ACUTE KIDNEY INJURY FOLLOWING SURGERY FOR HIP FRACTURE

LESÃO RENAL AGUDA APÓS CIRURGIA DE FRATURA DE QUADRIL

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ABSTRACT

Objective: An observational study was carried out to determine the rate of acute kidney injury (AKI) following surgery for hip fracture at our institution and to look for factors associated with AKI. Methods: Preoperative creatinine values were compared to post-operative results for all patients who underwent surgery for hip fracture at our institution between 1st January 2015 and 30th September 2016. AKI was defined as an increase in postoperative creatinine, greater than or equal to 1.5 times the preoperative value within 7 days. Chi-squared test and Student’s t-test were used to look for factors associated with AKI. Results: Out of 500 patients, 96 developed an AKI (19.2%). Patients with chronic kidney disease (CKD) were more likely to develop AKI (30.8%) that those without it (17.2%, p = 0.018). Similarly, patients with 2 or more comorbidities were more likely to develop AKI (22.0%) than those without it (12.4%, p = 0.009). No statistically significant association was observed between type of surgery and AKI. Conclusion: A large proportion of patients following surgery for hip fracture developed AKI. Patients with CKD and the presence of 2 or more comorbidities had significantly higher rates of AKI. Level III evidence, Retrospective comparative study.

Keywords: Hip Fractures. Acute Kidney Injury. Hip. Hemiarthroplasty. Fracture Fixation. Arthroplasty, Replacement.

INTRODUCTION

Hip fracture is a rising epidemic associated with prolonged stay in hospital and reduction in quality of life. Acute kidney injury (AKI) following surgery for hip fracture is common. Long- and short-term mortality rates are higher for patients who develop AKI following surgery for hip fracture compared to those who do not. This group of patients is aging with more comorbidities. Recent studies have shown that increasing age and number of comorbidities are associated with significantly more patients developing AKI following surgery for hip fracture. Observational studies have shown that up to 21% of patients following surgery for hip fracture can develop AKI. However, results vary among studies. The purpose of this study was to determine how many patients developed AKI following hip fracture in our institution and if previously suggested risk factors for postoperative AKI are true for this patient sample.

RESUMO

Objetivo: Estudo observacional realizado no Altnagelvin Hospital para determinar a taxa de lesão renal aguda (LRA) após a cirurgia de fratura de quadril e procurar fatores associados à LRA. Métodos: Os valores de creatinina pré-operatória foram comparados aos resultados pós-operatórios em todos os pacientes submetidos à cirurgia de fratura de quadril entre 1º de janeiro de 2015 e 30 de setembro de 2016. A LRA foi definida como aumento da creatinina pós-operatória maior ou igual a 1,5 vezes ao valor pré-operatório dentro de 7 dias. Os testes qui-quadrado e t-Student foram usados para procurar fatores associados à LRA. Resultados: Dos 500 pacientes, 96 desenvolveram LRA (19,2%). Pacientes com doença renal crônica (DRC) foram mais propensos a desenvolver LRA (30,8%) do que os pacientes sem a doença (17,2%, p = 0,018). Da mesma forma, pacientes com duas ou mais comorbidades foram mais propensos a desenvolver LRA (22,0%) do que os pacientes sem comorbidades (12,4%, p = 0,009). Nenhuma associação estatisticamente significativa entre tipo de cirurgia e LRA. Conclusão: Após a cirurgia de fratura de quadril uma grande proporção de pacientes desenvolveu LRA. Pacientes com DRC e duas ou mais comorbidades tiveram taxas significativamente maiores de LRA. Nível de evidência III, Estudo comparativo retrospectivo.

Descritores: Fraturas do Quadril. Lesão Renal Aguda. Quadril. Hemiartroplastia. Fixação de Fratura. Artroplastia de Substituição.

All authors declare no potential conflict of interest related to this article.
METHODS

All patients aged over 65 years who underwent surgery for hip fracture at Altnagelvin Area Hospital between 01/01/2015 and 09/21/2016 were identified using our hip fracture database. Baseline serum creatinine concentration (day of hospital admission) and postoperative serum creatinine concentration (day 1 and 4) were recorded at the Northern Ireland Electronic Care Record. Recorded information also included age, sex, type of fracture and surgery, date and duration of surgery, length of stay in hospital and medical comorbidities. AKI was defined as an increase in postoperative serum creatinine concentration greater than or equal to 1.5 times the baseline value within 7 days.

Statistics

Results are presented as mean and standard deviation (SD) for continuous variables. Binary and categorical variables are summarized by frequency. Chi-squared test and Student’s t-test were used to investigate risk factors associated with post-surgical AKI (increasing age, male sex, chronic kidney disease—CKD and 2 or more comorbidities). All analyses were performed with IBM SPSS Statistics version 20 (IBM Corporation, New York, US).

RESULTS

Baseline patient characteristics are summarized in Table 1. The mean age was 81.4 years and most patients were women. Frequent comorbidity included ischaemic heart disease (13%), chronic obstructive pulmonary disease (11.2%) and 14.2% of patients had a history of diabetes mellitus. The most common type of operation performed was hip hemiarthroplasty (46.8%), followed by dynamic hip screw insertion (29.8%) and long intramedullary nail insertion (16.2%). The least common operation performed was total hip replacement (7.2%) of patients. The mean preoperative serum creatinine was 90 micromoles per liter. Out of 500 patients aged over 65 years who underwent surgery for hip fracture, 96 developed AKI (19.2%).

A significant difference was identified between mean preoperative serum creatinine concentration and development of AKI ($p < 0.001$). No significant difference was found regarding sex ($p = 0.200$), mean age or type of surgery performed ($p = 0.282$) and development of AKI ($p = 0.459$).

