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Comprehensive Assessment of the Outcomes of Surgical Treatment of Patients with Metastatic Injuries of the Spine

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An increase in life expectancy affects the incidence rate of cancer. According to diverse sources, metastases in the spine are detected during autopsy in 30—90% of patients with a history of cancer. In Russian literature, there have been no in-depth studies of the quality of life in patients with various metastatic tumors of the spine who underwent surgical treatment, which determines the relevance of this study. **Objective.** The objective of the study was to demonstrate the need for implementing target setting in the combination treatment of patients with metastases in the spine as the main tool to identify the factors that adversely affect the patients' quality of life. **Material and Methods.** The quality of life of 56 patients aged 16 to 81 years was assessed, including 26 males and 30 females. Of them, 26 patients underwent surgical treatment between 2002 and 2009, and 30 patients underwent surgical treatment between 2009 and 2014. Kidney cancer was a primary disease in 30.3% of patients, multiple myeloma was a primary disease in 23.1% of cases, and single cases of melanoma, thymoma, as well as metastases of tumors of the gastrointestinal tract, uterus, ovary, lung, prostate, pancreas, and the thyroid gland also occurred and amounted on the average to 3.5% (1.8 to 7.14%). The primary tumor site was not identified during cancer screening in 10.5% of cases. The quality of life of patients was studied using the EORTC QLQ-C30 scale. The patients were surveyed prior to the surgery and then 1, 3, 6 and 12 months after surgical treatment during 1 year or until death. Preoperative and postoperative contrast-enhanced spiral CT and MRI examinations were used to control the extent of decompression of neural structures. **Results.** On the basis of these findings, the authors identified the main factors affecting the quality of life of patients and formulated a range of treatment goals for patients with metastases in the spine. **Conclusions.** Surgical treatment has a positive effect on the quality of life in patients with metastases in the spine. However, it is not a key factor with regard to survival rate of these patients. Therefore, a decision on the possibility and necessity of surgical treatment should be taken both by the patient and oncologists of different specialties.

Keywords: *metastatic tumors of the spine, quality of life, surgical treatment of metastases.*

Epidemiological studies indicate an increase in the number of patients with cancer. This is correlated to the increased life expectancy, expansion of diagnosis methods, new effective treatment modes for cancer, and other factors. Literature data reveal the spine to be more often a target for metastasizing than the other bones of the skeleton in the case of malignant tumors [1]. Thus, according to various data [2], from 4 to 20% of all bone tumors are localized in the spine. Of them, 4.6% are primary bone tumors, and the others are metastases (those of breast, lung, or prostate cancer in most cases). More than 30% of these tumors cause neurological symptoms [3—7]. Pain, pelvic organ dysfunction, and sensory and movement disorders occur among them more often. The severity of these symptoms depends on the location, size, and histological features of a tumor. Undoubtedly, neurological symptoms affect the quality of life in these patients. According to R. Coleman et al. [8], the median survival time of patients with metastases in the spine is higher than that of patients with metastases in the liver.

These facts are the ground for surgical treatment of patients with bone metastases, especially of those with metastases in the spine.

Adoption of new intraoperative visualization technologies, a variety of stabilizing systems, bone cements, and blood-saving techniques has significantly improved the safety and quality of surgical interventions. However, it is important to realize that surgical treatment of patients with metastases in the spine is overwhelmingly palliative. In this regard, an important step in making decision for surgery is to determine its specific objectives, which may be also the basis for objective evaluation of the quality of treatment of these patients. Decision on surgical treatment of patients with metastases in the spine is held together with the patient and/or patient's relatives. The oncologist, radiologist, and surgeon participate in this process. Main criteria for selecting patients for surgery include life span of a patient and the possibility to improve the condition of a patient with minimal surgical risk [9—13].

The need for surgical treatment to this day remains a matter of argument due to conflicting data on the long-term effectiveness of palliative surgery and due to the lack of accurate methods that could predict the life expectancy of these patients. In other words, one of the primary goals is aimed at identifying patients for surgical treatment that is known to result in bad outcome, but still is advisable in terms of the balance between risks and benefits. In our opinion, it was for situations such as this that formulating

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clear goals for an individual patient can significantly objectify the decision on surgical treatment.

We have not found in Russian literature detailed studies devoted to treatment outcomes of patients who underwent surgical treatment for metastatic lesions of the spine, which emphasizes the relevance of this work.

Material and Methods

A total of 56 patients (26 males and 30 females) with symptomatic tumors of the spine underwent surgical treatment at the Burdenko Neurosurgical Institute from January, 2002 to August, 2014. Of them, 26 patients underwent surgery during 2002—2009, and 30 patients underwent surgery during 2009—2014. The mean age of patients at the time of surgery was 57.4 years (range from 16 to 81 years). We established the presence of a metastatic tumor in the spine as the main criterion for patient selection, while patients with primary tumors of the spine, neurogenic tumors, and tumors of paravertebral soft tissues and adjacent organs, which infiltrated the vertebrae, were not included in the study. Data on the primary tumor foci are presented in **Table 1**.

