



COMPARISON OF CONSERVATIVE THERAPY AND SURGICAL TREATMENT OUTCOMES IN PATIENTS WITH UNCOMPLICATED AOSpine TYPE A3 FRACTURES AT THE THORACOLUMBAR JUNCTION

A.A. Grin¹, A.E. Talypov¹, A.Yu. Kordonskiy¹, V.A. Karanadze¹, I.S. Lvov¹, R.I. Abdrafiev¹, I.V. Pogonchenkova², E.V. Kostenko², M.R. Makarova², A.V. Leonov²

¹N.V. Sklifosovsky Scientific Research Institute of Emergency Medicine, Moscow, Russia;

²Moscow Research and Practical Center for Medical Rehabilitation, Restorative and Sports Medicine, Moscow, Russia

Objective. To perform comparative analysis of long-term clinical and radiological results of conservative therapy and surgical treatment of patients with uncomplicated fractures of the AOSpine type A3 vertebrae in the thoracolumbar junction.

Material and Methods. The research is a prospective comparative non-inferiority study with historical control. The inclusion criteria were patient age over 18 years, acute or subacute injury, uncomplicated AOSpine type A3 fracture at the T10–L2 level, and spinal canal stenosis of less than 50%. The conservative therapy group (CoT) received fracture immobilization with a rigid frame brace, followed by a two-phase rehabilitation course starting on the first or second day after diagnosis. The surgical treatment group (ST; $n = 23$) included patients who underwent anterior fusion or transpedicular fixation without decompression. The CoT group was followed for 12 months. The primary endpoint was the quality of life according to the Oswestry scale (ODI), secondary endpoints were the level of pain according to the VAS, the dynamics of the Cobb angle, spinal stenosis, as well as degenerative changes in the facet joints and intervertebral discs.

Results. Patients in the CoT group were on average 10 years older than those in the ST group upon admission ($p = 0.049$); other demographic and radiographic parameters did not differ significantly between the groups. At the follow-up, the median VAS pain scores in the CoT and ST groups were 0 and 2 points, ($p < 0.001$) and the ODI value was 4 and 12 ($p < 0.001$), respectively. The ST group demonstrated a smaller increase in the Cobb angle compared to the CoT group (0.7° and 4.9° , respectively) due to surgical correction of kyphosis and its maintenance using metal implants, as well as a twofold greater restoration of the spinal canal lumen (t -test; $p = 0.007$). However, the final spinal stenosis indices did not differ significantly between the groups. Ankylosis of the facet joints and intervertebral discs, both at the level of injury and in adjacent segments, was significantly more frequent after surgical treatment (χ^2 test; $p < 0.001$ and $p = 0.001$, respectively).

Fracture union as a result of treatment was detected in 91.3% of patients in the ST group and in 88.2% in the CoT group (χ^2 test; $p = 0.193$). **Conclusion.** Long-term treatment outcomes of uncomplicated AOSpine type A3 fractures at the thoracolumbar junction demonstrate that conservative therapy is comparable to surgical treatment for kyphotic deformity less than 14.9° , relative anterior vertebral body height greater than 51.8%, vertebral body index greater than 0.54, and spinal stenosis less than 43.9%. Rehabilitation should begin within 24 hours of diagnosis and continue in a rehabilitation center. Surgical treatment allows for better correction of kyphotic deformity and spinal canal stenosis, but it also promotes degenerative changes both in the fractured vertebra and in adjacent segments. The final decision regarding the choice of treatment method (surgical or conservative) should be made in consultation with the patient, taking into account the comparable clinical outcome, the need for deformity correction and the likelihood of complications.

Key Words: thoracolumbar junction fracture; uncomplicated spinal fracture; conservative therapy; transpedicular fixation; anterior spinal fusion.

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In Russia, spinal cord and vertebral injuries account for 0.7–8.0% of all trauma cases and 6.3–20.3% of all skeletal fractures. The majority of patients with spinal fractures are diagnosed with thoracolumbar junction (TLJ) injuries, with more than 50% of cases presenting without neurological deficit. Moreover, the majority of patients with such injuries are working-age men (25–45

years old), underscoring the high social significance of this type of trauma [1, 2]. The integration of advanced implants and minimally invasive techniques in spine surgery enhances clinical outcomes in patients with traumatic spinal cord and vertebral injuries. However, the necessity of open surgery in patients with uncomplicated TLJ burst fractures and minor spinal canal compromise remains

a subject of debate. On the one hand, surgical intervention facilitates early mobilization and an expedited return to work [3]. On the other hand, it may be associated with certain complications, and the fixation of two or more spinal motion segments can accelerate the development of degenerative processes [4, 5]. Conservative treatment helps avoid complications associated with

surgical treatment; a 2024 meta-analysis [6] demonstrated the high efficacy of conservative therapy in selected patients with uncomplicated TLJ fractures.

At the time of planning this study in 2023, according to the ClinicalTrials.gov database, two multicenter cohort studies comparing conservative and surgical treatment outcomes in patients with uncomplicated humeral shaft fractures were ongoing, while three others had been terminated at the beginning of the COVID-19 pandemic. This fact underscores the critical relevance of this issue and the growing attention it receives from the surgical community.

The aim of this study is to compare the long-term clinical and radiological outcomes of conservative treatment versus surgical treatment in patients with uncomplicated AOSpine type A3 fractures of the TLJ.

