THE USE OF TRANSFORAMINAL EPIDURAL BLOCK IN PATIENTS WITH HERNIATED DISCS AND RADICULAR PAIN

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Objective. To study the efficacy and safety of transforaminal epidural block (TEB) in patients with herniated intervertebral discs, as well as to compare the results of their treatment with those achieved in patients who were treated with other methods.

Material and Methods. The results of treatment of 248 patients with herniated intervertebral discs and persistent radicular pain syndrome, who had indications for surgical treatment, were studied. In 70 cases, the TEB was performed, and in case of its low efficacy (less than 50 % reduction in pain severity), surgical intervention was suggested. In 178 cases, surgical treatment was performed — microsurgical or endoscopic discectomy. The state of patients was followed-up during two years using VAS, Oswestry questionnaire and MRC scale for motor dysfunction in the limb.

Results. After 1 month, a decrease in the intensity of radicular pain (by 50 % or more) was determined in the TEB group with a lower frequency (84.3 %) than in the surgical treatment group (93.8 %), without a statistically significant difference ($p = 0.526$). At the same time, a stable reduction in radicular pain (by 50 % or more) without the need for surgical treatment was achieved in 62.9 % of patients in the TEB group. Also, there was not significant difference in VAS score for local low back pain ($p = 0.179$) and ODI score ($p = 0.348$) between groups. After 24 months, the benefits of functional outcomes in the TEB group as compared with the surgical treatment group were confirmed by median ODI (4 [0; 8] vs 12 [4; 20], respectively) and median VAS for low back pain (0 [0; 1] vs 1 [0; 3], respectively), $p < 0.001$. A significant (50 % or more) decrease in VAS score for radicular pain was achieved in all patients of the TEB group, while in the surgical treatment group — in 88.8 % ($p > 0.05$). In the TEB group, a stable analgesic effect without subsequent surgical intervention was achieved in 42 (60.0 %) patients, and the number of repeated surgical interventions performed for various reasons was significantly lower ($p = 0.001$), with a comparable incidence of disc herniation recurrence among operated patients who required repeated surgical treatment ($p > 0.05$).

Conclusion. The use of transforaminal epidural block (TEB) in the treatment of patients with herniated intervertebral discs at the lumbar level and persistent radicular pain makes it possible to avoid surgical treatment in 62.9 % of patients in the short term, and in 60.0 % during two year follow-up after the procedure, while maintaining a high quality of life.

Key Words: transforaminal epidural block, selective nerve root block, disc herniation, radicular pain, radiculopathy, diagnostic block.

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An intermittent pain in the lumbosacral spine occurs in 60–80 % of adults [1]. In the United States, lumbar pain ranks fifth in the frequency of requests for medical care and requires annual health care expenditures in the amount of 30 to 50 billion dollars [2].

Radicular pain is an essential subgroup among patients with degenerative disc diseases [3, 4]. Its incidence ranges from 12.2 to 43.0 % in various age groups [5], and the annual population-based incidence is from 1.0 to 5.0 % [6]. The modern understanding of the radiculopathy associated with herniated intervertebral discs as a complex issue includes the interaction of inflammatory, immunological, and compression factors [7–10].

Most of the patients manage to stop the pain syndrome using various conservative treatment methods and avoid invasive procedures [11–14].

Transforaminal epidural block (TEB) is a minimally invasive technique used to relieve radiculopathy quickly. The targeted delivery of drugs into the pathological area effectively relieves the pain syndrome in some patients. It is a highly safe procedure and can also have diagnostic and prognostic value, improving the outcomes of subsequent surgery [15, 16].

Modern national guidelines for the management of patients with herniated intervertebral discs of the lumbar spine do not provide clear regulations for the use of this technique and do not accurately define its place in the existing algorithm. Therefore, many neurosurgeons

do not resort to the widespread use of TEB in practice.

The objective is to study the efficacy and safety of TEB in patients with herniated intervertebral discs, as well as to compare the results of their treatment with those achieved in patients who were treated with other methods.

