

One Case of Patient with Lumbar Burst Fracture and Spinal Cord Injury through Percutaneous Endoscopic Treatment

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Keywords: Percutaneous Endoscopic Spinal Surgery; Percutaneous Pedicle Screw Technology; Burst Fracture of Lumbar Spine

Abstract: To conduct discussions on the feasibility and safety in the treatment of lumbar burst fractures by percutaneous spinal endoscopy. Method: 1 case of patient with lumbar burst fracture by treatment with percutaneous spinal endoscopy. Percutaneous pedicle screws and pedicle connecting rods were placed during the operation, and the fractured vertebral body was recovered. The loose bone was removed with the assistance of percutaneous spinal endoscopy and the fractured bone was driven into the vertebral body. X-ray and CT were performed 3 days after the operation to investigate whether there were residual bone blocks in the spinal canal so as to determine whether good decompression of the spinal canal was obtained and stability of the spine was reconstructed. Results: The minimally invasive surgery was successfully conducted for the patient, 3D postoperative CT review showed that the fracture vertebral body reduction was ideal, positions of pedicle screw were in good condition without perioperative adverse reactions and surgical complications. Good decompression of spinal canal and reconstruction of spinal stability are beneficial to the recovery of functions of spinal nerve. Conclusion: Percutaneous spinal endoscopy is endowed with characteristics in safety, minimally invasive and effectiveness in the treatment of lumbar burst fractures. It can be used as a minimally invasive surgical method for lumbar fracture.

1. Introduction

Lumbar burst fracture is a common disease in clinical practice with escalating trend in its morbidity year by year. The purpose of treatment of thoracolumbar fracture is to restore the spinal sequence and to fully decompress the spinal canal as well as to rebuild the stability of the spine, as a result, to create conditions for the recovery of neurological function. With the development of concept in minimally invasive, percutaneous pedicle screw technology has been widely used in the clinical treatment of lumbar fracture, and scholars at home and abroad have applied percutaneous spinal endoscopy technology to the treatment of spinal fracture, which displayed the advantages of less trauma, less bleeding, less side injuries, quick postoperative recovery in clinical practice with significant clinical effects. This case is a embodiment of modern minimally invasive surgery, endoscopic technology and the concept in minimally invasive. Good decompression of spinal canal and reconstruction of spinal stability are conducive to the recovery of spinal nerve functions.

2. Medical Records

The 35-year-old male patient was admitted to hospital after 5 hours of pain in the lower back and right heel caused after falling down from a high place. Physical examination shows tension in lumbar and back muscles, which leads to the limitation in activity and local buckling tenderness of L1-3 vertebral body (+); Femoral nerve pull test proved to be (-). SLRT shows that: left leg was

diagnosed 50° (+) and right 80° (+);The right foot is black and swollen. Strength: the left side of the iliopsoas was at IV level (L2-4), quadriceps at (L2-4) IV, pretibial muscle at (L4-5), extensor hallucis longus at (L4 - S1) IV level, bilateral gastrocnemius and soleus were at (L5 S2) V level. Normal utaneous sensation was sensed in the left leg. The knee and Achilles tendon reflexes of the left lower limb were in normal state.



Figure 1. Preoperative imaging

Imaging examination at admission showed mild fracture of T12 vertebral body. Besides, bursting fracture of vertebral body L1 was discovered with bone marrow edema and spinal stenosis at the same level. A few exudative changes in the subcutaneous soft tissue area of the lumbar and back. Comminuted fracture in right calcaneal was found with hydrops articulari and swelling of surrounding soft tissue. Clinical diagnosis showed that: 1. Lumbar burst fracture with spinal cord injury (L1); 2. Comminuted fracture of right calcaneus ". Percutaneous spinal endoscopic fracture reduction with nerve root decompression and percutaneous nail internal fixation plus open reduction of right calcaneal fracture were likely to be conducted after admission.

