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Analysis of the effectiveness of indirect spinal canal decompression in the treatment of burst fractures at the thoracolumbar junction

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Indirect decompression of the spinal canal through ligamentotaxis is one of the methods for remodeling the spinal canal in traumatic stenosis. Objective: To evaluate the effectiveness of indirect decompression of the spinal canal for different morphological types of burst fractures of vertebral bodies at the thoracolumbar junction. Methods. A preoperative and postoperative analysis of computed tomography scans was performed on 59 patients who were treated at the«Romodanov Neurosurgery Institute, National Academy of Medical Sciences of Ukraine» for burst fractures at the thoracolumbar junction. The criterion for the effectiveness of indirect decompression was the area of the spinal canal, measured at the level of injury in the zone of maximum compression. The grading of burst fractures was performed using the classification by F. Magerl et al. (1994). Results. In the preoperative period, the median degree of stenosis in the group of patients was 43.47 % (95 % confidence interval (CI): 37.53–46.22 %). For damage type A3.1, it was 36.9 % (95 % CI: 28.1–40.5 %), for type A3.2 — 46.1 % (95 % CI: 32.1–54.5 %), and for type A3.3 — 47.6 % (95 % CI: 37.5–56.5 %). After surgical treatment, the degree of stenosis decreased by 20.14 % (95 % CI: 15.93–21.56 %). For type A3.1, the effectiveness was 20.1 % (95 % CI: 9.5–22.7 %), for type A3.2 — 15.2 % (95 % CI: 7.51–17.3 %), and for type A3.3 — 21.7 % (95 % CI: 20.8–26.4 %). The difference between types A3.2 and A3.3 was statistically significant (p = 0.0018). It was found that indirect decompression is most effective with higher degrees of stenosis. For Grade I by D. Wolter (1988), the canal expansion achieved was 7.07 % (95 % CI: 5.69–8.65 %), for Grade II — 21.6 % (95 % CI: 20.4–22.7 %), and for Grade III — 30.3 % (95 % CI: 27.0–33.6 %). Conclusions. Closed remodeling of the spinal canal with transpedicular fixation and the effect of ligamentotaxis is an effective method for correcting traumatic spinal canal stenosis at the thoracolumbar junction. The effectiveness of the technique is determined by many factors, including the type of burst fracture, the initial degree of stenosis, and the level of injury.

Непряма декомпресія хребтового каналу внаслідок лігаментотаксису є однією з методик його ремоделювання за травматичного стенозу. Мета. Оцінити ефективність непрямої декомпресії хребтового каналу за різних морфологічних типів вибухових переломів тіл хребців на рівні грудо-поперекового переходу. Методи. Проведено аналіз доопераційних і післяопераційних комп'ютерних томограм 59 пацієнтів, які перебували на стаціонарному лікуванні в ДУ «Інститут нейрохірургії ім. акад. А. П. Ромоданова НАМН України» з приводу вибухового перелому в ділянці грудо-поперекового переходу. Критерієм ефективності непрямої декомпресії хребтового каналу обрано його площу, яку вимірюють на рівні ушкодження в зоні максимальної компресії. Градацію вибухових переломів виконували з використанням класифікації F. Magerl та співавт. Результати. У доопераційний період медіана ступеня стенозу в групі пацієнтів становила 43,47 % (95 % довірчий інтервал (ДІ): 37,53–46,22 %), для типу ушкодження А3.1 — 36,9 % (95 % ДІ: 28,1–40,5 %), за травми А3.2 — 46,1 % (95 % ДІ: 32,1–54,5 %), за А3.3 — 47,6 % (95 % ДІ: 37,5–56,5 %). Після хірургічного лікування ступінь стенозу зменшився на 20,14 % (95 % ДІ: 15,93–21,56 %), для типу ушкодження А3.1 ефективність становила 20,1 % (95 % ДІ: 9,5–22,7 %), у разі А3.2 — 15,2 % (95 % ДІ: 7,51–17,3 %), за умов А3.3 — 21,7 % (95 % ДІ: 20,8–26,4 %). Різниця між типами ушкодження А3.2 та А3.3 статистично значуща (p = 0,0018). Установлено, що непряма декомпресія найефективніша в разі великих показників стенозування. Для Grade I за D. Wolter досягнуто розширення каналу на 7,07 % (95 % ДІ: 5,69–8,65 %), для Grade II — на 21,6 % (95 % ДІ: 20,4–22,7 %), для Grade III — на 30,3 % (95 % ДІ: 27,0–33,6 %). Висновки. Закрите ремоделювання хребтового каналу транспедикулярною фіксацією з ефектом лігаментотаксису є ефективною методикою корекції травматичного стенозу хребтового каналу в ділянці грудо-поперекового переходу. Її дієвість визначається великою кількістю чинників, зокрема типом вибухового перелому, вихідним ступенем стенозування та рівнем ушкодження. Ключові слова. Непряма декомпресія, лігаментотаксис, грудо-поперековий перехід, вибухові переломи, транспедикулярна фіксація, травматичний стеноз.