Material and Methods

Study design

This is a prospective, comparative, non-inferiority study utilizing a historical control group. The prospective (main) cohort comprised patients who received conservative therapy (CoT group), while the retrospective control group consisted of patients who had previously undergone surgery at the N.V. Sklifosovsky Research Institute for Emergency Medicine (SuT [group]). During the study planning, protocol design, and study registration phases, it was intended to enroll patients with types A2 and A3 thoracolumbar and TLJ fractures. During the first year, due to an insufficient number of patients with type A2 fractures, the protocol and inclusion criteria were revised and modified to include patients with type A3 fractures at TLJ in the final comparison.

Eligibility criteria

Inclusion criteria:

- patients aged ≥ 18 years;
- acute or subacute phases of injury;
- AOSpine Type A3 fracture;
- absence of clinical evidence of nerve root or spinal cord compression at the level of the injury;
- spinal canal stenosis of less than 50% according to CT data; and

– informed Consent Form.

Non-inclusion criteria:

- severe polytrauma;
- severe concomitant diseases;
- verified osteoporosis;
- the CT attenuation of the TLJ is below 100 Hounsfield units (HU)
- previous spinal surgery;
- ASA Physical Status IV or V;
- inability to comply with the 1-year post-operative follow-up schedule;
- participation in other clinical studies related to the treatment of spine diseases or injuries.

Exclusion criteria:

- withdrawal of informed consent;
- patient non-attendance at scheduled follow-up visits; and
- development of complications or other diseases requiring a change in the chosen treatment strategy.

Methods of treatment

In patients of the CoT group upon admission to the Sklifosovsky Research Institute of Emergency Medicine following fracture verification, the initial stage of rehabilitation involved a standardized therapeutic exercise protocol based on the Gorinevskaya–Dreving method, combined with early patient mobilization. The therapeutic exercise program was aimed at reducing pain, improving tissue trophic function, and preventing biomechanical sequelae. Verticalization was performed on days 2–4 using a hyperextension frame orthosis. On days 7–10 post-injury, the patient was transferred to the second stage of medical rehabilitation at the inpatient department of the Spasokukotsky Moscow Research and Clinical Center for Medical Rehabilitation, Restorative and Sports Medicine. The subsequent rehabilitation program comprised compliance with the orthopedic regimen, individualized therapeutic exercises focused on strengthening the back extensors and lower extremities, as well as corrective, dynamic, and respiratory exercises, pain-contingent ambulation, and a course of physiotherapy aimed at pain reduction, localized trophic enhancement at the fracture site, and the stimulation of osteorepair processes. The duration of treatment at the medical rehabilitation center ranged

from 10 to 14 days. Subsequently, the patient was discharged for outpatient treatment. All patients wore the brace for 3 months.

The SuT group included patients who underwent interventions that did not disrupt the integrity of the posterior column (transpedicular fixation without decompression and anterior spinal fusion). All procedures were performed according to standard, generally accepted methodologies. Video-assisted endoscopy was used in anterior and combined interventions [7]. Immobilization with a rigid orthosis was performed for 1 to 3 months post-operatively. The patients did not receive specialized inpatient rehabilitation following surgery.

Endpoint evaluation

Endpoints in the prospective group were assessed 12 months post-injury. Patients in the SuT group were recalled for follow-up examinations between 2023 and 2025. The primary endpoint was the change in the Oswestry Disability Index (ODI) score. The ODI questionnaire was used in its version adapted for the Russian Federation [8] and includes 10 sections with 6 statements each. Depending on the response, a score (from 0 to 5) was assigned, with a maximum total score of 50, which was then converted into percentages (from 0 to 100%).

Visual Analog Scale (VAS) for pain and a number of radiographic parameters were used as secondary endpoints.

All patients underwent CT of the TLJ at admission and during follow-up examinations. CT scans evaluated the bisegmental Cobb angle, heights of the anterior and posterior vertebral body walls, and spinal canal area at the fracture and adjacent levels. In addition, the mean vertebral body density was calculated in the adjacent superior and inferior segments (HU1 and HU2). The following variables were subsequently calculated:

$$1) \text{ AVBH} = \left(\frac{A_0}{(A_1 + A_2)/2} \right) \times 100 \%,$$

where AVBH is the anterior vertebral body height ratio; A_0 – anterior vertebral body height of the fractured vertebra (mm); A_1 and A_2 – anterior vertebral body heights of the immediately superior and inferior vertebrae (mm);

$$2) VBI = \frac{A_0}{P_0},$$

where VBI – the vertebral body index, A_0 – anterior vertebral body height (mm), and P_0 – posterior vertebral body height (mm).

$$3) CT_{\Pi K} = \left(1 - \frac{S_{\Pi K0}}{(S_{\Pi K1} + S_{\Pi K2})/2}\right) \times 100 \%,$$

where $CT_{\Pi K}$ – spinal canal stenosis severity (%); $S_{\Pi K0}$ – spinal canal area at the fracture level (cm^2); $S_{\Pi K1}$ and $S_{\Pi K2}$ – spinal canal area at the levels above and below (cm^2).

For all patients, the differences between the final follow-up and baseline values of CobbA, $CT_{\Pi K}$, and $S_{\Pi K}$ were calculated.

CT analysis also included grading the severity of facet joint degenerative changes according to the Pathria et al. criteria [9]: grade I – normal; grade II – joint space narrowing with potential cyst formation and small osteophytes; grade III – minimal joint space, marked joint hypertrophy, and osteophytes; grade IV – bony ankylosis of the joint.

The degree of intervertebral disc (IVD) degeneration on CT was evaluated based on the tendency toward ankylosis formation: grade I – IVD with normal or reduced height, absence of osteophytes, and no signs of ankylosis formation; grade II – distinct osteophytes of adjacent vertebrae without fusion; grade III – bony ankylosis in the area of formed osteophytes or any other part of the IVDs.

