Case Report

Anterior and Navigated Posterior Fusion in Cervical Spondylodiscitis. A Case Report and Review of the Literature

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Abstract

Object: We describe the surgical treatment of a 44 year old woman presenting with spondylodiscitis from C4 to C6 and incomplete tetraparesis. She was transferred to our hospital after incomplete cervical decompression from C3-6 in a county hospital. Our therapy regimen was performed in 3 stages: First we performed an implant removal and external fixation using a halo-fixateur with microbial eradication followed by anterior fusion and finally navigated posterior stabilization and fusion from C3 to C7. This is the first documented case of computer navigated posterior CT-based fusion in multilevel cervical spondylodiscitis. The postoperative CT showed a correct implant positioning, the initial neurological symptoms decreased during the admission in our hospital and thereafter.

INTRODUCTION

Spondylodiscitis represents an important clinical problem that often requires aggressive medical therapy often followed by surgical debridement and stabilization [1]. There are three main contamination routes: hematogenous spread, external inoculation or involvement from adjacent tissue [1, 2].

Known risk factors for spondylodiscitis include diabetes mellitus, rheumatoid arthritis, immunosuppression, alcoholism, long-term steroid use, concomitant infections, severe trauma, tumor and previous surgery [1, 3, 4].

Cervical spondylodiscitis is a rare disease, that is linked, in comparison with other spinal locations, with significantly more neurological involvement, it also requires more often surgical treatment and represents an increased mortality [5].

Microbiological findings

Identifying the causative agent is crucial for successful conservative treatment; however the agent is found in 49% of cases only [6, 7].

In pyogenic spondylodiscitis, Staphylococcus aureus is the most frequent isolated agent, being found in more than 50% of the pyogenic spondylodiscitis while Gram-negative species as Escherichia coli are found in immunocompromised patients, the agents found in intravenous drug abusers consist of Staphylococcus aureus, Pseudomonas aeruginosa and S. epidermidis [8]. In patients with infective endocarditis, Streptococcus viridans should also be suspected. Coagulase-negative staphylococci and Propionibacterium are the microorganisms that are found in osteomyelitis after spinal surgery, particularly if instrumentation is used [1,9,10].

Diagnostic imaging

The first step in diagnostic imaging are plain photographs, which should be followed by magnet resonance imaging, as these imaging modalities can reach an accuracy of 90% in the diagnosis of spondylodiscitis [1,11]. Furthermore, specific aspects like epidural abscesses, the simultaneous presence of soft tissue swelling, obliteration of fat planes around the vertebral bodies, and fragmentation or erosive changes in the vertebral end plates can be evaluated [1, 11]. Magnet Resonance Imaging (MRI) is reported to be more sensitive than Computertomography (CT) especially in the early detection of osteomyelitis. However there may be several indications for the use of CT, e.g. when contradictions to MRI are present, if a fracture occurred or if a CT-guided biopsy or drain is planned [12,13].

While conservative treatment is the gold standard to handle spondylodiscitis, surgical treatment is necessary in some conditions, that include pathologic fractures, neurologic deficits, epidural abscess formations, persistent sepsis despite antibiotic treatment, unacceptable pain and distinctive deformities of the spinal column [1,2,14]. While cervical spondylodiscitis...
is generally treated using an anterior approach and anterior debridement followed by fusion; thoracic and lumbar spine patients are reported to benefit more from a posterior approach, posterior laminectomy, debridement and stabilization [1,15]. Segmental defects can be restored, depending on their size with either tricortical bone grafts, or titanium cages [16].

**CASE REPORT**

We report a 44 year old woman with a medical history of ongoing intravenous heroin abuse and Hepatitis B and C. She was first admitted to a county hospital in August 2013 with cervicobrachialgia in her right arm. After outpatient treatment, she visited the same hospital four weeks later with paralyses of both arms and the inability to walk. She also reported progressive weakness and decreased sensation in her extremities. On the same day, she received a MRI of the spine and anterior cervical body fusion with a corporectomy of C4 and 5 (See Figure 1). The microbiological diagnostics showed an infection with *Staphylococcus aureus*. Due to a persistent infection and remaining neurological symptoms the patient was transferred to the Trauma department of Hannover Medical School.

On admission, she presented with a temperature of 39.2 °C. Chest X-ray findings showed bilateral pleural effusions. Plain x-rays of the cervical spine revealed signs of cervical spondylodiscitis with partial corporectomy of the cervical body four and five with implant material in situ. Additionally, the CT scan revealed an anterior spinal haematoma that compressed the spinal cord, with destruction of the C3–C4 vertebrae.

