EARLY CORSET RECLINATION OF UNCOMPLICATED TYPE A3 COMMINUTED VERTEBRAL FRACTURES IN THE THORACOLUMBAR SPINE

M.S. Narkulov, S.N. Pardaev, A.Zh. Karshiboev, S.T. Meliboev
Samarkand Branch of the Republican Specialized Scientific and Practical Medical Center for Traumatology and Orthopedics, Samarkand, Uzbekistan

Objective. To analyze the results of staged preoperative correction of uncomplicated comminuted fractures in the thoracolumbar spine.
Material and Methods. Retrospective study included data from 51 patients (33 men and 18 women) 17–35 years old with type A3 spinal injuries without urgent indications for surgery. In preparation for a possible operation, patients received a corset treatment with reclination pneumopelot for 2–3 days.
Results. The results were evaluated based on clinical, radiological and CT data. The result after reclination corset treatment was considered good if a restoration of the vertebral height was achieved with its residual deficit of less than 10 % or local wedge shape not more than 10°; satisfactory – with a residual decrease in vertebral body height from 10 to 30 % or in kyphotic deformity from 10 to 20°; and unsatisfactory – with a decrease in body height of more than 30 %, and in kyphotic deformity of more than 20°. With an average decrease in the height of the fractured vertebral body before surgery by 45 % and the local kyphosis magnitude of 27.0° ± 5.5°, the staged reclination provided complete correction of kyphosis in all cases and restoration of the height of the compressed vertebra to a residual deficit of less than 10 % in 78 % of cases. Neurological disorders were not noted.
Conclusion. In case of incomplete burst vertebral fractures not complicated by compression of the spinal cord, the method of early (in the first 7 days after the injury) corset treatment with staged fracture reclination by a pneumatic chamber can be effectively used to eliminate local kyphotic deformity and restore the height of fractured vertebra.
Key Words: spine, trauma, corset treatment.
Please cite this paper as: *Narkulov MS, Pardaev SN, Karshiboev AZh, Meliboev ST. Early corset reclination of uncomplicated type A3 comminuted vertebral fractures in the thoracolumbar spine. Hir. Pozvonoc. 2020;17(2):58–63. In Russian.*
DOI: http://dx.doi.org/10.14531/ss2020.2.58-63.

Spinal fractures account for 4–8 % of all injuries of the musculoskeletal system, with the percentage of uncomplicated vertebral body fractures in the lower thoracic and lumbar spine amounting to 85 % of the spinal fractures [1, 2]. In this case, the variety of injuries complicates diagnosis and making optimal decisions about conservative or surgical treatment [3]. Conservative treatment of uncomplicated comminuted fractures of the thoracolumbar spine, being biomechanically sound [4], is not always supported by long-term outcomes [5]. On the other hand, modern tactical classifications of spinal fractures, which recommend surgical stabilization for mechanically totally unstable injuries [6–8], are not always unambiguous in the indications for urgent surgery for uncomplicated A2 (split), A3 (incomplete burst), and A4 (complete burst) fractures [9].

Elimination of the kyphotic deformity and restoration of anterior spinal column support in the treatment of these fractures are pathogenically substantiated. Even when interventions based on the damage control principle are performed only through the posterior approach, which is achieved in 82.6 % of patients, postoperative complications occur in 18 % of cases, and the loss of correction in the long-term period ranges from 6 to 24 % [6, 10, 11]. Apparently, the surgeon's main goal in an emergency situation is to improve the treatment outcome by means of minimally traumatic stabilization: if anterior reconstruction is necessary, patients can be transferred to specialized departments for elective surgery, especially because less than 15 % of surgeons actively operating on the spine are familiar with both (anterior and posterior) approaches to the spine [1, 2, 6].

