CASE REPORT

Unexpected Bacteriological Finding Using Sonication in Revision Spine Surgery (Report of Two Cases)

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Abstract

The number of spine surgeries around the world is increasing in recent years. Each time, new techniques and minimal invasive procedures are developing. However, the incidence of postoperative spinal infections (PSII) ranges from 0.7% to 20%. In cases of infection, identification of the pathogen is essential to apply the appropriate antimicrobial treatment. Most of the usual techniques are based on the recovery of samples from the periprosthetic tissue followed by inoculation in culture media. In the last years, the presence of biofilm-forming bacteria has increased, which has the ability to decrease the sensitivity of the traditional culture method. The application of sonication prior to culture on the rescued inert material, disrupts the biofilm and generates a significantly higher recovery of bacterial growth compared to conventional tissue culture. We present a case series from our service of patients undergoing apparently aseptic lumbar spine revision surgery with positive culture by sonication.

Level of evidence: IV

Keywords: Culture, Sonication, Spine, Surgery

Introduction

In the last years, the number of spine surgeries performed around the world is increasing.[1,2] Although new techniques and minimal invasive procedures are developing, the incidence of postoperative spinal infections (PSII) ranges from 0.7% to 20% in the literature.[3,4] Infections in patients with spine surgery prolong hospitalization and increase morbidity, mortality; and produce a consequent increase in healthcare costs.[5]

It is known that the placement of spinal implants improves the risk of infection than surgery without implants. It is because the possible adhesion of bacteria on the implant surface.[6] in certain apparently aseptic spinal revisions, there is a possibility of subclinical infections. The current guidelines in joint arthroplasty recommend obtaining intraoperative cultures.[7-9] However, the information about aseptic revision spine surgery is low.

In cases of infection, identification of the pathogen is essential to apply the appropriate antimicrobial treatment. Most of the usual techniques are based on the recovery of samples from the periprosthetic tissue followed by inoculation in culture media.[10] However, this technique can be interfered with by certain factors that decrease its sensitivity, such as the use of previous antibiotics, sampling errors, inadequate amounts of bacteria or inaccurate transport.[11] Another reason for the failure of microbial culture is the presence of bacteria that has the ability to form biofilms. This concept refers to communities of microorganisms that can be found adhered to a surface or can form aggregates without the need for adhesion; and are capable of causing a wide range of chronic diseases.[12, 13]

In addition, biofilms can impede the correct microbiological diagnosis.[14, 15] this biofilm is responsible for the preservation of implant-related infections; especially those caused by pathogens of low virulence.[16, 17]

In this regard, the application of sonication on the rescued inert material (implant, plastic, prosthesis) prior to culture disrupts the biofilm, leading to significantly improved recovery of bacterial growth compared to conventional tissue culture.[18]

Actually, there are no guidelines about the use of sonication in aseptic revision spine surgery, neither information about the microbiological profile of sonicated

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spine implants in this set of patients.

In this context, we present two cases from our service of patients undergoing apparently aseptic lumbar spine revision surgery with positive culture by sonication.

Case Presentation 1

This is a 54-year-old male patient, a former smoker (20 pack/y). He had a surgical history of L2-S1 arthrodesis by spondylolisthesis performed two years ago. Subsequently, it was revised with partial removal of the implants due to persistent low back pain associated with sagittal imbalance. The patient consulted us for bilateral lumbar pain that subsided at rest. In the imaging studies, the previous instrumentation was observed without signs of osteolysis or demarcation, with L5-S1 anterolysthesis [Figure 1 A-B and Figure 2]. At the time prior to surgery she had normal laboratory parameters: white blood cell count of 6800 mm^3, erythrocyte sedimentation rate of 7 mm/h, C reactive protein of 0.1 mg/dL. The lumbar spine revision surgery was performed in two stages.

