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POSTOPERATIVE INFECTIONS AFTER POSTERIOR SPONDYLODESIS OF THORACIC AND LUMBAL SPINE. SURGICAL SPINE INFECTIONS

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SUMMARY

Background: *Postoperative infection after posterior spondylodesis of thoracic and lumbal spine is the most common complication, and a reason for revision surgery. Aim of this work is to analyze rate of postoperative spine infections at our institution, and to determine eventual risk factors.*

Subjects and methods: *In our paper we analyze incidence of deep surgical infections after posterior spondylodesis, performed on our Spine department during last 5 years (September 1, 2008 – September 1, 2013). Including criteria were: posterior spondylodesis with transpedicular screws from Th1 to S2 due to different spine indications (injuries, degenerations, deformities, tumors), absence of local or general infection prior the index surgery, surgery performed by the same surgeon (MB). Excluding criteria were: needle procedures (kypho/vertebro-plasties, nerve root and faset blocades), anterior spine surgeries, cervical spine surgeries, and decompresive surgeries.*

Results: *One hundred sixty five patients with 183 surgeries have been included in this study. Early surgical infection (within a month after the surgery) has appeared at five patients (2.7%). There have been no late surgical infections. Analyzing patients' charts, we have found that Meticillin-susceptible Staphylococcus aureus (MSSA) and Methicillin-resistant Staphylococcus aureus (MRSA) have caused infections in two patients, while Clebisiela pneumoniae ESBL has caused infection in one patient. Those five patients with infections have had further risk factors: long preoperative hospitalization at four patients, polytrauma, diabetes and advanced age at one patient, each. Three patients with postoperative infection had completely non-titanium surface of implants, and other two had about 20% of non-titanium implant surface, although vast majority of surgeries have been performed by implants whose surface was completely titanium alloy. Infections have appeared between 10-30 postoperative days. In two patients where revision surgeries (debridement, drainage, antibiotic according the species) had been performed in two weeks after appearance of infection, infections have been cured. In three patients where revisions had been postponed for longer than two weeks, additional surgeries (removal of implants) were necessary for curing the infections.*

Conclusions: *This study presented that rate of infection, microbiological species and risk factors are similar to the other orthopedics procedures and other institutions. Early revision is preferable, since it effectively avoids implant removal.*

Key words: *posterior spondylodesis – spine – infection - treatment*

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INTRODUCTION

Postoperative infection after posterior thoracic and lumbal spine spondylodesis is the most common complication, and reason for revision spine surgery. The rate of postoperative spine infections ranges from less than 3% in diskectomies and laminectomies, to approximately 12% in patients with instrumented fusions. Following complex lumbar spine surgery it has been reported to be as high as 20%, although infection rates below 5% are commonly reported. The higher rate of infection in instrumented fusions is theorized to be the result of increased exposure and blood loss, increased operative time, and increased dead space. Deep postoperative wound infection presents as early as 4 days postoperatively, but can be diagnosed years after the index procedure. Signs of wound infection include pain, drainage, erythema, fever, elevated white blood cell count, C-reactive protein, or ESR (SRS Spinal Deformities Textbook 2014).

Weinstein, McCabe, and Cammisa reported 46 wound infections in 2391 spinal surgeries. These infections were for the most part acute. Wound drainage was common and occurred at an average of 15 days after surgery; however, fever was uncommon (Weinstein et al. 2000). It is noted that patients with instrumentation had a significantly higher ESR and C-reactive protein than patients without instrumentation, but these parameters normally decreased after surgery unless infection was present. Patients with postoperative infection tended to have a renewed elevation of these parameters (Takahashi et al. 2001).

Advanced imaging including MRI with gadolinium, scintigraphy, or CT scan with IV contrast can be helpful to identify any collections that must be targeted surgically. They can also identify an epidural abscess if concern exists. In the case of an epidural abscess a neurologic deficit may be present. The modalities are generally not necessary if the diagnosis of wound infection has already been assigned, since surgical debridement should include the entire wound regardless of imaging findings (Campbel's Operative ortopedics, Canale et al. 2013).

Risk factors for surgical site infections include diabetes, obesity, inappropriate antibiotic administration and the participation by more than 2 residents. Antibiotics should be a first generation cephalosporin dosed within one hour of incision, and the dose must be adjusted for the patient's weight. Patients with documented allergy to penicillin or cephalosporin may receive alternative prophylaxis according to institutional guidelines, usually vancomycin (Olsen et al. 2008). According to Fang et al., factors that increase the risk for a postoperative spine infection include age older than 60 years, previous surgical infection, poorly controlled diabetes, obesity, alcohol abuse, and smoking. In their study, the procedure most likely to be complicated by an infection was a combined anterior-posterior spinal fusion done in a staged manner under separate anesthesias (Fang et al. 2005).