The choice of delayed surgical treatment for a conditionally unstable mechanical fracture of the spine can be related to both objective and subjective causes, including technical readiness of the clinic for a complete radiographic examination of the patient and the presence of a surgeon familiar with these interventions. In some cases, the organization of such surgery, including transfer of the patient to a specialized hospital, may take several days within which simple conservative measures can not only simplify subsequent stabilization surgery but also raise the question of its reasonability. Corset reclination of the fracture can be used as this treatment option.

The purpose of this study was to analyze the outcomes of corset reclination in uncomplicated comminuted fractures of the thoracolumbar spine used in staged

preparation for surgical stabilization of the spine.

Material and Methods

The study was performed at the Navoi Regional Hospital (Uzbekistan). We studied the long-term treatment outcomes in 51 patients (33 males and 18 females) aged 17–35 years with an injury duration of 1 to 7 days who were hospitalized in 2016–2017. Criteria for inclusion in the study were as follows:

– T11–L3 vertebral fractures as the functionally most mobile, with a potential risk of neurological complications due to the spatial relationship between this level and the lumbar spinal cord enlargement;

– classification of the fracture according to the morphological component as type A3 with an intact ligamentous apparatus and the absence of neurological disorders [8, 9];

– single-level spinal fracture;

– injury duration of less than 7 days;

– CT examination of the spine in the course of treatment.

Mandatory exclusion criteria were as follows: injury to the ligamentous spinal structures, pathological vertebral fractures due to metastatic lesions, patients over 60 years of age (due to the possibility of an osteoporosis-associated fracture).

A feature of preoperative management of patients was local anesthesia according to the Schneck procedure with admission of 0.5 % *S. Novocaini* (100–150 mL), followed by (on the 2nd day) placing a corset with a posterior frame and gradual reclination for 2–3 days by increasing the height of a reclinator (pneumatic chamber) located at the fracture level. Given the lack of a correlation between pressure in the pneumatic chamber and the severity of subjective complaints and degree of deformity correction (this is associated with individual anatomical features and patient tolerance of the procedures), the following technique was used: the reclinator was filled with air under pressure control up to 30–40 mm Hg until moderate pain appeared in the compression area. After this, the procedure was stopped, with the pressure being maintained until pain relief, which usually occurred within 5–7 h. After relieving the pain, the pneumatic chamber was re-filled using the same procedure, repeating the procedure 3–4 times a day for 2–3 days. An indirect indicator for cessation of the manipulation was the absence of back pain upon blowing air into the chamber, which indicated achieving reclination of the vertebra [12, 13].

The outcome was evaluated based on clinical and radiographic indicators and CT data. Radiographic studies were performed with the patient in the prone position, without removing the corset. There were no significant differences between the prone position and only under extension in the corset ($p < 0.05$). The outcome was considered good if corset reclination resulted in restoration of the vertebral height with a residual loss of not more than 10 % or local wedging of not more than 10°. In the satisfactory outcome, a residual decrease in the vertebral body height was from 10 to 30 %, and kyphotic deformity was from 10 to 20°. In the unsatisfactory outcome, a decrease in the body height was more than 30 %, and a kyphotic deformity exceeded 20°.

The efficacy of surgery is not the study objective and is not addressed in this paper. However, it should be clarified that in the case of subsequent surgery, the corset was removed on the operating table with the patient in the prone position. In this case, the achieved complete restoration of the vertebral body height allowed transpedicular fixation without additional reduction of the fracture during instrumentation.

Results

The distribution of patients by the vertebral injury level is presented in Table 1.

The mean height of a fractured vertebral body on the first examination of patients was 45 % compared to the mean height of neighboring vertebrae; the mean local kyphotic deformity (vertebral wedging) was 27.0° ± 5.5°.

The results of staged conservative correction were assessed based on the number of patients who achieved changes in the vertebral body height and local kyphosis (Table 2). It is seen that staged reclination in the corset enabled elimination of local kyphosis in all patients, which allocated most of the patients (78.4%) to the group with a minimal decrease in the vertebral body height.