Data analysis of histological studies of a primary tumor focus indicated the tumor to be a kidney cancer metastasis in 30.3% of cases; plasmacytoma was a primary disease in 23.1% of cases, and the primary tumor site was not identified during cancer screening in 10.5% of cases. Tumors of different histological nature, i.e., melanoma, thymoma, as well as metastases of tumors of the gastrointestinal tract, uterus, ovary, lung, prostate, pancreas, and the thyroid gland occurred in single cases (on average, 3.5% of cases; range 1.8—7.14 %). Three out of 56 patients had spinal surgery in the history; the other 53 were surgically naïve patients.

On admission, patients presented with complaints typical of compression syndrome (**Table 2**). Thus, according to our data, the main disease manifestations in the case of a metastatic spinal lesion at the stage of reference to a neurosurgeon are the pain syndrome in the back or in a limb and motor deficits.

It is of utmost importance that 21.4% of patients were disabled and required medical assistance and/or nursing care. The degree of neurological deficits in these patients was evaluated using the Frankel scale (**Table 3**). Patients admitted to the hospital underwent neurological examination that revealed a range of clinical symptoms (**Table 4**).

Distribution of patients with respect to the localization of metastatic tumors in the study population is presented in **Table 5**.

Table 1. **Primary tumor location in patients with metastases in the spine (*n*=56)**

Primary tumor site	Patients	
	number of patients	%
Lung	4	7,1
Kidney	17	30,3
Melanoma	3	5,3
Multiple myeloma	13	23,1
Gastrointestinal tract	3	5,3
Not identified	6	10,5
Other	10	17,5

Surgical technique

In the study, main indications for surgical treatment were as follows:

(1)Pain syndrome:

— with no response to conventional technologies;

— caused by local compression of neural structures;

— caused by spinal deformity on the background of a pathological fracture;

— spinal instability due to a pathological fracture of the vertebral body followed by compression of neural structures by a tumor in the spinal canal or outside of it.

The study did not include patients with severe kyphosis or scoliosis which were caused by pathological process and required orthopedic correction.

The objective of the surgery was either to eliminate or prevent compression of the spinal cord and its roots, and if necessary, to achieve stability of vertebral segments.

On admission to the hospital or at the stage of medical consultation, all patients were assessed using a range of prognostic scales (the Tomita, Takuhashi, Bauer, and Van der Linden scales) aimed at reasonable approach in predicting the mean survival time for each particular patient. The neurological status was determined on the Frankel scale, the performance status was evaluated on the Karnofsky scale, and the intensity of pain was assessed on the VAS pain scale.

Surgical treatment was planned using the WBB[1] and SINS[2] scales and was based on the data of neuroimaging techniques, namely magnetic resonance imaging (MRI), spiral computed tomography (spiral CT), and functional spondylograms.

The EORTC QLQ-C30 scale (version 3.0) was used as a tool for assessing the quality of life. The questionnaire of this scale is adapted for patients with cancer and is highly sensitive to the specific symptoms [14, 15]. This fact enabled assessing the severity of symptoms related to the pathology of the spine and separating them from

[1]WBB is a scale for staging procedure and assessment of extent of tumor spread in a vertebra. The scale is titled by the first letters of the names of the authors: J. Weinstein, S. Boriani, and R. Biagini (Primary bone tumors of the spine. Terminology and surgical staging. Spine (Phila Pa 1976). 1997;22(9):1036-1044).

[2]SINS (Spinal Instability Neoplastic Score) is a scale for assessing the degree of spinal instability and for planning the size of the stabilizing construction (Spinal instability neoplastic score: an analysis of reliability and validity from the spine oncology study group. Journal of Clinical Oncology. 2011;29(22):3072-3077).

Table 2. **Main clinical signs (complaints) of patients with metastases in the spine at admission (*n*=56)**

Clinical sign (complaint)	Incidence rate, %
Back pain	80.0
Limb pain	20.0
Limb weakness	37.0
Pelvic organ dysfunction	26.8

Table 3. **Assessment of the neurological disorders on the Frankel scale in patients prior to surgery**

Grade according to the scale	Neurological disorder	Patients (*n*=56)	
		number of patients	%
A	Paraplegia	7	12,50
B	Deep paraparesis without sensory disturbances or with partial sensory block	6	10,70
C	Significant decrease in muscle tone	10	17,85
D	Slight decrease in muscle tone	11	19,60
E	Normal muscle tone	22	39,00

Table 4. **The incidence rate of symptoms detected during neurological examination of patients on admission**

