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A Case Report of Cervical Spine Infection Caused by Escherichia Coli

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Abstract: Spinal infectious disease (SID) is an infectious condition caused by specific pathogens that invade the vertebral bodies, intervertebral discs, and adjacent paravertebral tissues through trauma, surgery, or hematogenous spread. Although the incidence of SID is relatively low, it often leads to quite severe consequences. In recent years, with the intensification of population aging, the increasing number of patients with diabetes, immunosuppression, and long-term vascular access, the advancement of imaging technologies and diagnostic methods, as well as the growth in the number of spinal surgeries, the incidence of spinal infections has shown a gradual upward trend. We report a case of a 59-year-old male patient with cervical spine infection. Combined with relevant literature, we discuss the clinical symptoms, key diagnostic points, and treatment principles of this condition, aiming to provide guidance for clinical practice.

Keywords: Cervical Spine Infection; Escherichia Coli; Anti-infective Therapy.

1. Introduction

Spinal infectious disease (SID) is an infectious condition caused by specific pathogens that invade the vertebral bodies, intervertebral discs, and adjacent paravertebral tissues through trauma, surgery, or hematogenous spread [1]. SID accounts for 2% to 7% of infections in the musculoskeletal system, with a male-to-female incidence ratio ranging from 2:1 to 5:1 [2]. Although the incidence of SID is relatively low, it often leads to quite severe consequences. In recent years, with the intensification of population aging, the increasing number of patients with diabetes, immunosuppression, and long-term vascular access, the advancement of imaging technologies and diagnostic methods, as well as the growth in the number of spinal surgeries, the incidence of spinal infections has shown a gradual upward trend [3]. Herein, we report a case of a 59-year-old male patient with cervical spine infection. Combined with relevant literature, we discuss the clinical symptoms, key diagnostic points, and treatment principles of this condition, aiming to provide guidance for clinical practice.

2. Case Report

The patient was a 59-year-old male with a past medical history of flexible ureteroscopic lithotripsy plus double-J (D-J) stent placement for left ureteral calculi. He had no history of diabetes or trauma. One month prior to admission, he developed neck pain and left shoulder pain without obvious inducing factors, which could radiate to the radial side of the left forearm and presented as electric shock-like stabbing pain. The symptoms did not relieve after rest and worsened with movement. He had no complaints such as limb weakness or fecal/urinary incontinence. One week prior, he visited another hospital, where cervical spine plain CT scan showed local bone destruction at the C6/7 level accompanied by soft tissue swelling. After receiving analgesic and neurotrophic drug treatment, his neck pain did not alleviate, and he was subsequently admitted to our hospital for further management.

On specialized physical examination: The physiological curvature of the cervical spine was straightened. Tenderness was present between the spinous processes of C5/6 and C6/7. The head compression test was positive (+), and the cervical nerve traction test was positive (+). Muscle strength of both upper limbs was Grade V^{-}. Bilateral biceps reflexes and triceps reflexes were elicited symmetrically. Bilateral Hoffmann sign and Babinski sign were negative. Muscle strength of both lower limbs was Grade V. The Visual Analog Scale (VAS) score for pain was 8 points, and the Japanese Orthopaedic Association (JOA) score was 7 points.

Laboratory tests revealed: Erythrocyte Sedimentation Rate (ESR): 84.0 mm/h; White Blood Cell (WBC) count: 13.79×10^{9}/L; Neutrophil proportion: 0.746; C-Reactive Protein (CRP): 99.2 mg/L; Procalcitonin (PCT): 0.12 μg/L. Imaging examinations:

Cervical spine X-ray: Bone resorption and destruction of the C6-7 vertebral bodies, and lesions in the C6/7 intervertebral disc.

Cervical spine CT: Bone destruction and resorption of the C6-7 vertebral bodies, thickening and swelling of the C6/7 intervertebral disc and adjacent paravertebral soft tissues.

Cervical spine contrast-enhanced MRI: Abnormal changes in the C6-7 vertebral bodies, intervertebral disc, and paravertebral soft tissues.

Diagnosis and Treatment Process: Upon admission, the patient was immediately administered third-generation cephalosporins. On the 2nd day after admission, he underwent anterior cervical approach C6/7 abscess incision and drainage combined with autologous iliac bone grafting. Postoperative bacterial culture results indicated the presence of Escherichia coli (E. coli). Pathological examination results showed: edematous and degenerated nucleus pulposus tissue under the microscope, with focal infiltration of chronic inflammatory cells. After surgery, piperacillin sodium-tazobactam was administered based on drug sensitivity test results. The surgical wound healed well. Postoperatively, the VAS score was 4 points, and the JOA score was 11 points.

3. Discussion

Primary cervical spine infection accounts for only 6% of all spinal infections, which is rarer than infections in the thoracic and lumbar spine segments. It is characterized by rapid disease progression and can lead to neurological impairment in the early stage [4]. In this case of cervical spine infection, the pathogenic bacterium was Escherichia coli (E. coli). Considering the patient's past history of urinary calculi, it is highly likely that the pathogen originated from a urinary tract infection.

