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Postoperative Deep Wound Infection in Adults After Posterior Lumbosacral Spine Fusion with Instrumentation: Incidence and Management

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Summary: The authors reviewed 817 instrumented lumbosacral fusions in adults and found an incidence of 3.2% deep wound infections. The primary focus of this study was the management of these infections, with particular attention to whether the implants needed to be removed. A consulting infectious disease specialist indicated that an acute infection of a low back fusion wound could not be healed without removal of the metallic implants. This opinion was in contrast to the authors' daily experience and prompted this study. The authors identified and reviewed 817 cases of instrumented posterior lumbosacral arthrodeses in adults. A detailed analysis of any case with a deep wound infection was performed and yielded and infection rate of 3.2% (26 patients). Of these, 24 achieved a clean, closed wound without removal of instrumentation through a protocol of aggressive debridement and secondary closure. Instrumentation removal is not necessary to obtain a clean, closed wound using an aggressive approach with early diagnosis, vigorous debridement in the operative room under general anesthesia, delayed primary or secondary closure, and appropriate antibiotic coverage. **Key Words:** Adult—Wound infection—Instrumentation—Lumbosacral arthrodesis—Postoperative lumbosacral wound infection.

Postoperative wound infection in spinal surgery can be a significant problem with resulting prolonged hospitalization, increased costs, and compromise of the desired outcome. Despite strict attention to operating room sterility and the use of prophylactic antibiotics, wound infections continue to occur. Considerable controversy also exists regarding the best method to manage the infection once it occurs, particularly whether the internal fixation device needs to be removed for the infection to be eradicated. This study was designed to address both the incidence of wound infection in instrumented adult lumbosacral arthrodeses and the results of treatment of the infection. The study was stimulated by the written opinion of an infectious disease consultant who stated that successful solution of this acute infection problem cannot be achieved unless the surgeon removes the metallic implants.

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MATERIALS AND METHODS

Using the Twin Cities Spine Center computerized database, we identified 817 adult patients who had undergone an instrumented posterior lumbosacral arthrodesis between January 1980 and December 1994 at our center. There were 382 (47%) men and 435 (53%) women, whose

ages ranged from 19 to 83 years (mean, 44 years). The study was performed in 1996, which allowed a minimum of 2 years from the last surgery for any late infection to appear.

Only those patients whose arthrodesis included the sacrum were chosen. Lumbar fusions not including the sacrum were excluded to create a group of patients who had relatively the same amount of dissection trauma to the soft tissues. There were 206 (25%) patients who had a one-level arthrodesis, 419 (51%) who had a two-level arthrodesis, and 192 (24%) who had a three-level (or more) arthrodesis. Patients who had either same-day or staged anterior interbody arthrodesis in addition to the posterior procedure were also included.

Excluded were patients who had arthrodesis without instrumentation, patients 18 years or younger, arthrodeses that did not involve the sacrum, and long arthrodeses from the thoracic region to the sacrum performed for deformity problems. Also excluded were patients with superficial infections that did not involve deeper layers than skin and subcutaneous tissue.

The posterior surgical procedure was almost always a midline posterior approach with exposure of the laminae, facets, transverse processes, and sacral alae. Any necessary decompressive procedure was then performed, followed by facetectomy, by insertion of the instruments, decortication, and insertion of an iliac crest autogenous bone graft obtained through the same skin incision. The only exceptions to this procedure were the 16 cases performed through a bilateral muscle-splitting (Wiltse) approach. No patient received allograft bone.

All patients received prophylactic antibiotics. In most cases this consisted of 1 g cephazolin given intravenously at the start of surgery and every 8 hours for 48 hours. The only exceptions were those patients who were allergic to the cephazolin who were given other antibiotics on the same time schedule.