Symptom	Patients, *n*=56	
	number of patients	%
Local pain in the spine	54	96.4
Radicular syndrome	23	41.0
Monoparesis	7	12.5
Local pain, paraparesis, pelvic organ dysfunction	11	19.6
Pelvic organ dysfunction	13	23.2

Table 5. **Localization of metastatic tumors in the study population**

Part of the spine	Patients, *n*=56	
	number of patients	%
Cervical spine	9	16.07
Thoracic spine	22	39.28
Lumbosacral spine	21	37.50
Sacral spine	4	7.14

those of the underlying disease. The EORTC QLQ-C30 scale enables estimating social integration of patients, as well as significant aspects such as the physical health, emotional state, and the social status of a patient on the background of the disease. The questionnaire includes 30 items each with 4 possible answers. The answers are subsequently interpreted using a special table for determining the level of the principal criterion. The questionnaire includes a total of 7 criteria: physical health, emotional state, performance, cognitive function, financial issues, general health, and pain syndrome. The level of each particular criterion is measured in percentage terms [16]. Our patients completed the EORTC QLQ-C30 questionnaire before surgery and were surveyed during a year (at 1, 3, 6, and 12 months) after surgery or until death.

Table 6. **Types of surgical interventions**

Type of surgical intervention	Number of patients
Direct spinal angiography	4
Transcutaneous biopsy under CT control	4
Two-stage surgery*	56
Stabilization of spinal segments	1
Transcutaneous biopsy + vertebroplasty	2
Open biopsy + vertebroplasty	1
Surgical revision	4 (7 surgeries)

Footnote. * — stage I involved direct spinal angiography followed by either embolization using the adhesive compounds or occlusion using microcoils of afferent vessels feeding the tumor for reducing the volume of intraoperative blood loss; stage II involved decompression and stabilization of the spine.

Table 7. **Localization of metastatic lesions in the study population (*n*=56)**

Part of the spine	Incidence rate, %
Cervical spine	15.6
Thoracic spine	37.5
Lumbar spine	37.5
Sacral spine	9.4

Table 8. **Distribution of patients with regard to the number of spinal segments involved in the pathological process (*n*=56)**

Number of segments	Incidence rate, %
1	60.7
2	19.6
3 and more	10.7
More than 3 in different parts of the spine	9.0

Although the pain was assessed on the QLQ-C30 scale at various stages, we additionally controlled its intensity on the VAS pain scale before and after surgery.

Contrast-enhanced spiral CT and MRI were performed before and after surgery to control the extent of decompression of neural structures.

Results

Average length of hospital stay was 16.8 days (from 4 to 84 days). In the study, 56 patients underwent 82 surgical interventions (**Table 6**). It is significant to note that one patient was reoperated two years after the first surgery. In this case, the outcome was assessed after the second surgery without regard to the previous condition.

In our study, patients more often suffered a metastatic lesion of the lumbar and thoracic spine (**Table 7**). Analysis of the data on the number of vertebral segments involved in the pathological process (**Table 8**) reveals that only one vertebral segment was involved in most cases. In our study population, data on the parts of the spine subjected to surgical intervention is presented in **Table 9**.

Prediction of survival of patients according to the Takuhashi, Tomita, Bauer, and Van der Linden scales is presented in **Table 10**.

Data analysis of surgical approaches used (**Table 11**) revealed that the isolated posterior approach was performed in most cases. Importantly, two-stage surgery was performed in 16% of cases.

Forty-free patients underwent stabilization of spinal segments during surgeries involving the cervical (100% of

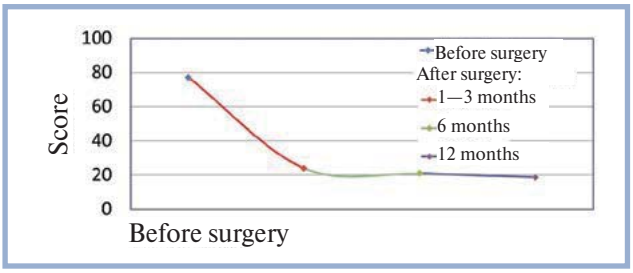

Fig. 1. **The pain syndrome dynamics according to the QLQ-C30 scale during 12 months of follow-up.**



Fig. 3. **T2-weighted MRI of the thoracic spine, sagittal view, signs of loss of the T5, T6 vertebral body height, myelopathy at the T5, T6 level.**

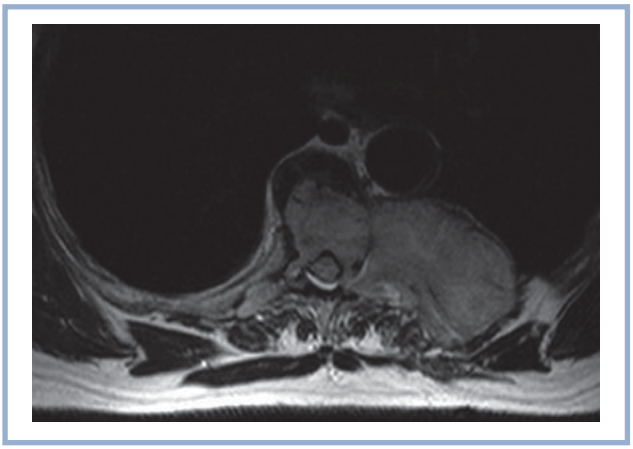

Fig. 4. **T2-weighted MRI of the thoracic spine, horizontal view, signs of a tumor of the T5, T6 vertebral bodies and of the 6th rib on the left side.**