Prophylaxis begins with patient selection. Risk factors must be optimized, including: weight loss, smoking cessation, and diabetes control. The patient is generally able to alter his risk through preoperative life style modification (Sorenson et al. 2003). The presence of other sources of infection; such as urinary tract or respiratory tract infection, can impair the immune response to surgery, and should be treated prior to elective operations (Ollivere et al. 2008).

Aim of this work is to analyze rate of postoperative spine infections at our institution, and to determine risk factors.

SUBJECTS AND METHODS

In our paper we analyze incidence of deep surgical infections after posterior spondylodesis, performed during last 5 years on our Spine section (Dept. for ortopedics and traumatology, Clinical centre University of Sarajevo). However, our Spine section is general orthopedic department whose scope of work mostly is limb trauma, endoprosthetics, artroscopies, tumors, etc.

Including criteria were: posterior spondylodesis with transpedicular screws from Th1 to S2 due to different spine indications (injuries, deformities, degenerations, tumors) treated on our Spine department in period from September 1, 2008 to September 1, 2013, absence of local or general infection prior index surgery, surgery performed by the same surgeon (MB).

Excluding criteria were: needle procedures (kypho/vertebro-plasties, nerve root and faset blocks), anterior spine surgeries, cervical spine surgeries, and decompresive surgeries. We have also excluded two patients with wound revisions after aseptic dehiscences (no bacterial growth). The first patient was older patient with degenerative scoliosis, and the second patient was a three years old boy with meningomyeolocoela. Other two patients with superficial infections have been cured by releasing 1-2 stitches and wound toilette, without need for revision surgery were also excluded.

Above described requirements have completed 165 patients, with its 183 surgeries. Indications for index surgeries were:

- spine injuries (fractures/dislocations) - 62 patients (33.9%);
- spine deformities (adolescent, congenital, and degenerative scoliosis and kyphosis) - 52 patients (28.5%);
- degenerative spine diseases (lystesis, stenosis, etc.) - 26 patients (14.2%);
- revision surgeries (distractions of fusionless systems, spondylodesis after decompresive surgeries, other reinstrumentations) - 20 patients (10.9%);
- tumors - 14 patients (7.6%).

There was equal distribution of lumbal and thoracic instrumentations (92:91). In average, we have implanted 8.91 screws per patient (4-36). Most commonly used screw systems were Neurofrance® (50%), Horizon® (25%), and Tenor® 20%. Expidium®, RRI-Instrumentarija®, Hipokrat®, and Signus®, have been implanted

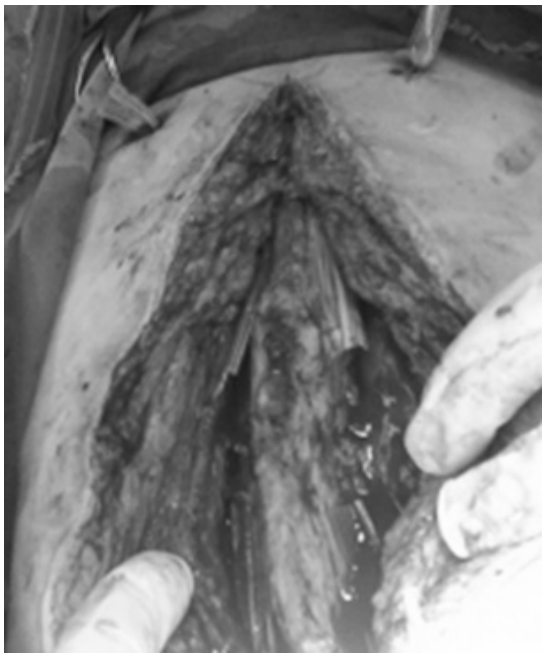

Figure 1. Revision of infected spine wound with implant removal and drain placement

just in 1-2 patients each. Neurofrance and Hipokrat are implants whose whole surface is titanium alloy (no stainless steel alloy or colored titanium - eloxed), while Tenor and RRI are implants whose whole surface in stainless steel alloy or colored titanium. Horizon, Expidium and Signus systems have only eloxed screw head (up to 20% of surface is eloxed).

Preoperative protocol, positioning of patient, surgical technique, system of drainage, wound closure, and postoperative care were very similar at all our patients, with exceptions related to the specifity of each patient.

