Wound Classification in Pediatric General Surgery: Significant Variation Exists among Providers

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BACKGROUND: Risk-adjusted rates of surgical site infections (SSI) are used as a quality metric to facilitate improvement within a hospital system and allow comparison across institutions. The NSQIP-Pediatric, among others, uses surgical wound classification as a variable in models designed to predict risk-adjusted postoperative morbidity, including SSI rates. The purpose of this study was to measure the level of agreement in wound classification assignment among 3 providers: surgeons, operating room (OR) nurses, and NSQIP surgical clinical reviewers (SCR).

STUDY DESIGN: An analysis was performed of pediatric general surgery operations from 2010 to 2011. Wound classification was assigned at the time of operation by the OR nurse and surgeon, and by the NSQIP SCR postoperatively, according to NSQIP methodology. Disagreement was defined as any discrepancy in classification among the 3 providers, and the level of agreement was determined using the kappa statistic.

RESULTS: For the 374 procedures reviewed, there was an overall disagreement of 48% among all providers, kappa 0.48 (95% CI 0.43 to 0.53). When comparing wound classification by surgeon and NSQIP SCR, 23% of cases were in disagreement, kappa 0.74 (95% CI 0.68 to 0.78). Disagreement between OR nurse and either surgeon or NSQIP SCR was higher: 38%, kappa 0.45 (95% CI 0.38 to 0.53) and 40%, kappa 0.44 (95% CI 0.37 to 0.51). Fundoplication, appendectomy, and cholecystectomy demonstrated the highest overall disagreement (73%, 71%, and 60%, respectively).

CONCLUSIONS: There is significant variation in assigning surgical wound classification among health care providers. For future SSI comparative analyses, it will be critical to improve uniformity and understanding of wound class assignment among providers and institutions. (J Am Coll Surg 2013;217:819–826. © 2013 by the American College of Surgeons)

Since publication of the National Research Council wound classification guidelines in 1964, surgical wounds have been classified according to the degree of contamination present before or during the operation.[1,2] Wounds are assigned to 1 of 4 main classes: "clean," "clean/contaminated," "contaminated," or "dirty/infected" according to specific definitions based on preoperative and intraoperative findings related to the degree of contamination or break in sterile technique. Estimated rates of expected surgical site infections (SSI) in adults based on each wound classification have been previously published.[2-4] However, traditional rates of SSI by wound classification category have been challenged in a more recent study in which SSI rates were much lower, especially for "contaminated" and "dirty/infected" wounds, reflecting potential changes in clinical practice, technical advances including laparoscopy, or reporting.[5]

Although it has been demonstrated that wound classification is associated with rates of SSI, using this variable

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Abbreviations and Acronyms

ACS	= American College of Surgeons
ASA	= American Society of Anesthesiologists
CPT	= Common Procedural Terminology
IQR	= interquartile range
NSQIP SCR	= National Surgical Quality Improvement Program Surgical Clinical Reviewer
OR	= Operating room
RN	= Registered nurse
SSI	= Surgical site infection

alone to predict risk of SSI is limited because it fails to account for the clinical factors that might predispose an individual patient to develop an infection. The Study on the Efficacy of Nosocomial Infection Control (SENIC) developed the first model allowing for risk-adjustment in the prediction of SSI.[6,7] This model was adapted further by the National Nosocomial Infections Surveillance (NNIS) system, in which 2 additional variables, American Society of Anesthesiologists (ASA) score and duration of surgery, were incorporated to allow better risk-adjusted prediction of SSI.[3,7] This proved to be better than wound classification alone in determining expected rates of SSI and was valid for a variety of surgical procedures in adults.

Although the pediatric population seems to be at lower risk of developing SSIs and typically has fewer comorbidities, the degree of contamination in the surgical wound appears to be significantly associated with the risk of SSIs in children, perhaps to an even greater extent than in adults.[8] Age, sex, ASA status, nutritional status, presence of a coexisting disease, and length of preoperative and postoperative hospital stay did not appear to be associated with risk of SSI in several studies, suggesting that factors related to wound contamination and surgical technique may be more important than physiologic patient factors in the pediatric population.[9,10]

In current practice, wound classification is one of the variables reported to the American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) at participating institutions and is used to determine risk-adjusted rates of SSIs, which is considered a NSQIP perioperative quality outcomes measure.[5,11] The ACS more recently launched NSQIP-Pediatric in 2008, specifically designed to collect and report similar data in the pediatric patient population. Currently, NSQIP performs a comparative analysis of all participating institutions, which is then reported back to each institution in order to facilitate quality improvement. Institutional postoperative complication rates, including SSIs, could potentially become an outcome reported to the public, regulatory agencies, or even insurance agencies, which could ultimately affect reimbursement.

Although wound classification continues to be considered an important variable in the prediction of postoperative SSIs for children and adults, it is unclear if surgical wounds are classified uniformly by the different health care providers who generate and report this assessment in the medical record. The purpose of this study was to measure the level of agreement in wound classification assignment in pediatric general surgery procedures among 3 providers: surgeons, operating room (OR) nurses, and the NSQIP surgical clinical reviewer (SCR) at a single institution. We hypothesized that there would be significant variation in wound classification assignment among these 3 raters and that this would vary by specific procedure type.

METHODS

At this institution, wound classification is routinely documented by the circulating OR nurse from a drop-down menu in the electronic OR record at the start of an operation. The OR nurse assigns wound class according to the most recent Association of Perioperative Registered Nurses guidelines; however, the nurses are not required to undergo any formal training in wound classification.[12] A surgeon, usually either a surgical resident or fellow, is also required to select the most appropriate wound classification assignment from a drop-down menu in the electronic medical record at the conclusion of the case. Residents, fellows, and attending surgeons also do not undergo any formal training in the definitions or documentation of wound class assignment at this institution. Discussion of the most appropriate wound classification may or may not occur between the OR nurse and the surgical team before documentation by each individual.

A random sample of all cases is then generated and reviewed by a certified NSQIP SCR. The NSQIP SCR is trained in the data definitions and methodology of ACS NSQIP and determines an independent wound classification assignment for designated cases through a comprehensive medical record review, although the SCR is aware of the previous assignments made by the surgeon and OR nurse.[13] The NSQIP definitions for wound class mirror those of the Association of Perioperative Registered Nurses.[14] This wound class assignment and other perioperative clinical variables are then deidentified and reported to the central ACS NSQIP database.

Before data collection, approval for this study was obtained from the Vanderbilt Institutional Review Board (IRB#111689). We collected deidentified data from July 21, 2010 through October 31, 2011 on all pediatric general surgery cases that had been selected for review