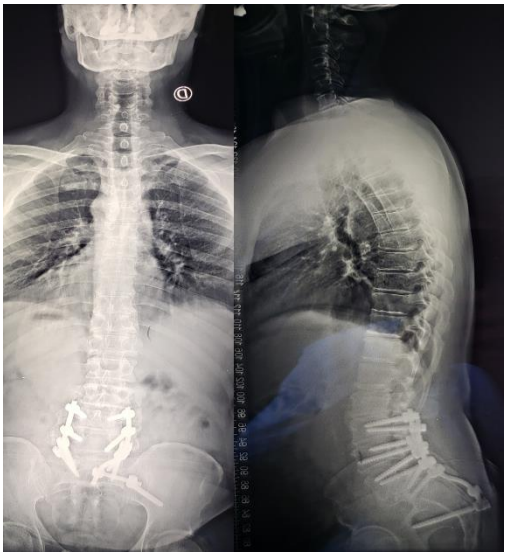

Figure 1. A-B Preoperative (EOS) X-ray showing sagittal imbalance and previous posterior surgery performed L2-S1

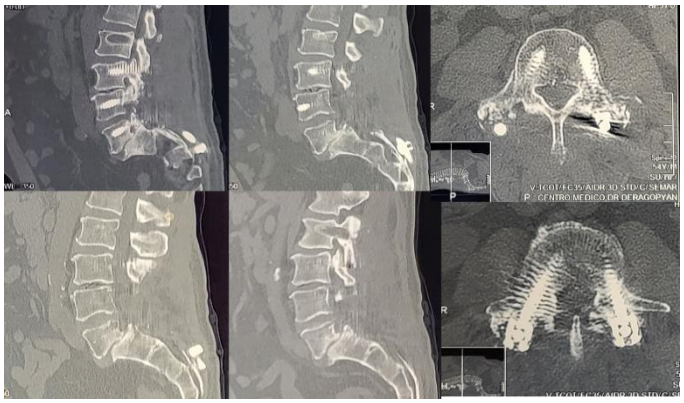

Figure 2. Preoperative TC slides showing no signs of demarcation

In the first instance, a posterior approach was performed with skeletonization from L2 to sacrum. Previous screws and rods were identified and removed; these were found to have signs of instability. It was decided to send one of the screws to culture by sonication method. Screws were placed under fluoroscopic guidance from L2 to sacrum, which were left in place for the second time. Profuse lavage and plane closure were performed. The patient was placed in right lateral decubitus. A 5 cm long transverse incision was made, dissection by planes and two L3-L5 interbody cages were placed with bone bank graft (15cc) in each one, via extreme lateral interbody fusion (XLIF). After 7 days, the second surgical stage was performed with placement of L5-S1 interbody cage via anterior lateral interbody fusion (ALIF) and then; definitive placement of rods via posterior route to perform correction maneuvers of sagittal and frontal axis correction [Figure 3 A-B]. In this instance, deep serohematic fluid was observed in the vicinity of the screws, so it was decided to send samples for culture and start prophylactic antibiotic treatment with cefepime / vancomycin intravenously. The fluid material sent from the second surgery remained without microbiological recovery; however, the sonication culture material showed a positive result for Cutibacterium acnes. With this result, the patient was treated with minocycline 100 mg orally for 6 weeks. Currently, the patient has been postoperative for one year, performing his usual activities without pain.

