POSTOPERATIVE DEEP WOUND INFECTIONS IN INSTRUMENTED SPINAL SURGERY

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ABSTRACT:

The infection rate in 174 instrumented spinal surgery was documented. The patients were investigated in terms of risk factors. Infections occurring after 12 months were considered as late. Eight (4.6 %) acute infections out of 174 instrumented spinal surgery were observed and treated by early surgical debridement. Three (1.7 %) late reactions were observed and treated by implant removal. These late reactions were not bacterial infections, rather they were a foreign body reaction around the implants. Metallic debris due to micromotion especially around the rod and the cross-link connections cause this inflammation. Metallic debris may cause foreign body reaction mimicking late infection which resolves after debridement and implant removal. This study was designed to analyze frequency, nature and risk factors of postoperative deep wound infections in instrumented spinal surgery.

Key Words: Spine, surgery, infection.

INTRODUCTION

Development of new methods in spinal surgery resulted in changes in the number and character of postoperative complications. Postoperative spinal wound infection is one of the devastating complications and it increases with complexity of the procedure. Discectomy is associated with less than 1% risk of infection; spinal fusion without instrumentation is associated with a risk between 1 and 5% , whereas fusion with instrumentation may be associated with a risk of 13% (mean=7%) (11,13).

A wound infection is defined as a presence of purulence at the operative site and a microbiological culture positive for one or more microorganisms. Infections may be deep or superficial; deep infections develop below the lumbodorsal fascia. Their presentation may be late and the diagnosis is more difficult to establish than with superficial infections. Management of wound infections should be done immediately with aggressive surgical debridement (8,12,14). The aim of this study was to investigate our cases with spinal fusion and instrumentation to find out the frequency and type of postoperative infections.

MATERIALS and METHODS

A retrospective chart review in patients who underwent spinal fusion and instrumentation between 1992 and 1996 was done. Seventy-two cases had surgery for spinal trauma, 67 for spinal deformity, 23 for spondylolisthesis and 12 cases for other conditions. The patients were also classified according to their host responses (systemic defense, metabolic capabilities, poorly controlled diabetes, cigarette smoking) (25). The complexity and extent of spinal instrumentation

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systems, poor operating theatre conditions were analyzed. Isola, TSRH, CD, Alıcı, Kaneda instrumentation systems were used for spinal stabilization.

A total of 174 operations were performed of which 11 were anterior, 110 were posterior, while 53 were operated both anterior and posterior. All patients received prophylactic antibiotic therapy; intravenous second generation cephalosporins were begun 1 hour prior to surgery and continued for 24 hours. Skin preparation was done just prior to surgery in the operating room after the patient was anesthetised. Tincture of dichlorhexidine was used for wound preparation and after draping iodophore adherent films were used. During the operation, double gloves were used and the outer one was changed every two hours.

Constant fever over 38.5°C after the second postoperative day, detection of fluid collection by palpation or ultrasonography, discharge or aspiration of pus from the wound with a positive gram stain suggested postoperative infection. This is an indication for prompt exploration of the wound. This was done in the operating theatre under general anesthesia. An immediate gram stain and culture of the wound was taken. Aggressive debridement and irrigation of the entire wound was done. Implants were not removed unless the infection persisted despite 3 repeated debridements performed every 48 hours. Unless grafted bone were not sequestrated, they were used again after irrigation and debridement. Adjuvant antibiotic treatment with Cefhiazolin 4x1 gr. and Gentamycin 3x80 mg. were given intravenously after obtaining appropriate cultures during operation. These antibiotics were modified, if necessary after obtaining the results of cultures and sensitivity. Following 3 weeks intravenous antibiotic treatment, 3 weeks oral treatment was given. If erythrocyte sedimentation rate and blood C-reactive protein did not return to normal levels, oral antibiotic treatment was extended to 3 months. The minimum follow-up period was 18 months. All wound infections occurred before 12 months postoperatively were considered as early infections.

RESULTS

For the infected cases, average operation time was 7 hours (5-9 hours) and the average number of vertebrae instrumented was 12 (9-15 vertebrae). We observed 8 (4.6%) acute infections and 3 (1.7%) foreign body reactions out of 174 cases. According to Thalgott's (25) classification, all the 8 infected cases were class A. The infection rate changed through the years and peaked in 1994 (Table 1).

Table 1. The infection rate and surgfical procedure through the years

	1992	1993	1994	1995	1996	TOTAL
ANTERIOR	-	-	3	4	4	11
POSTRERIOR	11	27(1)	21(1)	26(2)	26	110(4)
ANT-POST*	-	5	6(1)	15	11(1)	37(2)
ANT-POST**	1	1	5(2)	3	5	15(2)
TOTAL	12	33	35	48	46	174
INFECTION (%)	0	3.3	11.4	4	2	4.6

* ONE SESSION
** TWO SESSION
( ): Number of infections

The complexity of the procedure also well correlated with the rate of infection (Table 2).

Table 2. The complexity of procedure well correlated with the infection rate

	1992	1993	1994	1995	1996	TOTAL
TRAUMA	8	18(1)	11	17(1)	18(1)	72
DEFORMITY	3	8	17(4)	19(1)	20	67
LOW-BACK	-	4	4	9	6	23
OTHERS	1	3	3	3	2	12
TOTAL	12	33	35	48	46	174
INFECTION (%)	0	3.3	11.4	4	2	4.6

( ): Number of infections

Two out of 8 infected cases had paralytic scoliosis and 2 other patients were post- traumatic paraplegic cases. Methicilline resistant Staphylococcus aureus was the most common microorganism and was cultured from 6 cases. Pseudomonas aeroginosa was grown on culture and mixed infection occurred with both Enterobacter cloacea and Acinetobacter baumanii in another one.