Table 9. **Localization of surgical field (*n*=56)**

Surgical field	Incidence rate	
	number of patients	%
Craniovertebral junction	6	10,70
Spine:		
Cervical spine	3	5,46
Thoracic spine	22	39,20
Lumbar spine	21	37,50
Sacral spine	4	7,14

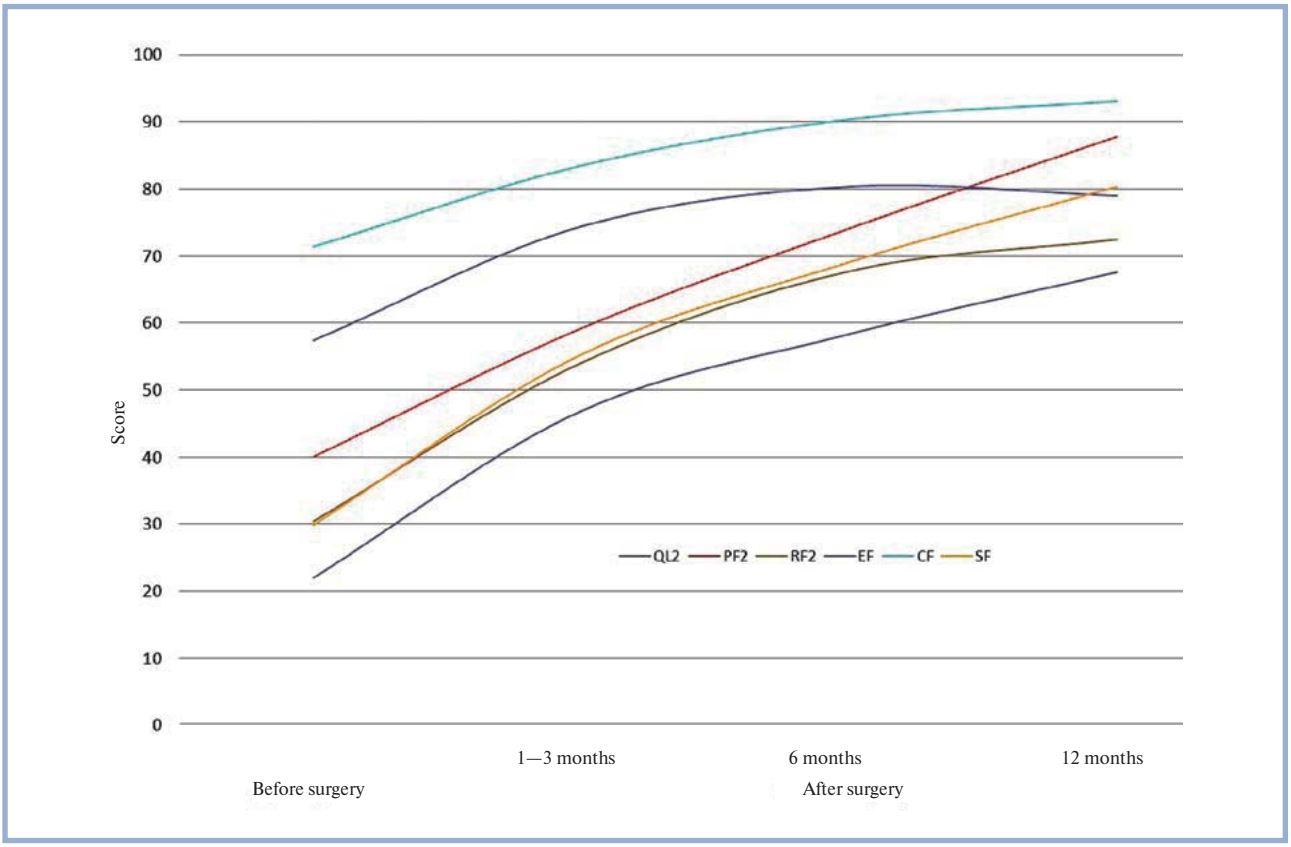

Fig. 2. **The quality of life dynamics in patients according to the QLQ-C30 scale during 12 months of follow-up.**

Table 10. **Assessment of patients on the Takuhashi, Tomita, Bauer, and Van der Linden scales predicting survival in patients (*n*=56)**