Keywords. Indirect decompression, ligamentotaxis, thoracolumbar junction, burst fractures, transpedicular fixation, traumatic stenosis

Introduction

The area of the thoracolumbar junction (TLJ) is the part of the spine that is most often injured [1, 2]. Burst fractures of this localization constitute a significant part of traumatic injuries and are often accompanied by the entry of fragments of the injured vertebra into the spinal canal. Surgical treatment of such injuries is now a generally accepted tactic, but at the same time it is also a subject of debate [3, 4]. Literature reviews indicate a slight correlation between the visible location of vertebral fragments and clinical manifestations, the presence and degree of neurological symptoms [5, 6].

In compliance with the principles of complete correction of kyphotic deformity, restoration of bearing capacity and stabilization of the damaged spine, issues regarding the expediency of restoring the volume of the spinal canal with decompression of the spinal cord or its elements remain debatable. Some authors suggest decompression only in cases of critical narrowing of the spinal canal [7], others are supporters of open decompression of the dural sac [8, 9] or only indirect instrumental remodeling of the spinal canal [10, 11]. Some scientists choose a decompression technique depending on the nature and degree of damage to the vertebral body and spinal stenosis [12]. There are also supporters of conservative treatment, as clinical studies have revealed the possibility of natural remodeling of the spinal canal in burst fractures [13, 14]. A different approach to solving the issue of decompression of the spinal canal indicates the urgency of solving this problem. On the other hand, this request is usually considered together with the question of the need to stabilize and restore the anterior support of the spine, which is one of the decompression techniques.

Purpose: to evaluate the effectiveness of indirect decompression of the spinal canal for different morphological types of burst fractures of the vertebral bodies at the level of the thoracolumbar junction.

Material and methods

Study design: prospective, retrospective, observational.

The study was conducted using the data of patients who were undergoing inpatient treatment at the State Establishment Academician A. P. Romodanov Institute of Neurosurgery of the National Academy of Sciences of Ukraine within the period from 2018 to 2023.

All patients gave their informed consent to the processing of the treatment results in compliance with confidentiality requirements. The study was approved by the commission on ethics and bioethics of the State University State Establishment Academician A. P. Romodanov Institute of Neurosurgery of the National Academy of Sciences of Ukraine (Protocol No. 4 dated 05.09.2018).

The criteria for inclusion in the study included the availability of the following data:

– sustained traumatic injury of the thoracic spine area, which was accompanied by an burst fracture of the body of one vertebra;

– findings of spondylography and computer tomography of appropriate quality, performed after the injury, making it possible to determine the type of injury;

– control post-operative computer tomograms performed before the patients was discharged from the hospital;

– manipulations for indirect decompression of the spinal canal were documented in detail in the surgical protocol;

– informed consent of the patient to participate in the study.

Exclusion criteria:

– registered infectious and inflammatory postoperative complications at any time of observation;

– repeated surgical interventions;

– incorrect initial installation of stabilization systems;

– history of injuries and/or operations on the spine before receiving the injury analyzed in this study;

– verified damage to the bodies of adjacent vertebrae or structures of the posterior support complex;

– the duration of the period from receiving the injury to performing surgical correction was more than 2 weeks.

Methods of evaluating clinical data

Basic demographic indicators: gender, age, mechanism of injury. Based on the data of preoperative computer and magnetic resonance imaging, the level of damage and the nature of bone-traumatic changes were determined according to the classification of F. Magerl et al. (1994) [15, 16] (Fig. 1).

