ANTERIOR AND POSTERIOR FIXATION OF SPINAL FRACTURE IN PATIENTS WITH ANKYLOSING SPONDYLITIS

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Objective. To evaluate the outcomes and methods of surgical treatment of patients with fractures of the cervical and thoracolumbar spine in ankylosing spondylitis.

Material and Methods. The study included 19 patients with ankylosing spondylitis, spinal fractures were diagnosed in seven of them. The average age of patients with fractures was 39 years (range: 32–58 years). Injuries to the cervical spine were observed in three patients, and to the lumbar – in four. Among patients with lumbar spine injuries, a clinical picture of profound inferior paresis was observed in one patient with previous kyphosis. Paraplegia was diagnosed in two patients with fractures at the C5–C6 level, and radicular pain – in one patient with injury at the C5–C6 level. The remaining patients had no neurological disorders. Patients were operated on in the period from three days to two weeks after the injury. CT study to confirm the diagnosis was performed in all patients. Injuries to the cervical spine were treated by anterior fixation, to the thoracolumbar spine – by transpedicular fixation.

Results. The results were evaluated according to X-ray and CT findings, as well as to a degree of neurological regression. Complications, instrumentation removal and increase in spinal deformity were not observed. In one patient with the cervical spine fracture, the pain caused by radicular irritation was eliminated. A regression of neurological complications from Frankel B to Frankel D was observed in one patient with the Th12–L1 fracture.

Conclusion. Surgical stabilization of the spine is the method of choice for the treatment of spinal fractures in ankylosing spondylitis. Graduated correction of kyphotic deformity in fractures may be one of the elements of surgical treatment.

Key Words: ankylosing spondylitis, fractures, fixation, correction.

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According to different authors [10, 14], spinal fractures are 4–11 times more common in patients with ankylosing spondylitis compared to the general population. Spinal fractures can even result from minor trauma [12]. These injuries are serious and they are potentially lethal for the cervical spine with high complication rates. The mortality rate ranges from 18 to 32 %, especially in injuries to the cervical spine [17].

Patients with ankylosing spondylitis are characterized by a high ratio of unstable spinal fractures and the associated neurological disorders, even after minor trauma. Moreover, non-unions and false joints accompanied by chronic pain and the danger of secondary displacement can occur at the fracture site. The treatment of these conditions requires not only solid surgical fixation, but also additional spinal fusion [4]. Significant kyphotic deformity may require spine biomechanical balance restoration, taking into account the grade and localization of the initial deformity [1].

These features of spinal fractures in ankylosing spondylitis put them among complex social concerns. The literature describing patients with spinal fractures in ankylosing spondylitis largely consists of single case reports or small case series [2, 9, 13]. Some papers are devoted to survey studies. Lukasiewicz et al. [12] reported on 939 patients with ankylosing spondylitis hospitalized with spinal fractures. While the reported findings on the nature, frequency, localization of injuries and their complications are generally similar, the treatment options vary substantially from conservative treatment to aggressive surgical management with long polysegmental fixation or anteroposterior spinal fusion [7]. No universal guidelines and standards of treating this category of patients have been developed so far.

The purpose of this study is to analyze the outcomes and methods of surgical treatment of patients with cervical and thoracolumbar spinal fractures in ankylosing spondylitis.

Material and Methods

The study included 19 patients with ankylosing spondylitis, spinal fractures

were diagnosed in seven of them. The mean age of patients with fractures was 39 (32–58) years. The patients with fractures included 6 men and 1 woman. One of the main obstacles in fracture diagnostics in ankylosing spondylitis is very uninformative data of radiograms, which in most cases fail to detect not only the proportion of fractured vertebral elements but also the fracture line. The presence of a fracture is suggested based on clinical data and indirect evidence on radiograms. Therefore, CT scanning was performed in addition to radiography.

Injuries to the cervical spine were noted in three patients and to the lumbar spine – in four. Among patients with injuries to the lumbar spine, a clinical presentation of profound inferior paresis (Frankel B) was observed in one patient with previous kyphosis, paraplegia – in two patients with fractures at the C5–C6 level, radicular pain – in one patient with injury at the C5–C6 level. Neurological disorders were not revealed in the remaining patients.