Table 2 shows the risk factors known to be associated with AKI following surgery for hip fracture. Patients with chronic kidney disease and the presence of 2 or more comorbidities had significantly higher rates of AKI (p-value = 0.018 and 0.009 respectively).

DISCUSSION

Recent studies have shown that between 12.7% and 24.0% of patients develop AKI following surgery for hip fracture. In this study, 19.2% of patients developed AKI within 7 days of surgery for hip fracture. This is comparable to the findings from other recent studies. Variability exists in relation to how AKI is defined, and this may contribute to the differences presented in numbers of patients developing AKI.

In one of the largest studies investigating AKI following surgery for hip fracture, 12.7% of 13,529 patients from hospitals in Denmark developed AKI. Baseline serum creatinine was estimated using an electronic database of blood results. The highest serum creatinine value in the first 5 postoperative days was compared to baseline. In this study, 19.2% of patients developed AKI within 7 days of surgery for hip fracture. This is comparable to the findings from other recent studies. Variability exists in relation to how AKI is defined, and this may contribute to the differences presented in numbers of patients developing AKI.

Table 2. Possible factors associated with acute kidney injury following hip fracture.

| Type of Surgery, n (%) | Patients with AKI | Patients without AKI | p value |
|-----------------------|-------------------|----------------------|---------|
| Dynamic hip screw     | 25 (5.0)          | 124 (24.8)           | 0.282   |
| Hip hemiarthroplasty  | 44 (8.8)          | 190 (38.0)           |         |
| Long intramedullary nail | 22 (4.4)      | 59 (11.8)            |         |
| Total hip replacement | 6 (1.2)           | 30 (6.0)             |         |

Table 1. Baseline patient characteristics and type of surgery.

| All Patients N = 500 |
|----------------------|
| Mean age, years (SD) | 81.4 (8.6) |
| Sex, n (%)          |
| Male                | 133 (26.6) |
| Female              | 367 (73.4) |
| Past Medical History, n (%) |
| Ischaemic heart disease | 65 (13.0) |
| Chronic obstructive pulmonary disease | 56 (11.2) |
| Cerebrovascular accident | 49 (9.8) |
| Diabetes mellitus   | 71 (14.2)  |
| Myocardial infarction | 31 (6.2)  |
| Type of Surgery, n (%) |
| Dynamic hip screw   | 149 (29.8) |
| Hip hemiarthroplasty | 234 (46.8) |
| Long intramedullary nail | 81 (16.2) |
| Total hip replacement | 36 (7.2)  |
| Mean preoperative creatinine concentration, micromoles/l (SD) | 90 (50.0) |

$^*${Cerebrovascular accident, transient ischaemic attack, cardiovascular disease, chronic obstructive pulmonary disease.}
Intraoperative measures also play an important role in preventing postoperative AKI. Hypovolaemia due to intraoperative blood loss will lead to reduced renal perfusion.\textsuperscript{12,13} Even short periods of low mean arterial pressure are poorly tolerated and associated with increased risk of postoperative AKI.\textsuperscript{12,13} This fact highlights the importance of accurate measurement of intraoperative blood loss, recording of blood pressure while the patient is anesthetize and careful assessment of fluid balance in the perioperative period.\textsuperscript{12,13} Another important modifiable risk factor for the development of postoperative AKI is the administration of nephrotoxic or potentially nephrotoxic medications.\textsuperscript{14} Drugs associated with an increased risk of AKI in general are non-steroidal anti-inflammatory drugs, angiotensin converting enzyme inhibitors and angiotensin receptor blockers, and mineralocorticoid receptor antagonists.\textsuperscript{14,15} If possible, these drugs should be discontinued preoperatively and held in the perioperative period.\textsuperscript{14,15}

In this study, the proportion of patients developing AKI was significantly higher in those patients with a past history of CKD or the presence of 2 or more comorbidities when compared to those without. This is in keeping with findings from other studies.\textsuperscript{2-5,8} Porter et al.,\textsuperscript{10} in a recent observational study, found a significant number of patients who developed AKI following surgery for hip fracture with a history of CKD or the presence of 2 or more comorbidities when compared to those without.

CONCLUSION

In this single-center observational study involving 500 patients, 19.2% developed acute kidney injury within 7 days following surgery for hip fracture. Patients with a medical history of CKD and 2 or more comorbidities were more likely to develop AKI than those without it.

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3. Khan MA, Hossain FS, Ahmed I, Muthukumar N, Mohsen A. Predictors of early perioperative period.\textsuperscript{14,15} Intraoperative measures also play an important role in preventing postoperative AKI. Hypovolaemia due to intraoperative blood loss will lead to reduced renal perfusion.\textsuperscript{12,13} Even short periods of low mean arterial pressure are poorly tolerated and associated with increased risk of postoperative AKI.\textsuperscript{12,13} This fact highlights the importance of accurate measurement of intraoperative blood loss, recording of blood pressure while the patient is anesthetize and careful assessment of fluid balance in the perioperative period.\textsuperscript{12,13} Another important modifiable risk factor for the development of postoperative AKI is the administration of nephrotoxic or potentially nephrotoxic medications.\textsuperscript{14} Drugs associated with an increased risk of AKI in general are non-steroidal anti-inflammatory drugs, angiotensin converting enzyme inhibitors and angiotensin receptor blockers, and mineralocorticoid receptor antagonists.\textsuperscript{14,15} If possible, these drugs should be discontinued preoperatively and held in the perioperative period.\textsuperscript{14,15}

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