critically ill hemodynamically unstable patients of an ICU who required SLED.

Mean age of the AKI patients admitted in ICU was 58 yrs in a study by Marshall,[6] 60 ± 15 yrs in study by Carvalho,[7] and 60 ± 14 yrs in our study. Epidemiologic studies have shown an increased incidence of AKI in men as compared with women. Men constituted 59% to 64% of cases of severe AKI among critically ill patients.[8] Our study also had male preponderance (67.4%).

In our study, DM was the commonest (72.1%) comorbidity, with Hypertension and IHD present in 60.5% and 25.6% patients respectively. Fifteen (35%) out of 43 patients did not have any history of previous renal disease, whereas twenty eight (65%) had chronic renal impairment (CKD stage 1 to 3) with a baseline serum creatinine value >1.4mg/dl. In the study conducted by Carvalho,[7] the most prevalent comorbid disease was HTN, and proportion of CKD patients was lower (48.8%) than our study. This difference may be explained by the fact

that we did this study in a tertiary care hospital specialized for DM. 72.1% of our patients were diabetic and 60.5% were hypertensive. Both these two comorbidities are independent risk factors for developing nephropathy.[9]

Acute tubular necrosis (ATN) is the most common cause of AKI in hospital setting.[10] But the aetiology of ATN differs in critical care and non-critical care settings. ATN due to sepsis is generally regarded as the most common cause of AKI in ICU, where as hypotension and nephrotoxins are the cause of AKI in non-ICU setting of hospital.[10] It is frequently not possible to isolate a single cause of AKI in critically ill patients. In the BEST Kidney study,[10] causes of AKI were septic shock (47.5%) followed by major surgery (34.3%) and cardiogenic shock (26.9%). After sepsis, AKI is common with cardiac surgery, trauma, low cardiac output, hypovolemia and medications in patients of general ICU.[11] In our study, 21 patients (48.8%) developed AKI due to sepsis. The second commonest cause of AKI in our study was cardiogenic (46.51%). But we did not have any post-surgical patients with AKI.

Severe sepsis, often complicated by renal hypoperfusion in septic shock, is characterized by a profound inflammatory milieu and associated dysfunction of multiple organ systems. Several studies[12] showed that incidence of AKI in patients with sepsis was 42.9%, and in those with severe sepsis and septic shock was 62.9% and 65.6% respectively. In a study done by Carvalho,[7] 43 hemodynamically unstable ICU patients with AKI were treated with SLED due to hemodynamic instability. Sepsis was the major cause of ICU admission (n=27, 62.7%) of these AKI patients and ischemic ATN was the major mechanism of kidney injury (81.8%). But Kumar et al[13] studied 15 patients with AKI who needed SLED. He found that obstetric sepsis was the main cause (40%) of AKI followed by hypovolemia (33.3%), sepsis due to non-obstetric cause (13.3%) and falciparum malaria (13.3%). This difference may be explained by the fact that 75% patients in his study were female patients who developed AKI in postpartum period. However, in other studies done on AKI patients requiring SLED by Kielstein[14] and Victoria,[15] sepsis were commonest cause (85%, and 48% respectively).

In a study done on 211 intensive care septic patients with AKI,[12] the major sites of infection involved the lung, biliary tract, intestines, blood, urinary tract, skin and soft tissue. The most common reasons for AKI requiring RRT in ICU patients in Austrian ICUs[5] were respiratory disease followed by sepsis and abdominal surgery. In other studies[12] of septic AKI, primary chest infections were the most commonly described in association with AKI. We also found similar result as 20 out of 21 septic patients had pneumonia as a source of sepsis.

Our study has several limitations. First, the sample size was small and we did not have any surgical patients. Second, this observational study was carried out in one ICU which represents a small segment of whole country. Third, the study hospital is predominately diabetic hospital. So, there was higher number of diabetic patients in our study which has influenced the study result.

Conclusion:

AKI occurring in ICU is a dangerous complication,

irrespective of its aetiology. Our findings show that higher age, pre-existing chronic renal impairment, DM and HTN were associated with AKI. Sepsis is the commonest cause of AKI followed by cardiac causes like AMI and cardiogenic shock. As expected, sicker patients with high APACHE II score were more likely to develop AKI. However, a larger scale study should be done including all hemodynamically unstable AKI patients admitted in different ICUs of Bangladesh.

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