The radiological results of the treatment were divided into three groups (Table 1) [10, 11]. In patients after surgery who showed no signs of bone fusion or ankylosis in the fixed segment, functional radiography was additionally performed to assess the stability of the pseudoarthrosis.

Statistical data processing

All radiological parameters were calculated using Radiant DICOM Viewer, version 2025.2. Statistical data processing was performed using the PC STATISTICA program (version 10).

Data normality was assessed using the Shapiro-Wilk test. Parameters with a normal distribution were compared using Student's t-test. In clinical studies, when

comparing continuous data between groups that were not normally distributed, the Mann–Whitney U test was used. For categorical and dichotomous variables, differences between groups were assessed using the χ^2 test or Fisher's two-tailed exact test. Statistical hypotheses were tested at a significance level of $p < 0.05$.

Ethical considerations

The study was performed in accordance with the World Medical Association Declaration of Helsinki. Written informed consent to participate was obtained from all patients. This multicenter study was conducted at two sites: N.V. Sklifosovsky Research Institute of Emergency Medicine (Moscow) and the S.I. Spasokukotsky Moscow Research and Practical Center for Medical Rehabilitation, Restorative and Sports Medicine. The study was approved by the local biomedical ethics committee of the Sklifosovsky Research Institute of Emergency Medicine (Minutes No. 5-23 dated 20.09.2023).

Results

General characteristics of patients

Between 2022 and 2025, a prospective study referred 46 patients to a rehabilitation center, with 17 subsequently enrolled in the study (Fig. 1). The historical control group comprised 23 patients operated on between 2009 and 2022. When comparing the CoT and SuT groups, no statistically significant differences were found in baseline demographic and radiographic characteristics, except for the mean age (Table 2). Patients in the main group (CoT) were, on average, 10 years older, which could have negatively impacted treatment outcomes. However, given the non-inferiority design of the study, if no significant differences are found between the groups in the primary endpoint, the age difference factor may be mitigated. Consequently, the study was extended and further statistical analysis of the data was performed.

The median time to treatment initiation in the CoT group was 3.0 days [Q1–Q3: 0.3–10.0]. In the SuT group,

this parameter was 8.0 days [Q1–Q3: 5.5–21.0]. The majority of control group patients ($n = 15$; 65.2%) underwent bisegmental anterior spondylodesis. In 12 of these patients, interbody fusion was performed using autograft or allograft bone, whereas a distractable cage filled with fragments of the fractured vertebra was used in three cases. The remaining third of the patients received transpedicular fixation without decompression, including three cases of short 4-screw fixation and five cases of long 6- or 8-screw fixation. There were no statistically significant differences between the subgroups regarding demographic and radiological parameters (Table 3). The follow-up periods were 13.2 ± 1.1 months in the CoT group and 67.7 ± 52.3 months in the SuT group.

Radiographic outcomes comparison between conservative and surgical treatment

Both study groups demonstrated nearly identical final Cobb angle values (Table 4). Although the SuT group showed less progression of the angle due to intraoperative kyphosis correction and its stabilization with metal implants, this difference was not statistically significant (0.7° and 4.9° , respectively; t -test, $p = 0.133$). The advantages of the SuT group were noted in the restoration of the spinal canal lumen, with a twofold greater increase in its area compared to the CoT group (t -test, $p = 0.007$); however, the final spinal canal stenosis rates did not differ significantly between the study groups (Fig. 2).

Regarding degenerative changes in the traumatized and adjacent segments, a benefit was identified in the CoT group. Despite the significantly higher mean age in this group, ankylosis of the facet joints and IVDs was significantly more frequent in the surgical treatment group (χ^2 test, $p < 0.001$ and $p = 0.001$, respectively).

Following treatment, fusion was achieved in 91.3% of patients in the SuT group and 88.2% in the CoT group (χ^2 , $p = 0.193$). In two cases within the CoT group, stable pseudoarthrosis was identified, which required no further medical intervention. Patients experienced no complications associated with the

injured area after conservative treatment. Within the SuT group, one patient experienced failure of the anterior fixation system 1 year postoperatively. This structural failure was accompanied by progressive kyphotic deformity and clinical manifestations of spinal instability, ultimately necessitating surgical revision. In one patient presenting with osteolysis around the lower pedicle screws, the treatment outcome was interpreted as stable pseudoarthrosis. In two cases, a subsidence of the prosthesis through the vertebral body cortical layer was observed, resulting in progressive kyphotic deformity, while another case involved a fracture of the two lower pedicle screws. Nevertheless, target block was achieved in these three cases, and the observed changes were likely incidental radiological findings. There were no superficial or deep surgical site infections in either the early or late postoperative periods.

Comparison of clinical outcomes between conservative and surgical treatment

When analyzing the clinical outcomes of the treatment, the CoT group demonstrated the following advantages:

- one-year post-injury, patients experienced a near-total absence of pain at the fracture site, which was reflected in their quality of life; the median pain score on the VAS in this group was 0 [Q1–Q3: 0–1], compared to 2 points [Q1–Q3: 1–3] in the SuT ($p < 0.001$);
- the ODI score in the CoT group was also significantly lower compared to the SuT group, at 4% [Q1–Q3: 0–4] and 12% [Q1–Q3: 6–26]; $p < 0.001$, respectively.

