

Accuracy and clinical implications of estimated GFR versus calculated GFR in patients undergoing elective lower limb arthroplasty and emergency hip fracture surgery

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Background

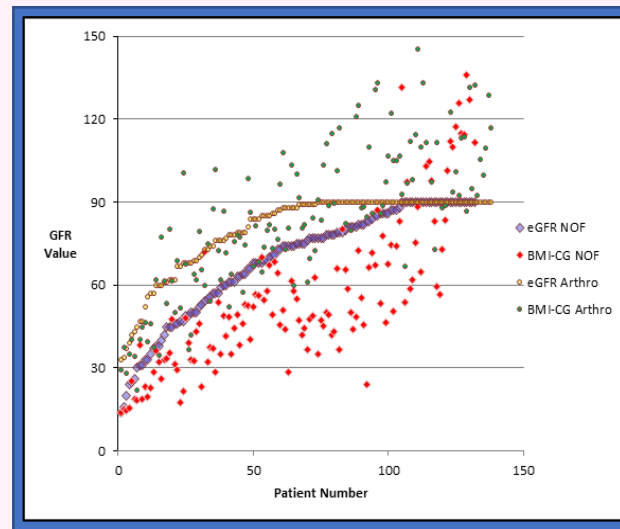
The routine care of patients awaiting elective lower limb primary arthroplasty or emergency neck of femur fracture surgery involves estimation of renal function, commonly calculated by CKD-EPI formulae and reported as estimated glomerular filtration rate (eGFR). This calculation is based on serum creatinine, age and sex. However, it is accepted that inaccuracies exist in this method¹.

Prescribing guidelines frequently have recommendations based on renal function to avoid complications of nephrotoxicity or accumulation of drugs due to reduced excretion. This study aimed to quantify the extent of the inaccuracies in eGFR reporting by comparing to a calculated BMI-adjusted Cockcroft-Gault GFR, and to identify any cases with resultant clinical implications.

Methods

For all primary lower limb arthroplasty patients between 04/01/2020 to 14/02/2020, we calculated the Cockcroft-Gault glomerular filtration rate adjusted for body mass index (BMI-adjusted CG-GFR)². 140 patients were identified with one exclusion due to incomplete data; 83 females and 56 males (68 TKRs and 71 THRs, respectively) with a median age of **67**. The two estimations of GFR (laboratory generated eGFR and BMI-adjusted CG-GFR) were compared for clinical significance using two limits; below 60ml/min/1.73m² for avoidance of gentamicin, non-steroidal anti-inflammatory drugs and oral morphine in the elderly; and below 30ml/min/1.73m² for avoidance of NSAIDs in those less than 65 years old³. **Clinically significant differences** were defined as when a patient's BMI-adjusted CG-GFR would preclude the administration of one of more medications when the laboratory eGFR would have allowed administration.

For neck of femur fractures, 140 patients were identified between 04/01/2020 and 28/02/2020. One paediatric patient was excluded from the analysis and seven patients with incomplete data, leaving 132; 48 male and 84 female patients, with a median age of **81.5**. The same GFR values as above were compared using the same definition for 'clinically significant difference'.



Results

In the elective group, **9%** (13 patients) had a BMI-adjusted CG-GFR that was clinically significantly different from the eGFR however, this was **48%** (64 patients) in the NOF group. This may have permitted administration of certain nephrotoxic drugs which could have contributed to acute kidney injury, which affects up to 20% of inpatients⁴ and contributes to longer term increased mortality and development of chronic kidney disease⁵. As demonstrated by the Bland-Altman plot above, there was less variability between estimated and calculated GFR at lower values where, clinically, accuracy matters most.

Discussion

The results show that patients with a reduced eGFR are at greater risk of renal injury due to laboratory overestimation when compared to Cockcroft-Gault calculations. In the elective population the clinical significance was limited to under 10% of cases, however, in the urgent care setting, the clinical importance of calculating GFR was far more significant. The demographics in the neck of femur fractures had many obvious differences; greater age, lower BMI and lower pre-operative eGFR measurements. These all contribute to a greater discrepancy between laboratory and calculated values. Considering that elective patients are pre-screened as 'fit' for surgery, they may tolerate renal insults better than their urgent surgery counterparts. In addition, the urgent care patients have greater risks of renal insult due to the combined effects of the original trauma plus the operation and this group may not be able to tolerate this without serious consequence. This study raises the question of whether, for patients near a clinically important estimated GFR value (<60 or <30), we ought to consider alternative renal function calculations such as BMI-adjusted CG GFR to prevent renal injury post-operatively. In order to do this, we must ensure that obtaining a current height and weight for emergency patients is made a priority during the pre-op process as it is for their elective counterparts.