Material and Methods

Patients

The retrospective-prospective study involved 248 patients who suffered from one or more herniated discs of the lumbar spine, confirmed by MRI data, as well as persistent radiculopathy, resistant to ongoing drug therapy with the use of non-steroidal anti-inflammatory drugs for at least four weeks from the moment of its development, or intolerable pain. Among patients with hernias at several levels, only one level was symptomatic.

Exclusion criteria:

– acute pelvic organs dysfunction by type of retention or incontinence;

– pronounced weakness in the leg muscles of the corresponding dermatome (plegia or paresis of grades 1-3) according to MRC Weakness Scale;

– previously performed spinal surgery at this or adjacent levels;

– non compressive radiculopathy;

– active bacterial or fungal infection;

– decompensated diabetes mellitus;

– decompensated pathology of the cardiovascular and respiratory systems;

– other degenerative pathology at this level, including multifactorial central canal stenosis, combined foraminal stenosis, spondylolisthesis, or pronounced segmental instability.

The study was performed at three multi-field in-patient care facilities. All procedures were done after the patients signed a voluntary informed consent.

The study group (TEB) included 70 patients with lumbar spine hernias who underwent TEB, and if it was ineffective, surgical treatment was offered. All the studied patients had previously been offered discectomy in other in-patient care facilities.

The comparison group (ST, surgical treatment) included 178 patients who were immediately offered surgical treatment: microdiscectomy (MDE) or endoscopic discectomy (ED).

Magnetic resonance imaging

All patients underwent lumbar magnetic resonance imaging on the Siemens Magnetom Aera 1.5T. The report included the following:

1) T2-weighted images (T2WI) in the sagittal and axial planes;

2) T1-weighted images (T1WI) in the sagittal plane;

3) T2WI FatSat (with fat suppression) in the sagittal and coronal planes;

4) T2-space (Sampling Perfection with Application optimized Contrasts using different flip angle Evolution) in the sagittal plane with a slice thickness of less than 1 mm and with the possibility of three-dimensional reconstruction in any plane for detailed visualization of nerve roots (Fig. 1).

Clinical symptoms were weighed against the images obtained at the level of radiculopathy. All scans were interpreted by an experienced radiologist, who was not aware of the clinical features of patients. A routine postoperative MRI was not performed.

Methods for the performance of TEB

The procedure is performed under local anesthesia to maintain contact with the patient and the possibility of receiving feedback both to confirm the effectiveness of the injection and for timely diagnosis of possible complications.

The patient is laid on the operating table in the prone position and locally treated with antiseptic solutions according to standard surgical guidelines. To determine the paravertebral needle entry point and correctly identify the level of interest, the vertebrae are counted in an anteroposterior view with the help of the Siemens Artis Zee angiographic system (Germany), starting from the sacral spine. To prevent an error, the calculation is performed twice. Then it is necessary to install the surgical C-arm into an anteroposterior view in such a way as to avoid the occurrence of a double contour of the vertebral endplates at the desired level. If the patient has a natural lordosis, for the convenience of displaying the lower lumbar vertebrae, a slight tilt of the upper detector in the cranial direction is required, as a rule.

The entry point on the skin is detected via a sterile radiodense surgical instrument. The upper detector is tilted to the ipsilateral side by 25–30°, until the onset of the Scottie dog radiological sign formed by the pedicle, transverse, articular, and spinous processes. Meanwhile, the entry point is located directly under the projection of the pedicle at the 6 o'clock position level.

After local anesthesia of soft tissues with, for example, 2 % lidocaine solution, an atraumatic needle with a guide (gauge 25-G, length 103/120 mm) is inserted at the entry point and injected a few centimeters deep into the paravertebral muscles. Radiological control is performed to confirm the correct path of the needle. When the needle tip is deflected, it is removed and repositioned.