Discussion

The decision regarding conservative treatment for patients with uncomplicated thoracolumbar burst fractures at TLJ remains controversial. Russian clinical guidelines for spinal cord injury either recommend surgical treatment exclusively [14] or lack clear recommendations regarding conservative treatment [15]. According to the guidelines of international neurosurgical societies, conservative treatment is

considered feasible in patients with mild compression and kyphotic deformity [16, 17]. Unfortunately, such ambiguous wording in clinical guidelines restricts the options available to surgeons and patients, rendering surgery inevitable. This situation is largely due to the lack of unequivocal results published from prospective studies (Table 5). Specifically, the only aspect on which the authors relatively agree is the advantage of surgery in correcting kyphotic deformity and maintaining the achieved effect in the long-term post-injury period. Simultaneously, studies with Level 2 evidence demonstrated completely different clinical results: a lack of significant difference [18], an advantage of conservative treatment [19], and better outcomes of surgical treatment [20]. Three prospective studies found no significant difference in the time to return to work [18, 19, 24]. The lack of clear guidelines from neurosurgical societies, combined with heterogeneous data in published studies, prompted the present study.

Thus, superior results were achieved in the CoT group regarding the primary endpoint. Quality of life assessed using the ODI was significantly higher in patients undergoing conservative therapy. Nevertheless, the difference between the median values was 8%, which is less than the MCID of 17.5% [12]. Therefore, this advantage of the CoT group is statistically but not clinically significant. Despite this, we demonstrated that conservative treatment achieved non-inferior clinical efficacy compared to surgical intervention, which we attribute to two main factors.

First, all patients in CoT group underwent a course of rehabilitation starting as early as the second day of hospitalization. It totaled 24 days, including the stay at the rehabilitation center. Among the published literature, only two studies [20, 21] indicate that patients in the conservative treatment group underwent rehabilitation or were transferred to a rehabilitation facility, a factor that could have definitively impacted the final results.

Secondly, we limited the sample to patients with AOSpine type A3 fractures

Table 1
Radiographic outcome criteria

Criterion	CoT	SuT
Fusion	Fusion of vertebral body fracture lines	Multiple bony bridges between the graft and the vertebrae, or ankylosis of the fixed segment in the area of the vertebral bodies or facet joints
Stable pseudoarthrosis	Nonunion of fracture lines up to osteolysis, without clinical or radiological signs of instability at this level	Nonunion in the operated segments without progression of kyphotic deformity, vertebral compression, or clinical signs of instability; peri-screw osteolysis within the fixation system may be present
Pseudoarthrosis with clinical and/or radiographic evidence of instability	Nonunion or absence of bone block with segmental instability, progression of kyphotic deformity and vertebral compression fracture amid structural collapse	

only. Virtually all comparative studies included all burst fractures (A3 and A4). Due to the involvement of the inferior vertebral endplate, type A4 injuries are more severe; consequently, we believe their inclusion in the primary group could compromise both radiological and clinical outcomes. Unfortunately, none of the previously published studies stratified by subgroups A3 and A4. Of note, that the historical control group included two treatment methods. This is due to the fact that pedicle screw fixation without decompression and anterior fusion yields no significant difference in long-term clinical outcomes, which is largely attributed to the preservation of the posterior column [26]. Given the selected primary endpoint, we decided to pool these two groups, especially since they did not differ significantly in terms of baseline demographic and radiological characteristics. We also grouped patients with varying spans of pedicle screw fixation together, because the fixation length exerted no significant influence on late clinical outcomes [27].

When evaluating the secondary endpoints of the study, it was also found that the correction of kyphotic deformity and the maintenance of the achieved effect

were slightly better in the SuT group, which is consistent with previously published studies (Table 5).

Despite the advantages of surgical methods for spinal canal decompression, the degree of residual stenosis did not differ significantly between the groups post-treatment. This fact, combined with the available meta-analysis findings, demonstrates that in patients with moderate spinal canal stenosis, bone fragment lysis during external immobilization yields outcomes comparable to those of surgical treatment in select patients.

Along with traditional radiographic indicators, we evaluated the severity of degenerative changes involving both the fractured vertebral level and the adjacent motion segments. Of note, that prior to treatment, patients in both groups showed no significant differences in the severity of degenerative changes in either the facet joints or the IVDs. As a result of rigid internal immobilization, only 10.8% of facet joints at the fracture level remained intact in the SuT group, compared to 72.7% in the CoT group. Additionally, surgical treatment was associated with a significantly higher incidence of adjacent-segment ankylosis, affecting both the disc level and the facet joints.

Thus, we obtained visual evidence of certain apparent drawbacks of surgical treatment, further supporting the necessity of hardware removal after pedicle screw fixation.

Thus, the study revealed that conservative treatment is non-inferior in clinical efficacy to standard surgical treatment in a specific cohort of patients with A3 fractures at TLJ. The authors of this study do not advocate for the complete abandonment of surgical treatment in these patients, but rather suggest considering conservative therapy as a non-inferior alternative. Furthermore, based on the findings, patients can make an informed treatment choice after receiving appropriate counseling from their physician.

Study limitations

The main limitation of this study is the use of historical controls. The inclusion of a prospective control group would improve the study's level of evidence. Nevertheless, we believe that several factors can partially mitigate this limitation. First, both groups were comparable in all baseline demographic and radiological parameters upon admission. Second, the surgical treatment sample was continuous and sequential, comprising all patients who met the inclusion criteria, underwent surgery at the N.V. Sklifosovsky Research Institute of Emergency Medicine over a long-term period, and were available for follow-up evaluation.

