Presurgical Molecular Testing for Staphylococcal Nasal Colonization: A Targeted Approach to Reducing Surgical Site Infections

A Diagnostics First Publication

Routine molecular testing of the nares for the presence of *Staphylococcus aureus* followed by targeted decolonization of patients carrying either *S. aureus* (SA) or Methicillin-resistant *S. aureus* (MRSA) prior to surgery is an effective strategy for preventing surgical site infections (SSIs).[1,2,3] It is consistent with both infection prevention and antimicrobial stewardship efforts. This article provides an overview of the value of presurgical molecular testing and targeted decolonization at reducing post–joint replacement SSIs.

Burden of joint replacement SSIs

There are more than 1 million total hip and total knee replacement procedures performed in the United States each year.[4] These procedures are now the most commonly performed inpatient surgeries for Medicare beneficiaries[5,6] and the number is likely to increase as the population ages. In fact, estimates suggest the number of hip and knee procedures is expected to more than double and quadruple, respectively, in the next decades.[7]

SSIs are a common yet often preventable complication of surgery, accounting for approximately 20% of all healthcare-associated infections (HAIs) in the United States.[8,9,10] The financial burden associated with SSIs is considerable. The cost of care for patients without an SSI is a fraction of the cost for those with an SSI.[9,11,12] For patients with SSIs, hospitalization is prolonged, readmission rates are higher, and resource utilization is increased.[11,12,13]

The readmission rate following joint replacement surgery is approximately 4% to 5%, with a third of patients readmitted due to postsurgical infections.[14] The projected costs of either a post–prosthetic knee or hip *S. aureus* infection is as high as $100,000 per infection.[15]

Yet, SSIs are not just a financial issue. There are considerable clinical implications to the patient for SSIs as well. Joint replacement–related infections are generally more severe than other surgical infections, and given the nature of the surgery performed and the obligatory presence of surgical hardware, morbidity and mortality are also increased.

Over 1 million

Total hip and total knee replacement procedures performed each year in the United States

4%—5%

Readmission rate following lower extremity joint replacement

$60,000—$100,000

Cost of a post-prosthetic knee or hip infection

>1/3 of readmissions due to infection

(63% of infections are due to Staph species like *S. aureus*)

Colonized patients are 9 times more likely to develop an SSI

More than 8 out of 10 cases of *S. aureus* bacteremia are believed to be caused by a patient's own flora

Standard culture techniques may miss MRSA colonization in up to a third of cases

Presurgical testing for nasal colonization to reduce risk of post–joint replacement infections

S. aureus is considered to be the most important organism responsible for SSIs in orthopedic patients due to its virulence, prevalence, and associated morbidity and mortality.[16] MRSA, methicillin-susceptible *S. aureus* (MSSA), and coagulase-negative staphylococci comprise the majority of SSIs after total hip and knee procedures, with *S. aureus* accounting for 53% of post–knee replacement and 65% of post–hip replacement infections.[17]

Intranasal colonization with MRSA or MSSA is a well-documented risk factor for developing a post-surgical infection. Colonized patients are up to 9 times more likely to develop an SSI,[18] and more than 8 out of 10 cases of *S. aureus* bacteremia are believed to be caused by a patient's own flora.[19,20] Intranasal mupirocin and daily chlorhexidine baths have been shown to be an effective preoperative eradication strategy for MRSA- or MSSA-colonized patients,[16,21] but indiscriminate use can result in the development of antibiotic resistance and runs counter to the principles of antimicrobial stewardship. Therefore, presurgical testing for MRSA and MSSA with appropriate decolonization measures for patients who test positive for these organisms can be an effective strategy prior to total joint and other orthopedic procedures.

Approaches to decolonization

While preoperative screening and decolonization in orthopedic patients has been shown to be an effective means to reduce SSIs,[21] questions remain about the most efficient and effective means of achieving this goal. One approach is universal decolonization of patients by using mupirocin and chlorhexidine baths. In theory, when all patients are decolonized, the risk of SSIs should be reduced. In practice, however, implementation of universal decolonization is often incomplete. Patients may undergo surgery before decolonization can be completed,[22] standard culture techniques may miss MRSA colonization in up to a third of cases,[23,24] and, more important, universal decolonization contradicts the principles of antibiotic stewardship by potentially driving antibiotic resistance through selection pressure.[25,26,27]

An alternative approach, which has been widely adopted in many hospitals in lieu of universal decolonization, is targeted decolonization after testing patients with rapid molecular diagnostic tests to identify carriers. The molecular tests have higher sensitivity than culture while maintaining high specificity. Infection control practices that include polymerase chain reaction–based presurgical testing have been proven to lower postoperative infection and mortality rates and reduce overall length of hospital stays and the cost of care.[1,2,3]

Presurgical testing using molecular diagnostics to guide SSI prevention efforts could also have a positive impact on Centers for Medicare & Medicaid Services quality incentive program measures by helping to prevent readmissions that could lead to penalties under the Hospital Readmissions Reduction Program.[28] Moreover, rapid and accurate detection of colonization facilitates targeted infection control practices, which can be incorporated into preoperative workflow procedures, and is in alignment with accepted infection control strategies.

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