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A Case Of Suppurative Cervical Spinal Infection With Delayed Dislocation And Cervical Spinal Cord Injury Caused By Salmonella Paratyphi B

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Abstract:

Objective*: This case reported a rare case of suppurative cervical spinal infection with delayed dislocation and cervical spinal cord injury caused by Salmonella paratyphi B.*

Materials and Methods*: The diagnosis, treatment and curative effect of the cured cases of suppurative cervical spinal infection, delayed dislocation and cervical spinal cord injury caused by Salmonella paratyphi B were retrospectively analyzed.*

Results*: Imaging examination and pathological examination of infected tissue are necessary conditions for diagnosis. For spinal instability or severe neurological dysfunction, surgical treatment combined with standard anti-infection treatment is the first choice.*

Conclusion: *Suppurative cervical spinal infection caused by Salmonella paratyphi B is rare, which can be cured after combined surgical treatment combined with standard anti-infection treatment.*

Key Word*: Salmonella paratyphi B; Suppurative cervical spine infection; Surgical treatment; Anti-infection treatment*

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I. Introduction

The incidence rate of suppurative cervical spine infection is low, accounting for 3%~11% of spinal infection [1], but it has high harmfulness. In developed countries, the mortality rate of suppurative spinal infection can reach 2% - 4% [2, 3]. With the development of the disease, suppurative cervical spinal infection may further develop into systemic sepsis, irreversible spinal cord nerve damage, and even high paraplegia and other catastrophic consequences [4]. Therefore, timely and effective treatment is very important for patients with suppurative cervical infection. The pathogenic bacteria of suppurative spinal infection are mostly Staphylococcus aureus [5, 6], while the suppurative cervical spinal infection caused by Salmonella paratyphi B is relatively rare. This case reported a rare case of suppurative cervical spinal infection, delayed dislocation and cervical spinal cord injury caused by Salmonella paratyphi B, and reviewed and summarized its diagnosis, treatment process and efficacy.

II. Case data

A 70-year-old male patient was admitted to the hospital complaining of "neck stiffness and pain with unstable walking for 2 months". In the past two months, the symptoms have gradually worsened, with low fever, the highest body temperature of 38.4 ℃, weight loss of 5kg, and poor diet. The flexion, extension and rotation activities of the head and neck are limited, and the pain is severe during passive activities. Special examination: obvious kyphosis was found in the neck, Chest and abdominal band feeling, muscle strength of both upper limbs of grade 3, bilateral knee tendon reflex and achilles tendon reflex hyperreflexia, bilateral Hoffmann sign and Babinski sign were positive, and bilateral ankle clonus were positive. The preoperative pain Visual Analogue Scale (VAS), Japanese Orthopaedic Association scores (JOA), Neck Disabilitv Index (NDI) and American Spinal Injury Association (ASIA) grading were shown in Table 1. The inflammatory indexes (WBC, ESR, CRP, PCT) were significantly increased, as shown in Table 2. The blood culture was negative, Widal's test was negative, PPD test and T-SPOT test were negative. X-rays showed that C5 vertebral body shifted backward (Figure 1). The enhanced MRI showed that according to the findings of the C4-7 vertebral body, appendages

and corresponding intervertebral spaces, the posterior part of the vertebral body and the anterior soft tissue, the infective lesions were considered, and the pus cavity of the anterior soft tissue was formed, and the C5 and C6 vertebral bodies were displaced (Figure 2). CT showed that soft tissue mass shadow was seen in the cervical spine, bone destruction in different degrees in the C4-7 vertebral body, dislocation in the C5-6 vertebral body, and abscess formation (Figure 3). Retrospective inquiry of the patient's past medical history and hospitalization data showed that the patient had been hospitalized in our hospital for urinary tract infection 2 months ago. The urine culture showed Salmonella paratyphi B, and the blood culture was negative. The patient recovered after anti-infection treatment, and did not return to the hospital after discharge.