This particular classification was chosen because the scheme developed by F. Magerl et al. contained more detailed systematization categories compared to the more modern AOSpine Thoracolumbar Spine Injury Classification System and therefore better met the objectives of this study [17]. The functional class of neurological disorders was assessed using the ASIA (American Spinal Injury Association) scale [18].

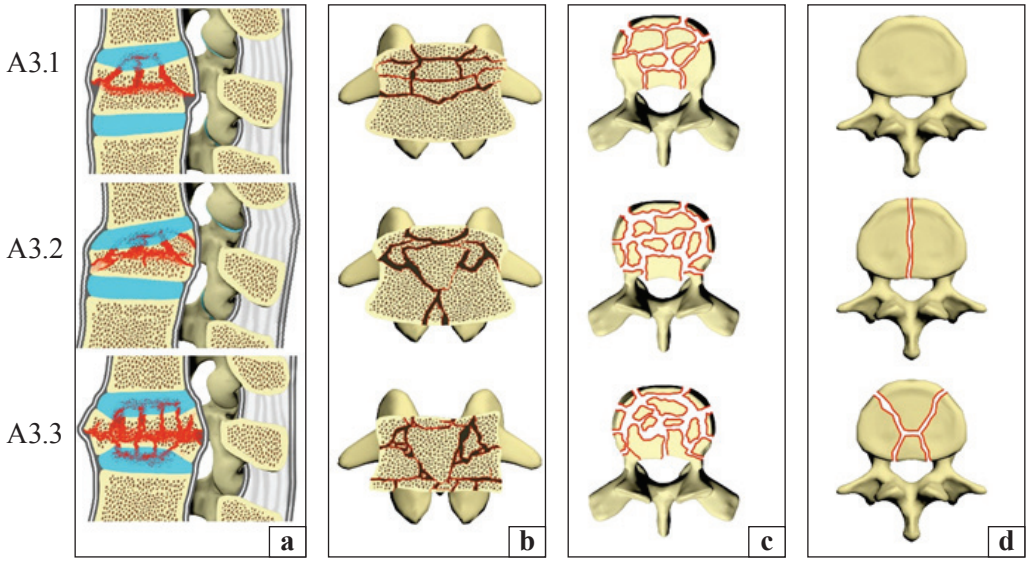

Fig. 1. Gradation of burst fractures according to the classification of F. Magerl et al. (schematic): a — mid-sagittal section; b — section in the coronal plane through the middle of the vertebral body; c — top view; d — bottom view

Area was used as a criterion for stenosis of the spinal canal. Measurements were performed using the RadiAnt DICOM Viewer software complex (Medixant, Poland. Version No. 2023.1, License No. 1860F047). The degree of stenosis was calculated according to the formula:

$$\Theta_B = \frac{\frac{(S_A + S_C)}{2} - S_B}{\frac{(S_A + S_C)}{2}} \cdot 100\ \%,$$

where ΘB is the degree of stenosis at the level of the damaged vertebra; SB is the area of the spinal canal at the level of injury; SA and SC are the area of the canal at the level of the vertebrae located above and below, respectively.

The measurement of the index of intact vertebrae was performed at the level of the middle of the root of the arch in a plane parallel to the upper locking plate of the corresponding vertebra. For the compressed one, the evaluation was performed at the point of greatest compression in the bisector plane formed by the lower and upper locking plates of the cranial and caudal vertebrae, respectively. The effectiveness of indirect decompression ΔΘ was determined as the difference between preoperative and postoperative stenosis indicators.

Statistical analysis

Statistical data processing was performed using R (version 4.0.5, R Foundation for Statistical Computing) in the RStudio development environment (version 1.4.1106).

Results

Initial processing of the disease histories of the patients identified 59 clinical cases that met the inclusion criteria. A brief description of the patients is given in the Table.