Conclusion

The performed study indicates that in patients with uncomplicated AOSpine type A3 fractures at TLJ, long-term clinical outcomes of conservative treatment are comparable to those of surgical treatment, provided that kyphotic deformity is $<14.9^\circ$, anterior vertebral body height (AVBH) is $>51.8\%$, vertebral body index (VBI) is >0.54 , and spinal canal stenosis is $<43.9\%$. Early rehabilitation should be initiated within 1–2 days of diagnosis and maintained in a specialized rehabilitation facility. Surgical treatment provides superior correction of kyphotic deformity and spinal canal stenosis; however, it

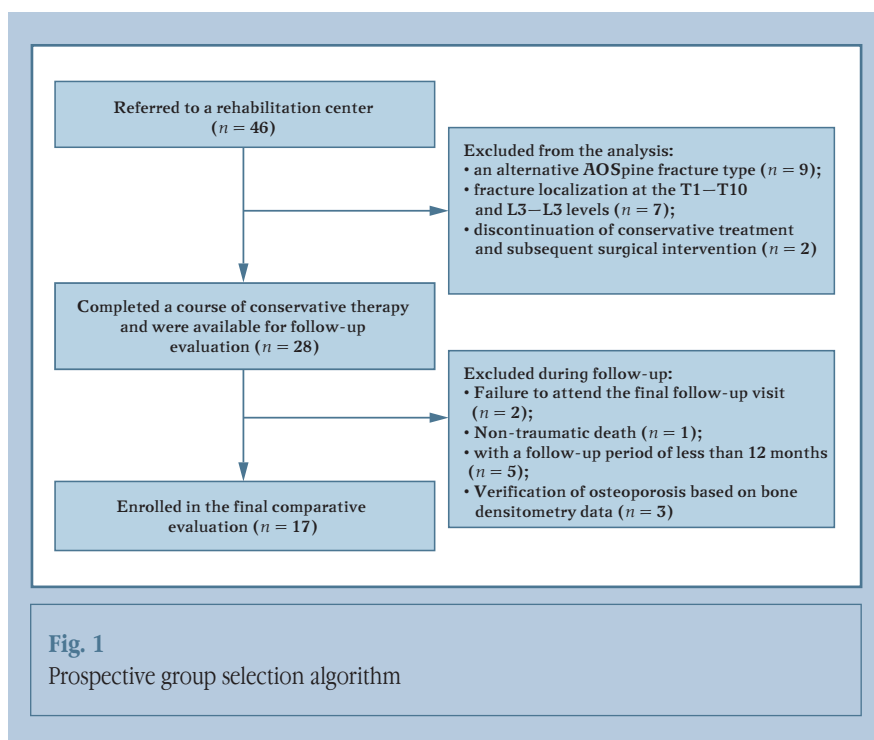


Table 2

Baseline characteristics of patients in the study groups at admission

Parameter	CoT (<i>n</i> = 17)	SuT (<i>n</i> = 23)	<i>p</i>
Demographic data			
Male / Female, <i>n</i>	6/11	11/12	0.525*
Age, years	52.4 ± 15.2	42.9 ± 13.9	0.049**
Radiographic outcomes			
Cobb angle, degrees (min—max)	7.8 ± 4.3 (0.4—14.9)	10.1 ± 5.5 (−3.0—21.1)	0.182**
Anterior vertebral body height ratio, % (min—max)	73.4 ± 8.9 (51.8—88.1)	69.2 ± 13.1 (44.1—94.3)	0.273**
Vertebral body index (range, min—max)	0.77 ± 0.10 (0.54—1.01)	0.74 ± 0.14 (0.44—1.01)	0.518**
Spinal canal stenosis, % (min—max)	20.1 ± 14.2 (0.2—43.9)	27.2 ± 12.5 (0.0—48.9)	0.103**
Superior adjacent segments, NU	152.5 ± 36.2	175.8 ± 40.6	0.079**
Inferior adjacent segments, NU	147.5 ± 32.9	166.4 ± 46.8	0.176**
Degenerative changes of the facet joints at the level of the fractured vertebra, <i>n</i>			
Grade I	49	61	0.215***
Grade II—III	17	10	
Grade IV	2	3	
Degenerative changes of the adjacent facet joints, <i>n</i>			
Grade I	51	67	0.447***
Grade II—III	12	14	
Grade IV	3	1	
Degenerative changes in the intervertebral discs at the level of the fractured vertebra, <i>n</i>			
Grade I	31	41	0.152***
Grade II—III	2	0	
Grade IV	1	0	
Degenerative changes in the adjacent intervertebral discs, <i>n</i>			
Grade I	29	43	0.064***
Grade II—III	3	0	
Grade IV	1	0	

* Two-tailed Fisher's exact test; ** Student's *t*-test; *** χ^2 test.

Table 3

General characteristics of subgroups upon admission based on the surgical method

Parameter	Transpedicular fixation (n = 8)	Anterior spinal fusion (n = 15)	p
Male / Female, n	4/4	7/8	1.000*
Age, years	40.3 ± 16.6	44.4 ± 12.5	0.511**
Cobb angle, degrees	12.3 ± 5.4	9.1 ± 5.5	0.252**
Anterior vertebral body height ratio, %	66.4 ± 17.6	70.4 ± 11.3	0.541**
Vertebral body index	0.68 ± 0.18	0.77 ± 0.12	0.205**
Superior adjacent segments, NU	178.4 ± 41.2	174.7 ± 42.0	0.861**
Inferior adjacent segments, NU	173.5 ± 28.0	163.1 ± 51.5	0.666**
Spinal canal stenosis, %	27.2 ± 10.0	27.3 ± 13.9	0.982**

* Two-tailed Fisher's exact test, ** *t*-test.

