



Injuries of the Thoracic and Lumbar Spine

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Abstract: Determination of the clinical efficacy of transpedicular fixation (TPF) in the treatment of injuries of the thoracic and lumbar spine.

Material and methods. 87 patients with injuries of the thoracic and lumbar spine were operated on. 56 (64.3%) of them had a spinal cord injury accompanied by a neurological deficit. In all patients, TPF was used to stabilize the damaged spinal segment.

Results. Differentiated use of various options for eliminating compression of the dural sac when using TPF for the treatment of patients with spinal injuries made it possible to obtain good treatment results in 63 (72.4%) patients, satisfactory - in 23 (26.4%), unsatisfactory - in 2 (2.2%). %).

Conclusion. In case of traumatic stenosis of the spinal canal in the thoracic and lumbar regions, the choice of the method of decompression of the dural sac should be planned individually for each patient, taking into account the time since the injury, the severity and dynamics of neurological disorders, and the localization of damage to the spinal column.

Keywords: spine, trauma, stenosis, decompression, transpedicular fixation.

Introduction

Spinal injuries and their surgical treatment is an actual problem of modern vertebrology [1, 9, 12, 13,]. The transitional sections of the spine are most often injured. The thoracolumbar transitional section accounts for about 58.4% of injuries, while in 30–70% of cases there is compression or damage to the spinal cord [2, 3,8, 9, 14]. Along with early decompression of the spinal cord, the main principles of surgical treatment of these injuries are full correction of traumatic deformity and strong stabilization of the damaged spine with restoration of its support capacity for early activation of the injured [1–7, 9, 10, 12, 13, 14]. Of the modern methods of correction and stabilization of the spine, transpedicular fixation (TPF) provides the greatest opportunities for solving the main problems of treating injuries.

The aim of the study was to determine the clinical effectiveness of decompression of the dural sac, reposition and stabilization of the spine with the use of TPF for the treatment of injuries of the thoracic and lumbar regions.

Material and methods

We observed 87 adult patients with injuries of the thoracic and lumbar spine and traumatic spinal stenosis. Among them, 66 men and 21 women from 17 to 68 years old. Traumatic stenosis of the spinal canal in all patients was measured by CT or MRI, stenosis ranged from 25 to 100% of the sagittal size of the spinal canal.

PJD injuries in patients were classified using the Universal Classification of Spinal Injuries [20]. Eleven (12.4%) patients had type A1 fractures, 6 (3.5%) had A2, and 21 (28.8%) had A3; in 17 (15.9%) - B1, in 15 (14.7%) - B2, in 5 (2.9%) - B3; 7 (10.6%) had C1, 4 (4.7%) had C2, and 1 (6.5%) had C3.

Damage to one SMS was recorded in 63 (72.4%) cases, two - in 24 (20.6%).

76 (68.2%) patients had spinal cord injury (SCI), accompanied by neurological deficits of varying severity, the remaining 11 (31.8%) patients had isolated spinal injuries not accompanied by vertebrogenic neurological disorders. In 74 (80.2%) patients, PSCI was localized at the level of Th10—L2, in 13 (19.8%) patients — L2—L3.

44 (38.0%) patients had lower paraplegia with complete anesthesia from the level of injury and lack of sensation in the S4—S5 segments (group A according to the ASIA/ISCSI scale); 15 (16.4%) patients had lower paraplegia with preserved elements of sensitivity in the S4—S5 segments (group B); 11 (31.0%) had neurological disorders in the form of lower paraparesis (group C). 17 (14.6%) patients had a limited neurological deficit in the form of mild lower paraparesis, radicular syndromes at the level of damage (group D).

Neurological disorders in 9 (7.8%) patients tended to regress in the first days after the injury (in the acute and early periods of PSCI); in 73 (87.9%), the neurological status remained without clinically significant changes until the time of surgery; 5 patients (4.3%) showed signs of worsening neurological deficit in the preoperative period.

In 54 (31.8%) patients with isolated injuries of the thoracic and lumbar spine, not accompanied by a neurological deficit, there was spinal stenosis.

Patients with PSCI were hospitalized in the clinic within a period of several hours to 3 months. since the injury. In the acute period of PSCI, 68 (58.6 %) patients were operated on, in the early period — 27 (31.9 %), in the intermediate — 2 (9.5 %).

The average value of traumatic stenosis of the spinal canal in 46 patients with PSCI was 55.6%; in 31 patients with isolated uncomplicated injuries - 42.7%. Local kyphosis in injured PDS averaged 14.8° according to Cobb in patients with SSCI and 10.8° in patients with isolated spinal injuries. In patients with neurological deficit, the vertical size of the ventral part of the injured segments was reduced to an average of 63.6%. In patients with isolated vertebral injury, the decrease in the vertical size of the osteoligamentous column reached 67.2%.

