Characteristics and outcomes of acute kidney injury resulting in hospital admission in patients with solid tumor: Experience of a single center

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Abstract

Aim

To describe the characteristics and outcomes of acute kidney injury (AKI) resulting in hospital admission in cancer patients managed at a comprehensive cancer center.

Methods

This was a prospective observational study conducted between December 2011 and July 2012. Patients admitted to the solid tumor service were screened to identify those who met the criteria of AKI upon admission. The identified cases were reviewed by two clinicians to determine the cause of AKI and to determine if AKI was the major cause for admission. Patient demographics, past medical and medication history were recorded. In addition, we evaluated patients for resolution of AKI.

Results

During the study period, 103 cases were identified, 57.3% were males, mean age was 64 years±11.2 (SD), 24 patients (23.3%) have diabetes, and 55 patients (53.4%) have hypertension. The most common causes of AKI were dehydration, medications, and tumor–related, reported in 40 (38.8%), 34 (33%), and 23 (22.3%) of these cases respectively. The most common medications associated with AKI were chemotherapy (n=13, 42%), mainly cisplatin (76.9%), followed by non–steroidal anti–inflammatory drugs (n=12, 38.7%). Eleven patients (10.7%) progressed to chronic renal failure and three patients required hemodialysis. In the remaining cases, AKI resolved after a mean of 6.39 days±3.73(SD). Transfer to the intensive care unit was required for 4 patients and death was reported in 3 patients.

Conclusion

AKI in cancer patients was mostly due to dehydration, medications, and the tumor. Measures to reduce the incidence of AKI are necessary to prevent unnecessary admission and the potential for further complications.

Keywords

Acute kidney injury, admission, causes, drug–induced, outcomes

Introduction

Acute kidney injury (AKI) is a common and serious condition in cancer patients. The development of AKI may impact the outcomes of cancer patients when chemotherapy regimens are delayed or doses are reduced. In addition, AKI has been associated with increased hospital length of stay, complications, cost, and mortality.[1,2]

The causes of AKI in cancer patients include those that are typically seen in non–cancer patients, but also from other contributing factors that are unique to

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this patient population such as the chemotherapeutic regimens and the disease itself. Therefore, AKI is seen more often in cancer patients, compared to non–cancer patients. In addition, the increased survival of cancer patients, the treatment of older patients, the use of multiple chemotherapeutic regimens and new therapeutic options have resulted in an increase in the number of cancer patients with renal failure.[1]

Although several studies have described AKI in cancer patients, data is very limited regarding AKI that requires hospital admission. The purpose of this study was to describe the causes, characteristics and outcomes of AKI that require hospital admission in patients with solid tumors.

Methods

This was a prospective observational study conducted at King Hussein Cancer Center, a 170–bed comprehensive cancer teaching center, in Amman, Jordan. The hospital's solid tumor in–patient service consists of three teams, with an average of 15 patients per team.

Adult patients (≥18 years–old) who were admitted to the solid tumor service between December 2011 and July 2012 were evaluated within 48 hours from admission to identify those who have AKI upon presentation to the hospital. AKI was defined as the increase in serum creatinine (SCr) by 50% or an increase in serum creatinine of 0.3mg/dl from baseline, based on the Kidney Disease: Improving Global Outcomes (KDIGO) criteria and the Acute Kidney Injury Network (AKIN) criteria [3,4]. Patients who have a history of chronic renal failure but were not on dialysis and met the criteria of AKI were included.

Patients who met the criteria for AKI were evaluated by two clinicians to identify the cause of AKI and to determine if AKI is a major cause for admission. In the event that there was a disagreement in the assessment of the two clinicians, a third clinician was consulted. Patients were followed on a daily basis until resolution of AKI or until discharge, death, or transfer, whichever occurred first. Recovery of acute kidney injury was defined as return of serum creatinine to within 20% of baseline value.

Baseline characteristics, past medical history, as well as current and previous medications were assessed. Baseline serum creatinine, serum creatinine on admission, dates of the last chemotherapy regimens and the current medications were all recorded for all cases. The baseline serum creatinine was the most recent serum creatinine value recorded within 1 month of the event.

Statistical analysis

Descriptive statistics were utilized. Continuous data was reported as MEANS and SD and nominal data was reported as absolute numbers and percentages. Univariate and multivariate analyses were conducted to determine if there was an association between the hospital length of stay and the etiology of AKI.

Results

During the study period, 103 cases of AKI were admitted to the solid tumor service at King Hussein Cancer Center. The characteristics of the patients are outlined in Table 1. Hypertension and diabetes were reported in 53.7% and 23.3% of the patients, respectively. In addition, 20 (19.4%) patients have a history of chronic renal failure, as documented in the patients' medical records. The most common types of tumor were genitourinary and gastrointestinal.