The instrumentation used was Cotrel-Dubousset pedicle fixation in 497 patients (61%), Steffee pedicle fixation in 159 (19%), Synergy pedicle fixation in 100 (12%), Luque rectangle with sublaminar wires in 19 (2%), Texas Scottish Rite Hospital (TSRH) pedicle fixation in 16 (2%), Wiltse pedicle fixation in 14 (1.7%), and other instrumentation in 12 (1.5%). This was not a study of the radiologic success of the arthrodesis or the clinical outcome of arthrodesis.

RESULTS

Of the 817 operations, 26 had a deep wound infection, for an incidence of 3.2%. There were 9 men and 17 women, and their mean age was 47 years, which was only slightly different than the mean age of the group as a whole (44 years).

When analyzed according to the type of instrumentation, 21 had Cotrel-Dubousset, 4 had Steffee, and 1 had Wiltse.

When analyzed according to the number of levels in the arthrodesis, those with a single-level arthrodesis had an incidence of 2.9% (6 of 206); those with a two-level arthrodesis had an incidence of 1.7% (7 of 419), and those with a three+-level arthrodesis had an incidence of 6.8% (13 of 192).

The bacteria identified in the infection was *Escherichia coli* in 8, coagulase-positive *Staphylococcus* in 8, *Pseudomonas* in 7, coagulase-negative *Staphylococcus* in 2, Proteus in 1, and *Staphylococcus epidermis* in 1.

Management of early-onset infections was in all cases a return of the patient to the operating room, where the wound was thoroughly debrided and irrigated with the patient under a general anesthetic. If the tissues looked good (clean and no necrosis) at that time, the wound was closed over suction drains (nine patients). Of these, all nine patients had satisfactory healing without the need for further operative treatment of their infection. They were all treated with intravenous antibiotics appropriate for their infection based on sensitivity studies. If the tissues looked questionable at this initial debridement procedure, the wound was packed open and redebrided in 2 to 4 days. Of these, six had successful closure at the conclusion of the second debridement. Three patients required three debridement procedures, one required four, four required five, and one required six debridements before the wound could be closed. None of these needed subsequent implant removal because of infection.

One patient had drainage that occurred first at 4 years after surgery. He had exploratory surgery, which showed that the fusion was solid; his implants were removed and the wound was closed successfully. Only one patient could not achieve a clean closed wound without implant removal. She had a total of eight debridements during 1 year.

Thus of the total group of 26 patients with deep wound infection, 24 achieved a clean, closed wound with one or more debridement-irrigation operations under appropriate antibiotic coverage without removal of the instrumentation. This left one patient who had to have instrumentation removal to obtain a clean closed wound, and the one with drainage at 4 years and instrumentation removal at that time.

Seven patients had their implants removed, but only two were related to infection. The other five were related to localized discomfort and the implants were removed at a later time with no evidence of infection then.

No osteomyelitis developed in any patient and none had chronic drainage after instrumentation was removed. No patient experienced anterior disk space or vertebral body

injection. No epidural abscesses developed. No patient experienced neurologic symptoms related to infection.

DISCUSSION

In 1964, Moe and Gustilo (7) reported an infection rate of 0.9% for posterior spinal arthrodesis without instrumentation performed to correct spinal deformity in adolescents. This was before the use of prophylactic antibiotics. In 1973, Lonstein et al. reported wound infection in spinal deformity surgery with Harrington instrumentation (6). They showed a 9.3% rate of infection when prophylactic antibiotics were not used and 2.8% when prophylactic antibiotics were used.

In 1972, Keller and Pappas described their findings in 150 patients with various forms of scoliosis who had posterior arthrodesis with Harrington instrumentation (5). They showed a 4% rate of infection (6 of 150 patients), with three requiring instrumentation removal.

In 1984, Transfeldt et al. (10) reviewed the wound infection problem in 7,769 spinal reconstructive procedures and found 194 infections (2.6%). Many of these cases had been done before instrumentation (all pediatric), and many were performed before the use of prophylactic antibiotics. There was a considerable variance according to diagnosis, with 1.4% infection with adolescent idiopathic scoliosis and 7.9% with myelomeningocele. There was only one deep anterior infection (myelomeningocele). The infection rate overall was 4.4% when antibiotics were used and 1.2% when they were not used. Adolescent idiopathic scoliosis with antibiotics (all with instrumentation) had an infection rate of only 0.1%. Irrigation, debridement, and primary closure with intravenous antibiotics resulted in a clean closed wound in nearly all cases when the infection was discovered within 10 days of the original surgery.

