Evaluating Renal Angina Tools for Predicting Acute Kidney Injury in Critically ill Adults at Fundación Cardioinfantil in an Emerging Upper-Middle-Income Economy

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Introduction

Acute Kidney Injury (AKI) is a syndrome characterized by a sudden decline in kidney function, potentially leading to renal replacement therapy. Despite its reversible nature, AKI can cause increased mortality, morbidity, and later cardiovascular complications, imposing economic burdens. The current limited utility of biomarkers for early AKI detection upon ICU admission necessitates evaluating innovative predictive tools.

Methods and Materials

A retrospective observational study was conducted from January 31st to September 30th, 2020, among patients aged >18 admitted to ICU at Fundación Cardioinfantil in Bogotá, Colombia.
Exclusion criteria: RRT dependency before admission, prior AKI diagnosis, kidney transplant, referral from another ICU, or ICU stay < 48 hours.
Demographic and lab data collected for seven days post-admission were applied to Malhotra et al renal angina tool.
AKI was defined per KDIGO classification, with KDIGO 2 and 3 labeled as severe AKI. The Youden method estimated an optimal cutoff point, and the GiViTi model assessed calibration.

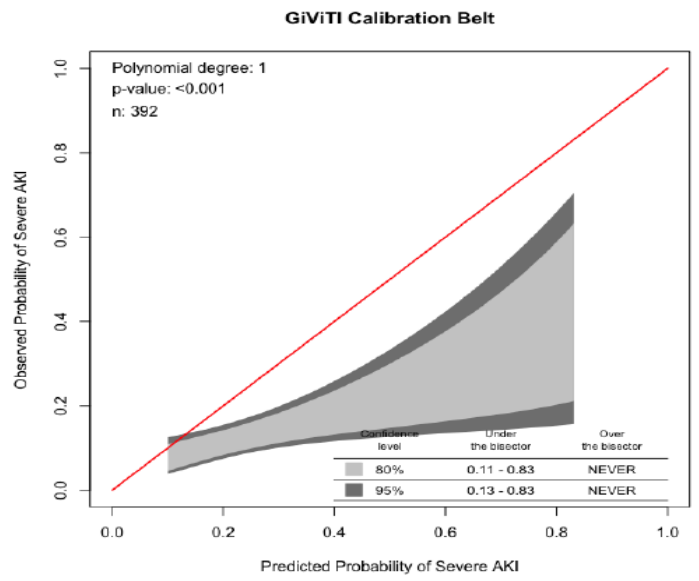
Table 1. Description of the population with the Renal Angina Scale by Malhotra et al.

Parameter	Non- severe AKI (N=323)	severe AKI (N=158)	Overall (N=481)
Sever AKI prediction tool, mean (SD)	5.53 (2.68)	7.59 (2.89)	6.2 (291)
Chronic risk factors – n (%)			
Chronic kidney disease	9 (2.8%)	18 (11.4%)	27 (5.6%)
Cirrhosis	18 (5.6%)	12 (7.6%)	30 (6.2%)
Heart failure	86 (26.6%)	61 (38.6%)	147 (30.6%)
Arterial hypertension	140 (43.3%)	108 (68.4%)	248 (51.6%)
Atheroscelrotic disease	43 (13.3%)	51 (32.3%)	94 (19.5%)
Acute risk factors – n (%)			
Sepsis	181 (56%)	80 (50.6%)	261 (54.3%)
Exposition to nephrotoxic agents (72 hours)	61 (18.9%)	37 (23.4%)	98 (20.4%)
Ventilatoy support	195 (60.4%)	112 (70.9%)	307 (63.8%)
pH (SD)	7.38 (0.0804)	7.35 (0.104)	7.37 (0.0898)
HTC (SD)	41.6 (8.86)	40.2(10.0)	41.1 (9.26)

SD=standard deviation, HTC= Hematocrit

Results

From 1,625 ICU patients, 481 were included (38.7% female) median age of 61.3 y. Main comorbidity was sepsis (54.3%). 158 patients (32.8%) developed AKI. Using a cut point of 5, the Malhotra scale exhibited a sensitivity of 81.6% (95% CI 74.7 - 87.3%), a specificity of 42.4% (95% CI 37% -48%) and a negative likelihood ratio of 0.43 (95% CI 0.30 - 0.62). An optimal cut point of 8 was determined using the Youden method with a sensitivity of 52.3% (95% CI 43.2% - 59.3%), specificity of 79.3% (95% CI 74.4% - 83.54%), and a negative likelihood ratio of 0.61 (95% CI 0.53 - 0.73). The Area under the ROC curve (AUC) was 0.698 (95% CI 0.649, 0.748). There was low calibration, with the GiViTi calibration belt encompassing the bisector only in the low probabilities.



Receiver operator characteristic curve of the tool for prediction of acute kidney injury.

Discussion and Conclusions

Using Malhotra original cutoff point, had good sensitivity but poor specificity. Although an optimal cutoff improved specificity diminished sensitivity. Tool's discrimination capacity is adequate.
We recommend the original cutoff point of 5 for this population, as the tool effectively identifies low-risk patients, potentially minimizing AKI preventive interventions.
A more targeted, cost-effective AKI management in ICU settings, beneficial in emerging economies.
The low calibration indicates a need for a modified tool to better predict severe AKI risk in this population.