Score	Patients	
	number of patients	%
Takuhashi scale		
Less than 8	23	41.07
9—11	26	46.43
12—15	7	12.50
Tomita scale		
2—3 (local control of the tumor)	22	39.28
4—5 (short-term local control of the tumor)	19	33.92
6—7 (short-term effect)	15	26.80
Bauer scale		
0—1	12	21.42
2 (short-term effect)	13	23.23
3—4 (short-term relapse-free period)	31	55.35
Van der Linden scale		
0—3 (Group A)	53	94.60
4—5 (Group B)	2	3.70
6 (Group C)	1	1.70

Table 11. **Surgical approaches used for surgical decompression (*n*=56)**

Surgical approach	Incidence rate	
	number of patients	%
Isolated posterior (laminectomy)	45	80.3
Anterior/anterolateral (corpectomy)	2	3.7
Single-stage combined (spondylectomy)	9	16.0

Table 12. **The dynamics of neurological symptoms on the Frankel, Karnofsky, and VAS scales (*n*=56)**

Grade/score	Before surgery		After surgery	
	number of patients	%	number of patients	%
		Frankel scale		
A	7	12.50	6	10.7
B	6	10.70	6	10.7
C	10	17.85	7	12.5
D	10	17.85	13	23.7
E	23	41.00	24	42.4
		Karnofsky scale		
90	1	1.76	5	9.00
80	5	9.00	14	25.00
70	40	71.40	26	46.40
60	6	10.70	4	7.14
50	4	7.14	4	7.14
<50	0	0.00	3	5.32
		VAS scale		
1—5	8	14.1	51	91.07
5—10	48	85.9	5	8.90

cases), lumbar (85.7%), and thoracic (77.2%) spine. No stabilization was performed in the surgical treatment for sacral tumors.

The dynamics of neurological symptoms according to the Frankel, Karnofsky, and VAS scales is presented in **Table 12**.

Monitoring of surgical treatment duration revealed that surgeries lasted from 30 to 660 min (275 min on average). The volume of blood loss in the study population ranged from 50 mL to 17 L (median volume of 2182 mL). Thirty-one patient required transfusion of blood components, and 8 patients needed their own erythrocyte reinfusion. In our view, it is of utmost importance that 83.3% of patients who underwent occlusion or embolization of afferent vessels during the first stage of surgical intervention also required transfusion of blood components during the surgery. The study revealed that the volume of intraoperative blood loss did not depend on the type of surgical approach.

The mean score of pain intensity according to the VAS pain scale was 7.2 before surgery. At discharge, all patients noted an improvement in pain intensity (average score of 2.7); preoperative score completely decreased in 6 patients. Then, the pain intensity was evaluated using the QLQ-C30 scale during follow-up **(Fig. 1)**.

When assessing neurological status on the Frankel scale after surgery, only 10 patients reported clinical progress. The status of some patients changed on the Frankel scale: 1 patient upgraded from A to B, 2 upgraded from B to C, 4 upgraded from C to D, and 3 upgraded from C to E. Meanwhile, neurological deficit progressed in 5 patients. In addition, 1 patient downgraded from C to B, from D to C, and from E to D in one case each, and 2 patients downgraded from E to C. However, compared to the preoperative period, we observed a significant increase in the number of patients in group D (23% vs. preoperative 17.85%) on the background of a decreased number of patients in group C (17% before surgery vs. 12% after surgery).

None of 13 patients had the pelvic organ function restored during follow-up. Meanwhile, on the basis of the results of the EORTC QLQ-C30 questionnaire, we achieved a clear positive dynamics of the quality of life for all criteria. The most significant improvement was detected within the first 3 months after surgery. The dynamics of the quality of life on the QLQ-C30 scale during 12 months after surgery is presented in **Fig. 2**.

The most significant improvement was observed during evaluation of social adaptation (an increase of 50.4%), physical health scale (47.8%), global health status (45.7%), and physical functions (42.2%). Cognitive function and emotional state criteria improved by 21.7 and 21.5%, respectively.

By the end of the study, only 13 (23.2%) out of 56 patients underwent control examination; the date of death of 17 (30.4%) patients is known for certain. At the time of writing this article, we have failed to contact 26 (46.4%) patients operated on generally until 2009 (more than 5 years ago) or their relatives. Of these patients, 6 were examined within 1 month, 10 were examined within 3 months, 5 were examined within 6 months, and another 5 were examined within one year after surgery. Out of 25 patients operated on more than 5 years previously, 9 patients survived a period of 12 months after surgery, and 11 patients were alive at the time of writing this article.