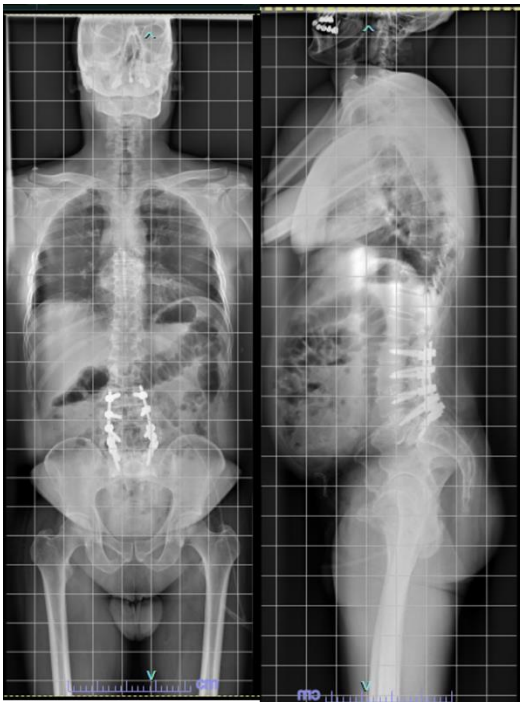

Figure3. A-B Postoperative (EOS) X – ray showing the new instrumentation L2-S1 and two interbody cages via XLIF

Case Presentation 2

This is a 61-year-old male patient with a clinical history of hypertension and dyslipidemia, former smoker (10 pack/y). He had undergone L2-S1 arthrodesis surgery 8 months

earlier for multiple lumbar discopathies performed at another center. The patient came for consultation because he presented right lumbosciatic pain that had begun 3 months after his surgery. The laboratory examination was within normal parameters: white blood cell count of 5300 mm^3, erythrocyte sedimentation rate of 10 mm/h, C reactive protein of 0.2 mg/dL. The imaging studies showed signs of loosening of the implant with lumbar pseudoarthrosis [Figure 4 A-B and figure 5]. A posterior lumbar approach was performed in the first instance. Signs of instability were observed in the bilateral screws of L2, L5 and sacrum; one of which was sent to culture by sonication. It was decided to remove all the previous implant and place pedicle screws with bone augmentation technique. Then the second surgical procedure was performed with the patient in supine decubitus. An anterior approach was performed via ALIF, the previously placed PEEK cage was identified, removed and sent for analysis by sonication method. A new cage was placed with 12 degrees of lordosis with ground bone graft and the wound was closed. After one week, a third surgical procedure was performed with the placement of interbody cages via XLIF L2-L3 and L4-L5 [Figure 6 A-B].

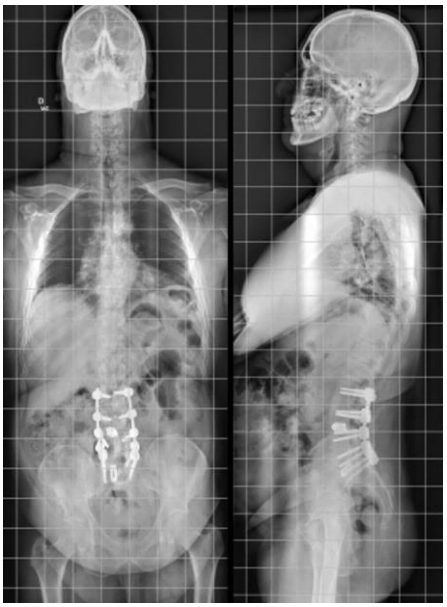

Figure4. A-B. Preoperative (EOS) X-ray showing sagittal imbalance and previous instrumentation L2-S1 and two interbody