The patients were operated on in the period from three days to two weeks after the injury. Three patients with thoracolumbar spine injury without profound previous kyphosis and without neurological disorders underwent transpedicular fixation with four pairs of screws. A patient with symptoms of spinal cord compression and neurological disorders (Frankel B), with previous kyphosis underwent partial laminectomy with the release of the posterior dural sac, transpedicular fixation with four pairs of screws and graduated correction of the deformity using curved rods. The patient with injury at the C5–C6 level with radicular irritation underwent partial horizontal corporectomy of adjacent vertebrae at the fracture level followed by interbody fusion with tricortical autograft, reclination of the spine and anterior fixation with pre-curved plate. The female patient with the cervical spinal fracture and tetraplegia (Frankel A) underwent resection of the fractured C5 vertebral body, anterior decompression of the spinal cord, and replacement of the fractured cervical vertebral body with endoprosthesis (Fig. 1). Anterior plate fixation was performed to a patient with the C5–C6 fracture and the spinal cord involvement (Frankel A).

Results and Discussion

Patients with uncomplicated injuries in the lumbar spine were discharged from hospital in satisfactory condition and were followed-up during a year. Control radiography in the early postoperative period (3–5 days after surgery) and in 3, 6 and 10–12 months was performed. The female patient with complicated cervical spinal fracture (Fig. 1) and one patient with complicated thoracolumbar spinal fracture (Fig. 2) were examined by CT in the early postoperative period. The results were evaluated using radiography and CT, as well as based on the grade of neurological regression. Patients with injuries to the cervical spine underwent external fixation with Philadelphia collar for 3.5–4 months. Patients with injuries to the thoracolumbar and lumbar spine had external fixation with semi-rigid removable corset to 6–8 months. Complications in the early postoperative period and during the follow-up were not observed. Fixation system was retained at the initial level before fracture consolidation. In a patient with the thoracolumbar spinal fracture (T12–L1) and neurological disorders (Frankel B), the correction of the posterolateral vertebral displacement with the formation of an angular lordosis of 15° was achieved after surgery and neurological symptoms regressed to Frankel C–D within the first 3 months.

Clinical case 1. Patient L. aged 51 was hospitalized on May 15, 2013. The examination led to a diagnosis: ankylosing spondylitis, the central form, fracture of ankylosed spine at the level of T12–L1 with anterolateral displacement. Frankel B neurological deficit was present. T12 laminectomy, transpedicular fixation at T10, T11–L1, L2 using the KONMET transpedicular construct augmented with a transverse fixator and correction of the deformity on the operating table were performed. The patient preserved sensation and both motor function in the lower extremities with muscle strength of 3–4 scores and pelvic organ function recovered (Frankel C–D) within 3 months after surgery. The achieved correction with formed 15° lordosis remains on CT after surgery and on radiograms 10 months postoperatively, construct integrity was preserved and construct displacement was not observed. Neurological disorders did not regress completely (Fig. 2).

Radicular pain was eliminated during the first week after surgery in one patient after correction of the deformity, anterior interbody fusion at C5–C6 and anterior plating. Plate fixation was retained in the initial position up to fracture consolidation.

Clinical case 2. Patient Kh., 55 years old was admitted to the clinic on November 8, 2011 after falling. The patient complained of intense pain in the region of the right hip joint and both the shoulder girdle and arms. Clinical and radiography examination led to a diagnosis: fracture-dislocation of the right femoal head, injury to the neck and the shoulder girdle. Trauma-related changes were not detected on radiograms of the cervical spine. Total hip replacement was performed for fracture-dislocation of the right femoral head on November 17, 2011. The patient underwent CT examination of the cervical spine because of persistent pain in the arms, which revealed fracture with displacement at the border of C5–C6 vertebrae. The patient underwent intervertebral disc removal through an anterior approach at the fracture level with resection of endplates of the adjacent vertebrae and decompression of the dural sac, wedging interbody corporodesis and bone void replacement with tricortical autograft and anterior fixation with LCP-plate. In the first days after surgery, the patient reported the disappearance of pain in the arms and the shoulder girdle, significant improvement and convenience in the head and corpus position when lying on the back. The improvement of horizontal vision during mobilization was observed. The patient had no complaints at the control examination after 6 months, radiograms revealed bone fusion at C5–C6 vertebral bodies without loss of correction (Fig. 3).