Of 67 patients with neurological deficit, in 23 (25.9%) traumatic spinal stenosis was caused by a single large fragment of the vertebral body with reversion ($u15^\circ$ or more), in 12 (10.4%) - by a single large fragment without reversion. Spinal stenosis of this type averaged 51.8% of its sagittal size. Traumatic stenosis with two free fragments of the vertebral body with reversion (and 15° or more) occurred in 14 (12.1%) patients, without reversion - in 15 (12.8%). Stenosis of this type averaged 52.2% of its sagittal size. Stenosis of the spinal canal with several small fragments of the body or fragments of the roots of the arches and the broken arches themselves in the group of patients with neurological deficit occurred in 19 (16.4%) cases and averaged 55.9%. Dislocations (fracture dislocations) of the vertebrae caused traumatic stenoses in 26 (22.4%) cases; the value of dislocation of the cranial vertebra of the injured PDS averaged 34.9%, traumatic stenosis - 66.3% of its sagittal size.

In the group of patients without neurological deficit, in 15 (35.2%) cases, the cause of traumatic stenosis of the spinal canal was a single large fragment with reversion (15° or more), in 17 (31.5%) cases, a single large fragment without reversion. Stenosis of this type in patients with isolated injuries of the spine averaged 41.4% of its sagittal size. Stenosis of the spinal canal with two free fragments with reversion was recorded in 8 (14.8 %) cases, without reversion — in 7 (12.9 %) cases. Its average value is 45.3%. Traumatic stenosis by several small fragments, as well as fragments of the roots of the arches and the broken arches themselves in the group of patients without neurological deficit occurred in 2 (3.7%) cases and averaged 66.5%. Dislocation (fracture dislocation) of a vertebra was the cause of stenosis in 1 (1.9%) case and accounted for 29.3%.

All patients underwent surgical treatment, which included decompression of the neurovascular formations of the spinal canal at the level of injured SMS, correction of anatomical relationships, and reliable stabilization of the spine. In all cases, surgical correction and stabilization of the spine was performed using TPF of the injured SMS. The spinal CHM system was used. TPF was used during one PDS in 4 (2.4%) cases, two - in 137 (80.6%), three - in 18 (10.5%), four - in 7 (4.1%), five — in 4 (2.4%). Four-screw spinal systems were used in 144 cases, and six-screw systems were used in 26 cases.

The choice of method for performing decompression of the dural sac was determined individually for each patient. Whenever possible, preference was given to the least traumatic decompression options based on indirect repositioning reconstruction of the spinal canal. Preoperative planning took into account the depth and dynamics of the neurological deficit, the time since injury, spondylometric characteristics of traumatic deformity, the magnitude and type of spinal canal stenosis, and the level of spinal injury. In each particular case, the possibility of performing indirect repositioning decompression due to the ligamentotaxis effect was predicted. In the presence of traumatic stenosis of the spinal canal and signs of regression of neurological disorders, spinal angiography (3 patients) and/or CT myelography in two projections (5 patients) was performed to clarify the indications for various options for decompression of the dural sac at the stage of preoperative planning.

Laminectomy during TPF was performed in 52 patients. Open decompression of the dural sac from the posterior approach was performed in 20 patients. In 16 (9.4%) patients with severe neurological deficit, meningomyelodiverticulolysis was performed. After laminectomy, with persistent rough anterior compression of the dural sac, anterior open decompression was performed in 13 (7.7%) patients due to subtotal corpectomy during a staged intervention on the ventral spine.

76 (44.7%) patients were operated on within the first three days after the injury; after 4-14 days - 11 (30.6%). In 45 (47.1%) patients, decompression of the dural sac was performed without opening the spinal canal and was achieved during TPF due to the effect of ligamentotaxis. Among these patients, 29 (28.8%) had isolated uncomplicated spinal injuries, 16 (18.2%) had SSCI. In 39 (22.9%) patients with comminuted fractures of the vertebral bodies, to eliminate spinal canal stenosis, the method of reconstruction of the spinal canal in comminuted fractures was used [11], the use of which provides a selective maximum repositioning effect on the elements of the middle osteoligamentary column.

Results

Analyzing the clinical effectiveness of technical variants of TPF in injuries accompanied by traumatic stenosis of the spinal canal, we assessed the possibilities of repositioning the injured SMS and decompression of the dural sac in various types of displacements, taking into account the time elapsed since the injury, the regression of post-traumatic neurological deficit, as well as the stability of fixation of the injured SMS during the period of vertebral consolidation or formation of an interbody bone block after corporodesis. The repositioning capabilities of TPF in these types of injuries were characterized by indicators of correction of the main components of traumatic deformity - spinal canal stenosis, local kyphosis at the level of spinal injury, transverse dislocations in injured SMS with subluxations and dislocations, and a deficit in the vertical size of the ventral osteoligamentary column. In patients with PSCI, the regression of neurological deficit systematized according to the ASIA/ISCI scale was characterized by the degree of recovery of the main functions of the spinal cord in the intermediate and late periods of PSCI, the stability of TPF was characterized by the frequency of cases and the magnitude of partial loss of correction in the postoperative period.