There were several causes of AKI in the patients enrolled (Table 2). The most common cause was

Mean Age(years) ± SD	64.1 ± 11.2
Male, n(%)	59 (57.3)
Female, n(%)	44 (42.7)
Past medical history, n(%)	
Hypertension	55 (53.7)
Diabetes	24 (23.3)
Chronic renal failure	20 (19.4)
Others	48(46.6)
Primary cancer , n(%)	
Genitourinary	22 (21.4%)
Gastrointestinal	19 (18.4%)
Breast	12 (11.6%)
Gynecology	11 (10.6%)
Head and Neck	10 (9.7%)
Lymphoma	10 (9.7%)
Multiple myeloma	7 (6.8%)
others	12 (11.6%)

Table 1: Characteristics of patients with AKI resulting in hospital admission

Causes	Number of patients	Percentage of patients
Dehydration	40	38.8
Drug induced kidney injury	31	30
Tumor related causes	23	22.3
Urosepsis	5	4.9
Contrast	3	2.9
Herbs	1	1

Table 2: Causes of Acute Kidney Injury

dehydration, which accounted for 40 cases (38.8%), and was secondary to decreased oral intake, diarrhea and vomiting. Drug–induced kidney injury was reported in 31 cases (30%), while tumor–related causes, such as tumor obstruction, were the result of 23 (22.3%) of the cases.

The most common medications associated with AKI were chemotherapy (n=13, 42%), which were mainly related to cisplatin, reported in 10 cases (76.9%). The cisplatin doses for patients who developed cisplatin–associated AKI ranged between 75 mg/m2 to 100 mg /m^2. Non–steroidal anti–inflammatory drugs were associated with 12 cases (38.7%). Other medications include, zolindronic acid and ketoconazole.

Recovery of AKI was observed in 87 cases (85.3%), 58.6 % of them were males, while the remaining were females. The mean time of hospital stay until recovery was 6.39 ±3.73(SD), There was no association between the duration of hospital stay and the etiology of AKI. Three patients (2.9%) required hemodialysis, eight patients (7.8%) progressed to chronic renal failure, and 4 patients (3.9%) were transferred to the ICU.

Discussion

AKI is common in patients with cancer and may result in serious complications. In this study, we describe the causes, characteristics and outcomes of AKI that required hospital admission in a population of patients with solid tumors. To our knowledge, there

were no studies that have specifically described AKI that required hospital admission in this patient population. It is important to identify causes of AKI and develop strategies to prevent it in order to reduce hospital admission and prevent the complications associated with AKI.

A retrospective study reviewed the medical records of 335 cancer patients with AKI during their hospital stay.[5] The average age was 68.7 years, which was close to the mean age of patients who have AKI in our study. Patients who have metastatic cancer comprise 60.4% of the cases, while 12.1% of the cases have regionally developed disease, and 18.7% with cancer limited to one organ. The highest incidence of AKI was reported in patients with cervical, ovarian, prostate, breast, and gastric cancers. In our study, the most common types of cancer associated with AKI was genitourinary tumors, such as bladder cancer and prostate cancer, followed by gastrointestinal tumors, breast cancer and gynecological tumors. The most common causes of AKI in the study were hypovolemia (35%) and obstruction of the urinary tract (26%). Hemodialysis was required for 14.5% of the cases. In the group of dialyzed patients, 38.5% of them died, and 61.5% were discharged from the hospital after resolution of renal injury.

In Jordan, a few studies evaluated AKI but none of the studies evaluated specifically the cancer population. In one study, 215 medical patients with acute renal failure (AKI) in three centers in Jordan were evaluated. The most common causes for AKI were parenchymal renal insult (58%), pre–renal azotemia (28%), and acute obstructive uropathy (14%). Complete recovery of kidney impairment was seen with 80% of the patients (5). The percentage of AKI recovery was similar to that reported in our study. Forty–seven patients (21.9%) died . Sepsis and cardiac complications were together responsible for almost 75% of the deaths [6].

Another study in a general hospital in Jordan described 111 medical patients who were admitted to the hospital with AKI or developed AKI during their hospital stay.[7] The study described etiologies of acute renal failure in hospitalized Jordanian patients. The causes of acute renal failure included dehydration, diuretics, sepsis, contrast media, nonsteroidal anti–inflammatory drugs, glomerulonephritis, systemic lupus erythematosus, stones, and others. Ninety–

five patients (85.6%) were discharged home, and 16 patients (14.4%) died in the hospital. Mortality was affected by the age of patients and the duration of hospitalization.[7]

In our study; the most common cause of acute renal failure was dehydration (40 % of the cases) , drug induced AKI came in the second place that was induced by chemotherapy and NSAID. The most common chemotherapy associated with AKI was cisplatin; Cisplatin caused AKI in doses more than 75 mg /m^2 which is a high dose that may increase the risk of cisplatin induced toxicities including delayed nausea and vomiting, nephrotoxicity, and other side effects.[8] We didn't look at the preventability of those events, but this would be an area that requires further research to assess the preventability of certain hospital admission

The most common cancers associated with AKI were genitourinary tumors followed by gastrointestinal tumors then breast cancer. The use of nephrotoxic chemotherapeutic agents in these types of tumors and the possibility of obstructive uropathy may be the cause for the high rate of AKI in those cancers. In one large study that was done in Denmark , the highest risks occurred among patients with liver cancer, kidney cancer, or multiple myeloma, and in patients presenting with distant metastases at time of cancer diagnosis.[9]

This study includes a few limitations. The most important is the inability to determine the onset of AKI prior to admission since SCr measurements are typically not done for all out–patients. In addition, we did not measure the creatinine clearance for the patients enrolled, which may have provided a more accurate estimation of the actual renal function. Finally, we did not assess the preventability of AKI in the patients enrolled.

In conclusion, AKI was found to be a common complication in cancer patients. Our study revealed that the most common cases of AKI associated with dehydration and medications. This area should be further evaluated to determine a preventive measures that could save patients kidney functions and prevent any complications such as delay in treatment, prolongation of hospital stay and death.

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