Table 4

Comparison of radiological parameters and treatment outcomes between the study groups

Parameter	CoT (n = 17)	SuT (n = 23)	p
Changes in radiographic parameters			
Cobb angle (final), degrees	12.8 ± 9.2	11.6 ± 7.5	0.678*
Change in Cobb angle, degrees	4.9 ± 8.3	0.7 ± 8.3	0.133*
Spinal canal stenosis (final percentage), %	9.3 ± 8.9	6.7 ± 8.9	0.377*
Progression of spinal stenosis, %	10.7 ± 8.8	21.0 ± 14.0	0.012*
Changes in spinal canal cross-sectional area, cm ²	0.4 ± 0.3	0.9 ± 0.7	0.007*
Dynamics of degenerative changes in the facet joints at the fracture level, n			
No	48	7	<0.001**
Progression to grade II–III	7	12	
Ankylosis	11	46	
Progression of degenerative changes in adjacent facet joints, n			
No	50	54	0.163**
Progression to grade II–III	13	17	
Ankylosis	2	9	
Progression of degenerative changes in the adjacent intervertebral discs, n			
No	33	27	0.001**
Progression to grade II–III	—	7	
Ankylosis	—	7	
Radiographic findings, n			
Fusion	15	21	0.480**
Stable pseudarthrosis	2	1	
Unstable pseudarthrosis	0	1	

* t-test; ** χ^2 test.

accelerates degenerative changes both within the fractured vertebra and in the adjacent segments. The definitive choice

between surgical and conservative treatment for such fractures should be a shared decision made with the

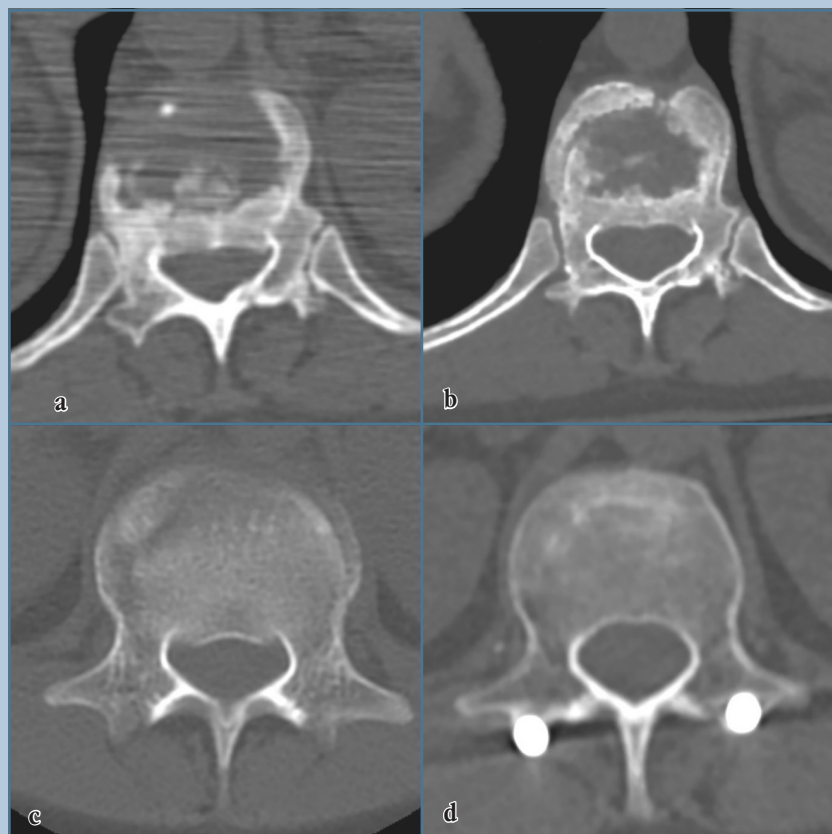
patient, taking into account comparable clinical outcomes, the need for deformity correction, and the risk of complications.

Table 5

Comparative studies demonstrating the advantage of conservative versus surgical treatment in long-term outcomes

Source	Level of evidence	Change in Cobb angle	Progression of spinal stenosis	VAS	Clinical outcome	Return to work
Shen et al. [18]	3	SuT	—	NS	NS	NS
Wood et al. [13]	3	NS	NS	NS	CoT	NS
Siebenga et al. [20]	2	SuT	—	SuT	SuT	SuT
Post et al. [21]	3	—	—	NS	NS	—
Landi et al. [22]	3	—	—	—	SuT	SuT
Mohamadi et al. [23]	2	SuT	—	—	—	SuT
Pehlivanoglu et al. [24]	3	SuT	—	NS	NS	NS
Gonzales-Portillo et al. [25]	3	NS	—	NS	—	—

SuT — surgical treatment; CoT — conservative treatment; NS — not statistically significant advantage of conservative over surgical treatment.

**Fig. 2**

CT scans of a fractured vertebra following conservative (**a, b**) and surgical (**c, d**) treatment: (**a**) baseline CT scan of the T12 vertebra post-injury demonstrating 32.3% spinal canal stenosis; (**b**) follow-up CT scan of the T12 vertebra post-therapy demonstrating 10.6% spinal canal stenosis and a 0.523 cm² increase in the spinal canal cross-sectional area; (**c**) baseline CT scan of the L1 vertebra at admission demonstrating 22.2% spinal canal stenosis; (**d**) follow-up CT scan post-pedicle screw fixation demonstrating 0.0% spinal canal stenosis and a 0.967 cm² increase in the spinal canal cross-sectional area