In the group of patients with post-traumatic neurological deficit, 9 patients tended to positive dynamics of neurological status before the start of surgical treatment. After the operation, positive dynamics up to stage I. according to the ASIA/ISCI scale, it was achieved in 5 people, 3 had regression to stage II, and 1 had a complete regression of neurological symptoms.

In the group of 5 patients with a tendency to negative dynamics of the neurological status before the start of treatment, 2 people did not experience regression after surgery, positive dynamics up to stage I. achieved in 2, improvement to II st. - at 1.

In the group of patients in whom no changes in neurological symptoms were observed before surgery, after surgery, there was a positive trend up to stage I. achieved in 30 cases, regression to II Art. - at 26, to III Art. — in 4. In 35 patients, there were no changes in the neurological status, mainly patients with severe neurological disorders (30 people — group A according to the ASIA/ISCSI scale, 2 — group B, 3 — group C).

After the operation, local kyphosis in injured PDS averaged 7.6° according to Cobb in patients with PSCI; the correction value is 7.2° on average. In patients with isolated spinal injuries, local kyphosis after surgery is 6.5° ; the correction value is 4.3° on average. After corporodesis, the loss of correction of local kyphosis in patients with neurological deficit was 6.5° , and without neurological deficit — 2.9° .

The immediate results of the treatment of unstable injuries of the thoracic and lumbar spine were evaluated after 2 months. after the final surgical step. Long-term results of treatment were studied one year after its completion.

The immediate results of treatment were observed in all operated patients: good results were obtained in 65 (78.8%), satisfactory in 9 (19.4%), unsatisfactory in 3 (1.8%). In two cases, unsatisfactory results of treatment were associated with destabilization of the metal structure, which in one case required remounting of the metal structure, and in the other case, fixation was extended one more level higher. In one case, after surgery, there was a persistent (deterioration from level C to A on the ASIA/ISCSI scale) increase in neurological symptoms.

In 26 patients, no significant loss of correction was observed in the long-term (one year or more) periods; in 4 patients, due to destabilization of the metal structure (fracture of screws, loosening of nuts) before the completion of the formation of the interbody bone block in the injured SMS, the average loss of correction was 16.2%; two of these patients underwent reestablishment of the TPF system.

Long-term results of treatment one year after surgical interventions were followed up in 92 (54.1%) patients: good — in 73 (79.3%), satisfactory — in 16 (17.4%), unsatisfactory — in 3 (3.3%). In 1 patient, a fracture of one of the screws of the metal structure, eruption of the adjacent screw with developed severe kyphotic deformity were revealed; another 1 had loosening of the fastening nuts of the polyaxial metal structure, which led to kyphotic deformity. In the first case, corporodesis was not performed at the second stage due to the patient's refusal; in the second case, corporodesis was performed at a later stage (5–6 months). In both patients, the hardware was reinstalled within the first 4–7 days.

Discussion

The obtained results showed that TPF allows restoring anatomical relationships in injured SMS, including reconstruction of the spinal canal, and stabilizing all supporting osteoligamentary columns.

With dislocations or fracture-dislocations that provoke gross deformity and stenosis of the spinal canal, but are not accompanied by destruction of the posterior part of the vertebral bodies and arches, reformation, as a rule, does not cause difficulties.

The analysis of the obtained results showed that not every case of critical traumatic stenosis of the spinal canal with injuries of the thoracic or lumbar spine requires open decompression of the dural sac by corporectomy or laminectomy. In such cases, in the absence of a neurological deficit or in the presence of a clear positive dynamics of the vertebral neurological status with the use of TPF, indirect decompression of the dural sac due to the effect of ligamentotaxis and reformation of the spinal canal with repositioning instruments of the spinal system may be sufficient.

Conclusions

1. In case of traumatic stenosis of the spinal canal in the thoracic and lumbar regions, the choice of a method for decompressing the dural sac, taking into account the spondylometric characteristics of injuries in the injured SMS, the time since the injury, the severity and dynamics of neurological disorders, and the localization of damage to the spinal column.
2. For effective reconstruction of the spinal canal, it is necessary to use spinal systems that provide multidirectional force repositioning effects on implanted screws during surgery.
3. The option of decompression based on repositioning reconstruction of the spinal canal is more preferable, as it ensures minimal trauma of the operation, does not provoke the development of a rough cicatricial adhesive process in the spinal canal.
4. In case of unrepaired stenoses of the spinal canal, in conditions of reliable stabilization of the injured SMS, in the absence of neurological manifestations or with their complete regression, perform an open reconstruction of the spinal canal.

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