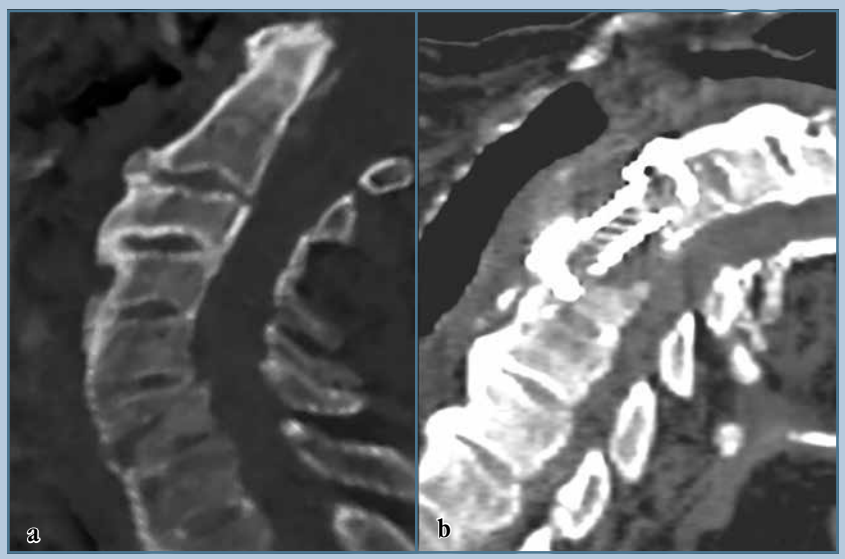

Fig. 1
Fracture of C6 vertebra with spinal cord injury: **a** – distraction fracture of C6 on CT before surgery; **b** – CT after total corporectomy and decompression of dural sac with replacement of the bone void with endoprosthesis

There was no regression in patients with tetraplegia caused by injury to the cervical spine. One patient died 2 months after surgery.

The subaxial fractures of the cervical spine in patients with ankylosing spondylitis rarely come up in general discussions of cervical spine fractures but they are quite common in patients with this disease. These fractures are serious and potentially lethal injuries. Trauma to the ankylosed cervical spine brings a poorer prognosis than similar injuries to the cervical spine without ankylosis.The development of spinal column rigidity with the associated osteoporosis as the disease progresses results in brittle, rigid structures poorly suited to withstand stress. Thus, even minor trauma can result in a fracture. The lower cervical spine is the most common site of fractures in these patients [16]. Spinal cord trauma can occur due to several causes, including dislocation or bone displacements, epidural hematoma, bulging of ossified yellow ligament or intervertebral disc herniation [9].

The proposed treatment options of these fractures include nonsurgical (skeletal traction, cervical-thoracic halo-device immobilization) and surgical methods (anterior plating, posterior wiring stabilization and posterior plates fixed with lateral mass screws) [16]. All these methods have disadvantages and complications. Long posterior fixation and posterior fixation in conjunction with anterior plating provide more rigid and solid stabilization. But such interventions are traumatic; according to Backhaus et al. [6], the average blood loss is 2119 (450–6800) ml.

Currently, the vast majority of authors consider internal osteosynthesis as the only possible stabilization of the spine. Taking into account that ankylosing spondylitis is generally accompanied by concomitant diseases, we try to avoid aggressive interventions, such as circumferential anteroposterior stabilization or long fixation in the cervical spine.

Various methods are available for the stabilization of cervical spine fractures: anterior, posterior and anteroposterior stabilization. The literature contains clinical cases of anterior fusion with autobone, plate and screw fixation using different plates, stabilization with screw and hook constructs [3, 8].

