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Infection

Do silver-impregnated dressings limit infections after lumbar laminectomy with instrumented fusion?

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Abstract

Background: Silver has been used to reduce infection for centuries. This study retrospectively analyzed whether the introduction of silver-impregnated dressing (SD; Silverlon, Argentum Medical, LLC, Lakefront, GA) rather than RD (iodine- or alcohol-based swab and dry 4 × 4 gauze) would reduce the risk of superficial or deep infection after lumbar laminectomy with instrumented fusion.
Methods: The first 128 patients had RD applied postoperatively, whereas the second population of 106 patients received SD. These dressings were used for the first 2 weeks after surgery. Other clinical, surgical, and outcome data were comparable for both groups.
Results: Three of 128 patients who underwent multilevel laminectomies with instrumented fusions receiving RD developed deep postoperative wound infections (culture confirmed). All were successfully managed with 6 weeks of postoperative antibiotics, and none required secondary surgery. In addition, 11 patients who had RD developed superficial infection/irritation; 7 required oral antibiotics (7-10 days) alone, whereas 4 were referred to plastic surgeons for superficial wound revision. Alternatively, there were neither deep nor superficial wound infections/irritation among the 106 patients who received SD. Although the number of cases in each series was small, there appeared to be a positive trend toward a reduction in postoperative wound infection using SD.
Conclusions: Use of SD for application on lumbar wounds after laminectomies with instrumented fusions appeared to limit/reduce the incidence of both postoperative deep and superficial wound infections.
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Keywords: Superficial infection; Deep infection; Silver-impregnated dressings; Lumbar laminectomy; Instrumented fusions

1. Introduction

Silver has been used for centuries or even thousands of years to counter infection [8,9]. More recently, silver-impregnated wound dressings containing slow-release silver compounds/ions (ie, Ag+) have been used to limit/treat bacterial, yeast, and viral-induced wound infections associated with surgery, burns, trauma, and ischemia [3,8,9]. Here, the relative infection rates using RD vs SD (both for the first 2 postoperative weeks) were compared in 2 populations of patients undergoing lumbar-instrumented fusions. The first group of patients (n = 128) received routine postoperative dressings (RD) defined by the use of either an iodine or alcohol swab with a dry 4 × 4 gauze. The second group of patients (n = 106) received SD (Silverlon, Argentum, Lakemont, Ga).

2. Materials and methods

2.1. Silver-impregnated dressings

Silver, and in particular silver nitrate ($AgNO_3$), has long been used to control/treat infection [3,8,9]. At the micro-

Abrreviations: $AgNO_3$, silver nitrate; MR, magnetic resonance; MRSA, methicillin-resistant *Staphylococcus aureus*; PA, *Pseudomonas aeruginosa*; RD, routine dressings; SA, *Staphylococcus aureus*; SD, Silverlon dressings.

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cellular level, silver ions overturn the transmembranous energy metabolism of bacteria, resulting in a dose-related bacterostatic or bactericidal reduction of infection [15]. Silver has been effectively used in the laboratory and clinically used to treat such organisms as MRSA and PA [2,10,11,14]. Silverlon dressings have demonstrated activity against microorganisms with 1 to 2 hours of application, and the same dressings continue to show activity for up to 7 days if appropriately cleaned once daily with sterile/clean water alone (eg, no alcohol, iodine, saline) [7].

2.2. Lumbar laminectomies

Two patient populations underwent lumbar laminectomies with posterolateral instrumented fusions (Table 1). The first group, consisting of 128 patients, received RD postoperatively (2 weeks duration). The second group of 106 patients received SD postoperatively (2 weeks duration). Of note, most other clinical and surgical factors were comparable for both groups: average age, neurologic deficits, number of laminectomy/fusion levels, average operative time, average hospital stay, rate of pseudarthrosis/reoperation, average time to fusion, and outcome (Table 1). All patients were fused with the same pedicle/screw instrumentation system (3D, Medtronic).

Table 1
Data for patients undergoing lumbar laminectomy/fusion with postoperative regular or SD

Variable	Laminectomy and fusion with RD (128 patients)	Laminectomy and fusion with SD (106 patients)
Age, y (range)	49.14 (29-75)	49.6 (23-77)
Men, n	74	51
Women, n	54	55
Average laminectomy (range)	3.9 levels (3-6 levels)	3.75 levels (3-6 levels)
Average levels fused	1.3	1.27
One level fusion	88	77
Two level fusions	40	29
Types of fusion	Pedicle/screw [a]	Pedicle/screw[a]
Incidence of deep infections	3 deep wound infections	0
Treated antibiotics alone	3	0
Treated surgical removal	0	0
Incidence of superficial infections	11	0
Treated with antibiotics	7	0
Required plastic surgery	4	0
Fused/fibrous union	124	103
Average time to fusion, mo	4.5	4.2
Pseudarthrosis/reoperation	4	3
Comorbidities		
Diabetes	4	3
Hypertension	2	16
Obesity	15	29
DVT	5	2
Prior surgery	11	11
Depression	8	3
Coronary disease	5	1
Outcomes: Odom's criteria		
Excellent/good	116	97
Fair/poor	12	9
Average operative time, h	5.1	4.6
Average hospital stay, d	4.8	4.5
Average follow-up, y (range)	4.0 (2.25-16)	1.45 (1-2.5)

[a] Pedicle/Screw (3D; Medtronic, Memphis, Tenn).