Table

Characteristics of patients

Indicator	Value
Gender: male	42 (71.19 %)
female	17 (28.81 %)
Age (median, range), years	34 (95 % ДІ: 27–39 %), 18–62
Circumstances of injury: traffic accident	29 (49.15 %)
falling from a height	18 (30.51 %)
falling on the ground	8 (13.56 %)
other	4 (6.78 %)
Time between injury and surgery (median, range), days	7 (95 % ДІ: 5–8 %), 2–12
Damage level: Th_{XI}	6 (10.17 %)
Th_{XII}	18 (30.51 %)
L_I	23 (38.98 %)
L_{II}	12 (20.34 %)
Type of damage: A3.1	19 (32.2 %)
A3.2	17 (28.81 %)
A3.3	23 (38.98 %)

Note. CI is a confidence interval.

The analysis of computer tomography of the patients obtained in the preoperative period revealed that the median indicator of stenosis of the spinal canal was 43.47 % (95 % confidence interval (CI) — 37.53–46.22 %). When ranking the described changes by severity according to D. Wolter [19] Grade I (stenosis less than 1/3 of the estimated value) was

registered in 17 patients, Grade II (1/3–2/3 of the estimated value) in 40, Grade III (over 2/3) in 2 subjects.

The median frequency of damage type A3.1 was found to be 36.9 % (95 % CI: 28.1–40.5 %); A3.2 — 46.1 % (95 % CI: 32.1–54.5 %); A3.3 — 47.6 % (95 % CI: 37.5–56.5 %). Comparison of groups revealed statistically significant differences ($p = 0.0194$, Kruskal-Wallis test). A pairwise comparison revealed differences between damage types A3.1 and A3.3 ($p = 0.018$, Wilcoxon test). The analysis of the distribution of degrees of severity depending on the type of body injury revealed that in the case of A3.1 Grade I and Grade II were recorded with a frequency of 42.1 and 57.9 %, and there were no cases of Grade III. Under conditions of damage A3.2, the frequency for Grade I, II and III was 29.4, 64.7 and 5.9 %, respectively, for A3.3 — 17.4, 78.3 and 4.35 %.

Analysis of the degree of stenosis depending on the anatomical level of injury did not reveal statistically significant differences ($p = 0.684$). The obtained values for Th_{XI} and Th_{XII} vertebrae were 43.8 % (95 % CI: 28.6–56.1 %) and 45.6 % (95 % CI: 27.7–53.0 %), respectively, for L_I vertebrae and L_{II} — 37.7 % (95 % CI: 33.3–44.8 %) and 45.8 % (95 % CI: 37.0–54.4 %).

After surgical interventions, a certain reduction in the degree of stenosis was recorded in all cases, the minimum value of $\Delta\Theta$ was 4.20 %, the maximum value was 33.57%, and the median value was 20.14 % (95 % CI: 15.93–21.56 %). Evaluation of the dynamics by types of damage revealed that for A3.1 the degree of stenosis decreased by 20.1 % (95 % CI: 9.5–22.7 %), in the case of A3.2 — by 15.2 % (95 % CI: 7.51–17.3 %), A3.3 — by 21.7 % (95 % CI: 20.8–26.4 %). The difference between damage types A3.2 and A3.3 was statistically significant ($p = 0.0018$). In addition, the fact that the effectiveness of indirect decompression largely depends on the initial degree of stenosis ($p < 0.0001$) is noteworthy. Thus, for Grade I, the expansion of the canal was achieved by 7.07 % (95 % CI: 5.69–8.65 %), Grade II by 21.6 % (95 % CI: 20.4–22.7 %), Grade III by 30.3 % (95 % CI: 27.0–33.6 %). Thus, for these types, postoperative stenosis rates were 16.3 % (95 % CI: 15.0–19.3 %), 25.8 % (95 % CI: 20.7–29.9 %) and 37.8 % (95 % CI: 35.9–39.6 %).

In the postoperative period, the degree of stenosis corresponding to Grade I was registered in 48 patients, Grade II in 11. There were no cases of Grade III.

During the analysis of the effectiveness of decompression at different levels of traumatic injury, the following indicators were obtained: $\Delta\Theta$ for burstfractures at the Th_{XI} and Th_{XII} levels was 16.5 % (95 % CI: 9.5–21.4 %) and 19.7 % (95 % CI: 8.99–21.7 %), at the level of L_I and L_{II} — 22.0 % (95 % CI: 18.6–26.6 %) and 19.5 % (95 % CI: 8.26–28.4 %), but the differences were statistically insignificant ($p = 0.1382$).