An et al. [5] reported on anterior discectomy and fixation in the cervical spine. According to literature references [11, 16], a posterior fixation is only adequate if the anterior axial load-bearing column is competent, in the case if the anterior column fracture is linear across the axial plane. We used this tactics and surgical technique in three cases of injuries to the thoracolumbar spine. Decompressive laminectomy is performed in the presence of spinal cord compression or neurological disorders [11, 15]. Thus, the tactics of treating fractures in the thoracolumbar and cervical spine, which we have chosen, is largely consistent with the literature data of recent years. We do not use bone grafting to provide extra support to the spine, which has been proposed by Kanter et al. [11] and Taggard et al. [16], along with simultaneous correction of kyphosis, because during a correction procedure, a duplication of overlapping each other layers of previously cut off complexes of spinous processes occurs which significantly strengthen the posterior support complex of the spine.

Destabilization of the spine or an increase in spinal deformity were not observed and instrumentation removal was not performed in the presented cases with anterior fusion and short fixation in cervical fractures. This technique helped to avoid massive intraoperative blood loss and other complications. A relatively small number of cases and wide variation of methodological approaches and the nature of surgical interventions necessitate further investigation to determine the optimal treatment strategy for the patients with spinal fractures in ankylosing spondylitis.

Conclusions

1. CT and MRI have a leading importance for the diagnostics of a spinal fracture, identification of the fracture line, displacement of spinal segments and spinal cord compression.

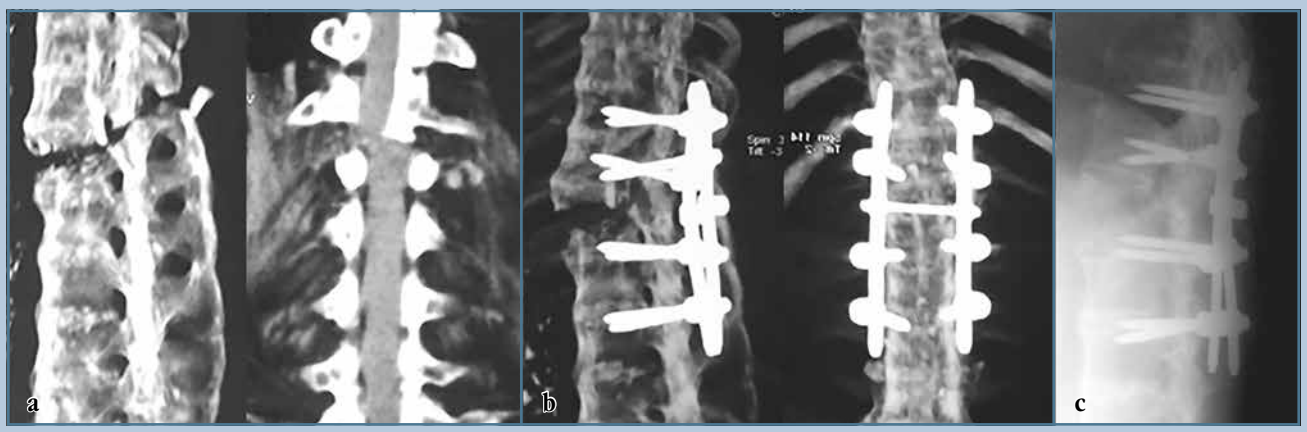

Fig. 2
Unstable fracture at the T12–L1 level: **a** – profound lateral displacement on CT before surgery; **b** – CT after surgery: lordosis of 15° was formed, lateral displacement was eliminated; **c** – radiogram 10 months after surgery: correction and fixation are preserved

Fig. 3
Ankylosing spondylitis, fracture at the C5–C6 level: **a** – radiogram of the cervical spine: fracture was not identified; **b** – CT before surgery; **c** – radiogram after surgery; **d** – radiogram 6 months after surgery: bone block at the place of interbody fusion using autograft and anterior fixation with LCP-plate

2. Surgical stabilization of the spine is the method of choice in the treatment of fractures in ankylosing spondylitis.

3. Graduated correction of kyphosis in fractures can be one of the elements of surgical treatment.

4. The issues related to the extent of surgical intervention in the form of anteroposterior spinal fusion or long posterior fixation in the cervical spine require further observation and discussion.

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