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Do silver impregnated dressings prevent SSI?

Surgical site infections are the most common healthcare associated infection (HAI) in the United States, causing approximately $3 billion of additional healthcare costs each year. Development of new surgical products to reduce surgical site infections is a multi-million-dollar industry. Some manufacturers of silver impregnated dressings have claimed that these dressings reduce the risk of surgical site infection. This newsletter will review 1) the mechanism of microbicidal activity of silver, 2) types of commercially available silver dressings, 3) pathophysiology of SSI and 4) evidence related to the efficacy of silver impregnated dressings in preventing SSI.

Antimicrobial Properties of Silver (Ag)

Silver has a long history of medical uses. It has been used to treat a variety of venereal infections, acne, and leg ulcers. In the late 1800s, physicians began placing sliver-containing eye drops in the eyes of neonates to prevent postpartum eye infections. Silver-containing salves or other silver-containing wound care products were introduced in the 1960s. One of these products, silver sulfadiazine is still commonly used in wound management.

Unbound silver has a positive charge (Ag^+) that leads to disruption of bacterial cell membrane transport and cellular metabolism causing bacterial cell death in vitro. Silver ions also bind to DNA thus inhibiting bacterial cell replication. These known complex and multiple killing mechanism may be responsible for the limited ability of most microorganisms to develop resistance to the antibacterial effects of silver ions.[1]

Available silver impregnated dressings:

Commercially available silver-impregnated dressings deliver a constant concentration of Ag^+ to incisions. Commercially available silver impregnated products include hydrofibers such as Aquacel, hydrocolloids such as Contreet Ag, and polymeric film and meshes including Arglaes, Acticoat, or Aquacel surgical. Each of these products release Ag^+ at different rates for different durations. The concentration and rate of delivery of silver determines the time interval for removal and replacement of particular products (e.g, Acticoat requires changes every 3 or 7 days, depending on product purchased.) The manufacturers of all of these products claim that use of their products will reduce the risk of developing a postoperative SSI.[2]

Surgical Site Infection Pathophysiology:

Any intervention aimed to prevent SSI must target one or more of the three cornerstones to SSI pathophysiology: 1) microbe factors, i.e., sufficient microbial burden of contamination, 2) patient factors, e.g., inability for the host's immune system to clear the contamination, and 3) operation related factors. All surgical incisions inevitably become contaminated with bacteria capable of producing infection. Furthermore, incisions predictably induce an immune response,. A component of that immune response is an influx of neutrophils within the first 24 hours after incision. These neutrophils kill the bacteria in the incisional bed and in most situations, rapidly decreasing the microbial burden below the threshold needed to cause infection. However, immunosuppressed or poorly controlled diabetic patients cannot mount this appropriate immune response. Moreover, the presence of hematoma, necrotic tissue, or prosthetic material in or around the incision creates an ideal environment for bacterial replication. [3-5]

Silver impregnated dressing use to prevent SSI:

A basic rationale for the use of silver impregnated dressings is the assumption that silver cations in dressings reduce antimicrobial burden while facilitating healing of the incision, hence reducing SSI. Multiple investigators have used various study designs to answer the key question: Do silver impregnated dressings measurably reduce the risk of SSI? To our knowledge, none of the preceding trials proved that silver impregnated dressings actually reduced the risk of SSI. A 2010 Cochrane Review pooled the data from 26 randomized controlled trials (RCT) evaluating silver impregnated dressings for prevention of wound and incisional infections.[2] Wound types included in this review were burns (20 RCT) and mixed wounds (acute, chronic, surgical incisions, and non-surgical wounds; 6 RCT). In seventeen of the 26 RCT, the authors compared wound and incision infection rates for 21 silver containing dressing combinations to 21 non-silver dressing combinations. Overall, the silver dressing combinations the same wound and incision infection rates as the non-silver dressing combinations were found in 15 studies. Silver dressings had ***increased*** rates of wound and incision infections compared to non-silver dressings in 5 studies.

Since the publication of the above meta-analysis, a number of other studies have been published evaluating various types of silver impregnated dressings. Kadar et al randomized 55 elderly patients who underwent hip arthroplasty to receive a silver dressing (SD) or a regular sterile gauze dressing (RD) post operatively. The authors followed the patients for 5-7 days after surgery. During the 5-7 post-operative days, the authors collected skin swabs to assess microbial colonization on the incisional margins and they serially visually inspected the wounds to evaluate for signs of SSI. The use of silver dressings had no benefit in terms of colonization rate (12/19 or 63% in SD group vs. 4/8 or 50% in RD group, p=0.67) or SSI rate (2/31 or 6.4% in SD group vs. 2/24 or 8.3% in RD group, p=1.0). [6]

Similarly, Epstein evaluated the benefit of silver impregnated dressings in patients undergoing spinal surgery.[7] He conducted a retrospective review of SSI rates before and after implementation of silver dressings (SD) in lumbar fusion patients. Outcomes of 128 patients who received regular dressings (RD) after lumbar surgery were compared to outcomes of 106 patients who received SD after lumbar surgery. Three patients in the RD group had a deep SSI; no deep SSIs were reported in the SD group. This retrospective review had significant limitations and should be interpreted with caution. First, as in all retrospective reviews of interventional studies with a before-and after study designs, bias is a serious risk. Second, the authors did not attempt to control potential confounders through standardization of wound care in both phases. Finally, there was no mention of a statistical analysis plan, or frankly, any

meaningful statistical analysis of the data in the manuscript. Therefore, it is our opinion that this study is overall of poor quality, and does not support use of silver impregnated dressings.

Other small randomized controlled trials have evaluated if silver dressings reduce non-orthopedic surgical site infections. For example, Ruiz-Tovar et al randomized 147 patients with colorectal cancer undergoing elective colorectal surgery to silver dressings (SD), mupirocin ointment (MO), or regular gauze dressings (RD) postoperatively[8]. The authors and surgeons were blinded to dressing type. Ruiz-Tovar et al followed patients for 30 days postoperatively. The authors found no difference in rates of SSI between the SD group (18.4%) and the RD group (20.4%) at 30 days. However, the MO group had a significantly lower rate of SSI (4.1%) compared to both the SD and the RD groups. Therefore, the authors concluded that silver dressings were not effective in preventing surgical site infection.

Take Home Points:

- Silver has natural antibacterial properties when in its cationic state and bacterial resistance to silver is minimal.
- Silver impregnated dressings theoretically reduce microbial burden at the incision site.
- Current evidence, however, does not show that use of silver impregnated dressings reduces the risk of surgical site infections, and in fact, may actually increase SSI rates.
- DICON recommends simple and meticulous post-operative wound care practices to reduce surgical site infections. Post-operative wound care practices should be standardized and include hand hygiene by all who care for the wound, use of sterile gloves for initial dressing change, and timely changing of soiled or loose bandages.

References:

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