Editorial

Classification of the Surgical Wound: A Time for Reassessment and Simplification

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Classification of the surgical wound in the operating room by surgeons and nurses is a time-honored routine that has been practiced for at least 30 years, since the time of the National Academy of Sciences National Research Council study on the influence of ultraviolet irradiation on surgical wound infection.[1] This traditional method uses four classes of wounds based on the risk level and type of contamination expected or observed at operation.[2-3] Clean surgical wounds (Class I) are those in which only exogenous (airborne) contamination is expected or observed and the predicted wound infection rate is approximately 2%, largely due to gram-positive microorganisms such as *Staphylococcus aureus*. Clean-contaminated (Class II) wounds are those in which generally both exogenous and endogenous (aerobic-anaerobic) bacterial contamination occur during elective operations. The infection rate in this category is estimated at 5% to 15% and is usually due to the polymicrobic endogenous flora. Contaminated wounds (Class III) are those with early endogenous leakage or delayed exogenous contamination in the absence of established clinical infection and carry a greater than 15% infection rate. In dirty wounds (Class IV) where active infection is encountered during operation, a postoperative infection rate of greater than 30% is anticipated.

During the last decade, there have been problems identified with the use of this traditional wound classification system and the accuracy of the predicted infection rates in each category. The major limitation lies in the lack of attention to the varying risk of infection among subjects in each class of wound.[3] Haley et al[4] at the Centers for Disease Control and Prevention were among the first to publish on the importance of identifying the varying individual risks for infection among patients in each of the traditional four categories of wounds. Using stepwise multiple logistic regression in nearly 59,000 patients, they developed a new predictive index using four risk factors that, when studied in an equally large group of surgical patients, was able to accurately predict the incidence of wound infection. They identified three different risk groups (low, medium, and high) in both the clean and clean-contaminated wound classes and only two risk groups (medium and high) in the contaminated and dirty classes. There were surprisingly close similarities of predicted infection rates among Class I and II and in Class III and IV wounds. The infection rates in Class I wounds were reported as 1.1% (low risk), 3.9% (medium risk), up to 15.8% (high risk) with an overall rate of 2.9%, while they were predicted as 0.6% (low), 2.8% (medium), up to 17.7% (high), with an overall 3.9% in Class II wounds. The infection rates in Class III wounds, where no low-risk group was identified, were 4.5% (medium) and up to 23.9% (high) with an overall rate of 8.5%, while in Class IV wounds, also without a low-risk group, they were predicted at 6.7% (medium), up to 27.4% (high), and 12.6% overall.

It seems apparent from the above study that

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today the overall infection rates are lower than have been traditionally predicted for all classes of wounds except Class I, which is slightly higher. More important, it is obvious that a combination of patient risk factors and wound classification, rather than wound classification, alone more clearly predicts postoperative infection.[5,6] However, infection rates in both the overall and in the different risk groups were similar in Classes I and II and in Classes III and IV.

A recently reported 13-year study of the incidence of postoperative wound infection in a large group of patients undergoing clean surgery has also stressed the great variation in the incidence of infection for different patients with varying risks.[7] High wound infection rates were found in patients having splenectomy in the face of schistosomiasis (21.2%) and for abdominal incisional hernia repair (14.7%). Based on these studies, it must be stressed that the wound infection rate following a clean surgical procedure cannot be assumed to be low.[4-7]

In this issue of *Infection Control and Hospital Epidemiology*, Cardo et al[8] have reported on the high degree of accuracy of wound classification accomplished by circulating nurses (CNs) compared with a "gold standard" physician observer. The accuracy of classification is reported at 94% in 50 general surgical cases, whereas it is 82% in 50 cases of trauma surgery. The lower rate in trauma surgery may be due to the necessity of surgical exploration to assess if injuries to the gastrointestinal tract are present before classification is possible and to increased failure of communication between the surgeon and those observers in the operating room during emergency procedures. Most important, this study shows that the classification by CNs is even more accurate when wound classification is divided into just two categories (clean and clean-contaminated or contaminated and dirty).

The authors have listed breaks in technique that they termed "major," but which many observers would consider minor. In their study, 97 such breaks were observed in 2,014 operations (4.8%); 69 instances related to foreign matter on the wound or sterile field and the majority of the remainder related to surgical glove or gown failures. I feel that none of these types of breaks to date have been shown to influence the postoperative wound infection rate. I would, however, be interested in knowing whether the gastrointestinal tract was inadvertently entered in any of these 100 surgical procedures. This occurrence would be, in my opinion, a true major break that would translate to a higher postoperative infection rate.[9] However, glove perforation[10] and surgical gown barrier breakthrough" allow for the contact of the patient's blood with the skin of the healthcare worker. Most believe that these contacts with the patient's blood increase the chances of the worker acquiring occupationally transmitted bloodborne diseases, but have little or no role in increasing wound infection rates.

In conclusion, the traditional four-class system of estimating risk for postoperative wound infection is largely dependent on the nature and extent of perioperative contamination, reflecting little focus on individual patient risk factors. Additionally, the classification levels overlap. Although this system has served us well, the data presented above indicate that a simplified two-tiered system could be more effective. The risk of postoperative wound infection depends largely on the combined effects of the nature and extent of perioperative contamination, as well as individual patient risk factors. More attention should be focused on delineating the general risk factors, including specific disease or operative factors, for infection in the surgical patient.[3]

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