Table 1. Preoperative and postoperative scores of patients

Classification	Preoperative	Postoperative 6 months	Postoperative 12 months
VAS	8	2	2
JOA	8	13	15
NDI	42	11	9
ASIA	C	E	E

Table 2. Changes of inflammatory indicators during treatment

Classification	Preoperative	Postoperative 3 days	Postoperative 2 months	Postoperative 4 months	Postoperative 6 months	Postoperative 8 months	Postoperative 12 months
WBC(*10^9/L)	15.23	14.23	9.66	7.86	7.81	6.64	6.40
ESR(mm/H)	86.0	63.0	53.0	53.0	27.0	26.0	24
CRP(mg/L)	67.3	72.0	43.34	11.30	2.86	2.75	2.24
PCT(ng/mL)	0.29	0.28	0.04	0.03	0.03	0.02	0.02

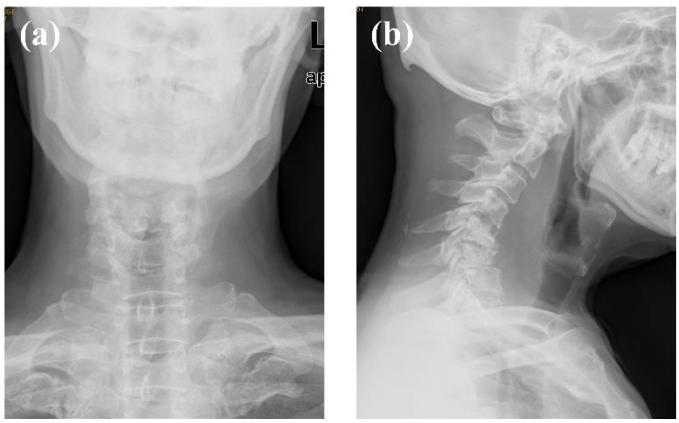

Figure 1. The preoperative X-ray shows that the cervical vertebra reverse arch, the C5 vertebral body moves backward, hyperosteogeny and cuspidation can be seen at uncinate joint and the posterior and anterior edge of C5-7 vertebral body, and the corresponding intervertebral space is narrowed.

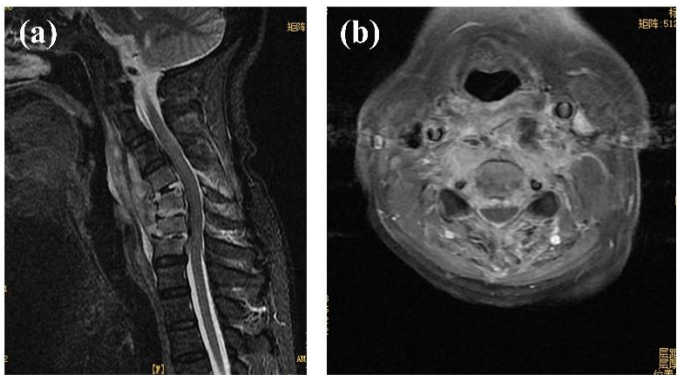

Figure 2. Enhanced MRI shows multiple bone marrow edema in the C4-7 vertebral body and appendages (C5 and C6 move backward relative to the lower vertebral body), and long T2 signal can be seen in the corresponding intervertebral space. Strips of T1 and long T2 signals can be seen at the back of the vertebral body and at the front edge of the vertebral canal, resulting in the narrowing of the vertebral canal and slight compression of the cervical spinal cord. The soft tissue in front of C1-T1 vertebral body swelled, mixed signals were shown on T1WI and T2WI, involving bilateral musculus longus colli, and the left side was marked. The

above lesions were obviously and unevenly enhanced on the enhanced scan. There was no enhanced area in the anterior vertebra, and no clear abnormal signal was found in the cervical spinal cord.

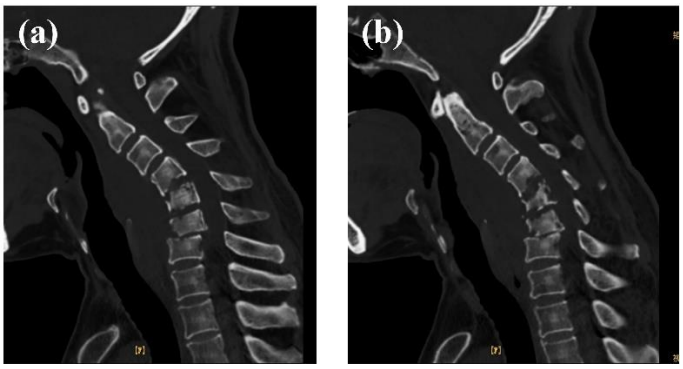

Figure 3. CT shows: 1. Soft tissue mass shadow can be seen in the cervical spine, and bone destruction in different degrees can be seen in the C4-7 vertebral body. The C5-6 vertebral body is unstable and dislocated, considering infection and abscess formation.2. Cervical reverse arch deformity.