After infection has appeared, we have made microbiological analysis, preoperative preparation, and revision surgery. Cephasoline antibiotics were changed after getting results of antibiogram. Revision surgery was consisted of removing of all sutures, generous irigation, removal of all necrotic nonbleeding tissue, placement of perfusion drains (two-four Redon and two Pen Rose drains), and meticulous wound closure (Figure 1). Wound irrigation lasted up to 5 days, depending of flow rates on the exiting drains, wound healing and decreasing of CRP. All drains have been gradually removed one by one during 7 days, sutures after 2-3 weeks, and patients have been discharged.

RESULTS

One hundred sixty five patients with 183 surgeries have been included in this study. Early surgical deep infection (one month after surgery) has appeared at five patients (2.7%). There have been two superficial infections, and two aseptic dehiscences, all four have been cured by nonsurgical measures. There were no late surgical infections. The results presented in Table 1. we have collected retrospectively from patients' charts. Due to design of this study, only descriptive statistic has been used, and there were no ethical obstacles.

Table 1. Demographic and medical data about 5 patients with postoperative spine infection

Initials	Gender	Age	Indication	Postop. day of infection	Days before wound revis.	Bacteria	Risk factors	Final surgery	Titanium surface %
SS	M	47	Fr./lux. L3-L4	20	70*	Clebsiela pn. ESBL	Polytrauma, ↑hospitalization	implant removal	0%
MM	M	54	Lumbal stenosis	28	90**	MSSA	↑hospitalization	implant removal	0%
NM	F	47	Fracture L1	14	16	MRSA	Diabetes, ↑hospitalization	implant removal	0%
MM	F	28	Lystesis L5-S1 gr.II	30	14	MSSA	↑hospitalization***	wound revision	80%
NO (Fig. 2)	F	72	Lystesis L3-L4-L5	10	4	MRSA	Age	wound revision	80%

* General condition of patient, very mild symptoms of infection, and other injuries/comorbidities dictated delaying of revision surgery;
** instability after extensive posterior decompression was reason for delaying of revision surgery;
*** ↑hospitalization – means prolonged pre or post-op. hospitalization due to clinical reasons (physical and neurological therapy, treatment of other injuries/comorbidities)

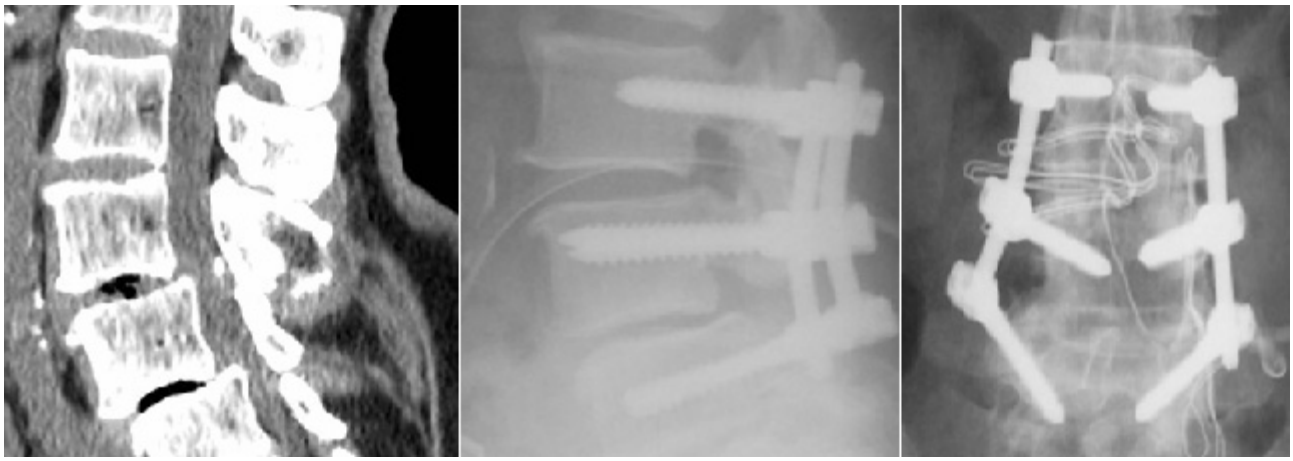

Figure 2. Double degenerative lystesis L3-L4 et L4-L5 with bilateral neurological claudication; posterior corrective spondylodesis L3-L5 with L4-L5 foraminotomy

DISCUSSION

This study has shown that after posterior instrumented fusion (internal fixateur) we had 2.7% infection rate. The most common bacteria were MSSA and MRSA (two pts. each), while Cebisiela pn. ESBL noted at one patient. Long preoperative hospitalization was risk factor at four of our five patients with infection, while polytrauma, advanced age and diabetes were risk factors at one patient, each. Infections have appeared usually between 10-30 postoperative day. In two patients where revision surgeries (debridement, drainage, antibiotic according the species) had been performed in two weeks after appearance of infection, infections have been cured. In three patients where revisions had been postponed for longer than two weeks, additional surgeries (removal of implants) were necessary for curing of infections.