Clinical case No. 1

A 48-year-old patient V. was injured in a traffic accident. During the initial hospitalization in a medical and preventive institution, a neurological deficit corresponding to ASIA C was registered. Spiral computed tomography (SCT) showed an burst fracture of the Th_{XII} vertebra of type A3.2. A certain regression of neurological disorders was observed following therapy. Nine days after the injury, the patient was transferred for surgical intervention to the State Establishment Academician A. P. Romodanov Institute of Neurosurgery of the National Academy of Sciences of Ukraine. Neurological symptoms corresponding to ASIA D were diagnosed. During the analysis of tomography findings, the following calculated parameters were obtained: $S_{Th_{XI}} = 2.1$ cm^2, $S_{Th_{XII}} = 1.284$ cm^2, $S_{L_I} = 3.16$ cm^2 (Fig. 2). Accordingly, the degree of stenosis was $\Theta_{Th_{XII}} = 51.179$ %.

Given the positive neurological time course, a decision was made to perform indirect decompression of the spinal canal during stabilization surgery. On the 11th day after receiving the injury, a transcutaneous installation of a transpedicular fixation system was performed with dosed distraction of the injured vertebral-motor segment. Computed tomograms obtained 2 days after stabilization revealed a decrease in the degree of stenosis: $S_{Th_{XII}} = 2.1$ cm^2, respectively $\Theta_{Th_{XII}} = 25.894$ %, $\Delta\Theta_{Th_{XII}} = 25.285$ % (Fig. 3).

Clinical case No. 2

A 23-year-old patient S. received an injury during a fall from a height of about 3 m. She was hospitalized in a medical and preventive institution at the place of residence with lower back pain. Assessment of the neurological status did not reveal any convincing abnormalities. The X-ray examination of the spine verified a compression fracture of the Th_{XII} vertebra (Fig. 4, e). CT scan clarified the nature of the injury: burst fracture type A3.1 (Fig. 4, a, b). For surgical correction, the patient was transferred to the State Establishment Academician A. P. Romodanov Institute of Neurosurgery of the National Academy of Sciences of Ukraine. The neurological status corresponded to ASIA E. She had severe pain (up to 7 points on the digital rating scale) in the area of the TLJ [20].

The degree of stenosis of the spinal canal corresponded to Grade I: $\Theta_{Th_{XII}} = 29.089$ % ($S_{Th_{XI}} = 1.818$ cm^2, $S_{Th_{XII}} = 1.565$ cm^2, $S_{L_I} = 2.596$ cm^2).

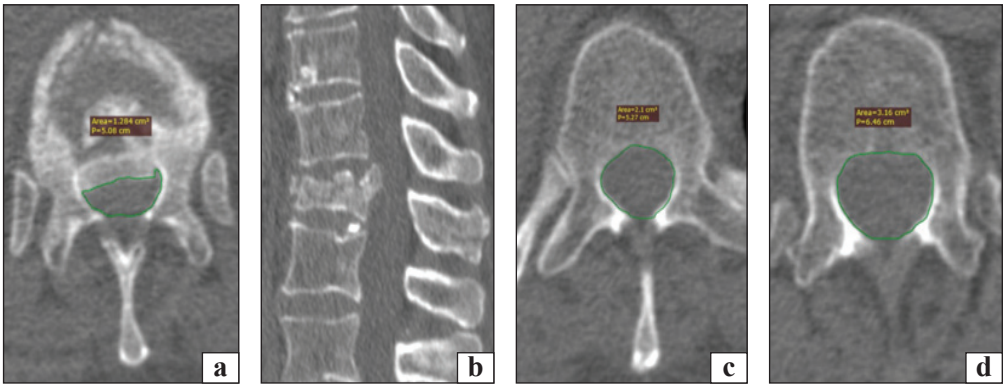

Fig. 2. SCT of patient V. before surgical correction: a — axial section at the level of the middle of the root of the arch of the Th_{XII} vertebra; b — vertebra Th_{XI}; c — vertebra L_I; d — mid-sagittal reconstruction

