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Suture thread check test for detection of surgical site contamination: a prospective study

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ABSTRACT

Background: Surgical site infection (SSI) is a common complication of surgical procedures.
Aim: Our study aimed at investigating a new method based on assessment of suture thread colonization to identify patients developing an SSI.
Materials and Methods: We prospectively enrolled 119 patients undergoing elective surgery. For each patient, a synthetic absorbable thread in Lactomer 9-1 (Polisorb Gauge 2) inserted in the surgical site at the end of surgery was sent to the microbiology laboratory after 48 h to assess colonization of its inner tract.
Results: Forty (33.6% of cases) patients had a colonized thread. Antibiotic prophylaxis was administered to 66 of 79 patients who did not display a colonized thread and to 20 of the 40 patients with a colonized thread (83.5% *versus* 50%, respectively, $P = 0.0002$). An SSI was observed only in patients with a colonized thread (10% *versus* 0, $P = 0.02$). The microorganisms identified in colonized threads were the same identified in SSIs.
Conclusions: Since an SSI was found only in patients with colonized threads, the method described here may be valuable for identifying patients developing an SSI. Moreover, the method can also be useful for targeting efficient antibiotic therapy to the culprit microorganisms.

Introduction

Surgical site infection (SSI)[1] is a common complication of surgical procedures. According to Centers for Disease Control and Prevention criteria,[2] infection related to surgery occurs within 30 days of the operation if no implant is left in place or within 1 year if an implant is in place. SSI complicates up to 10%-20% of operations[3] and represents one of the most common health care–associated infections, leading to a significant increase in hospital stay, morbidity, mortality, and economic costs.[4]

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Factors influencing the incidence and risk of SSIs are several and mainly related to the class of operation (clean, clean-contaminated, contaminated, dirty, or infected), use of prosthetic devices, duration of hospital stay before surgery, duration of surgery (lasting more than the 75th percentile for the specific procedure), and host comorbidity (i.e., concomitant diseases according to the American Society of Anesthesia [ASA] score).[5-12]

Prevention and effective management of SSI are fundamental issues. With regard to risk prevention, it is crucial to assess factors that may impact on surgical wound healing during preoperative, intraoperative, and postoperative phases.[13-16] Preoperative strategies are based on evaluating corrective factors related to patient health status and, accordingly, on using appropriate antisepsis measures. Intraoperative strategies include the assessment of factors related to type, duration, and complexity of surgery and the application of a correct antimicrobial prophylaxis aimed at reducing the colonization of the surgical site, and, consequently, the risk of infection. To this purpose, it is important that the antibiotic selected for prophylaxis is capable to cover the expected pathogens for the specific operative site, according to local resistance patterns. Finally, the postoperative phase should focus on a careful and thorough assessment and follow-up of the patient after discharge.

Concerning SSI management, clinicians need to quickly recognize it to carry out a tailored management according to the specific condition of the patient.

Antimicrobial prophylaxis has the aim to reduce surgical site colonization and, thus, the risk of infection.[15-17] To be efficient, the antibiotic should be administered in a single dose intravenously (except for particular conditions, e.g., prolonged surgery, significant blood losses, and so forth) in the 60 min preceding surgical incision.[1] Furthermore, the antibiotic selected for prophylaxis must cover the expected pathogens for the specific operative site, according to local resistance patterns.[12,18]

Although international guidelines on the indication and use of antimicrobial prophylaxis in surgery have been published all along,[8,17,19] antimicrobial prophylaxis is still a matter of debate. For example, on one side, the list of clean procedures to be subjected to prophylaxis is increasing, whereas, on the other hand, the large use of antibiotics in this setting is one of the factors associated with the development of antibiotic-resistant bacteria or very serious events, such as colitis by *Clostridium difficilis*.

Based on these premises, in this article, we report on a new method assessing surgical site contamination to precociously identify patients who may potentially develop an SSI.

Patients and methods

Patients

This was a prospective open study with consecutive patient enrollment at the Surgery Unit of "Luigi Vanvitelli" University of Campania, Naples, Italy, from July 2015 to March 2016.

Each patient underwent a complete physical examination as well as liver and kidney function tests. Patient health status and comorbidities were assessed according to the criteria proposed by ASA score.[5] We included only patients with a short duration of hospitalization (less than 2 days) consenting to participate in the study. No dirty and emergency procedures were included in the study. By the end of the enrollment period, 119 consecutive patients were recruited.

A clean surgical procedure is defined as an elective operation that, by using or not prosthetic devices, shows no signs of inflammation and does not involve the respiratory, alimentary, or genitourinary tracts.[1] A clean-contaminated procedure is an operation in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination.[1] A contaminated procedure is defined as an operation where acute inflammation (without pus) is encountered, or where there is a visible contamination of the wound.[1]

The protocol of the study did not foresee patient allocation for antibiotic prophylaxis. In other words, indication and type of antimicrobial prophylaxis or therapy was decided by clinicians according to individual risk factors for infection and type of surgery. All surgical procedures were planned according to standardized surgical techniques.

For each patient enrolled in this study, a synthetic absorbable suture thread gauge 2 (Coated, Braided Lactomer 9-1),[20,21] which is routinely used in clinical practice, was inserted in the surgical site at the end of surgery. Suture threads ranged between 5 and 10 cm, depending on the wound type; externally, they all measured 5 cm. After 48 h, the suture thread was removed, and, through a sterile method, only the inner tract of removed threads, which were below the skin, was sent to laboratory for microbiological tests (Fig. 1). Before thread extraction from surgical site, the skin was always disinfected with chlorhexidine 2% to reduce the risk of contamination by skin microorganisms at the time of removal. Specifically, a thread was considered colonized when a presence of microorganisms without apparent clinical symptoms or tissue reaction was observed by microbiological methods.

All procedures were carried out in accordance with the international guidelines and with the Helsinki Declaration of 1975, revised in 1983. The Ethics Committee of the teaching hospital of the "Luigi Vanvitelli" University of Campania approved the study (no. 960/2015). All patients signed an informed consent for surgery, collection and storage of biological samples (including the suture thread), and for the anonymous use of their data for research purposes.

Microbiological methods

Suture threads were put each into a container and were completely covered with 10 mL of Ringer's solution. To planktonize microorganisms in the biofilm on the surface of suture threads, they were vortexed for 30 seconds and subsequently exposed to low frequency (40 kHz) ultrasound (VWR Scientific Products) for 60 seconds.[22] The sonication process was performed in an ultrasound bath especially designed for microbiological analysis. After sonication, containers were vortexed again for 30 seconds. Twenty milliliters of sonication fluid was centrifuged at 3000 g for 10 minutes. Supernatants were discarded, and sediments