NORTHERN OHIO FOOT & ANKLE FOUNDATION

The Northern Ohio Foot and Ankle Journal *Official Publication of the NOFA Foundation*

A Literature Review of Causes and Risk Factors for Surgical Wound Dehiscence

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The Northern Ohio Foot and Ankle Journal 4(26): 1-5

Abstract*:* Postoperative wound healing plays a significant role in facilitating a patient's recovery and rehabilitation. Surgical wound dehiscence (SWD) impacts mortality and morbidity rates and significantly contributes to prolonged hospital stays and associated psychosocial stressors on individuals and their families. Most common risk factors associated with SWD include obesity and wound infections, particularly in the case of orthopedic surgery. There is limited reporting of variables associated with SWD across other surgical domains and a lack of risk assessment tools. Furthermore, there was a lack of clarity in the definition of SWD in the literature. This review provides an overview of the available research and provides a basis for more rigorous analysis of factors that contribute to SWD.

Key words*:* Dehiscence, wound infection, obesity

Wound dehiscence is one of the most common complications of surgical incision sites. Typically, the sutures or closures around wound edges should stay intact while new tissue, known as granulation tissue, starts forming to help heal the wound. However, when wound dehiscence occurs, the edges start to separate, and the wound reopens instead of healing as planned (4). Spontaneous durability of the wound in the first day after surgery is virtually non-existent and gradually increases with time. The third week after surgery the durability equals 20% of the initial strength, and after 6-12 weeks it reaches 70-80% (1). Sutures placed during surgery allow the tissues the necessary time to regain structural and functional integrity. If the healing process is disturbed, this can lead to partial or complete dehiscence of individual layers of the sutured wound or to wound dehiscence along its entire depth, called eventration. Dehiscence or eventration usually occurs 4 to 14 days after surgery. Timely and sustained postoperative wound healing plays a significant role in optimizing a patient's

postoperative recovery and rehabilitation. It has been established that surgical wound dehiscence contributes to increased morbidity and mortality rates, and implicit and explicit costs for individuals and health care providers (1,5). Explicit costs result from prolonged hospitalization, the need for community nursing and support services and the use of wound management consumables (7). Social costs include delay in return to employment, reduced ability to self-care and limitations on returning to previous social roles in the community including family support. SWD is defined as the rupture or opening of a previously closed surgical incision site, according to the Centre for Disease Control (CDC). A SWD can be classified as either superficial or deep (6).

Etiology

Wound dehiscence can be caused by poor surgical techniques such as improper suturing, over-tightened sutures or inappropriate type of sutures. Wound dehiscence can also be caused by increased stress to the wound area because of strenuous exercise, heavy lifting, coughing, laughing, sneezing, vomiting or bearing down too hard with bowel movements. In some cases, wound dehiscence could be secondary to wound infection or poor healing as seen in patients with chronic diseases, malnutrition or weak immune systems. Secondary wound dehiscence can occur in patients with AIDS, renal disease, diabetes mellitus and those undergoing chemotherapy or radiotherapy (9).

Orthopedic surgery complications such as infection and SWD can lead to extended hospital stays, increased patient morbidity and an excess fiscal burden for patients and the health care system. Numerous studies have investigated the use of staples versus sutures and the relationship of this closure technique to wound complications (5). Smith et al. and Shetty et al. reported an increase in superficial wound infection occurrence with the use of staples when compared with suture in hip or knee procedures (1,4). Interestingly, other research has demonstrated statistically significant higher risk of developing infection following hip surgery when patients have been closed with staples compared with sutures (16). Further research by Newman et al. reported significantly fewer complications occurred with staples than sutures after total knee replacement, and similar findings were reported by Khan et al. following hip replacement (1,6). Whilst associations between wound closure methods and wound complications following orthopedic surgery have been reported, there appears to be little research investigating associations between patient comorbidities, behavioral factors and orthopedic SWD. A Cochrane review by Bandari and Tizzy reported the incidence of SWD following saphenous

vein harvesting to be 9·3% in patients closed with staples and 8.8% in patients closed with sutures (4). The incidence of surgical site infections (SSI) following this procedure was also reported to be 10·8% when the wound was closed with staples and 8% when the wound was closed with sutures (8).

SSI is frequently perceived to be precursor to SWD (3). In the UK, SSI constitutes 20% of all hospital health care associated infections and it is reported that at least 5% of patients will develop an SSI (40). The high economic cost is in part owing to prolonged hospital stays or readmission costs, which were just under £90 000 per patient in 2000 (7). In North America, the estimated costs of SSI are reportedly $10 billion annually in direct and indirect medical costs (5). Furthermore, Urban identified that superficial SSIs amount to $400 per case, whereas organ or tissue space infections can amount to $30,000 per patient.

Orthopedic procedures such as a total hip replacement had a reported SSI rate of 2%, an extended stay of 7 days and additional costs of $3,767 per patient (4). Total knee replacement SSI rates were reported to be 9·8% with an extended stay of 13·5 days, which resulted in a total cost of $6520 per patient (41). However, as these data were obtained from inpatient surveillance solely and did not include post-discharge follow-up, it is possible that the findings outlined above could be an underestimate of the total fiscal burden and incidence of SWD.

