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Original Article

Incidence and Risk Factors of Postoperative Acute Kidney Injury in Non-Cardiac Major Surgery.

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Abstract:

Acute kidney injury (AKI) occurs in approximately 1-7% of all hospitalized patients. Those patients undergo major surgical procedures are at high risk for AKI due to high volume blood loss, electrolytes disturbance, development of preoperative infection or sepsis and presence of several co-morbidities that may impair renal function. However, published data on postoperative kidney injury are scarce outside the cardiovascular surgery setting. Therefore the study was designed to find out the incidence and risk factors of postoperative acute kidney injury in non-cardiac major surgery. A cross-sectional observational study was conducted in the department of nephrology, BSMMU, Dhaka from January 2014 to December 2014. In this study we found the overall incidence of postoperative AKI 6%. Among the risk factors-male sex, increased age, lengthy operation, exposure to general anesthesia, perioperative hypotension, blood transfusion and use of nephrotoxic drugs (NSAIDs, Aminoglycosides) are important.

Key words: Acute Kidney Injury, Incidence, Risk Factors, Major Surgery.

Introduction:

Acute kidney injury (AKI) is common among hospitalized patients. It affects about 3-7% of patients admitted to the hospital and approximately 25-30% of patients in the intensive care unit[1]. But there are no large studies addressing renal dysfunction after noncardiac nonvascular surgery. The study of renal dysfunction is challenged by the wide variation in definitions. We used the definition of acute kidney injury (AKI) proposed by the acute kidney injury network (AKIN). The diagnostic criteria require an increase of serum creatinine $\geq$ 0.3mg/dl, or a change in serum creatinine $\geq$ 50% from baseline within 48 hours, or a reduction in urine output <0.5ml/kg/hr. for >6 hours following adequate volume resuscitation[2]. Surgery remains a leading cause of acute kidney injury (AKI) in hospitalized patients. This has been best researched in the cardiac surgery setting where it has been shown, that up to 15% of patients exposed to cardiopulmonary bypass will develop AKI. Acute kidney injury (AKI) is not limited to cardiac surgery although its incidence outside cardiac surgery setting is often underappreciated[3]. But postoperative acute kidney injury has serious implications associated with higher mortality morbidity and a more complicated hospital course and increased cost.

The occurrence of postoperative acute kidney injury depends upon the nature of surgery, preoperative and intraoperative hemodynamic and renal condition. All intravenous and volatile induction agents affect renal function by decreasing cardiac output and blood pressure. Extradural block or high spinal up to the level of T4 reduces sympathetic tone to the kidneys, resulting in a decrease in renal blood flow & GFR. Mechanical ventilation with positive pressure also decreases renal blood flow. Major surgery with extensive third space loss can lead to hypovolaemia and renal hypoperfussion.

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Materials and Methods:

A cross sectional observational study was carried out in the department of nephrology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka in collaboration with the Department of General Surgery, Orthopaedic Surgery & Gynecology of the same hospital, from January 2014 to December 2014. Sample size was 300. Patients who fulfilled the inclusion criteria were requested to participate in the study. At first 300 patients from the department of general surgery, orthopedic surgery and gynecology whose renal function (serum creatinine) was normal before operation were selected. Then their renal function (serum creatinine) was reassessed after 48 hours of their operation. Those patients developed Acute Kidney Injury (AKI) after surgery their variables (age, sex, type of anesthesia, duration of operation, perioperative hypotension, blood transfusion, use of NSAIDs and other nephrotoxic drugs) were analyzed to find out the risk factors of postoperative Acute Kidney Injury (AKI).

Results:

Incidence of postoperative AKI:

Among 300 patients 18 patients (6.0%) developed postoperative AKI. Incidence of postoperative AKI was higher in older patients > 50 years (6.3%) and lower in < 50 years (5.9%). It is more common in male (7.0%) than in female (5.2%). Incidence of postoperative AKI was found higher in general surgery (9.0%) & lower in gynecological operation (3.0%) (Table - I).

Table I: Incidence of postoperative AKI (n=300).