We were not able to show any microorganism from the aspiration material in late cases. Histological examination of the granulation tissue obtained in late cases revealed foreign body reaction with foreign body type multinuclear giant cells and metallic debris which possibly caused this reaction. Following debridement, the implants were removed in all late cases as there was enough union. Postoperative cultures were negative. We did not use further antibiotic treatment.

In only one of the cases with acute infections, the implants were removed 3 months postoperatively, as debridements alone were not enough to eradicate infection. The implants were removed in all the acute cases in a time of 3 to 5 years postoperatively either due to recurrence of infection or because of fistula formation.

DISCUSSION

The increased complexity and extent of spinal instrumentation systems have resulted in longer operating time. Additionally, these more complex operations may be associated with greater blood loss, longer period of anesthesia, and postoperative complications (10-13,15,16,24). Certain host factors are known to increase the likelihood of postoperative wound infections. Advanced age, chronic malnutrition, poorly controlled diabetes, immunosuppression, steroid therapy, smoking, infection at remote sites are established risk factors (1,18,22). Any of the 8 cases which infection occurred did not have these risk factors and all were class A according to Thalgott's (25) classification. Literature documents that operations lasting longer than five hours have increased the wound-infection rates (9,19,23). Robson (21) documented that the bacteria colonization per 1 gr. tissue in a wound after 2.2 hours is 10^2 and increases to 10^5 in 5.7 hours, which means a 90% risk for infection. In our series, infected cases operation time was 5 to 9 hours, with an average duration of 7 hours. Postoperative infection rate increased to 25% especially in paralytic and myelomeningocell cases (3,28). Two out of 8 infected cases had paralytic scoliosis and 2 other patients were post-traumatic paraplegic cases. The average number of vertebrae instrumented in the infected cases was 12(9-17 vertebrae) and three of them were long instrumentations (two T2-S1 and one T4-L4). The role of prophylactic antibiotics in spinal surgery is well established (9,13). Lonstein (13) reported a decreased infection rate from 9.3% to 2.8% with prophylactic antibiotic usage. We used second generation cephalosporins beginning 1 hour prior to surgery and continued for 24 hours postoperatively. Second generation cephalosporines

were selected as they are effective against both Staphylococcus species and gram (-) bacteria and its usage 12 hours apart saved nursery overload. As reported in most previous studies, Staphylococcus aureus was the most commonly isolated microorganism on culture in these cases (7,14). Self-retaining retractors should be released periodically to allow tissue perfusion (17). We tried to limit the wound exposure to air by closing the inactive surgical field with sponges. Before closure of the wound, necrotic tissues due to compression of retractors, poor tissue handling and electrocautery, were debrided. If possible, the implants should be left in place to promote union (3,10,12,16,25,27). Maintaining the implants were possible in most of our cases except in one. All the implants of acute cases were removed in a time of 3 to 5 years due to recurrence of infection or fistula formation. Maintenance of the implants resulted in bony union, but as in all of our acute cases infection recurred, it is possible to conclude that infection were only controlled and complete removal only results with cure.

Operation conditions were also very important as it has been documented that infection rate increases in crowded operation theatres (14,26,27). In our series, there was an significant increase in the infection rate between 1994 and 1995 in a 8 months period and we correlated this to the bad operation theatre conditions which were than overcomed and all the above mentioned preventive measures decreased the infection rate to acceptable levels (2%).

Robertson (20) reported 2 late deep wound infections following Dwyer anterior spinal instrumentation and was not able to grow any microorganism in one of the cases. Heggeness (7) reported 6 late deep wound infections and was able to grow microorganisms in all of them and stated that they may be due to hematogenous seeding. Wimmer (28) reported 10(2%) late infections out of 499 instrumented spinal procedures. In our series, there was granulation tissue and a bursa like cystic formation surrounding the cross-links in late reactions. No microorganism grew in the cultures taken from this region. Histological examination demonstrated that there was metallic debris which possibly caused a foreign body reaction. In our cases with late reactions, it was possible to solve the problem by just removing the implants without the need of using and in that, these late tissue reactions may not be true bacterial infections, but a foreign body antibiotics, and any problem were observed in the follow up (minimum 2 years). Our opinion reaction that was caused by metallic debris due to micromotion around the rod and the cross-link connections. These late reactions may also result with infection by hemotogenous seeding which complicates the management. Late infections after implantation of biomaterials, has also been reported. The presence of a glycocalyx around the implants may result with microbial adherence (5, 6), which could also explain the late recurrence of infection in all of our acute cases. This is different from foreign body reaction as in our late cases, the reaction was limited to cross link- rod connections around which micromotion caused metallic debris. Dubousset (2) reported 18 (1%) late inflammatory reaction with CD instrumentation and could not identity any microorganism in 17 and histological analysis revealed inflammation with granuloma formation. All healed with complete hardware removal and without extended antibiotic treatment. Dubousset (2) thought that this inflammatory reaction was due to corrosion of implant.

CONCLUSIONS

Infection is a serious complication which may cause very poor outcome in spinal surgery with instrumentation. Long segment instrumentation, an excessive long operation time, bad operation theatre conditions, poor surgical technique, and paralytic cases are risk factors for postoperative infections. Recognition and management of risk factors, and prophylactic antibiotic usage may help to reduce the postoperative infection rate in instrumented spinal surgery. Micromotion around the rod and cross-links can cause metallic debris which may cause a foreign body reaction and pus formation.

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