



Original Contribution

Incidence of acute kidney injury after elective lower limb arthroplasty[☆]

Aleksandra Nowicka MD, FRCA^{a,b,*}, Thomas Selvaraj MD, FRCA^{b,1}^aSpeciality registrar in anaesthesia, Warwickshire School of Anaesthesia^bDepartment of Anaesthesia and Intensive Care, Warwick Hospital, Lakin Rd, Warwick, CV34 5BW, UK

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Keywords:Acute kidney injury;
Lower limb arthroplasty**Abstract****Study objective:** The aim of this study was to establish the incidence of acute kidney injury (AKI) in patients undergoing elective hip and knee arthroplasty.**Design:** This was a retrospective cohort study.**Setting:** The study was conducted in a district general hospital in the United Kingdom.**Patients:** All patients undergoing elective hip and knee arthroplasty over a period of 6 months were included in the study.**Measurement:** Preoperative and postoperative serum creatinine concentration was recorded in all patients. AKI was defined according to the Acute Kidney Injury Network classification as an increase of serum creatinine concentration of $>26.5 \mu\text{mol/L}$ ($\geq 0.3 \text{ mg/dL}$) or increase to 1.5-fold from baseline.**Main results:** Three hundred thirty-seven patients were included in the study. Forty-eight had preexisting stage 3 chronic kidney disease (CKD). The overall incidence of AKI in our study was 6.2%. The incidence in patients with preexisting stage 3 CKD (estimated glomerular filtration rate $<60 \text{ mL}/[\text{min } 1.73 \text{ m}^2]$) was 16.3%, whereas in patients without preexisting stage 3 CKD, the incidence was 4.5%.**Conclusion:** We identified stage 3 or higher CKD as a major risk factor for developing postoperative AKI. Preexisting CKD raised the risk of developing AKI 4-fold. We recommend that all patients undergoing lower limb arthroplasty should have renal function assessed preoperatively. In the perioperative period, renal function should be monitored in all patients. This is of particular importance in patients with estimated glomerular filtration rate <60 .

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1. Introduction

Acute kidney injury (AKI) is a serious complication of surgery. It is now recognized that even mild postoperative AKI

may result in the development of chronic kidney disease (CKD) in previously normal kidneys and accelerated progression of the disease in patients with preexisting CKD, with about a 5-fold increased risk for end-stage disease. It is also associated with increased mortality and morbidity, prolonged hospital stay, and increased cost [1,2].

Recently, the Acute Kidney Injury Network (AKIN) introduced a new definition of AKI intended for uniform use in the research studies. The group recommended that further research is needed to determine the incidence of AKI in various surgical groups [3]. The AKIN criteria have since been validated in

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* Corresponding author at: Birmingham Women's Hospital, Mindelson Way, Edgbaston, Birmingham, B15 2TG, United Kingdom. Tel.: +44 121 472 1377x4088.

E-mail addresses: a.nowicka@hotmail.com (A. Nowicka), thomasselvaraj@doctors.org.uk (T. Selvaraj).

¹ Tel: +44 1926 495321.

several various groups of patients including intensive care patients, patients undergoing cardiac surgery, and the general hospital inpatient population [4-6].

To our knowledge, to date, only 1 study looked at the incidence of AKI after lower limb arthroplasty using the AKIN definition. In patients without preexisting kidney dysfunction (ie, the glomerular filtration rate estimated by the Cockcroft-Gault formula [eGFR] > 60 mL/[min 1.75 m²]), the incidence of postoperative AKI was found to be 2%. The study however was not designed to determine the incidence of AKI, and the authors admit that the observed rate may be an underestimate [7].

Patients undergoing lower limb arthroplasty are often elderly, and CKD is prevalent in this group. To our knowledge, no studies to date have reported the incidence of this complication in patients with preoperative kidney dysfunction. Our aim was, therefore, to establish the incidence of AKI in a general population undergoing elective knee and hip arthroplasty to aid early detection, treatment, patient information, and consent.

2. Materials and methods

We conducted a retrospective study after obtaining approval from the hospital's audit department. We included all patients who had undergone elective, unilateral hip and knee arthroplasty in Warwick Hospital over a 6-month period between October 2013 and March 2014. Patients who required emergency operations, revision, or bilateral surgery were excluded.

The list of patients and procedures undergone was obtained from the hospital joint replacement register. The hospital computerized results reporting system was used to abstract demographic data and the results of laboratory investigations. The data were entered manually by the authors onto the electronic data collection form and analyzed using the Microsoft Excel software.

All patients included in the study had serum creatinine concentration checked in the preoperative assessment clinic and on the first postoperative day. Whenever the serum creatinine was repeated on the second postoperative day, the higher value was taken into account. Other patient data recorded included the age, sex, surgical procedure, surgical time, postoperative reduction in blood hemoglobin concentration, length of hospital stay,

and preoperative eGFR. Date when the serum creatinine concentration reached preoperative values was also noted.

AKI was defined according to the AKIN classification [3] (Table 1) as an increase of serum creatinine concentration of more than 26.5 $\mu\text{mol/L}$ (≥ 0.3 mg/dL) or increase to 1.5-fold from baseline in the 48-hour postoperative period.

Pearson χ^2 test and Fisher exact test were used to determine the statistical significance of the increased incidence of postoperative AKI in patients with CKD. Unpaired Student *t* test was used to compare the length of hospital stay of patients with and without AKI. *P* values < .05 were considered statistically significant. IBM SPSS 22.0 software was used for statistical analysis.

2.1. Anesthetic management

In patients undergoing lower limb arthroplasty, anesthesia with subarachnoid block and sedation is the standard practice in our hospital. General anesthesia and peripheral nerve blocks are less commonly used. When general anesthesia is used, sevoflurane is the maintenance agent of choice. Surgical site infection prophylaxis protocol includes a single dose of flucloxacillin (1 g) and gentamicin (120 mg). One gram of tranexamic acid is administered at induction of anesthesia to aid hemostasis. High-volume local anesthetic infiltration with or without 30 mg of ketorolac is routinely used as an element of multimodal analgesia. The choice of postoperative analgesia is at the discretion of treating anesthetist, and no standard protocol is in place. Regular prescription of paracetamol; ibuprofen, if not contraindicated; and opioid is commonly used, combined, as required, with additional opioids.

3. Results

A total of 337 patients were included in the study. Forty-eight (14.2%) patients had preexisting stage 3 CKD as defined by eGFR of between 30 and 60 mL/(min 1.73 m²). Patients' characteristics are outlined in Table 2.

Twenty-one (6.2%) patients developed postoperative AKI. Thirteen of these had normal preoperative renal function, and 8 had preexisting stage 3 CKD. The incidence of AKI in patients with preexisting stage 3 CKD was 16.7%, nearly 4 times higher than that in patients with normal preoperative renal

Table 1 Patient characteristics

Patient characteristics	All patients (N = 337)	Normal preoperative renal function (n = 289)	Stage 3 CKD (n = 48)
Mean age, y (SD)	70 (11.0)	68 (11.0)	77 (7.2)
Male, n (%)	137 (41)	119 (41)	18 (37)
Female, n (%)	200 (59)	170 (59)	30 (63)
Type of surgery n (%)			
Primary knee replacement, n (%)	181 (53.7)	152 (52.6)	29 (59)
Primary hip replacement, n (%)	156 (46.3)	137 (47.4)	19 (40)

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