A bedside tool predicted the need for dialysis after cardiac surgery

Mehta RH, Grab JD, O'Brien SM, et al. **Bedside tool for predicting the risk of postoperative dialysis in patients undergoing cardiac surgery.** Circulation. 2006;114:2208-16.

Clinical impact ratings: Hospitalists ★★★★★☆☆ Cardiology ★★★★★★☆ Nephrology ★★★★★★☆

QUESTION

In patients having cardiac surgery, how well does a bedside tool predict the need for postoperative dialysis?

METHODS

Design: 2 cohort studies, 1 for derivation and 1 for validation from the Society of Thoracic Surgeons (STS) National Cardiac Surgery Database.

Setting: > 600 hospitals from 50 U.S. states and 5 Canadian provinces contributed data to the STS database.

Patients: The derivation set comprised 449 524 patients (median age 67 y, 70% men) who received coronary artery bypass grafting (CABG), mitral or aortic surgery, or a combination of CABG and mitral or aortic surgery between 1 July 2002 and 31 December 2004. Patients who were on dialysis before surgery were excluded. The validation set consisted of 86 009 patients having surgery between 1 January and 30 June 2005 who met the same inclusion and exclusion criteria.

Description of prediction guide: Logistic regression was used to identify risks for dialysis from patients' preoperative characteristics. The resulting model of 22 risk factors was refined to a simplified model approximation of 10 variables. Regression coefficients from the simplified model were converted into whole integers to create a bedside risk-scoring system.

Outcomes: Need for postoperative dialysis.

MAIN RESULTS

6451 patients (1.4%) in the derivation cohort and 1372 patients (1.6%) in the validation cohort required postoperative dialysis. Odds ratios for the 10 variables in the simplified model that predicted need for postoperative dialysis are in the Table. The bedside tool performed well in predicting which patients overall (*c* statistic = 0.83) and which patients having other types of cardiac surgery (*c* statistic range 0.75 to 0.83) would require dialysis. In the validation set, the bedside tool performed equally well overall (*c* statistic = 0.83) and in other surgery subsets (*c* statistic range 0.74 to 0.83).

CONCLUSION

In patients having cardiac surgery, a bedside tool could accurately predict the need for postoperative dialysis.

Source of funding: STS National Cardiac Surgery Database.

For correspondence: Dr. R.H. Mehta, Duke Clinical Research Institute, Durham, NC, USA. E-mail mehta007@deri.duke.edu.

Variables in a simplified model approximation predicting need for dialysis after cardiac surgery*

Variables	Groups	Odds ratio (95% CI)
Serum creatinine		4.62 (4.34 to 4.92)
Type of surgery	Aortic valve surgery	1.44 (1.29 to 1.60)
	Aortic valve surgery + CABG	2.14 (1.97 to 2.32)
	Mitral valve surgery	2.00 (1.77 to 2.26)
	Mitral valve surgery + CABG	3.12 (2.87 to 3.39)
Age (in 5-y increments starting at < 50 y)		1.23 (1.21 to 1.24)
Diabetes	Treated with insulin	2.17 (2.03 to 2.33)
	Treated with oral agents	1.42 (1.33 to 1.51)
Chronic lung disease		1.57 (1.49 to 1.66)
Myocardial infarction in the past 3 wk		1.44 (1.36 to 1.53)
Cardiogenic shock		2.36 (2.10 to 2.64)
NYHA class IV		1.49 (1.41 to 1.58)
Race (nonwhite vs white)		1.28 (1.19 to 1.38)
Previous cardiovascular surgery		1.63 (1.51 to 1.75)

*CABG = coronary artery bypass graft; NYHA = New York Heart Association. CI defined in Glossary.

COMMENTARY

Patients with kidney failure who require dialysis after cardiac surgery constitute a subgroup at extraordinary risk for mortality. Who is at highest risk for this serious complication, and how can this risk be quantified for physicians and their patients? Mehta and colleagues have used a multicenter registry of cardiac surgeries and associated outcomes to help address this question.

The authors examined preoperative characteristics associated with the need for postoperative dialysis, noting 10 factors that most accurately predicted this outcome. The risk factors they identified for their scoring system are all routinely available and easily transformed into an individual risk. Most of the risk factors are intuitive: higher creatinine level, diabetes, and age all define a population with greater risk for intrinsic kidney disease, and heart failure and more complex surgery define a group at greater risk for surgical complications and for hypoperfusion of other organs.

A previous study addressed the same question (1) and produced a risk score with similar, although not identical, parameters: Higher creatinine level, diabetes, heart failure, chronic obstructive pulmonary disease, and surgical complexity were important contributors to risk for dialysis. The study by Mehta and colleagues has the advantage of being larger and including patients from > 1 center. The similar risk factors in the 2 studies support their external validity.

A few limitations should be considered. Need for dialysis is a binary variable, and so any difference between patients requiring 1 dialysis session and those who go on to permanent kidney failure is lost. Development of acute kidney injury after cardiac surgery without the requirement for dialysis is also associated with adverse outcomes, but this was not evaluated. Finally, the risk model included patients requiring urgent or emergency surgery (46%). Such scoring systems are often best applied to elective cases, when patients and families have the luxury of time and choice. Despite these minor limitations, the identification of a score that predicts risk for dialysis requirement is an important contribution to the literature.

Dena E. Rifkin, MD
Mark J. Sarnak, MD, MS
Tufts–New England Medical Center
Boston, Massachusetts, USA

Reference

1. **Thakar CV, Arrigain S, Worley S, Yared JP, Paganini EP.** J Am Soc Nephrol. 2005;16:162-8.