3. Surgical Method

(1) Percutaneous pedicle screw fixation

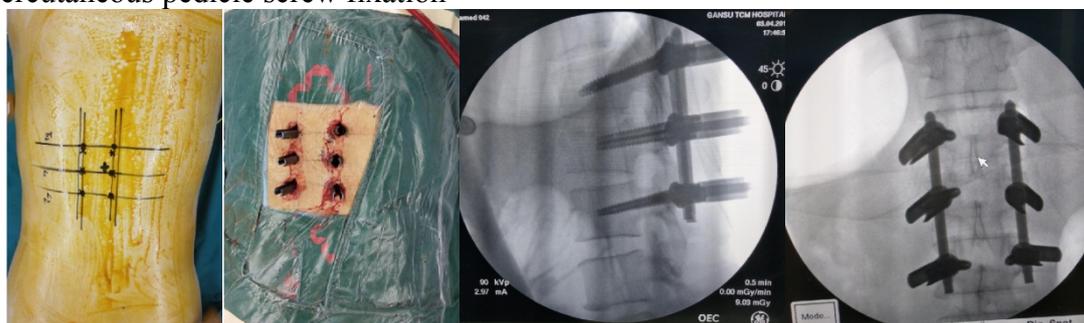


Figure 2. Percutaneous pedicle screw fixation through intraoperative images

The patient was placed on a cushion with prone position. The patient was applied with anesthesia and the operative area was conducted with routine disinfection with preparation of towels. Imaging was made to determine the location T12, L1 and L2 vertebral pedicle position on both sides. 1.5 cm incisions were made on the center on the body surface. With the assistance of "C" shaped arm fluoroscopy, the entry points for pedicle of vertebral arch can be made clear, and work string was then placed for opening in entry points respectively. As probe channel is proved to be osseous

channel, conducting wire can be implanted. The register pin was in good condition. To insert 2 pedicle screws of 6.0×40mm, 6.0×40mm and 6.5×45mm respectively through pedicle channel on both sides of T12, L1, and L2, and the screws were on vertebral pedicle.

(2) Endoscopy-assisted decompression in the spinal canal

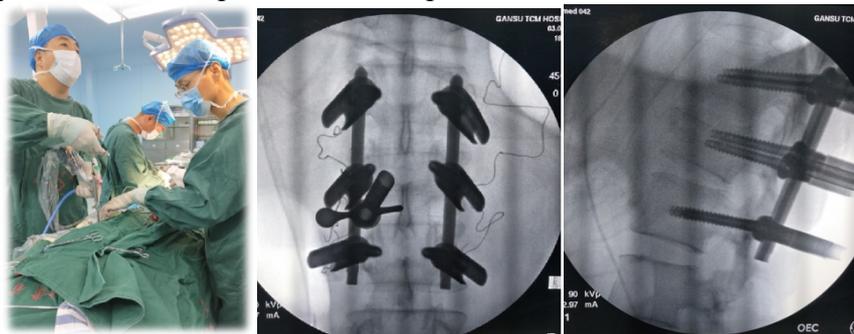


Figure 3. Intraoperative operative images of endoscopic-assisted decompression in the spinal canal

Under the perspective of type C arm positioning T12 - L1 intervertebral disc and surface markers, T12 - L1 spines gap edge on the right side for the puncture point 0.5 cm mark the skin incision of about 1 cm, the incision to T12 - direction between L1 vertebral plate in soft tissue expansion pipe, perspective confirmed expansion tube tip is located in between T12 - L1 vertebral plate on the right side, the soft tissue expansion pipe screwing work channels and placed endoscopy to the work, continuous saline flushing, mirror work rotating under the channel to the surface of yellow ligament, bite open yellow ligament between T12 - L1 vertebral plate, to the outside, caudal biting except yellow ligament and vertebral plate to broaden horizons and nerve root and the catheter. Then, the working channel was inserted into the spinal canal, and the T12 nerve root and dural membrane were protected inside the channel. Microscopically, the protruding vertebral canal fracture fragment could be seen, and the loose part was removed after exploration. After the position of the fracture block was determined, the fracture block was struck into the vertebral body with the working sleeve through the channel. The free bone block was explored toward the posterior lower edge of the L1 vertebral body, and the free bone block was removed. The contralateral and caudal exploration again showed that there was no residual fracture block, and the reduction of the fracture block was satisfactory. Microscopically, no active bleeding was observed. 1ml of methyltolone was injected around the nerve root, the endoscope and working channel were withdrawn, and 2ml of ropivacaine was injected subcutaneously through the incision, sutured, and aseptic dressing was performed. The operation was smooth, the intraoperative bleeding was about 50ml, and there was no side injury.

