
The Concept of a Composite Perioperative Quality Index in Kidney Transplantation

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BACKGROUND: Public reporting of patient and graft outcomes in a national registry and close Centers for Medicare and Medicaid Services oversight has resulted in transplantation being a highly regulated surgical discipline. Despite this, transplantation surgery lacks comprehensive tracking and reporting of perioperative quality measures. Therefore, the aim of this study was to determine the association between a kidney transplantation centers' perioperative quality benchmarking and graft and patient outcomes.

STUDY DESIGN: This was an analysis of 2011 aggregate data compiled from 2 national datasets that track outcomes from member hospitals and transplantation centers. The transplantation centers included in this study were composed of accredited US kidney transplantation centers that report data through the national registry and are associate members of the University HealthSystem Consortium.

RESULTS: A total of 16,811 kidney transplantations were performed at 236 centers in the United States in 2011, of which 10,241 (61%) from 93 centers were included in the analysis. Of the 6 perioperative quality indicators, 3 benchmarked metrics were significantly associated with a kidney transplantation center's underperformance: mean ICU length of stay (C-statistic 0.731; $p = 0.002$), 30-day readmissions (C-statistic 0.697; $p = 0.012$) and in-hospital complications (C-statistic 0.785; $p = 0.001$). The composite quality index strongly correlated with inadequate center performance (C-statistic 0.854; $p < 0.001$, $R^2 = 0.349$). The centers in the lowest quartile of the quality index performed 2,400 kidney transplantations in 2011, which led to 2,640 more hospital days, 4,560 more ICU days, 120 more postoperative complications, and 144 more patients with 30-day readmissions, when compared with centers in the 3 higher-quality quartiles.

CONCLUSIONS: An objective index of a transplantation center's quality of perioperative care is significantly associated with patient and graft survival. (J Am Coll Surg 2014;218:588–598. © 2014 by the American College of Surgeons)

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Clinical outcomes within transplantation are meticulously monitored and publically reported; detailed donor and recipient characteristics and patient and graft survival rates from across all US transplantation centers are reported to, and validated by, the Scientific Registry of Transplant Recipients (SRTR). These data are used to develop comprehensive risk models, calculate expected event rates, and identify inadequately performing transplantation centers. The Centers for Medicare and Medicaid Services and a number of private insurance companies use this publically reported data to determine in-network eligibility and transplantation center certification.^{1,2}

Unfortunately, transplantation lacks national comprehensive tracking and reporting of perioperative quality metrics, such as is conducted for a wide array of other surgical disciplines by the American College of Surgeons' NSQIP.^{3,4} This discrepancy has led to a unique situation

Abbreviations and Acronyms

LOS = length of stay
O/E = observed-to-expected
ROC = receiver operating characteristic
SRTR = Scientific Registry of Transplant Recipients
UHC = University HealthSystem Consortium

in which transplantation centers have a broad understanding of their donor and recipient risk characteristics and graft and patient survival rates, but very limited data about the comparative level of perioperative quality of care they are providing. This has important clinical implications, as it can hinder efforts to develop and track quality initiatives aimed at improving postoperative care.⁵ Studies conducted in a multitude of surgical procedures have demonstrated that the tracking and comparison of perioperative quality metrics, coupled with the promotion of best practices, can substantially improve the provision of surgical care.^{4,6-8} Therefore, the objectives of this study were to determine the association between perioperative quality metrics and patient and graft outcomes with the goal of developing a correlative composite transplantation quality index in a subgroup of US transplantation centers.

METHODS**Study design**

This was an IRB-approved analysis of national registry data with the primary aim of determining the association between perioperative quality metrics and patient and graft outcomes. A database was developed by combining 2011 aggregate variables downloaded and integrated from 2 primary data sources (www.uhc.edu and www.srtr.org). The University HealthSystem Consortium (UHC) is an alliance of 416 academic medical centers and affiliates that contains detailed perioperative clinical data that is gathered, aggregated at the hospital level, and available for download by affiliate members. Specific information available from UHC includes mean and variance data on patient sociodemographics, acuity of illness, admission diagnoses and procedures, hospital and ICU lengths of stay, in-hospital complications, mortality, and readmissions. Data available from the SRTR annual reports includes aggregate means for donor and recipient demographics, as well as observed and expected graft loss and mortality.

Study objectives

The primary aim of this study was to determine the association between benchmarked perioperative quality metrics and inadequate SRTR reported center performance. Perioperative quality metrics that were significantly associated with SRTR performance were incorporated in a

composite quality index. The secondary objective of this study was to determine the predictive performance of this index using a number of statistical modalities.

Study definitions

Inadequately performing transplantation centers were defined as programs that were cited for having higher than expected event rates for 1 month, 1-year or 3-year graft loss or patient death. Mean observed-to-expected (O/E) event rates were calculated for each center based on graft loss and patient death for 1 month, 1 year, and 3 years.

Perioperative quality measure definitions included mean length of stay (LOS) and ICU LOS, which was defined as mean days in the hospital and ICU after the transplantation surgical event. The LOS index was a calculation of the ratio of the mean O/E LOS for each transplantation center. Expected LOS is projected by UHC using regression modeling calculated separately for each MS-DRG. In-hospital mortality was defined as the mean percent of in-hospital deaths for patients undergoing kidney transplantation. In-hospital complication was a composite definition of the mean percentage of in-hospital complications occurring in patients undergoing kidney transplantation and calculated for each transplantation center. Complications are determined by UHC using diagnostic codes. Complications included in this analysis were subclassified as follows: cardiovascular complications were defined as in-hospital cerebral vascular accident, shock, acute myocardial infarction, or other cardiac abnormalities. Infectious complications were defined as in-hospital aspiration pneumonia, catheter-associated urinary tract infection, nosocomial pneumonia, wound infection, or sepsis. Surgical complications were defined as in-hospital reopening of the surgical site or mechanical complications due to device implant or graft. Development of a safety issue was defined as in-hospital pressure ulcer (decubitus ulcer), foreign body left in during procedure, iatrogenic pneumothorax, central line-associated blood stream infection, hip fracture, hemorrhage or hematoma, respiratory failure, pulmonary embolism or deep vein thrombosis, sepsis, wound dehiscence, accidental puncture or laceration, transfusion reaction, or complications of anesthesia. Finally, readmissions were defined as the percent of kidney transplant recipients readmitted to the transplantation center within 7, 14, or 30 days after discharge.

Statistical analysis plan

Initially, perioperative quality metrics for each transplantation center were benchmarked. These included hospital and ICU LOS, in-hospital mortality, in-hospital complications

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