Clinical case (Fig.). A 42-year-old male patient S. was admitted to the clinic with a closed uncomplicated comminuted fracture of the L1 vertebra (type A3) on November 01, 2019. Low quality X-ray (before hospitalization) was presented. The presence of a fracture was obvious, and an examination at the hospital was limited to CT. Features of the fracture detected during the radiographic examination included a decrease in the anterior L1 body height by 45 % and local kyphosis of 23°; T12 wedging without a traumatic component, which was confirmed by CT data. The patient underwent anesthesia of the fracture site (according to Schneck) with 0.5 % *S. Novocaini* (100 mL) and placement of an orthosis, after which reclination was performed according to the described procedure for 3 days. An X-ray examination confirmed elimination of the kyphotic deformity and almost complete restoration of the fractured vertebra height (residual loss of the anterior vertebral height was 10 %). Given the patient's desire to return to active life as quickly as possible, he underwent two-segmental transpedicular fixation. The patient was verticalized on the 4th day after surgery. The outcome was followed-up after 6 months: the patient had a lifestyle consistent with that before the injury and had no complaints.

Discussion

Since introduction of the first tactical classification of spinal fractures, which was based on assessment of angulometric and linear indicators [14], there has been a discussion on the features of choosing a method for surgical stabilization of the spine based on these criteria [2, 6–10, 15]. In this case, it has been proved that restoration of the fractured vertebral body height and indirect decompression of the spinal canal contents due to

ligamentotaxis in the case of potentially unstable vertebral fractures in the thoracolumbar spine can be effectively achieved only within the first 7–10 days after injury [2, 5, 16].

Due to various causes, such urgent surgery is not always possible, but the available time can be used quite effectively. Our study has demonstrated that early corset reclination in incomplete burst fractures (type A3), which starts in the first days after injury, reduces the number of patients with a vertebral body height loss of more than 10% from 84.6 % to 21.6 % and with compression of more than 30 % from 42.3 % to 5.9 %, which is more optimistic than the data on restoration of height of a compressed vertebra in only 9.3 % of operated patients [10]. This is also true with regard to correction of local kyphosis, which has been achieved in 87 % of patients undergoing surgery [17] and in all cases in our series.

It should be noted that selection of patients for corset correction requires a clear tactical classification of injuries with observance of two mandatory conditions: the absence of neurological disorders and preserved stability of the posterior spinal column [6, 8, 14, 15]. In this case, an incomplete burst fracture with linear injury to the vertebral arch can correspond to conditionally unstable injury when surgical management is not always unambiguous [9].

In our opinion, corset reclination for uncomplicated vertebral fractures should be considered as one of the effective options in the arsenal of a traumatologist and a neurosurgeon. Probably, for this reason, interest in conservative treatments of these fractures has remained so far despite the rapid development of spinal surgery [18].

Conclusion

In the case of incomplete burst vertebral fractures not complicated by compression of the spinal cord, a technique of early (within the first 7 days after injury) corset treatment with staged reclination of the spine using pneumatic chamber can be effectively used to eliminate local kyphotic deformity and restore the height of fractured vertebral body.

The presented technique can be used to prepare a patient for a possible surgical intervention and (in the case of a patient's refusal of surgical treatment) as an independent method for treatment of uncomplicated vertebral fractures (type A3).

Potential limitation on the reliability of results. In this study, the fracture type was assessed only on the basis of X-ray and CT data. In this case, the patients included in the analysis did not have any convincing signs of potential injury to the ligamentous apparatus, which does not exclude the possibility of these findings if MRI were performed, the routine use of which in the absence of neurological complications is not always indicated and possible.

Table 1
Distribution of patients according to vertebral injury levels, n (%)

Injury level	Patients
T11	6 (11.5)
T12	22 (42.3)
L1	17 (34.6)
L2	4 (7.7)
L3	2 (3.8)
Total	51 (100.0)

Acknowledgments

The authors thank Dr. Med. Sci., Prof. A.Yu. Mushkin for methodological, scientific, and editorial assistance in preparing this manuscript.