After admission, skull traction and immobilization were performed, and anti-infection treatment with ceftriaxone sodium injection was performed empirically. The preoperative examination was completed and then anterior cervical subtotal vertebral resection, focus removal, spinal cord decompression, and autogenous iliac bone grafting and internal fixation were performed. During the operation, a large amount of purulent fluid was aspirated from the front of the neck, and C4-C7 vertebral body bone destruction and abscess granulation were found. Dead bone and granulation tissue were cleaned and sent for pathological examination. After subtotal resection of the C5 vertebral body, the dura mater was found to be undamaged. After repeatedly washing the operation area, autogenous iliac bone fusion was implanted in the C4-C6 intervertebral space and C6-C7, and the anterior cervical plate and screw fixation was performed. The results of tissue culture showed that Salmonella paratyphi B; The results of pathological examination showed that a large number of neutrophils infiltrated in the fibrous tissue, and a small amount of cartilage tissue could be seen locally, consistent with the changes of infection (Figure 4). According to the drug sensitivity results (Table 3), ceftriaxone and levofloxacin were given intravenous drip anti-infection treatment after the operation, and the incision healed in grade A. After discharge, continue to take levofloxacin tablets for half a year until the relevant inflammatory indicators gradually fall to the normal range (Table 2). The cervical bracket was protected for 8 weeks after operation. The VAS score, JOA score, NDI index and ASIA grade were followed up at 6 and 12 months after operation (Table 1). Postoperative X-ray examination showed that the structure of cervical vertebra recovered (Figure 5). After 6 months of follow-up, the spinal cord nerve function of the patient returned to normal and could independently complete all daily work. The MRI showed that paravertebral abscess disappeared 6 months after operation (Figure 6). One year after operation, CT scan showed bone graft fusion without internal fixation failure and infection recurrence (Figure 7).

Table 3. Results of intraoperative tissue culture

Specimen results	Antibiotic	Quantitative results	Qualitative results
Salmonella paratyphi B	Cefatriaxone	≤1	Sensitive
Salmonella paratyphi B	Piperacillin/tazobactam	≤4/4	Sensitive
Salmonella paratyphi B	Cefoperazone/sulbactam	≤2/1	Sensitive
Salmonella paratyphi B	Ceftazidime	≤4	Sensitive
Salmonella paratyphi B	Imipenem(Tienam)	≤1	Sensitive
Salmonella paratyphi B	Chloramphenicol	≤8	Sensitive
Salmonella paratyphi B	Ciprofloxacin	≤0.06	Sensitive
Salmonella paratyphi B	Cefepime	≤2	Sensitive
Salmonella paratyphi B	Levofloxacin	≤0.12	Sensitive
Salmonella paratyphi B	Meropenem	≤1	Sensitive
Salmonella paratyphi B	Compound Sulfamethoxazole	≤0.5/9.5	Sensitive
Salmonella paratyphi B	Minocycline Hydrochloride	≤4	Sensitive
Salmonella paratyphi B	Ampicillin	≤8	Sensitive
Salmonella paratyphi B	Ampicillin/sulbactam	≤2/1	Sensitive

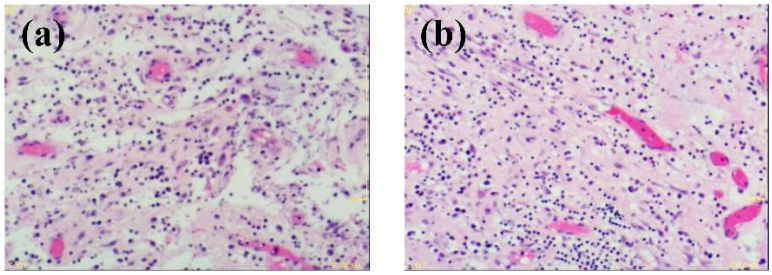

Figure 4. Pathological examination: a large number of neutrophils infiltrated in the fibrous tissue, and a small amount of cartilage tissue can be seen locally, consistent with the change of infection.