References

1. Farion AO, Paskov RV, Sergeev KS, Bazarov AY, Prokopec AN, Dadashov SI. Analysis of epidemiological indicators, hospital treatment, the nature and type of spinal injuries in adult patients treated at a level I trauma center. *N.N. Priorov Journal of Traumatology and Orthopedics*. 2025;32(1):61–70. DOI: <https://doi.org/10.17816/vto629457> EDN: ASDDQV
2. Morozov IN, Mlyavykh SG. Epidemiology of spinal cord injury (review). *Medical Almanac*. 2011;(4):157–159. EDN: NUJLSD
3. Grin AA, Talypov AE, Kordonskiy AY, Karanadze VA, Lvov IS, Smirnov VA, Abdrafiev RI. Efficacy and safety of short segment pedicle screw fixation in patients with neurologically intact burst fractures of the lower thoracic and lumbar spine: a meta-analysis of studies published over the last 20 years. *Russian Journal of Spine Surgery (Khirurgiya Pozvonochnika)*. 2024;21(3):14–24. DOI: <https://doi.org/10.14531/ss2024.3.14-24> EDN: RBBLQI
4. Rometsch E, Spruit M, Hrtl R, McGuire RA, Gallo-Kopf BS, Kalampoki V, Kandziara F. Does operative or nonoperative treatment achieve better results in A3 and A4 spinal fractures without neurological deficit? Systematic literature review with meta-analysis. *Global Spine J*. 2017;7:350–372. DOI: <https://doi.org/10.1177/2192568217699202>
5. Grin AA, Talypov AE, Karanadze VA, Kordonskiy AY, Abdrafiev RI. Degenerative changes in the spinal motion segment following surgical treatment of thoracic and lumbar spine fractures. *Russian neurosurgical journal named after professor A.L. Polenov*. 2025;XVII(3):43–53. DOI: https://doi.org/10.56618/2071-2693_2025_17_3_43 EDN: JSSNFY
6. Grin AA, Karanadze VA, Kordonskiy AY, Talypov AE, Lvov IS, Abdrafiev RI. Efficacy and safety of conservative treatment in patients with neurologically intact thoracolumbar burst fractures: a meta-analysis. *Russian Journal of Spine Surgery (Khirurgiya Pozvonochnika)*. 2024;21(2):27–38. DOI: <https://doi.org/10.14531/ss2024.2.27-38> EDN: NGRFQW
7. Liu GKP, Das K. Video assisted thoracoscopic surgery for spinal conditions. *Neurol India*. 2005;53:480–485. DOI: <https://doi.org/10.4103/0028-3886.22619>
8. Cherepanov EA. Russian version of the Oswestry Disability Index: cross-cultural adaptation and validity. *Russian Journal of Spine Surgery (Khirurgiya Pozvonochnika)*. 2009;(3):93–98. DOI: <https://doi.org/10.14531/ss2009.3.93-98> EDN: KXDEM R
9. Pathria M, Sartoris DJ, Resnick D. Osteoarthritis of the facet joints: accuracy of oblique radiographic assessment. *Radiology*. 1987;164:227–230. DOI: <https://doi.org/10.1148/radiology.164.1.3588910>
10. Brantigan JW, Steffee AD. A carbon fiber implant to aid interbody lumbar fusion. Two-year clinical results in the first 26 patients. *Spine (Phila Pa 1976)*. 1993;18:2106–2107. DOI: <https://doi.org/10.1097/00007632-199310001-00030>
11. Lee YP, Sclafani J, Garfin SR. Lumbar pseudarthrosis: diagnosis and treatment. *Semin Spine Surg*. 2011;23:275–281. DOI: <https://doi.org/10.1053/j.sems.2011.05.009>
12. Hung M, Saltzman CL, Kendall R, Bounsanga J, Voss MW, Lawrence B, Spiker R, Brodke D. What are the MCIDs for PROMIS, NDI, and ODI instruments among patients with spinal conditions? *Clin Orthop Relat Res*. 2018;476:2027–2036. DOI: <https://doi.org/10.1097/CORR.0000000000000419>
13. RiskCalc Sample Size Calculator. Cleveland Clinic Lerner Research Institute; 2016–2025. [Electronic resource]. URL: <https://riskcalc.org/samplesize> (дата обращения: 14.09.2023). [RiskCalc Sample Size Calculator. Cleveland Clinic Lerner Research Institute; 2016–2025. [Electronic resource]. URL: <https://riskcalc.org/samplesize>. Accessed date 14/09/2023].
14. Fracture (dislocation) of the thoracic and lumbosacral spine. Clinical guidelines / Association of Neurosurgeons of Russia, Association of Traumatologists and Orthopedists of Russia, Association of Spine Surgeons, Union of Rehabilitation Specialists of Russia. Approved 2024. URL: https://cr.minzdrav.gov.ru/preview-cr/448_4.
15. Fractures (dislocations) of the thoracic and lumbar spine. Clinical guidelines. Approved by the Ministry of Health of the Russian Federation. Moscow, 2023. URL: https://disuria.ru/_ld/1274_kr21S2S2S3S32MZ.pdf.
16. Peev N, Zileli M, Sharif S, Arif S, Brady Z. Indications for nonsurgical treatment of thoracolumbar spine fractures: WFNS Spine Committee Recommendations. *Neurosurgery*. 2021;18:713–724. DOI: <https://doi.org/10.14245/ns.2142390.195>
17. Rabb CH, Hoh DJ, Anderson PA, Arnold PM, Chi JH, Dailey AT, Dhall SS, Eichholz KM, Harrop JS, Qureshi S, Raksin PB, Kaiser MG, O'Toole JE. Congress of neurological surgeons systematic review and evidence-based guidelines on the evaluation and treatment of patients with thoracolumbar spine trauma: operative versus nonoperative treatment. *Neurosurgery*. 2019;84:E50–E52. DOI: <https://doi.org/10.1093/neuros/nyy361>
18. Shen WJ, Liu TJ, Shen YS. Nonoperative treatment versus posterior fixation for thoracolumbar junction burst fractures without neurologic deficit. *Spine (Phila Pa 1976)*. 2001;26:1038–1045. DOI: <https://doi.org/10.1097/00007632-200105010-00010>
19. Wood K, Buttermann G, Mehdod A, Garvey T, Jhanjee R, Sechriest V. Operative compared with nonoperative treatment of a thoracolumbar burst fracture without neurological deficit. A prospective, randomized study. *J Bone Joint Surg Am*. 2003;85:773–781. DOI: <https://doi.org/10.2106/00004623-200305000-00001>
20. Siebenga J, Leferink VJ, Segers MJ, Elzinga MJ, Bakker FC, Haarmann HJ, Rommens PM, ten Duis HJ, Patka P. Treatment of traumatic thoracolumbar spine fractures: a multicenter prospective randomized study of operative versus nonsurgical treatment. *Spine (Phila Pa 1976)*. 2006;31:2881–2890. DOI: <https://doi.org/10.1097/01.brs.0000247804.91869.1e>
21. Post RB, van der Sluis CK, Leferink VJ, ten Duis HJ. Long-term functional outcome after type A3 spinal fractures: operative versus non-operative treatment. *Acta Orthop Belg*. 2009;75:389–395.
22. Landi A, Marotta N, Mancarella C, Meluzio MC, Pietrantonio A, Delfini R. Percutaneous short fixation vs conservative treatment: comparative analysis of clinical and radiological outcome for A3 burst fractures of thoraco-lumbar junction and lumbar spine. *Eur Spine J*. 2014;23 Suppl 6:671–676. DOI: <https://doi.org/10.1007/s00586-014-3554-x>
23. Mohamadi A, Googanian A, Ahmadi A, Kamali A. Comparison of surgical or nonsurgical treatment outcomes in patients with thoracolumbar fracture with Score 4 of TLICS: A randomized, single-blind, and single-central clinical trial. *Medicine (Baltimore)*. 2018;97:e9842. DOI: <https://doi.org/10.1097/MD.00000000000009842>
24. Pehlivanoglu T, Akgul T, Bayram S, Meric E, Ozdemir M, Korkmaz M, Sar C. Conservative versus operative treatment of stable thoracolumbar burst fractures in neurologically intact patients: is there any difference regarding the clinical and radiographic outcomes? *Spine (Phila Pa 1976)*. 2020;45:452–458. DOI: <https://doi.org/10.1097/BRS.0000000000003295>
25. Gonzales-Portillo GS, Mamaril-Davis JC, Riordan K, Avila MJ, Aguilar-Salinas P, Burket A, Dumont T. Evaluation of the thoracolumbar injury classification and severity (TLICS) score over a two-year period at a level one trauma center. *Cureus*. 2023;15:e43762. DOI: <https://doi.org/10.7759/cureus.43762>
26. Wang T, Wang Z, Ji P, Zhang J, Zhang C, Zhang L. The efficacy and safety of anterior versus posterior approach for the treatment of thoracolumbar burst fractures: a systematic review and meta-analysis. *Ann Transl Med*. 2022;10:309. DOI: <https://doi.org/10.21037/atm-22-903>
27. Grin A, Karanadze V, Lvov I, Kordonskiy A, Talypov A, Smirnov V, Zakharov P. Effective method of pedicle screw fixation in patients with neurologically intact thoracolumbar burst fractures: a systematic review of studies published over the last 20 years. *Neurocirugia (Engl Ed)*. 2024;35:299–310. DOI: <https://doi.org/10.1016/j.neucie.2024.07.009>