In 20–45% of cases, wound dehiscence/eventration becomes the main cause of death (2, 3). Many papers on this subject identified various risk factors which can lead to this condition. They included age (>65 years), gender (male), tobacco smoking, obesity, chronic steroid treatment, anemia, jaundice, uremia, diabetes, hypoalbuminemia, chronic obstructive pulmonary disease (COPD), neoplastic disease, wound infection and emergency surgery. Furthermore, factors related to the surgery itself were identified, and included the incision location, technique and type of the closing suture as well as the degree of postoperative hypothermia, oxygenation and blood supply (4). There are also papers indicating that the operating surgeon themselves is a risk factor for wound dehiscence (5). However, the most important single factor leading to this complication is wound infection. Studies indicate that the best technique for closing a vertical incision wound is to use a continuous monofilament suture, non-absorbable or slowly absorbable, applied through all

layers (except for the skin), with the suture length to wound length ratio of 4:1

Comorbidities Associated with SWD

Several authors have identified various factors associated with SWD, such as age, gender, ascites, jaundice, cardiovascular disease, pneumonia and infection, and have sought to identify associations between patient comorbidities and SWD across specific surgical domains (1,2). Risk factors that they proved to be significant were age, gender, an emergency surgical procedure, type of surgical procedure, the presence of ascites, chronic pulmonary disease, coughing and wound infection. In the field of cardiothoracic research, workers have identified potential causes and risk factors for SWD, which include age, gender, obesity, COPD and procedure-related factors such as duration of surgery, use of bilateral mammary graft and reoperation for control of bleeding (6).

It is well known that smoking affects wound healing. The occurrence of wound complications and delayed healing are higher in smokers than in non-smokers (7). Reduced tissue oxygenation has a detrimental effect on the reparative process during healing and neutrophil defense in the presence of pathogens (5). Research has shown that smoking cessation by patients prior to surgery compared to those patients who continue to smoke has an improved healing outcome and less wound complications (5).

Types of Wound Dehiscence

There are two basic types of wound dehiscence, partial or complete. In partial dehiscence, only the superficial layers or part of the tissue layers reopen. In complete wound dehiscence, all layers of the wound are separated, revealing the underlying tissue and organs, which may protrude out of the wound (9).

Signs and Symptoms of Wound Dehiscence

Signs and symptoms of wound dehiscence are clear and easy to identify by the patient and may present as one or more of the following:

- Open wound
- Broken sutures (without healing)
- Pain at the wound site

- Wound bleeding
- Pus and/or frothy drainage in infected wounds (8)

Patients at risk

Every person who has a surgical wound has at risk of dehiscence, especially in the first two weeks after surgery, when the tissue is still weak and not completely healed. The two most important factors controlling the risk of wound dehiscence are:

- The patient's health status - the risk is higher in patients with a weak immune system, malnutrition or chronic medical illness.
- The surgical procedure - the risk of dehiscence increases with over-tightening of sutures, poor suturing technique, inappropriate surgery site or suturing material.
- Other factors - the risk is greater with smoking, obesity, premature post-surgery exercise, heavy lifting, recurrent vomiting, coughing or an improper diet that leads to constipation. (6)

Management

A wound dehiscence is treated as a new wound, and takes into consideration the surgical history of the wound. The antibiotic therapy used to treat the patient is considered, along with any ongoing infection that might have caused the dehiscence. Antibiotics may be used to prevent any future infections if none were present, as wound dehiscence increases the risk of wound infection.

Surgical debridement is typically performed to treat wound dehiscence by removing the dead or infected tissue to enable better healing of the wound. Next the wound must be closed properly with the appropriate surgical technique and sutures. Finally, the patient's wound should be closely monitored to prevent dehiscence from recurring. Frequent dressing change is recommended to reduce the risk of infection, while allowing exposure to air to help the wound heal faster (1).

Prevention

Wound dehiscence can be prevented by taking the following measures:

- Complying with the doctor's post-operative instructions and prescribed medication
- Good wound care and hygiene (with appropriate dressing and cleaning as instructed by your doctor)
- Maintaining good hydration and a healthy diet (to help the wound heal faster and to prevent constipation)
- Avoid unnecessary stress or strain to wound area (like heavy lifting, exercise, vomiting, coughing, constipation)
- Bracing body with a hand or a pillow at the wound site may help relieve stress to wound when doing an activity (9)

Discussion

SWD is a significant problem for patients, clinicians and the wider community. Management of these wound complications poses a continuous challenge. It is clear there is a under-reporting of SWD, and a lack of clarity around the definition, as SSI does not translate directly into dehiscence. It is reported that

the most common pathogens associated with SSI are staphylococcus aureus and the flora associated with the skin (2). This review revealed that there was a lack of reported pathogens associated with SWD; therefore, more rigorous investigation is required if one is to determine a causal link to pathogens as being a catalyst for deep dehiscence. Discussion in the literature on the impact of biofilms on wound healing is considerable (3); however, research into biofilms is still in its formative years. James et al. demonstrated that only 6% of acute wounds had biofilms compared with chronic wounds (60%) (7). Speculatively, biofilms could be present if the surgical procedure is a second or third surgical attempt at closure or if the patient is undergoing multiple revision procedures. An association between biofilms and wound dehiscence is deserving of further investigation.

Identified intrinsic risk factors such as uncontrolled patient comorbidities may contribute to delayed healing and subsequent dehiscence. Of those that were found to be commonly reported across different surgical procedures were high BMI and diabetes (4,5). Other associated factors that span surgical domains and are associated with SWD include age gender and prolonged ventilator use.

Conclusions

Results show that wound dehiscence is a complex process, influenced by both general and local factors as well as pre-, intra- and postoperative factors. Most risk factors do not depend upon the surgeon but mostly on the patient's gender, age, type of disease treated in an emergency setting, and steroid use. The most important risk factor for wound dehiscence is SSI. Therefore, the surgeon, along with the entire team caring for the patient, should make every effort to reduce the risk of this complication. One should also remember that a knowledge of the above factors may allow a more detailed preoperative assessment and more informed patient's consent to the surgery (4).

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