Out of 56 patients, 9 (16.1%) were followed up no less than during 1 month, 18 (32.1%) were followed up

Table 13. **The scale of achievement goals (the beginning)**

Check whether the physician and patient discussed the scale in detail	*Yes__ No__*	*Yes__ No__*	*Yes__ No__*	*Yes__ No__*	*Yes__ No__*
Achievement goals; grades	**Goal 1 (w_i=10) Pain intensity reduction (do painkillers are needed or not?)**	**Goal 2 (w_i=9) Pain intensity reduction (according to the QLQ-C30 pain scale)**	**Goal 3 (w_i=8) Clinical effect (dynamics of neurological symptoms)**	**Goal 4 (w_i=5) Function (back pain or lower/ upper limb pain) prevents to care for yourself**	**Goal 5 (w_i=6) Treatment satisfaction**
The worst treatment outcome (−2)	Permanently	>70	Progression of neurological symptoms	Often	Not satisfied
Lesser than expected treatment outcome (−1)	Often	50—70	Neurological symptoms have not changed	Sometimes	Not quite satisfied
Expected treatment outcome (0)	Sometimes	30—50	Reduction in symptoms of nervous tension without sensory, motor, and reflex changes	No, but I try to be careful when moving	Satisfied
Greater than expected treatment outcome (+1)	No	Up to 30	Partial regression of neurological symptoms in the sensory, motor, and reflex domains	No, I often forget about caution	The effect of the treatment exceeded my expectations
Maximal successful treatment outcome (+2)	I do not remember when I last bought painkillers	0	Complete regression of neurological symptoms	No, and I forgot about the disease	I recovered

Achievement goals; grades	**Goal 6 (w_i=2)** Disability	**Goal 7 (w_i=4)** Functional activities at work	**Goal 8 (w_i=3)** Functional activities at home	**Goal 9 (w_i=7)** Period of temporary disability	
				vertebroplasty, days	tumor resection and fixation, months
The worst treatment outcome (−2)	I do not work, since I am disabled	I am looking for another job due to the forced decrease in motor performance	I cannot do without assistance my daily domestic tasks	<90	<6
Lower than expected treatment outcome (−1)	I am disabled with rights to work	I became less active; I try to limit physical activities at work (no lifting weights, to sit longer, etc.)	I perform limited domestic tasks, since some movements cause back pain or lower limb pain	<30	<5
Expected treatment outcome (0)	I returned to my previous job with temporarily sheltered employment	I am doing the previous scope of work (the same as before the illness)	I perform domestic tasks without assistance	<21	<4
Greater than expected treatment outcome (+1)	I returned to my previous job and hold my previous position	I started to work more intensive than prior to illness	I perform domestic tasks and work in the garden without restrictions	<14	<3
Maximal successful treatment outcome (+2)	I move without fear, lift weights, and perform any task	The surgery does not affect my motor activities at work	I forgot about the disease; I engage in sports activities	<3	<1

during 3 months, 7 (12.5%) were followed up within 6 months, and 19 (33.9%) were followed up during 1 year. Three (5.4%) operated patients did not survive a month after surgery and died from complications in the immediate postoperative period.

Among the complications that caused death, the blockage of the pulmonary artery branches (pulmonary embolism) occurred in 100% of cases and caused the development of sepsis, multiple organ failure, and death of patients on the 14th, 25th, and 8th day after surgery. Only 1 patient survived massive pulmonary embolism, which developed due to phlebothrombosis of the iliac vein and the inferior vena cava, and after sepsis caused by suppuration of a surgical wound, which leaved open for 39 days. A total of 6 cases of superficial surgical site infection were observed, including the aforementioned clinical case. In 5 patients, the existing serous cavity in soft tissues was suppurated on the background of superficial wound infection. Primary deep infection followed by necrosis of wound edges occurred in 1 patient after a multi-stage surgery and massive blood loss (up to 17 L).

The average follow-up was approximately 6 months (range from 0.25 to 48 months).

Discussion

The development of medical technologies contributes to significant progress in the treatment of cancer. The life expectancy of the population increases; doctors increasingly diagnose bone metastases, particularly in the spine. In this regard, one of the major problems in spinal surgery is the selection of patients with metastatic lesions of the spine for whom surgical treatment would be reasonable. When choosing the optimal therapeutic approach, doctors should assess now several variables: potential life expectancy; study objectives of the estimated surgery, its risks, and expected effectiveness.

Undoubtedly, it is extremely important to assess the effectiveness of alternative therapy (chemotherapy and radiosurgery). It should be noted that surgical treatment being compared to radiosurgery and chemotherapy was not an objective of the study, although it is extremely important. In 2004, P. Klimo et al. [1] conducted a meta-analysis that showed surgical treatment to enable faster decrease in pain intensity compared to radiosurgery. Then, the combination of surgery and radiotherapy was recognized to be even more effective.

According to our point of view, special attention should be given to the target setting approach for managing patients with this pathology. The range of targets is currently being developed to enable assessing the quality of treatment for patients with metastatic spinal lesions that is based on the assessment of goal achievement (**Table 13**).

A clinical case of the use of target setting in the treatment of a female patient with persistent spine cancer is presented below.