(3) Internal fixation with plate for right calcaneal fracture

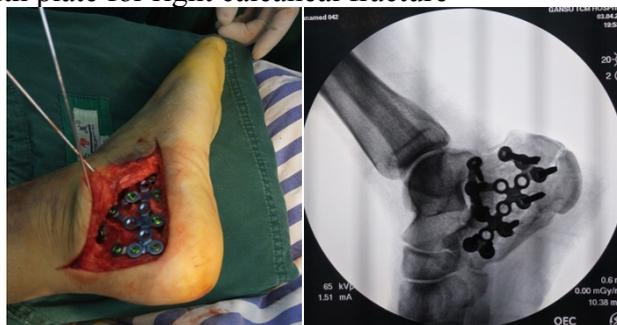


Figure 4. Internal fixation of right calcaneal fracture with plate

Routine disinfection of the operative area of the right calcaneus was performed and towel was laid. A tourniquet can be applied after blood cleaning. The "L" shape incision on the outer edge of calcaneus can be conducted with length of 10 cm and the skin and subcutaneous tissue should be incised respectively until the fractured bones were exposed. Reduction of fracture can be applied during intraoperative traction, Kirschner wire can be used for fixation, and images showed good fracture reduction, calcaneal tubercle angle is recovering well. Calcaneal locking plate can be used,

Bone graft can be used for the subsidence parts of calcaneus. Steel plate was transplanted in heel lateral of calcaneus after shaping with subsequent drilling. 7 screws were placed after measurements of depth. Intraoperative shooting images showed that good effect in reduction of fracture was received with good counterpoint. At the end of the operation, the wound should be dealt with and loose the tourniquet. There were about 100 ml of hemorrhage with brace fixation after surgery.

4. Postoperative Treatment

Postoperative patients were required to adopt a supine position, and antibiotics were given to prevent infection. Besides, non-steroidal anti-inflammatory drugs were offered to patients, and mecobalamine was given to nourish nerves. During bed rest, the patients were required for dorsal extension and exercises in straight leg raising and active quadriceps flexion exercises. The drainage tube was removed 1 day after surgery, and the patient got out of bed wearing a brace 3 days after surgery.

5. Results

Demonstration of 3D review after operation



Figure 5. 3D postoperative review images

The lumbar internal fixators were placed in the vertebrae T12, L1 and L2, and the lines of the posterior edge of the vertebrae were neatly arranged. No obvious signs of loosening or fracture were observed for the internal fixators. The broken end of the right calcaneus fracture was in good alignment, and the internal fixation position was satisfactory. Good effect of healing was received in I period after postoperative incision, the stitches were moved after 2 weeks.

The reexamination image showed 3 months after operation



Figure 6. Re-examination image at 3 months after postoperation

The lumbar internal fixator was in stable condition and the line of the posterior edge of the vertebral body was neatly arranged, the vertebral body sequence was in normal state, the size and shape of the vertebral canal were basically normal, no obvious abnormality was observed in the paravertebral soft tissue, the broken end of the right calcaneus fracture was in good alignment, and the fracture line was blurred than before. The patient was performed with lumbar internal fixation and calcaneal fracture internal fixation in our department on January 16th, 2020-January 16th, and the operation was successful. After treatment, the the disease condition of the patient was improved, with stable thoracolumbar activity and good ankle joint activity function, and no adverse complications occurred during postoperative follow-up.

6. Discussion

Lumbar spine burst fracture was a commonly seen disease in clinical practice with rising incidence year by year, the purpose of the treatment of thoracolumbar fractures was to restore spinal sequence and to achieve full vertebral canal decompression, at the same time to rebuild the stability of the spine so as to create conditions for the recovery of neural function. There is controversy for the treatment of burst fractures without neurologic damage and the goal for treatment is to prevent deformity based development, chronic pain and delay of nerve damage. In general, conservative treatment is appropriate for patients with stable injury and undamaged nervous system. For the elderly, the vertebral strengthening, decompression surgery or fusion invasive interventions add risks of surgery, and such kind of patients were usually diagnosed with other diseases. Defects of the nervous system, internal fixation failure and complications such as bleeding and infection were likely to be discovered in the process of operation, which may bring potential problems to the patients with general anesthesia, as a result, postoperative recovery was more difficult. Based on the above mentioned concerns, conservative treatment should be given in priority in patients with sufficient pain relief. Patients with neurological impairment tend to be treated surgically. In the traditional treatment of lumbar fracture, open reduction and pedicle screw internal fixation are usually used, which has significant clinical efficacy. However, traditional surgery will cause great trauma, more intraoperative bleeding, more damage to paraspinal muscle and bone structure, and slow postoperative recovery [1-2].