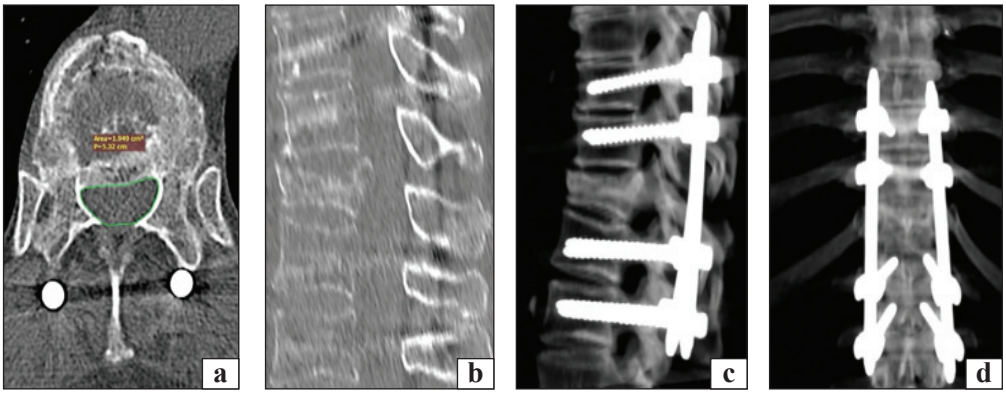

Fig. 3. SCT of patient V., performed on the 2nd day of the postoperative period: a — axial section at the level of the middle of the root of the arch of the Th_{XII} vertebra; b — median sagittal reconstruction. Overview spondylography of the TLJ area in lateral (c) and anteroposterior (d) projections

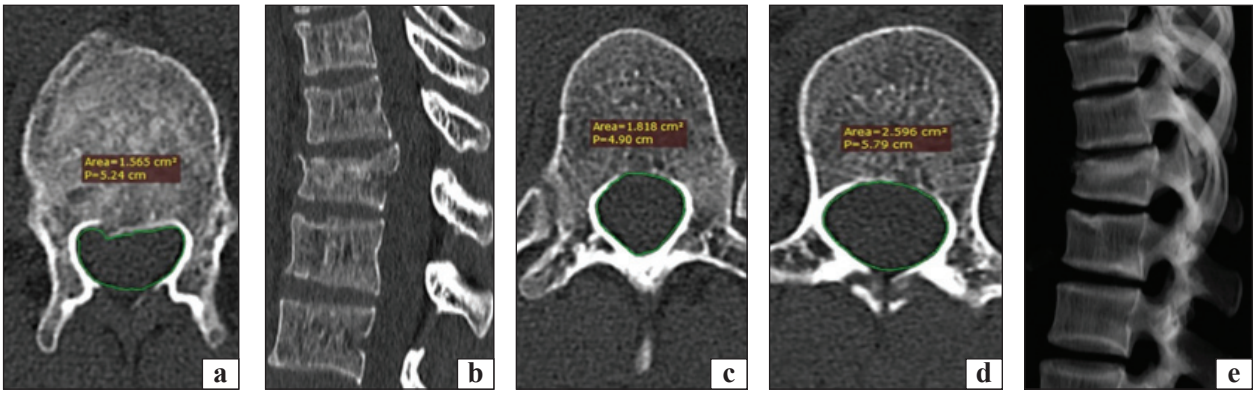

Fig. 4. Results of preoperative examinations of patient S. SCT: a — axial section at the level of the middle of the root of the arch of the Th_{XII} vertebra; b — vertebra Th_{XI}; c — vertebra L_I; d — median sagittal reconstruction; d — spondylography in the lateral projection