3. Results

Three of the 128 patients who underwent multilevel laminectomies with instrumented fusions receiving RD dressings developed deep postoperative wound infections with SA. All infections were confirmed based on wound cultures and were corroborated with enhanced MR scans. Major comorbidities for these 3 patients included severe diabetes (1 patient required an insulin pump), hypertension (2 patients), morbid obesity (2 patients), and prior surgery (1 patient). All 3 infections were successfully managed with 6 weeks of postoperative antibiotics, and none required secondary surgery. Enhanced MR studies continued to demonstrate progressive resolution of infection up to 6 months after antibiotic administration. In addition, 11 patients developed superficial wound infection/irritation; 7 were successfully managed with 7- to 10-day courses of oral antibiotics, whereas 4 required superficial plastic surgical wound revisions. Alternatively, none of the 106 patients managed with SD developed deep or superficial wound infections.

4. Discussion

The value of silver in limiting/controlling infection has been known for centuries [3,8,9]. The antimicrobial activity of the silver ion (Ag+) is attributed to its ability to reversibly or irreversibly block (depending on concentration) transmembranous energy metabolism in bacteria [8]. In 1968, silver sulfadiazine (Silvadene, Marion Kansas City, Miss) was introduced as a topical agent to treat wounds and burns [3,8]. Since then, several slow-release silver sulfadiazine–impregnated dressings have become available to treat postsurgical, traumatic, ischemic, and/or burn-related wounds. Three commonly used dressings include the Silverlon (Argentum, Lakemont Ga) used in this series, Acticoat (Smith and Nephew, Largo, Fla], and the Silvasorb (Medline Industries Inc, Mundelein, Ill) [3]. When Heggers et al [3] performed a laboratory study using a Sprague-Dawley rat model for assessing the treatment of burns, they documented that the 3 SD noted earlier equally countered infection, especially those attributed to PA and SA. Thomas and McCubbin [12] also documented the use of different silver dressings to counter infections attributed to gram-positive and gram-negative organisms, and yeast. Other laboratory and clinical studies evaluating the treatment of burns observed that SD not only effectively limited nosocomial infections/bacterial growth (PA, SA, MRSA), but also prevented wound adhesions, promoted wound

healing, reduced pain, and limited the frequency of dressing changes [2-4,8,10,11,13-15]. Silverlon dressings created an effective antibacterial barrier within 1 to 2 hours of application that could be maintained by using the same dressing for up to 7 days (ideally cleaned once a day with sterile water/clean water) [7,5]. Used in a clinical series of burn patients, the Acticoat dressing effectively reduced the incidence of burn wound cellulites and antibiotic use, and was less expensive than Silvazine [1]. One of the rare negative factors observed when using Acticoat in burn patients was an increase in scar formation at skin graft donor sites [6]. Although the numbers of patients presented in the 2 surgical series using RD (128 patients) or SD (106 patients) were small, there appeared to be a "trend" toward a reduction in both deep and superficial wound infections when SD were used. A larger series of patients undergoing multilevel lumbar laminectomies with instrumented fusions should be prospectively analyzed to better determine whether SD significantly reduce the risk of postoperative deep and superficial wound infections.

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Commentary

When I was in training in Neurosurgery the 1960s, my mentor was Eric Oldberg, who was Harvey Cushing's last single resident. Eric used to recount the tale that Cushing insisted on covering the surgical wound with a thin layer of silver foil in order to prevent infection. He (Cushing) based this concept on finding out from his laboratory technicians that bacteria could not grow on silver doorknobs, which were plentiful at the time and consistently handled so that they were inundated with plenty of bacteria. Oldberg insisted that the technique be assiduously carried out in all cases performed at our department, the Neuropsychiatric Institute. Although the rest of the surgery units in the then Research and Educational Hospitals at the University of Illinois had long since dropped that particular dressing technique, Neurosurgery continued to use the silver foil dressings until Oldberg retired in 1973. No one conducted a study to compare the infection rates between our service and that of the others, but anecdotally, our infection rate was low, consistent with the findings in the current study. As Dr Epstein points out, a prospective study is clearly indicated.

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