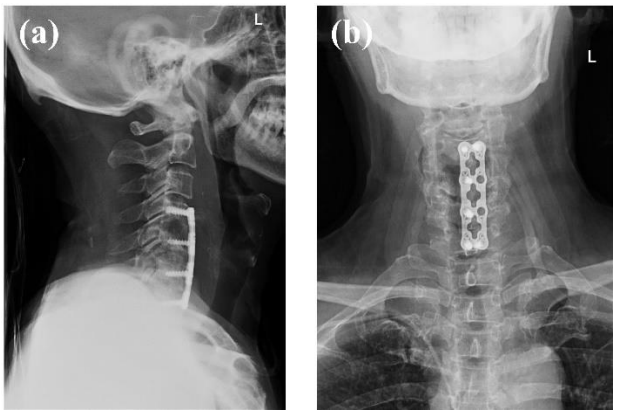

Figure 5. Postoperative X-ray shows that the curvature of cervical spine becomes straight; The bone density of some vertebrae in C4 and C5 decreased; Metal internal fixation shadow can be seen in C4-7 vertebral body, internal fixation is not loose or broken, and vertebral space is normal.

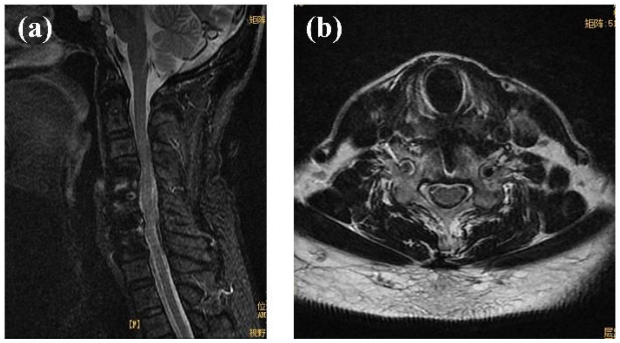

Figure 6. The MRI at 6 months after operation showed that the physiological curvature of cervical spine became straight; Magnetic sensitive artifacts can be seen in C4-7 vertebral body (caused by internal fixation after operation), and no abnormal enhancement is found in cervical vertebral body and paravertebral soft tissue; The morphology and signal of cervical spinal cord are normal, and there is no abnormal enhancement; C1-T1 pre-vertebral and post-vertebral soft tissue edema was basically absorbed.

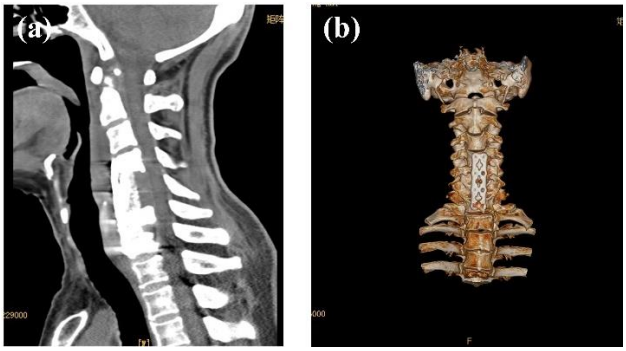

Figure 7. One year after operation, CT showed that high-density bone graft shadow could be seen in the operation area of C5 vertebral body and C6/7 intervertebral disc, and the bone graft was partially fused with the

adjacent vertebral body; High-density internal fixator shadow can be seen in C4-7 vertebral body, and no signs of break and loosening are found; The swelling of soft tissue in the operation area has been relieved.

III. Discussions

Salmonella infection is mainly caused by gastrointestinal tract infection, and can also occur in bone marrow, joints, meninges, arteries and other parts [7]. The humoral immunity, cellular immunity and the barrier function of gastrointestinal mucosa play an important role in resisting the invasion of Salmonella typhimurium. When patients have risk factors such as malnutrition, diabetes, immunosuppressive diseases, malignant tumors, end-stage chronic renal failure, long-term use of glucocorticoid drugs, the probability of infection increases greatly [8]. Most patients with normal immune function can recover after infection and standard drug treatment. The mortality rate of patients without standardized treatment after infection can reach 50% [9]. However, clinically, the suppurative cervical spinal infection caused by Salmonella paratyphi B is relatively rare, and there is no relevant literature report at present. This case reports a case of suppurative cervical spinal infection with delayed dislocation and cervical spinal cord injury caused by Salmonella paratyphi B infection, which was cured after surgical treatment and regular drug anti-infection treatment.