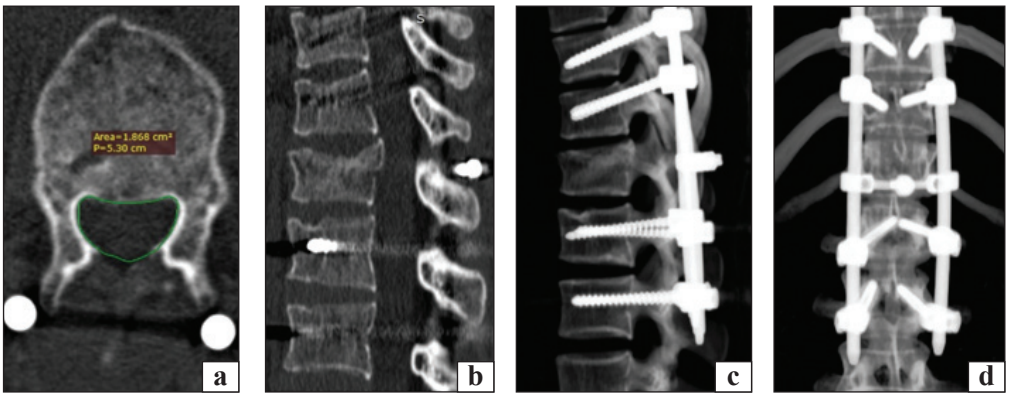

Fig. 5. SCT of patient S. on the 3rd day of the postoperative period: a — axial section at the level of the middle of the root of the arch of the Th_{XII} vertebra; b — median sagittal reconstruction. 3D reconstruction in lateral (c) and anterior-posterior (d) projections

Given the nature of the injury, severe pain, and the need for rapid rehabilitation, the patient underwent minimally invasive transpedicular stabilization with additional installation of a transverse brace at the level of the injured vertebra (in the Th_{XI}–Th_{XII} interspinous space). As a result of reclination and distraction, correction of the spinal axis at the level of injury, restoration of the height of the front parts of the compressed vertebral body (Fig. 5, c) and reduction of the degree of stenosis of the spinal canal to 15.36 % were achieved, $\Delta\Theta Th_{XII}$ was 13.729 %. The patient was uprighted the next day after surgery. At the time of discharge from the hospital, the pain syndrome regressed to 3 points. No neurological disorders were registered at all stages of treatment.

The data analysis made it possible to draw the following conclusions:

– injuries of type A3.1 are accompanied by a lower degree of stenosis of the spinal canal compared to types A3.2 and A3.3;

– the degree of traumatic stenosis does not depend on the anatomical level of injury;

– transpedicular stabilization of burst fractures with a reclination-distraction maneuver in all cases contributes to the reduction of stenosis, but the quantitative indicator of this change varies significantly;

– the effectiveness of indirect decompression depends on the type of injury. It is the least effective type A3.2;

– reduction of the degree of stenosis of the spinal canal during indirect decompression is largely determined by the initial indicators of narrowing. It is most effective for significant stenosis rates.

Discussion

According to the literature, there are many conflicting opinions regarding the treatment of burst fractures with spinal stenosis. In 2006, studies of the Spine Trauma Study Group were published, in which 22 leading surgeons from 20 trauma centers from 7 European countries participated [21]. The results demonstrated different approaches to treatment, which led to the need for additional research to develop more effective methods of therapy.

15 years later, in 2021, the recommendations of the WFNS Spine Committee were published. Despite the considerable accumulated clinical material and new methods of data analysis, criteria for choosing a certain method of intervention as the most effective have not been proposed [22]. This indicates that there is still uncertainty regarding the choice of optimal treatment tactics.

In addition, the large number of publications in the last decade, devoted to the explosion fractures of the TLJ, introduces dissonance into the holistic perception of the problem, more than it adds clarity [23–25]. Heterogeneity of results and different research methodologies make it difficult to form a single standard of treatment, which makes it necessary to conduct complex studies and develop agreed recommendations.

The attitude towards spinal stenosis is ambiguous. Although all authors agree that there is no correlation between the degrees of spinal canal stenosis and neurological disorders, it is noted that with spinal canal narrowing of more than 50 %, neurological symptoms are observed more often [26-28]. The degree of stenosis of the spinal canal due to burst fractures in the thoracolumbar and lumbar regions of the spine is a very variable value — from a few percent to ≥ 90 %, although the average number is 35–55 % [29]. When determining the degree of stenosis of the spinal canal, it is noted that in a number of cases the midsagittal size does not reflect the real narrowing of the spinal canal. Such a situation is observed in an oblique location in the channel of one large fragment or in a significant displacement of one of the bisegmental fragments. That is why we chose the area indicator as the most informative of the publicly available measurement methods [11, 30]. The impact of symmetry of compression on the neurological presentation and treatment outcomes remains unexplained in modern publications.

The possibility of spontaneous remodeling of the spinal canal without any interventions is not denied. The authors use this phenomenon as an argument for choosing a type of treatment. Some scientists consider the possibility of self-remodeling as an argument against any surgical method of treatment [30], others recommend avoiding intracanal intervention and trying to remodel with transpedicular fixation [11, 29]. The technique of circular decompression from the back, front or combined approaches has gained considerable popularity [31–33].