The study was conducted without financial support. The authors declare no conflict of interest.

Table 2
Distribution of patients according to the efficacy of preoperative deformity correction, n (%)

Stage	Vertebral body height loss			Local kyphotic deformity		
	<10 %	10–30 %	>30 %	<10	10–20	>20
At admission	6 (11.5)	24 (46.2)	21 (42.3)	8 (15.3)	39 (77.0)	4 (7.7)
After reduction	40 (78.4)	8 (15.7)	3 (5.9)	51 (100.0)	–	–

Fig.
A 42-year-old male patient S. with a L1 vertebral fracture (type A3): **a** – a lateral X-ray and a CT scan at admission; local kyphosis = 23°, anterior vertebral height loss = 45 %; **b** – an X-ray at the stage of reduction using a device for treatment of the spine; the deformity is completely eliminated; height of fractured vertebra is partially restored; the residual loss of anterior vertebral height is 10 %; **c** – appearance of the patient before placing in the prone position; **d** – an X-ray of the spine (two projections) after two-segmental transpedicular fixation and posterior spinal fusion

References

1. **Sergeev KS, Durov MF, Kucheryuk VI, Gunter VE, Prokhorov NA, Paskov RV, Faryon AO, Oleneva TYu.** Surgical Stabilization of Lower Thoracic and Lumbar Spine Fractures. Tyumen, 2005. In Russian.
2. **Afaunov AA, Kuzmenko AV.** Transpedicular fixation for thoracic and lumbar spine injury with post-traumatic spinal stenosis. Hir. Pozvonoc. 2011;(4):8–17. In Russian.
3. **Ramikh EA.** Injuries of the thoracic and lumbar spine.Hir. Pozvonoc. 2008;(2):94–114. In Russian. DOI: 10.14531/ss2008.2.94-114.
4. **Mushkin AY, Ulrikh EV, Zuev IV.** Normal and pathological biomechanics of the spine: major aspects of investigation. Hir. Pozvonoc. 2009;(4):53–61. In Russian. DOI: 10.14531/ss2009.4.53-61.
5. **Rerikh VV, Borzykh KO.** Post-traumatic spinal canal narrowing and its surgical remodeling for thoracic and lumbar burst fractures. Hir. Pozvonoc. 2011;(3):15–20. In Russian. DOI: 10.14531/ss2011.3.15-20.
6. **Dulaev AK, Kutyanov DI, Manukovskiy VA, Parshin MS, Iskrovskiy SV, Zhelnov PV.** Decision-making and technical choice in instrumental fixation for neurologically uncomplicated isolated burst fractures of the thoracic and lumbar vertebrae. Hir. Pozvonoc. 2019;16(2):7–17. In Russian. DOI: 10.14531/ss2019.2.7-17.
7. **Magerl F, Aebi M, Gertzbein SD,Harms J, Nazarian S.** A comprehensive classification of thoracic and lumbar injuries. Eur Spine J. 1994;3:184–201. DOI: 10.1007/BF02221591.
8. **AOSpine thoracolumbar injury classification score.** [Electronic resource]. URL: http:/www.aospine.org/Classification.
9. **Lee JY.** Thoracolumbar Injury Classification and Severity Scale (TLICS). [Electronic resource]. URL: https://www.mdcalc.com thoracolumbar-injury-classification-severity-scale-tlics#creator-insights.
10. **Berdugin KA, Chertkov AK, Shtadler DI, Berdugina OV.** On unsatisfactory outcomesof transpedicular fixation. Hir. Pozvonoc. 2010;(4):19–24. In Russian. DOI: 10.14531/ss2010.4.19-24.
11. **Davne SH, Myers DL.** Complications of lumbar spinal fusion with transpedicular instrumentation. Spine. 1992;17(6 Suppl):S184–S189. DOI: 10.1097/00007632-199206001-00021.
12. **Pardaev SN, Urinbaev PU.** Device for the treatment of the spine: Patent RF 2033775, appl.07.09.1992, publ. 30.04.1995. In Russian.
13. **Narkulov MS, Pardaev SN, Karshiboev AZh, Meliboev ST.** The way to stabilize the spinal column for comminuted injury to the vertebral body in the thoracolumbar spine: Patent IAP 05898. Publ. 2019. In Russian.
14. **McCormack T, Karaikovic E, Gaines RW.** The load sharing classification of spine fractures. Spine. 1994;19:1741–1744. DOI: 10.1097/00007632-199408000-00014.
15. **Avanzi O, Landim E, Meves R, Caffaro MF, de Albuquerque Araujo Luyten F, Faria AA.** Thoracolumbar burst fracture: load sharing classification and posterior instrumentation failure. Rev Bras Ortop. 2015;45:236–240. DOI: 10.1016/S2255-4971(15)30363-3.
16. **Verheyden AP, Holzl A, Ekkerlein H, Gercek E, Hauck S, Josten C, Kandziora F, Katscher S, Knop C, Lehmann W, Meffert R, Muller CW, Partenheimer A, Schinkel C, Schleicher P, Schnake KJ, Scholz M, Ulrich C.** [Recommendations for the treatment of thoracolumbar and lumbar spine]. Unfallchirurg. 2011;114:9–16. In German. DOI: 10.1007/s00113-010-1934-1.
17. **Zaretskov VV, Arsenievich VB, LikhachevSV, ShulgaAE, Titova JuI.** Transpedicular fixation in comminuted fractures of bodies of thoracic and lumbar vertebrae. Saratov Journal of Medical Scientific Research. 2014;10 (3):441–446. In Russian.
18. **Spiegl UJ, Fischer K, Schmidt J, Schnoor J, Delank S, Josten C, Schulte T, Heyde CE.** The conservative treatment of traumatic thoracolumbar vertebral fractures. Dtsch Arztebl Int. 2018;115:697–704. DOI: 10.3238/arztebl.2018.0697.