Any disease that impairs the immune system, such as diabetes mellitus, renal failure, liver cirrhosis, and malnutrition, is a risk factor for spinal infections [5]. Cervical spine infections usually involve the anterior and middle columns of the spine. The initial clinical manifestations of patients include neck pain (85%), fever (48%), and neurological impairment (32%)—all of which are non-specific symptoms, often leading to delayed diagnosis [6].

Laboratory tests for inflammatory markers (ESR and CRP, which are elevated in almost all cases) are characterized by high sensitivity but low specificity. Etiological diagnosis is the gold standard for confirmation [7]. Sampling of the paravertebral soft tissues at the lesioned intervertebral level can be performed under CT guidance and sent for laboratory testing [8]. For patients with clinically suspected cervical spine infection, it is necessary to first complete imaging examinations such as cervical spine X-ray, CT, and MRI, and collect blood samples (double bottles from both sides) as well as conduct specific tests (T-SPOT, Brucella serum agglutination test, and rose Bengal plate agglutination test).

For the tuberculosis infection T-cell spot test (T-SPOT.TB), the positive predictive value ranges from 50% to 60%, while the negative predictive value is >90%; therefore, a negative result is more reliable for ruling out tuberculosis infection.

Regarding the treatment of cervical spine infection, the first steps are bed rest with immobilization and antibiotic administration. The selection of antibiotics should be based on bacterial culture and drug sensitivity test results, while also considering antibiotic side effects and tissue penetration. For patients with unclear infection, empirical antibiotic use can be chosen, such as vancomycin combined with third- or fourth-generation cephalosporins [9]. According to relevant literature reports, there is no significant difference in clinical cure rate or side effects between a 6-week course of intravenous antibiotics and a 12-week course [10]. It is generally recommended to administer intravenous antibiotics first for 6 weeks, followed by oral sequential therapy.

An analysis of factors leading to the failure of conservative treatment shows that if epidural abscess is complicated, the failure rate of conservative treatment is as high as 41%; other risk factors include diabetes mellitus, CRP >115, white blood cell count >12.5×10⁹/L, and positive blood culture [11].

For the evaluation of treatment efficacy, 4 weeks is generally used as the assessment time point, with evaluation indicators including ESR and CRP. After 4 weeks of antibiotic treatment, if ESR > 50 mm/h and CRP > 27.5 mg/L, it is recommended to switch to surgical treatment.

Inflammatory markers (CRP and ESR) are sensitive indicators for monitoring therapeutic effect, among which CRP is more sensitive. A 50% weekly reduction in CRP indicates a favorable prognosis. In MRI examinations, focus should be placed on changes in abscess and local inflammatory signals. However, since the improvement shown by MRI lags behind clinical improvement, rechecking MRI within 4 weeks is of limited significance.

In this case of cervical spine infection caused by E. coli, although the pathogenic bacterium could not be identified in the early stage, empirical antibiotic treatment could be selected based on the results of laboratory tests and imaging examinations. When acute or progressive neurological impairment, intraspinal abscess, spinal instability, or failure of non-surgical treatment occurs, surgical treatment should be performed immediately for thorough debridement, drainage, and adjuvant antibiotic therapy. The boundaries of non-surgical treatment include the absence of spinal instability and intraspinal abscess. For cases where abscess causes bone destruction or spinal instability, simple internal fixation surgery is required. In contrast, for those complicated with intraspinal abscess or neurological impairment, spinal canal decompression combined with internal fixation surgery should be performed. The selection of surgical approaches mainly includes anterior debridement, bone grafting and fusion, posterior debridement, bone grafting and fusion, as well as one-stage or two-stage combined anterior-posterior surgery. In recent years, there have been increasing reports on the application of minimally invasive techniques for treatment; however, the overall indications are relatively narrow, and the therapeutic efficacy requires further research. The anterior approach allows direct access to the lesion, thorough debridement, and anterior column reconstruction without damaging the posterior column structure. The posterior approach can correct deformities, achieve rigid fixation, and also perform debridement and reconstruction, but it cannot directly reach the lesion. The combined anterior-posterior approach integrates the advantages of both anterior and posterior approaches, but the surgery is more traumatic to the patient. The minimally invasive lateral retroperitoneal approach provides a new option for surgical intervention. It is difficult to define the optimal surgical treatment for spondylodiscitis. There are some accepted principles of surgical management, including debridement of necrotic tissue, decompression of neural element, and stabilization of the spine. Based on clinical experience, the anterior approach ensures thorough and reliable debridement of the lesion. The posterior pedicle screw fixation, which achieves three-column stabilization, exerts strong corrective force and is conducive to spinal stability and fusion. For the minimally invasive lateral approach, it features safe and convenient operation, thorough debridement, and satisfactory therapeutic efficacy. The left-sided approach is generally preferred; however, for abscesses in the right psoas major muscle, percutaneous puncture and drainage are often required as an adjunctive procedure.

Long-term follow-up and observation are still required for this patient.

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