Comparison of Estimated Glomerular Filtration Rate Using Five Equations to Predict Acute Kidney Injury Following Hip Fracture Surgery

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Introduction

- Hip fractures are a common injury and a source of disability and mortality in the aging population[1]
- Acute kidney injury (AKI) is a common and potentially serious complication following hip fracture surgery[2]
- Estimated glomerular filtration rate (eGFR) is used as an indicator of renal function
- Several equations are commonly used to calculate eGFR
- The purpose of this study was 1) to evaluate the agreement between five equations in calculating eGFR, and 2) to confirm which equation can best predict AKI in patients undergoing hip fracture surgery.

Materials and Methods

- 146,702 cases of surgical stabilization of hip fracture were queried from the National Surgical Quality Improvement Program (NSQIP) from 2012 to 2019
- Preoperative eGFR was calculated using the Cockcroft-Gault (CG), Modification of Diet in Renal Disease (MDRD) II, re-expressed MDRD II, Chronic Kidney Disease Epidemiology Collaboration, and Mayo quadratic (Mayo) equations
- The primary outcome measure was AKI
- Cases were stratified into two cohorts based on the development of postoperative AKI
- These cohorts were compared based on demographic and preoperative factors
- Multivariate regression analysis was used to evaluate independent associations between preoperative eGFR and postoperative renal outcomes

Results

	CG	MDRD II	Re-expressed MDRD II	CKD-EPI	Mayo
Mean eGFR	74 ± 35.1	82.7 ± 38.5	68.3 ± 35.6	83.3 ± 19.9	83.8 ± 23.6
≥90	24,533 (26)	33,513 (35)	19.016 (20)	33,382 (35)	38,256 (40)
≥60, <90	34,552 (36)	36,201 (38)	32,130 (33)	53,120 (55)	43,338 (45)
≥45, <60	20,083 (21)	14,930 (16)	21,983 (23)	5,409 (5.6)	6,759 (7.0)
≥30, <45	12,796 (13)	8,272 (8.6)	16,120 (17)	2,878 (3.0)	4,670 (2.74)
≥30, <15	3,896 (4.1)	2,906 (3.0)	6,235 (6.5)	1,186 (1.2)	2,638 (2.7)
≤15	292 (0.3)	330 (0.3)	668 (0.7)	177 (0.2)	491 (0.5)

Table 1. Distribution of patients by preoperative eGFR based off each of the five equations.

Equation	Acute Kidney Injury			
	Odds Ratio (95%CI)	P-value	AIC	AUC
CG	0.84 (0.80- 0.88)	<0.001	5187	0.800
MDRD II	0.89 (0.85- 0.92)	<0.001	5239	0.815
Re-Expressed MDRD II	0.93 (0.89- 0.97)	<0.001	5228	0.783
CKD-EPI	0.82 (0.77- 0.87)	<0.001	5201	0.737
Mayo	0.77 (0.74- 0.81)	<0.001	5116	0.729

Table 2. Logistic Regression Analysis of Odds of Developing AKI by Each of the Five Equations

- Six hundred ninety-nine (0.73%) patients acquired AKI after hip fracture surgery.
- The Mayo equation yielded the highest mean eGFR (83.8 ± 23.6), while the Re-expressed MDRD II equation yielded the lowest mean eGFR (68.3 ± 35.6) **(Table 1)**
- Multivariate regression analysis showed that a decrease in preoperative eGFR was independently associated with an increased risk of postoperative AKI in all five equations **(Table 2)**
- The Akaike information criterion (AIC) was the lowest in the Mayo equation (5116) **(Table 2)**

Conclusions

- Preoperative decrease in eGFR in all five equations was independently associated with increased risk of postoperative AKI.
- The Mayo equation had the highest predictive ability of acquiring postoperative AKI following hip fracture surgery
- Understanding which equation may best capture the patients at highest risk of developing AKI may help providers make decisions on perioperative management in these patients

References:
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