

Editorial

Wound Infection Rates Following Clean Operative Procedures: Can We Assume Them To Be Low?

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Postoperative wound infection rates have historically been reported to be lower following clean operative procedures than for other traditional categories of surgery.^{1,2} This was thought to be due primarily to the low levels of exogenous contamination that occur during these procedures, as contrasted to the higher combination of exogenous-endogenous contamination that occurs during other surgical procedures. Over 500,000 wound infections are estimated to occur nationally each year, approximately 2.8 per 100 operations performed.³ At least 50% of these infections will take place after hospital discharge in this age of outpatient and same-day surgery.^{4,5} Standardized effective surveillance programs to detect and control surgical wound infection have been proven to be beneficial in reducing their incidence.⁵

In the mid 1970s, the development of postoperative wound infection, following commonly performed operative procedures, was noted to be associated with a doubling of the average duration of hospital stay and, correspondingly, significant increases in the cost of hospitalization.⁶ Today, these increases in real cost and length of hospital stay are undoubtedly much lower for most wound infections because of the fact that most surgical procedures are accomplished in the outpatient setting. Wound infections diagnosed in this setting usually do not require hospital admission and are treated in the outpatient clinic or in the patient's home.⁷ An exception to this can be cited for sternal wound infections following cardiac operations that continue to have a dramatic impact, increasing the duration of hospitalization as much as 20-fold and the cost of hospitalization five-fold.⁸

The pathogens usually isolated from surgical wound infections following clean surgical procedures continue to be exogenous, aerobic, gram-positive cocci typified by *Staphylococcus aureus*. Rarely, however, unusual microorganisms such as rapidly grow-

ing mycobacteria, *Rhodococcus bronchialis*, and *Candida tropicalis* have been implicated in outbreaks of both superficial and deep wound infections following open heart surgery or augmentation mammaplasty.^{9,12}

The absolute prevention of postoperative wound infection seems to be an impossible goal. The attainment of low rates depends on many factors including good surgical judgment and proper technique as well as the general health and stage of disease of the individual patient. Many other factors such as length of preoperative stay, techniques of preoperative cleansing and hair removal, use of prophylactic abdominal drainage, and the presence of remote infection at the time of elective operation significantly influence the development of postoperative wound infections in clean surgery.^{2,13} The use of prophylactic antibiotics in clean surgical procedures that use a prosthesis or foreign body is generally advocated.^{14,15} There is debate, however, concerning the use of prophylactic antibiotics in clean surgical procedures that do not use foreign materials such as in most breast operations and hernia repairs.^{14,16}

What incidence of wound infection should one assume to be acceptable in clean surgical procedures? Should it be the time-honored 2% or below? Should we assume that all patients undergoing a clean surgical procedure have an equally low risk for the development of postoperative wound infections? In this issue of *Infection Control and Hospital Epidemiology*, Ferraz and colleagues discuss their 13-year study of the incidence of postoperative wound infection in 1,542 patients undergoing clean surgery.¹⁷ They have identified a great variation in the incidence of infection for the different procedures studied. The lowest infection rate was 4.7% in inguinal hernia repair, while the highest infection rates were observed following the repair of an abdominal incisional hernia (14.7%) and in

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splenectomy for patients with schistosomiasis (21.2%).

Many investigators in the last decade have outlined specific patient risk factors that favor the development of postoperative wound infection in many different clinical settings including Caesarean section, hysterectomy, appendectomy, penetrating abdominal trauma, open heart surgery, peripheral vascular surgery, and elective colon resection.⁷ Haley and colleagues of the Centers for Disease Control (CDC) were the first to publish on the importance of identifying individual patients who are at high risk for surgical infection in each of the traditional categories of operative procedures.¹⁸ In order to predict the likelihood of surgical wound infection from several risk factors, the authors used information collected on 58,498 patients undergoing operations in 1970, and they developed a simple multivariate risk index analyzing ten possible risk factors by stepwise multiple logistic regression techniques. The developed model contained four risk factors: abdominal incision, operation lasting over two hours, contamination or dirty infection operations by traditional wound classification systems, and patients who have three or more diagnoses on their hospital front sheet at discharge. These factors were found to better predict wound infection in 59,352 patients when compared with other approaches.¹⁸ Of importance to this study was the finding that the overall infection rates in clean surgical procedures was 2.9%. Of even more significance was the variation of infection rates within this group of operative procedures: 1.1% in low-risk patients to 15.8% in high-risk patients. Abdominal incisional hernia repair, because of the associated risk factors noted above, would appear to have been in the higher risk category as suggested by Ferraz and colleagues.¹⁷ These authors appropriately conclude that the classification of clean operation carries the potential for a great variation of wound infection depending on the risk factors present in the patient undergoing each surgical procedure. The postoperative infection rate cannot be assumed to be low because the operation is classified as clean.

Most recently, CDC investigators have reported on a new composite risk index for the development of wound infection based on data collected from over 100,000 patients in the National Nosocomial Infections Surveillance (NNIS) systems.¹⁹ It differs from the previous index by using three factors: the American Society of Anesthesiology (ASA) score, presence of contamination at the operation, and a procedure-related time cut-point (T-time). This simple approach showed nearly a doubling of infection rate in clean surgical procedures for each of these risk factors present; 1.8% infection rate if no factors were present to 13.6% if all three were present.

The risk of infection in each traditional category of surgical procedures varies greatly depending on the individual patient risk factors. The infection rate in clean surgical procedures cannot be assumed to be low. Realization of the presence of patient risk factors in each surgical procedure will result in more accurate assessment of the initial risk of wound infection and will allow for prophylactic or therapeutic interventions, which may ideally lead to an overall decrease in the incidence of wound infection.

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