With the development of the concept of minimally invasive surgery, percutaneous pedicle screw technique is widely used in clinical treatment of lumbar fractures, which displayed the advantages in small trauma, less bleeding, faster recovery and others [3-4]. However, it can be done with percutaneous operation under X-ray fluoroscopy, and fewer perspective may lead to certain deviation in position of the pedicle screws, and even cause damage to nerve, spinal cord, or blood vessels. Frequent intraoperative fluoroscopy will expose patients and medical personnel under more radiation [5]. Literature [6] showed that the failure of placing pedicle screws was generally as high as 4.9% ~ 37.5%. At the same time, for patients with fracture block protruding into the spinal canal and obvious root symptoms, percutaneous pedicle screw technology cannot be used to reduce the fracture block and decompression of the spinal cord and nerve root, resulting in poor clinical efficacy [7].

Percutaneous spinal endoscopy is proved to be the fastest developing minimally invasive surgery in recent years, showing great clinical advantages in the treatment of lumbar disc herniation, lateral crypt stenosis, cervical disc herniation and thoracic disc herniation [8-10]. At the same time, domestic and foreign scholars have applied percutaneous spinal endoscopy to more orthopedic surgeries, including the clinical treatment of cervical spondylotic myelopathy, lumbar spondylolisthesis and lumbar posterior margin epiphyseal dissection, and achieved good clinical efficacy [11]. Besides, the technology was even applied to the clinical treatment of spinal infectious diseases [12]. The percutaneous spinal endoscopy technology showed the clinical advantages of less trauma, less bleeding, less side injuries, quick postoperative recovery and so on in the treatment of spinal fracture, and the clinical effect is significant. However, due to its long operation duration and more intraoperative fluoroscopy, operators with higher surgical skills were required. Surgical accuracy needs to be further improved due to greater surgical risks [13].

This case is a combination of modern minimally invasive surgery, endoscopic technology and minimally invasive concept, which can not only be used to accurately detect whether there is bone block residual in the spinal canal, but also to safely remove the bone block, so a more thorough decompression of the spinal canal can be obtained. Postoperative imaging examination showed that the decompression of the spinal canal in this case was in a perfect condition, and there was no residual bone block. Good decompression of the spinal canal and reconstruction of the stability of the spine were conducive to the recovery of the spinal nerve function. According to the relevant literature at home and abroad, there are few clinical reports on the treatment of lumbar burst fractures assisted by percutaneous spinal endoscopy, which may be related to the long learning

curve and great technical difficulty of percutaneous spinal endoscopy.

In the clinical treatment of lumbar burst fractures by application of percutaneous spinal endoscopy and percutaneous pedicle screw technology, the purpose of anatomical reduction for vertebral fractures can be achieved with obvious curative effect. Like all minimally invasive surgeries, it has the advantages of high surgical accuracy, high safety, less trauma, less bleeding, quick postoperative recovery and so on. However, in this group, the observation time was short with fewer cases, and the statistical significance was insufficient. Therefore, a large sample of controlled clinical studies were needed to observe the clinical efficacy.

Acknowledgements

Special appreciations to the following projects for the support:

1. Natural Science Fund Project of Gansu Province, No.18JR3RA067

Study on the Mechanism of Huoxue Bushen Decoction in Selectively Regulating Osteoporosis Fracture Based on Wnt10b/ β -catenin Signal Pathway

2. Lanzhou Talent Innovation and Entrepreneurship Program, No.2020-RC-54

Study on residual symptoms after percutaneous spinal endoscopic treatment of lumbar intervertebral disc herniation treated by Guiqi Tongbi prescription

Thanks for the support of the above projects.

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