Laboratory investigations yielded a normal level of leucocytes, a raised C-reactive protein with 48 mg/l, IL-6 of 54 ng/l, and Procalcitonin of 0.1 mg/l. Serum transaminases and renal function were all within normal limits. Urine analysis was normal and HIV testing negative. The microbiological investigation of apparent pleural effusions showed no microorganisms, the microbiological analysis performed by the previous hospital revealed a *Staphylococcus aureus*. The Antibiotic susceptibility showed multisensivity, all tested antibiotics were sensitive. An antibiotic therapy was started with Clindamycin and Ceftriaxone.

A MRI after admission to our clinic revealed a persistent epidural abscess from C2 to C7; a surgical procedure was planned in several stages.

First, 3 days after admission to our hospital, we performed an anterior implant removal, debridement of the spinal canal and completion of the resection of the vertebral bodies C4 to C6. Moreover we implanted a cement spacer soaked with gentamicine. For stability purposes, a halo fixateur was applied afterwards (see Figure 1). As to an intraoperative complication, the right artery vertebralis needed to be clipped.

The first neurological examination could be performed postoperatively only, due to external ventilation during the first 3 days. It revealed a cervical accentuated tetraparesis with sensory impairment from C4 and 5 and motoric impairment on both arms as well as a moderate paraparesis of the lower extremities with grades of muscular strength (British Medical Research Council’s (BMRC) system from 1978) from M1 to M3.

Second, we did implant a distractible titanium cage (ADD, Ulrich Medical, Ulm, Germany), a locked anterior plate (CSLP, Synthes, Umkirch, Germany) and again refixed the halo fixateur 2 weeks after admission to our hospital.

Third, 4 weeks after initial admission to our clinic, a navigated CT-based three-dimensional (Brainlab, Feldkirchen, Germany) dorsal instrumentation (Mountaineer, DePuy Orthopädie GmbH, Germany) from the third to the seventh cervical body was performed, afterwards the halo fixateur was removed (see Figure 2). For the navigated procedure, the reference clamp was positioned on the third spinal process. The preoperative images were transferred to the navigation workstation and a manual point matching procedure was performed. Afterwards, the surgeon was able to navigate through the complete 3D CT dataset. The position of the screws was specified using a navigated drill guide. Postoperative x-rays and CT scans of the cervical spine showed a complete decompression of the cord as well as fusion from C2 to C7, the sagittal alignment was reconstructed.

Fever disappeared by the 5th day of antibiotic treatment and neurological signs regressed progressively under prolonged physical therapy. The last documented neurological status six weeks after surgery showed intact sensory of both lower extremities and of the right arm and shoulder. On the left side, disaesthesia was found in fingers 1 to 3. The motor activity was still reduced, with increased activity in both arms from M2-5 and M5 in both lower extremities. Six weeks after admission, the patient was transferred to a rehabilitation clinic. No clinical signs of a persistent infection could be found; microbiological examination of the second and third surgery procedure could show no proof of ongoing infection.
DISCUSSION

Spondylodiscitis in the cervical spine is less frequent than in the thoracic or lumbar localization and is linked with more neurological involvement and epidural abscesses. Furthermore cervical spondylodiscitis has to be operated on more after and mortality rates are increased compared to other locations [5,17].

The main therapy for spondylodiscitis remains conservative treatment, especially if the microbe can be identified and no neurologic symptoms are present [1,17,18].

In our case, the infectious agent was known: Staphylococcus aureus, that is present in over 50% of the spondylodiscitis infections [1,19].

Furthermore, the described case showed signs of instability with loosened implant material and a vertebral height reduction and spinal angulation. The preoperative MRI showed an epidural abscess with contact of the abscess to the anterior implants. As some authors describe, that the presence of infectious material is a contradiction for bone transplants and instrumentation[18,20].

We performed an implant removal and implantation of a cancellous bone-like spacer with antibiotics accompanied by an external fixation using a halo fixateur. As an injury of a vertebral artery occurred intraoperatively, the third stage of the surgery was performed with the aid of computer navigation. In the literature no case of 3D CT-based navigation was described for the treatment of cervical spondylodiscitis so far. Nevertheless, higher accuracy with the use of computer navigation has already been described with rates of malpositioning of 4% navigated vs 17% with fluoroscopic guidance [21]. In our case, after anteroposterior multi-level fusion of the spine, all implant material showed a correct position and stability. We could reduce radiation exposure as it was limited to only intraoperative two-dimensional images, which might even be lowered because of the navigation in the 3D CT dataset. With the help of CT navigation, the whole cervical spine could be accessed with one CT scan only, while 3D c-arm navigation can only provide a dataset with length of about 12x12 cm, which may represent about 2 to 3 cervical segments [22].

REFERENCES