Five years before her admission, conventional X-ray revealed a tumor that involved the costovertebral angle and the 6th rib on the left side. The tumor was verified as plasmacytoma and resected. During the following 4.5 years, the patient felt well. However, 6 months prior to admission, the patient reported acute pain in the thoracic spine and gait disturbance after a fall from her own height. The patient gradually felt difficulty when walking and urinating. Contrast-enhanced MRI of the cervical and thoracic spine revealed a tumor of the 5th and 6th ribs that infiltrated the T5 and T6 vertebral bodies and spread into the spinal canal, the collapse of the T5 and T6 vertebral bodies, increasing kyphosis, and signs of spinal cord compression **(Figs. 3 and 4)**. The patient started to receive combination chemotherapy and completed two courses prior to admission.

When examined, the patient showed symmetrical spastic lower limb paraparesis (score of 2 or 3; grade C according to the Frankel scale) and incomplete

Table 14. **Results of the survey according to the QLQ-C30 scale before and after surgery, %**

Index according to the scale		Before surgery	After surgery
item	abbreviation		
Global health status	QL2	83	100
Physical health scale	PF2	93	93
Physical functions	RF2	100	100
Emotional state	EF	100	100
Cognitive function	CF	83	100
Social adaptation	SF	100	100
Symptoms	NV		
Fatigue	FA	22	0
Nausea and vomiting	NV	0	0
Pain	PA	70	0
Respiratory impairment	DY	0	0
Insomnia	SL	0	0
Lack of appetite	AP	0	0
Constipation	CO	33	0
Diarrhea	DI	33	0
Financial issues	FI	0	0

urinary retention as the pelvic organ dysfunction. The patient could not stand even with assistance; her muscle tone in the lower limbs was increased and conductive sensory disturbances from the T5 level on both sides were detected.

General oncologist, chemotherapist, radiologist, and neurosurgeon discussed the clinical case. Given the increasing neurological deficit, immediate surgery was indicated. However, given the diagnosis (heavy chain disease, the tumor of the T5 vertebral body, state after partial resection of the tumor), no radical surgery was planned. It was decided to modify chemotherapy and radiation therapy of the tumor spread area, to resect the T5 and T6 vertebral bodies, and to perform interbody stabilization at the T4—T7 level using a telescopic vertebral prosthesis and a side plate for decompressing the spinal cord and preventing the development of spinal deformity.

When discussing the treatment schedule with the patient, we found out that the target of the treatment was to restore the function of the lower extremities and to decrease the amount of painkillers which the patient was taking. She was aware that the purpose of the surgery was the spinal cord decompression and total tumor resection was not due to the absence of the growth dynamics after radiotherapy.

When assessing the state of the patient, we observed the severity of pain on the VAS pain scale corresponding to the score of 7 for the back pain and to the score of 6 for the lower leg pain. The results of survey according to the QLQ-C30 scale are presented in **Table 14**. The WBB and SINS scales were used for planning the surgical intervention. The score on the WBB (A, B, C, and D zones, 1—4 sectors; C and B zones, 1—8 sectors) and on the SINS scales was 12 in each case, which corresponds to severe spinal instability and deformity that require correction and stabilization of the supporting anterior column.

Given the fact that the tumor spread mainly in the area of vertebral bodies and compressed the spinal cord anteriorly, we chose the anterolateral approach to resect the tumor. Using transthoracic access with partial resection of the 5th and 6th ribs, we removed the T5—T6 vertebral bodies via curettage and hi-speed drill under the control of intraoperative CT and navigation system. After the spinal cord decompression, stabilization of the supporting anterior column was performed in the spinal canal using a telescopic vertebral prosthesis. The T4—T7 vertebral bodies were fixed using a plate and transcortical screws. The volume of blood loss did not exceed 700 mL. According to the data of neurophysiological intraoperative monitoring, no hemodynamic changes and a decrease in potentials were observed during surgery.

In the early postoperative period, the patient reported a significant improvement in her state: the pain regressed on the 2nd day, following which the patient was activated, became confident to stand on her own feet with assistance, and her normal urination recovered on the 10th day (residual urine volume was less than 100 mL). According