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Authors' Info

Andrey Anatolyevich Grin, MD, Dr. Sci. (Medicine); eLibrary SPIN: 2194-2598; ORCID: 0000-0003-3515-8329; aagreen@yandex.ru

Aleksandr Ernestovich Talypov, MD, Dr. Sci. (Medicine); eLibrary SPIN: 3415-8260; ORCID: 0000-0002-6789-8164; dr.talypova@mail.ru

Anton Yuryevich Kordonskiy, MD, Cand. Sci. (Medicine); eLibrary SPIN: 1263-2284; ORCID: 0000-0001-5344-3970; akord.neuro@mail.ru

Vasily Amiranovich Karanadze, MD, Cand. Sci. (Medicine); eLibrary SPIN: 8101-3583; ORCID: 0000-0003-0180-9154; karanadzev@mail.ru

Ivan Sergeyevich Lvov, MD, Cand. Sci. (Medicine); eLibrary SPIN: 1252-3377; ORCID: 0000-0003-1718-0792; speleolog@mail.ru

✉ Rinat Irfanovich Abdrafiev; 3 Bolshaya Sukharevskaya sq., Moscow, 129090, Russia; ORCID: 0000-0003-3328-8349; rinat-abdratiev@mail.ru

Irena Vladimirovna Pogonchenkova, MD, Dr. Sci. (Medicine), Associate Professor; eLibrary SPIN: 8861-7367; ORCID: 0000-0001-5123-5991; pogonchenkovaiv@zdrav.mos.ru

Elena Vladimirovna Kostenko, MD, Dr. Sci. (Medicine), Professor; eLibrary SPIN: 1343-0947; ORCID: 0000-0003-0629-9659; ekostenko58@mail.ru

Marina Rostislavovna Makarova, MD, Cand. Sci. (Medicine); eLibrary SPIN: 7640-4570; ORCID: 0000-0002-1787-7015; MakarovaMR@zdrav.mos.ru

Aleksey Vladimirovich Leonov; eLibrary SPIN: 6733-1637; ORCID: 0009-0005-9492-4953; LeonovAV51@zdrav.mos.ru