Address correspondence to:
Narkulov Maksudzhon Saidkasimovich
Samarkand branch of the Republican Specialized
Scientific and Practical Medical Center for Traumatology
and Orthopedics,
5 Fusuli str., Samarkand, 140100, Uzbekistan,
pmaqsud@mail.ru

Received 20.11.2019
Review completed 21.05.2020
Passed for printing 25.05.2020

Maksudzhon Saidkasimovich Narkulov, physician of the spine department of the Samarkand branch of the Republican Specialized Scientific and Practical Medical Center for Traumatology and Orthopedics, 25 Fusuli str., Samarkand, 140100, Uzbekistan, ORCID: 0000-0002-9090-9933, pmaqsud@mail.ru;
Saidkasim Narkulovich Pardaev, Head of the Department of the Samarkand branch of the Republican Specialized Scientific and Practical Medical Center for Traumatology and Orthopedics, 25 Fusuli str., Samarkand, 140100, Uzbekistan, ORCID: 0000-0002-9743-0482, said-03-10@mail.ru;
Abduvakhob Zhambaevich Karshiboev, physician of the spine department of the Samarkand branch of the Republican Specialized Scientific and Practical Medical Center for Traumatology and Orthopedics, 21 Movorounahr str., Samarkand, 140100, Uzbekistan, ORCID: 0000-0002-0351-9831, karshiboev75@bk.ru;
Salim Tashtanovich Meliboev, physician of the spine department of the Samarkand branch of the Republican Specialized Scientific and Practical Medical Center for Traumatology and Orthopedics, 28 Fotima Kasimovna str., Samarkand, 140100, Uzbekistan, ORCID: 0000-0002-5246-6246, meliboev80@bk.ru.