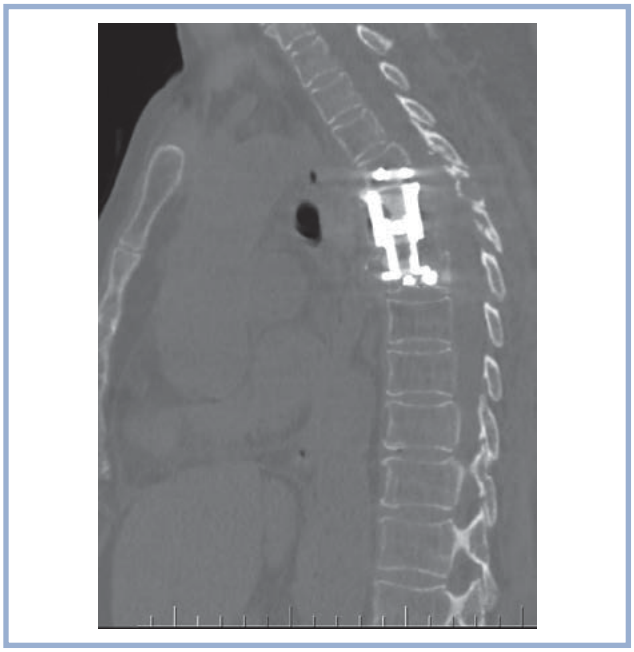

Fig. 5. **Spiral CT of the thoracic spine, sagittal view.**
View of a stabilizing construction. Condition of the patient after decompression and stabilization at the T4—T6 level.

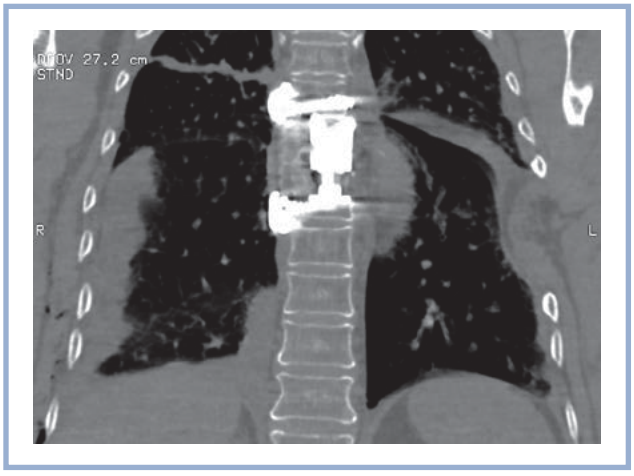

Fig. 6. **Spiral CT of the thoracic spine. Frontal view.**

to the control spiral CT of the cervical and thoracic spine, surgical complications were absent and the stabilizing construction was satisfactorily positioned **(Figs. 5, 6)**. The patient's condition improved at discharge on the 16th day after surgery.

On the whole, we achieved good treatment outcome for a given patient according to all scales (survey results according to the QLQ-C30 scale are presented in **Table 14**). Treatment outcome was also assessed using the aforementioned achievement goal scale (see **Table 13**). The patient filled in the table after surgery (anterior decompression and corporectomy of the T5 and T6 vertebrae). It turned out that we achieved the initial goal,

namely, the amount of painkillers was significantly reduced and the pain that the patient suffered before the surgery regressed completely **(see Table 13**; goals 1 and 2). With regard to restoring the lost function of limbs (goal 3), we also achieved improvements, i.e. function deficits partially regressed and leg muscle strength increased. Subjective evaluation was also high in regard to treatment satisfaction (goal 5). The patient settled in quite easily due to pain regression and due to recovered lost movements in her legs (goal 4).

We believe that studies of treatment outcomes of patients with metastatic spinal lesions must be sustained in perpetuity within the framework of the portal version of the Russian spine registry (http://www.itlaboratory.ru). Despite the organizational difficulties in this process concerning the need to give this work additional time, we consider it advisable to continue to cooperate with the N.N. Blokhin Russian Cancer Research Center.

Conclusion

Surgical treatment has a positive effect on the quality of life in patients with metastases in the spine, but is not of primary importance in terms of their survival. Therefore, firstly, the decision on the choice of surgical treatment for metastatic lesions of the spine should be based on a balanced assessment of its risks and potential benefits, as well as on a comparative assessment of the effectiveness of alternative treatment technologies (chemotherapy, radiosurgery, and their combinations); secondly, discussions on indications and usefulness of surgical treatment for patients with metastatic lesions of the spine should involve the patient (his relatives or his trusted persons), as well as the oncologist, radiologist, neurosurgeon, and chemotherapist.

On the basis of the analysis of multi-criteria assessment scales (EORTC QLQ-C30 and QLQ-C30), the results of this study suggest that surgical treatment enabled reducing the pain intensity (according to the VAS pain scale) and improving the quality of life of patients with metastatic lesions of the spine. In order to improve our research and receive a large amount of objective data on patients of this category, it is advisable to add data on the course of treatment and its outcomes in the prospective spine registry portal.

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Commentary

In the article, the authors summarize their experience in surgical treatment of patients with metastatic tumors of the spine. The authors give reasons for surgical indications and for the extent of the surgery. Details on patients' pre- and postoperative status were given; methodologies and outcomes of surgical interventions were described. The proposed scale of goal achievement used for assessing treatment outcomes requires special attention.

In the article, the authors deeply analyzed oncological and functional outcomes of surgical treatment of severe group of patients with metastatic tumors of the spine; conclusions were drawn up and future prospects were indicated.

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