Characteristics	Total number of patients	Number of postoperative AKI patients (%)	
Age of patient:			
>50 years	80	5	6.3%
<50 years	220	13	5.9%
Sex of patient			
Male	128	9	7.0%
Female	172	9	5.2%
Type of operation			
General surgery	100	9	9.0%
Orthopedics	100	6	6.0%
Gynecology	100	3	3.0%

Risk Factors of Postoperative AKI:

Postoperative AKI was more common in those patients who were given general anesthesia (7.0%) than spinal anesthesia (4.4%). Postoperative AKI developed in lengthy operation (123±43min) than short duration operation (80±29min), postoperative AKI was commonly found in those patients who developed perioperative hypotension (43.5%) & those who needed blood transfusion during operation (18.5%), postoperative AKI frequently occurs with Ketorolac (16%) than Tramadol (1.4%) (Table - II).

Table II: Risk Factors of postoperative AKI (n=18).

Factors	Total number of patients	Number of postoperative AKI patients (%)	
Anesthesia			
General anesthesia	186	13	7.0%
Spinal anesthesia	90	04	4.4%
Other	24	1	4.1%
Perioperative Hypotension	23	10	43.5%
Blood transfusion	65	12	18.5%
Use of NSAIDs			
Ketorolac	66	11	16%
Diclofenac	91	5	5.7%
Tramadol	142	2	1.4%

Postoperative AKI was more common in those patients who were suffering from carcinoma (33.3%) and hepatobilliary system disease (23%) (Fig-I).

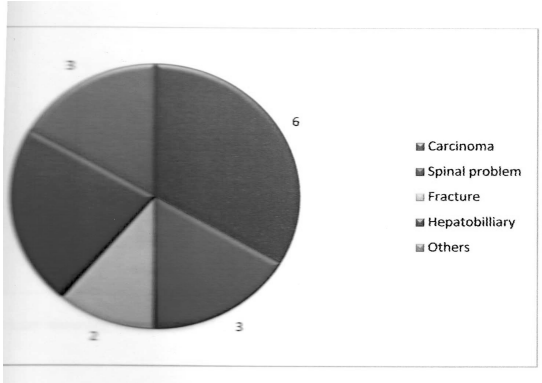

Fig. I: Pie chart, showing primary diseases of postoperative AKI patients (n=18).

Discussions:

This study assessed the incidence and risk factors of postoperative AKI in noncardiac major surgery. We reported, the incidence of postoperative AKI was 6%. This result was consistence with other studies; the incidence of postoperative AKI varies from 1.1% to 17% depending on the definition of AKI[4]. In this study the incidence of postoperative AKI in general surgery, orthopedic surgery and gynecological surgery were found 9%, 6% and 3% respectively. A study conducted in postoperative surgical ICU area found almost the similar incidence 7.5%[5]. The overall incidence of kidney dysfunction after orthopedic surgery is reported as 8.9%[6]. The incidence of postoperative AKI among the gynecological patients was found as 0.89%[1].

In addition to the incidence of postoperative AKI, we observed the risk factors of postoperative AKI based on patient´s preoperative and postoperative characteristics. Old age is one of the important risk factor for postoperative AKI[5,7]. Our study found similar findings which shows that increased age especially over 50 years is significantly associated with the development of postoperative AKI.

In this study we found that exposure to general anesthesia, prolong duration operation, perioperative hypotension & blood transfusion were identified as risk factors of postoperative AKI. Several studies illustrates that patients who receive general anesthesia have more risk to develop postoperative AKI. Prolong duration of operation is a risk factor for developing postoperative AKI[3,5]. In this study, perioperative hypotension was identified as a risk factor of postoperative AKI. Perioperative hypotension may be due to anesthetic agents or profuse bleeding[8]. There is an apparent link between perioperative hypotension and postoperative AKI[6]. Blood transfusion during operation was found as a risk factor for developing postoperative AKI. The reason might be the patients who developed hypovolaemia needed blood transfusion and hypovolaemia caused postoperative AKI[5].

Use of NSAIDs especially Ketorolac is an important cause of postoperative AKI[9]. Our study also found similar findings, NSAIDs were used in almost each patient in this study where postoperative AKI were more common who received ketorolac. Malignancy is a risk factor of postoperative AKI. Present study found that patients underwent major surgical procedure due to malignancy are more prone to develop postoperative AKI[10].

Conclusions:

AKI is a common problem in the postoperative period. Postoperative AKI is an important cause of prolonged hospital stay, increased treatment cost and higher morbidity & mortality. Therefore, adequate assessment before surgery is desirable. In this study, we have attempted to find out the risk factors of postoperative AKI. So that high risk patients for developing postoperative AKI might be identified and if possible, risk factors should be mitigated before surgery and adequate precautions should be taken to prevent morbidity and mortality.

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