The routes of suppurative spinal infection include blood-borne infection, iatrogenic infection and external inoculation, among which blood-borne infection accounts for 3% - 5% [10]. Among the suppurative spinal infection caused by blood borne transmission, the incidence rate of cervical spine infection accounts for 11% [11]. The study found that Salmonella can spread to distant lesions such as the neck through blood or lymphatic vessels after entering the blood, causing infection [8]. The blood flow of cervical venous plexus is slow, and the pathogenic bacteria are easy to stay around the vertebral body after entering the venous plexus around the vertebral body, which is an important factor for cervical intervertebral disc and vertebral body infection. In this case, the patient had a history of Salmonella paratyphi B infection in the urinary system 2 months before the onset of the disease. The pathological tissue culture of the patient during the operation showed that the pathogenic bacteria was Salmonella paratyphi B, suggesting that the possibility of blood transfer infection could not be ruled out. Therefore, it is necessary to trace the past medical history of patients with spinal infection, including but not limited to family infectious history, urinary system infection history, respiratory system infection history, invasive operation treatment history and contact history of animals such as cattle and sheep.

Typical imaging manifestations of suppurative spinal infection are: erosion of vertebral endplate, osteolytic disease and compression fracture, which further lead to the risk of spinal instability, deformity and spinal cord compression [12, 13]. The infection spread beyond the bone structure due to untreated or mistreatment, and the pathogenic bacteria spread to the surrounding tissues, causing paravertebral soft tissue infection and abscess. When it spreads into the spinal canal, it can cause epidural abscess, subdural abscess and even central nervous system infection. MRI is considered as the gold standard for imaging diagnosis of spinal infection [14, 15], which has high sensitivity and specificity for spinal infection [16, 17], and can clearly display the detailed information of soft tissue, intradural and extradural, and spinal nerves. CT examination is the best detection method to evaluate bone changes, which can identify bone destruction, dead bone, etc. [18]. In addition, inflammatory indexes of patients with suppurative spinal infection were at a high level. In this case, enhanced MRI showed infection of cervical vertebra, appendages and surrounding tissues. CT showed bone destruction of vertebral body, and the diagnosis of suppurative cervical infection was clear.

The purpose of the operation is to clear the focus, relieve the compression of the spinal cord, and reconstruct the structural stability of the cervical spine [19]. One-stage focal debridement and fusion has the dual benefits of eliminating infection and stabilizing the spine [20]. In this case, the formation of cervical paravertebral abscess caused by suppurative cervical infection, instability of cervical structure and spinal cord nerve damage are the main reasons for deciding the surgical treatment. After surgery, the patient's cervical spine recovered structural stability, cervical function and spinal nerve function recovered, and the quality of life improved. The treatment effect is similar to that of other spinal suppurative infections [21, 22]. The patients with suppurative cervical infection caused by Salmonella paratyphi B with bone destruction and spinal cord nerve damage can be cured after surgical treatment combined with standard anti-infection treatment.

Tissue culture examination of infected focus is the gold standard for diagnosis and medication of infectious diseases [23], and microbiological and histological diagnosis plays a key role in determining specific drug treatment scheme. Suppurative spinal infection can only be treated with antibiotics after a definite diagnosis. If empirical antibiotic treatment is needed, the scope of antibiotic treatment must be extended to the most common pathogens of suppurative spondylitis, such as Staphylococcus aureus and Escherichia coli [24]. If there are no patients with spinal instability and mild neurological symptoms, regular antibiotic treatment is expected to improve. For patients with spinal instability or severe neurological dysfunction, or ineffective anti-infection treatment, surgical treatment combined with standard anti-infection treatment is the preferred treatment [24, 25]. This case has well confirmed the effectiveness of the above treatment schemes. After surgical treatment to

eliminate the infection focus and stabilize the spine, combined with standard anti-infection treatment, the paravertebral abscess disappeared, the inflammatory index returned to normal, and the infection did not recur.

In conclusion, through this case report, early detection and treatment of suppurative cervical spinal infection caused by Salmonella paratyphi B can effectively prevent the spread of infection and bone destruction. In case of bone destruction and spinal cord nerve damage, timely surgical treatment can effectively clear the focus, relieve spinal cord compression, and reconstruct the stability of cervical spine structure. Standardized anti-infection treatment after surgery can effectively prevent the recurrence of infection.

Abbreviations:
VAS: Visual analogue scale
JOA: Japanese orthopaedic association scores
NDI: Neck disability index
ASIA: American spinal injury association
CT=Computed tomography
MRI=Magnetic resonance imaging
ESR=Erythrocyte Sedimentation Rate
PPD=Purified protein derivative
C=Cervivcal vertebra
WBC=White blood cell count
ESR = Erythrocyte sedimentation rate
CRP = C-reactive protein
PCT=Procalcitonin

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