In 1992, Stambaugh and Beringer (9) discussed 19 patients with postoperative wound infection, 13 deep and 6 superficial. All had draining wounds at an average of 17 days after surgery. *Staphylococcus aureus* was responsible in 14 of the 19 cases. The infections were managed by allowing the wound to heal by secondary intention. Poor nutrition (as determined by total lymphocyte count) was noted in 16 of the 19 patients.

In 1992, Davne and Myers (2) reported their 5-year experience with 533 low back fusions using Steffee screws and plates. They reported a 2.6% infection rate (1.1% superficial and 1.5% deep).

In 1993, Esses et al. (4) reported their results with a collective series of 617 patients who had a low back fusion with pedicle fixation. A 4.2% deep wound infection rate was noted. Patient management was not discussed.

In 1995, Abbey et al. (1) described the treatment of postoperative wound infection after arthrodesis with instrumentation. These authors described the difficulty in determining whether a wound infection was superficial, intermediate, or deep. Only surgical exploration allowed them to determine this.

Dubousset et al. (3) in 1994 discussed late wound infections, as did Richards (8) in 1995.

The most recent article was published in 1996 by Wimmer and Gluch from Austria (12). They discussed 28 wound infections that occurred in 502 patients (5.6%) with instrumented posterior spinal arthrodeses. This included deformity and low back arthrodeses in adolescents and adults (age range, 13 to 69 years). Eighteen of the 28 were early-onset (less than 3 weeks) infection and 10 had late-onset (36 to 100 weeks) infection. Of the 18 early infections, 14 were deep and involved the instrumentation. All were managed by debridement and irrigation and none of the 14 required instrumentation removal, either early or late. Of the 10 patients with late-onset infection, the instrumentation was removed in all, because pseudarthroses were detected in 3 of the 10.

These authors noted that patients with early infection were cured after 4 to 6 weeks of intravenous antibiotics, and the late-onset infections required only 1 or 2 weeks of intravenous antibiotics.

In a yet unpublished study, Weinstein et al. (11) reported 1,594 spinal procedures with a 2.1% infection rate. The mean age of the patients with infections was 57 years. Of the 33 patients with infections, 19 had arthrodeses. Delayed primary closure was performed in the majority and none required acute removal of the implants. Two patients had late presentation and had implant removed at exploration. Both had solid arthrodeses.

Therefore, the literature indicates that most postoperative wound infections after posterior instrumented arthrodeses can be eradicated by prompt recognition, aggressive debridement and irrigation under general anesthesia, primary or delayed (2 to 4 days) closure, and appropriate intravenous antibiotic therapy without removal of the internal fixation.

If there is late (after more than 36 weeks) appearance of infection, the arthrodesis is often solid and the instrumentation can be removed as part of the debridement and irrigation procedure (12).

The results of our study correspond closely with this literature review. Of the 26 deep wound infections, 24 were able to achieve a clean, closed wound without removal of the instrumentation. Of the total group of 26 patients, only 7 had their instrumentation removed at any time. Therefore, it is clearly evident that instrumentation removal is not necessary in acute infections. The instrumentation should remain in place to achieve the desired immobilization for arthrodesis. If drainage persists, or oc-

curs later, the instrumentation can be removed once the arthrodesis is solid.

In conclusion, a retrospective review of 817 adult posterior lumbosacral arthrodeses with instrumentation revealed an infection rate of 3.2%. Prompt recognition and debridement and irrigation under general anesthesia with appropriate antibiotic coverage, without removal of the instrumentation resulted in a clean, closed wound in most patients. Instrumentation was removed to achieve infection control in only two patients.

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