
Previous Methicillin-Resistant *Staphylococcus aureus* Infection Independent of Body Site Increases Odds of Surgical Site Infection after Ventral Hernia Repair



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- BACKGROUND:** Methicillin-resistant *Staphylococcus aureus* infections can be difficult to manage in ventral hernia repair (VHR). We aimed to determine whether a history of preoperative MRSA infection, regardless of site, confers increased odds of 30-day surgical site infection (SSI) after VHR.
- STUDY DESIGN:** A retrospective cohort study of patients undergoing VHR with class I to III wounds between 2005 and 2012 was performed using Vanderbilt University Medical Center's Perioperative Data Warehouse. Preoperative MRSA status, site of infection, and 30-day SSI were determined. Univariate and multivariate analyses adjusting for confounding factors were performed to determine whether a history of MRSA infection was independently associated with SSIs.
- RESULTS:** A total of 768 VHR patients met inclusion criteria, of which 46% were women. There were 54 (7%) preoperative MRSA infections (MRSA positive); 15 (28%) soft tissue, 9 (17%) bloodstream, 4 (7%) pulmonary, 3 (6%) urinary, and 5 (9%) other. Overall SSI rate was 10% (n = 80), SSI rate in the MRSA-positive group was 33% (n = 18), compared with 9% (n = 62) in controls (p < 0.001). Multivariate analysis demonstrated that a history of MRSA infection significantly increased odds of 30-day SSI after VHR by 2.3 times (95% CI, 1.1-4.8; p = 0.035). Other factors associated with postoperative SSI were performance of myofascial release, increasing BMI, length of operation, open repair, and clean-contaminated wound classification.
- CONCLUSIONS:** A history of site-independent MRSA infection confers significantly increased odds of 30-day SSI after VHR. Additional investigation is needed to determine perioperative treatment regimens that might decrease odds of SSI in VHR, and optimal prosthetic types and techniques for this population. (J Am Coll Surg 2015;221:470-477. © 2015 by the American College of Surgeons)
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Ventral hernia repair (VHR) is one of the most common procedures performed by general surgeons. In 2006, these hernia repairs were estimated to cost the United States \$3.2 billion in hospital expenses alone.¹ Due to a

higher-than-expected rate of surgical site infections (SSI) compared with other clean procedures and concern about mesh infections, a history of MRSA soft tissue infection presents a specific dilemma when considering VHR.²

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Abbreviations and Acronyms

EMR	= electronic medical record
LOS	= length of stay
OR	= odds ratio
PDW	= perioperative data warehouse
SSI	= surgical site infection
VHR	= ventral hernia repair
VUMC	= Vanderbilt University Medical Center

Much controversy exists about whether these patients should be managed differently, and a true correlation between a previous MRSA infection and postoperative SSIs has not been clearly defined. Some groups have suggested screening and eradication of MRSA in carriers to reduce postoperative infections, yet more than half of the patients with MRSA SSI in one of these studies were negative on nasal swab screening.³

In addition, the prevalence of MRSA continues to increase nationwide (66.4 per 1,000 inpatients in 2010 compared with 46.3 inpatients in 2006), with MRSA being the primary organism causing skin and soft tissue infections in the United States.^{4,5} *Staphylococcus aureus* infections are the most common contributor to SSIs, and constitute 30% to 50% of SSIs that develop after clean procedures.^{6,7} A 2005 study by Anderson and colleagues⁸ found that MRSA was the most common organism isolated in SSIs from 26 hospitals, representing 17% of all SSIs and 53% of SSIs attributable to *S aureus*.

Faraday and colleagues⁹ found that a history of preoperative skin infections, no matter how remote from the date of operation, was associated with a 3-fold higher risk of deep and organ space SSI and infectious death after high-risk clean procedures. Although this study and others evaluated the links between preoperative skin and wound infections and SSI, there remains a paucity of knowledge about whether preoperative MRSA infections independent of body site contribute to the odds of SSI.^{10,11} The objective of this study was to determine whether a preoperative MRSA infection at any body site increases the odds of 30-day SSI after VHR. If a history of site-independent MRSA infection is found to increase the odds of postoperative SSI, efforts could then focus on appropriate interventions to reduce these odds.

METHODS

Study design and data sources

A retrospective cohort study was performed that included adult patients at Vanderbilt University Medical Center (VUMC) who underwent VHR between July 2005 and May 2012. Patients were identified by CPT codes

(49560, 49561, 49566, 49568, 49570, 49572, 49585, 49587, 49590, 49652, 49653, 49654, 49655, 49657) using Vanderbilt's Perioperative Data Warehouse (PDW). The PDW is an institutional database containing clinical and administrative data on patients undergoing procedures. Vanderbilt University Medical Center's electronic medical record (EMR) was queried and abstracted to supplement PDW data when needed. This study included elective repairs of both primary and incisional hernias. Small umbilical hernias and laparoscopic repairs were included, along with open VHRs, because mesh is often used in all of these cases, and concern exists about the use of prosthetic material in patients with a history of MRSA. Patients meeting any of the following criteria were excluded from analysis in this study: death within 30 days of operation without an SSI developing; active SSI at the time of operation; active mesh infection at the time of operation; and patients with class IV wounds. The Social Security Death Index was used to determine death status. Study data were collected and managed using REDCap electronic data capture tools, which is supported by the UL1 TR000445 grant from National Center for Advancing Translational Sciences/NIH and hosted at VUMC.¹² The Human Research Protection Program at VUMC approved this study protocol.

Determination of preoperative methicillin-resistant *Staphylococcus aureus* status

Preoperative MRSA exposure was defined as a documented history of MRSA infection at any body site, up to and including the date of operation. Nasal swab screening is not routinely performed at VUMC, and our definition of MRSA positive focused on patients with a history of an active infection rather than the asymptomatic carrier state. Methicillin-resistant *S aureus* status was determined initially by a free-text query of the VUMC EMR for the term *MRSA*, followed by in-depth review of preoperative clinic notes, anesthesia evaluations, and laboratory cultures for any mention of MRSA, *S aureus*, methicillin, or methicillin resistance. Culture results, including date and site of infection, as well as antibiotic sensitivities, were obtained from the VUMC laboratory, when available, for patients with a history of MRSA infection (MRSA positive). Referring hospital culture results were reviewed for patients without culture results at VUMC.

Outcomes measures and confounding variables

The primary outcome measure was 30-day SSI, as defined by the CDC and NSQIP criteria.¹³ The EMR (including progress notes, discharge summaries, emergency department visits, and outpatient clinic notes) was evaluated

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