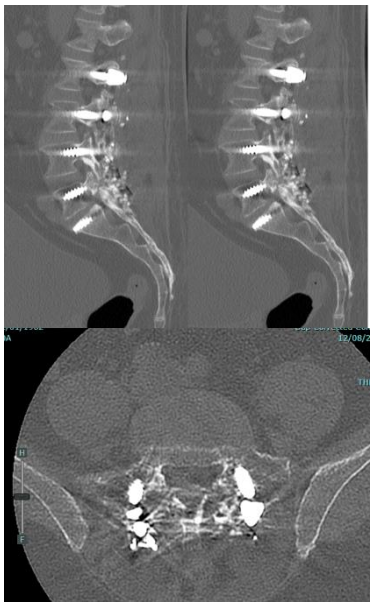

Figure5. Preoperative TC slides showing signs of osteolysis and demarcation

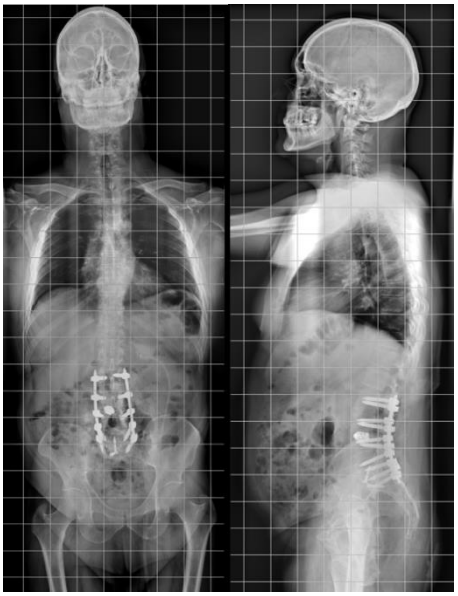

Figure6. A-B. Postoperative (EOS) X – ray showing the new instrumentation L2-S1 and the cage L5-S1 via ALIF

As for the laboratory results, the culture of the pedicle screw remained negative. In the case of the interbody cage, the culture by sonication method was positive for methicillin-resistant Staphylococcus warneri. The patient at no time in his postoperative state presented clinical signs of infection or altered laboratory parameters. However, in view of the positive result of the culture, antibiotic treatment with minocycline 100 mg for 6 weeks was started.

Currently, the patient has been 14 months since his surgery and is performing physical and work activities without limitation.

Discussion

During a revision spine surgery, the diagnosis or exclusion of spinal implant infection is important.[19] although there are certain typical markers of infection after spinal surgery such as fistulous tracts, elevated white blood cell count, erythrocyte sedimentation or C reactive protein, local swelling and fever; occult infections can be difficult to diagnose.[20]

In the literature, there are studies that use sonication to remove bacteria adhering to biofilms on implant surface. This technique allows the isolation of microorganisms in many culture-negative cases. At this point, we can conclude that in some cases with suspected aseptic failure, there may be an underlying infectious etiology.[21-23]

So far, there are few studies in the literature on the microbiological results of implant cultures by sonication in patients undergoing spinal surgery. A study by Pumberger et al.[24] showed a positive sonication culture in more than 40% of all patients with suspected aseptic spinal revision surgery. Another study by Shifflett et al. [25] reported on the microbiologic profile in revision spine surgeries without preoperative parameters of infection and showed that 40.5% of cases were positive.

C. acnes and S. warneri were the microorganisms isolated in our study. Actually, it is unclear whether these microorganisms are truly pathogenic. Because of that, the

decision whether to treat them or not remains a matter of debate.[26]

Although some studies have considered C. acnes only as a cultural contamination,[27] other studies have shown C. acnes to be a cause of late infection after spinal surgery.[28, 29] on the other hand; some authors have reported associations between C. acnes and degenerative disc disease.[30-32] this association is very relevant as it could explain the development of typical degenerative changes at the disc level and formation of osteophytes. [33]So far, there is no reference definition for the diagnosis of PSII in the different studies, leading to non-comparable results. The time of sonication duration, the way of incubation and CFU cutoff value for the diagnosis of an infection is not well established yet. Therefore, the diagnosis of PSII requires a multimodal approach, including clinical, paraclinical, microbiological, and histopathological findings.

Conclusion

In conclusion, infection in patients that require spinal revision should always be considered, even in the absence of clinical evidence of infection. As we have shown in our study, sonication has the ability to isolate microorganisms from implant surfaces. Therefore, we recommend ultrasound therapy in all revision spinal surgery, especially when implant failure is the indication for revision surgery. A multidisciplinary team should evaluate each patient in particular and develop an individualized treatment plan based on microbiological findings.

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