Logically, each step in preparation of patient, performing surgery and postoperative regime might poses a risk for infection. Preoperative recommendations for reducing infections risk are tobacco cessation, minimally to abstain for at least 30 days before operation, maintaining of nutritional status, particularly during the postoperative period, treatment of a potential urine infection, etc. (Singh & Heller 2005).

During index surgery adherence to aseptic technique as well as limiting personnel in the operative suite, particularly unnecessary traffic are beneficial. The wound should be kept moist and retractors repositioned often to avoid tissue necrosis. Any nonviable tissue should be debrided prior to wound closure. The use of pulsed lavage prior to wound closure may likewise limit contamination (Canale et al. 2013). The use of postoperative wound drainage and the duration of postoperative antibiotic prophylaxis are debated. The use of drains in major spinal reconstructive surgery is felt to lessen the risk of wound hematoma and infection. Most surgeons prefer to continue postoperative antibiotics until drains are removed in spite of CMS recommendations that antibiotics be discontinued within 24 hours (Hospital compare, 2009). A NASS panel was unable to offer definitive recommendations on perioperative antibiotic duration due to a lack of definitive data (Watters et al. 2007).

In the case of deep wound infection, particularly in the case of an instrumented fusion, it requires thorough debridement and irrigation of the entire surgical wound. Instrumentation is to be assessed at the time of debridement, wellfixed implants must be retained if a robust fusion is not present. The wound may be closed over suction drains. If closure is impossible, the wound may require flap closure in consultation with a plastic surgeon or closure by secondary intention. Vacuum assisted closure may hasten healing by secondary intention (Mehbod et al. 2005). Repeat irrigation over drains is done at 48-hour intervals until the wound is without necrotic tissue, and cultures and Gram stain are negative.

Infection can usually be eradicated/controlled with instrumentation retention. If the infection persists despite prolonged antibiotic administration, the instrumentation may be removed after a solid fusion mass is confirmed. After instrumentation removal, some loss of correction can occur, particularly in long fusions or with persistent sagittal imbalance. It is advisable to attempt to retain instrumentation in deformity constructs due to risks of decompensation, even if this requires long term suppressive antibiotics (Canale et al. 2013). Numerous authors have shown that infections can be treated without removal of the instrumentation. Picada and coauthors reviewed 817 instrumented lumbosacral fusions with 26 postoperative infections treated with retention of the instrumentation; only two failed to heal. Instrumentation is removed only when the fusion is solid or when fixation is lost. Bone graft pieces that are loose should be removed at the time of debridement. This is also our method of treatment of acute postoperative infections (Picada et al. 2000). Recalcitrant wounds may require local V-Y flaps or free flaps when bone or implants are exposed, according to Chen and coauthors (1996).

Three patients who needed implant removal have had implants with completely non-titanium surface. Other two patients who needed only wound revision have had implants with about 20% of non-titanium implant surface, although vast majority of surgeries have been performed by implants whose surface was completely titanium alloy. Many other authors have reported superiority of implants with titanium alloy surface in comparison to implants with stainless still alloy surface (Di Silvestre et al. 2011, Shirai et al. 2011, Shirai 2009, etc.). We have confirmed their results, too.

Limitation of this study is a lack of data related to antibiotic usage, relative heterogeneity of the sample, and differences in treatment all five infected patients. Those differences were consequences of medical and technical circumstances. For acquiring a statistical significance we would need more comprehensive study with higher number of participants, and stricter including criteria. However, similar studies with even larger limitations and lower number of participants have been published in the literature and may have helped clinicians in decision-making.

CONCLUSION

This study presented that rate of infection, microbiological species and risk factors are similar to the other orthopedics procedures and other institutions. Risk factors which we can change are length of hospitalization, usage of implants with titanium alloy surface, including of infectologist in planning of antibiotic

therapy, meticulous wound closure, and additional caution at patients with comorbidities. Early wound revision is necessary, since it effectively avoids implant removal.

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