Critical narrowing of the spinal canal is important when choosing surgical treatment tactics. P. A. Rasmussen considers the critical area of the spinal canal at the L_I level to be 1 cm^2 (stenosis ≈ 67 %) [34]. All patients with this area of the spinal canal were paraplegic. T. Hashimoto et al. showed that stenosis of the spinal canal at the level of Th_{XI}–Th_{XII} > 35 % usually leads to neurological disorders, for L_I this indicator is > 45 %, and for L_{II} — > 55 % [35]. Currently, many authors use this concept to determine indications or contraindications for operative treatment.

There are different indicators regarding the possibility of ligamentotaxis in the remodeling of the spinal canal depending on the type of burst fracture and the nature of displacement of the fragments. W. P. Shuman, from the experience of treating 12 patients, found that in the case of a fracture type A3.3, almost complete recovery of the spinal canal was observed in all patients after surgery, but during A3.2, less than half [36]. These findings are somewhat consistent with the obtained results. In addition, we found that the protrusion of the lower posterior fragment of the vertebral body into the spinal canal was significantly less responsive to ligamentotaxis compared to more frequent cranial injuries.

However, there are publications on the different effectiveness of indirect decompression depending on the level of injury. Thus, W. Schlickewei et al. demonstrated a decrease in the effectiveness of ligamentotaxis below the level of the L_{III} vertebra, which is explained by a progradient craniocaudal decrease in the mechanical strength of the posterior longitudinal ligament [26]. At the same time, the authors note that, in general, the effectiveness in injuries at the level of vertebrae L_I and L_{II} is higher than in injuries at the level of vertebrae Th_{XI} and Th_{XII}. The data of our study to some extent support this opinion, but the difference does not reach the level of statistical significance.

In the last decade, the technique of indirect decompression of the spinal canal in traumatic stenosis is gaining relevance. Obvious advantages, such as reducing the duration of surgical intervention, the volume of blood loss and the risk of infection, minimizing soft tissue injuries, maximally preserving the bone structures of the posterior support complex and preventing the scar-adhesion process in the epidural space, led to the wide implementation of the technique in clinical practice.

It is also economically feasible as minimally invasive interventions in most cases make it possible to achieve indirect decompression. Despite the higher cost of stabilization systems, percutaneous installation has advantages, namely the reduction of medication in the intraoperative and postoperative periods, as well as the overall length of the patient's stay in the hospital [37, 38]. That is why a number of researchers use indirect decompression techniques even in severe neurological disorders [39]. Currently, such an approach is not regulated in Ukraine, which may have certain legal consequences in case of patient dissatisfaction with the amount of regression of neurological disorders. Accordingly, the problem is relevant and requires further comprehensive study.

Our findings do not answer all the clinician's questions. In fact, the data we obtained are a kind of screening, which revealed the promising method and outlined directions for further research.

Since during the correction, surgeons do not have the opportunity to directly visually assess the degree of compression regression, and intraoperative spondylography has limited information, it is essential to carry out preoperative assessment of the impact of such factors as the history of the injury, the degree of kyphotic angulation of the injured segment, the gender and age of the patient, the state of bone tissue (signs of osteopenia).

The development of a tool for predicting the effectiveness of indirect decompression, considering the individual characteristics of the patient and the pathomorphology of the injured vertebral-motor segment, will make it possible to significantly optimize outcomes in this group of patients.

Conclusions

Closed remodeling of the spinal canal by transpedicular fixation with the effect of ligamentotaxis is an effective method of correction of traumatic stenosis of the spinal canal in the area of the TLJ. The effectiveness of the technique is determined by many factors (type of explosive fracture, initial degree of stenosis, level of damage, etc.). Further study of the predictors of the effectiveness of the specified method is appropriate for the development of a prognostic tool that will help optimize treatment and improve clinical outcomes.

Conflict of interest. The authors declare no conflict ofinterest.

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ANALYSIS OF THE EFFECTIVENESS OF INDIRECT SPINAL CANAL DECOMPRESSION IN THE TREATMENT OF BURST FRACTURES AT THE THORACOLUMBAR JUNCTION

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