Then the C-arm is switched to a lateral projection in such a way as to visualize the needle tip and intervertebral foramen. The needle is slowly injected towards the foramen under constant radiological control until it gets in it by a few millimeters. If a patient complains of acute, shooting pain radiating along the nerve, the procedure is interrupted, and the needle tip is raised by 1–2 mm. In an anteroposterior view, the needle should reach a point that is no medial than 5:30 o'clock position on the right and 6:30 o'clock position on the left under the pedicle projection. The optimal trajectory is confirmed by the bull's-eye phenomenon, when the needle tip injected parallel to the course of X-rays is completely overlapped by its mandrel, forming an image similar to the center of the target (Fig. 2a).

After that, the guide is removed, and 0.5 ml of an iodine-containing contrast medium (for example, *Sol. Iopromidum* 300 or 370 mg/ml) is injected under dynamic radiological control. If the needle tip is injected correctly, the contrast agent spreads along the nerve root to the epidural space, which is confirmed by radiological control in the anteroposterior view. There are signs of contrast agent accumulation in the vascular bed during intravascular administration of the agent.

In this case, it is possible to reposition the needle and repeat the introduction of the contrast agent (Fig. 2b).

After excluding intravascular penetration, a solution of a local anesthetic is injected (for example, *Sol. Bupivacainum* 0.25 % – 0.5 ÷ 1.0 ml, *Sol. Ropivocainum* 7.5 mg/ml – 0.5 ÷ 1.0 ml). The effectiveness of the procedure is assessed after 1–2 minutes by reducing the pain intensity while preserving the motor function of the limb. Then 0.5–1.0 ml of a solution of corticosteroid (dexamethasone, betamethasone, or methylprednisolone) is injected.

During the S1 root block, a radiological display of the 1st dorsal sacral foramen is made in a slight oblique projection at 10–15°. The reference point in this case is the upper medial quarter of the foramen. The needle is injected towards the inner contour of the posterior wall of the sacral canal, not reaching it by 1–2 mm.

In central, subarticular, or mixed (central and subarticular) hernia localization, the block is performed at two levels: directly at the level of the hernia and at the level of the exit of the compressed root from the intervertebral foramen.

After the block, patients receive analgesic therapy using only NSAIDs or in combination with anticonvulsants for one week.

Patients are instructed on the need to comply with the orthopedic routine, including restrictions on strenuous exercise, sports, and prolonged sitting positions.

Surgical procedures such as microdiscectomy and endoscopic discectomy were performed in accordance with the standards of the technique [17].

All procedures at the lumbar spine (TEB, microdiscectomy, and endoscopic discectomy) were performed by experienced neurosurgeons with at least 15 years of experience at multi-field inpatient care facilities with specialized neurosurgical units and modern, fully equipped operating rooms.

Follow-up

The patients' condition was evaluated before the procedures and during two years after them.

Neurological status was evaluated before treatment and 1 and 24 months after treatment. The severity of the pain syndrome for local pain (VASl) in the lower back and for root pain (VASr) on a 10-point VAS scale was assessed before treatment and in 1 and 12 months separately. Dynamic control over the pain intensity in the TEB group was performed immediately after the block in both groups within a week and then at 1, 6, 12, and 24 months after treatment.

To evaluate the functional status of patients, the adapted Russian-language Oswestry Low Back Pain Disability Questionnaire (ODI) was used. Patients were questioned before surgical treatment and 1, 12, and 24 months after it.

Statistical analysis

Statistical analysis was performed using Microsoft Excel and the SPSS Statistics software version 23.0 (IBM, USA).

Since the distribution of most quantitative indicators did not correspond to normality (according to the previously conducted analysis of frequency histograms), the median and quartiles were used to describe them. Frequency and proportion (in percentage) were used to describe categorical variables.

The comparison of groups by quantitative variables was performed using the Kruskal – Wallis one-way analysis of variance. This test was also applied to check the homogeneity of the studied groups with nonparametric indicators. The comparison of groups by categorical variables was done using Pearson's chi-squared test or Fisher's exact test. In all cases, two-sided versions of statistical tests were used. The null hypothesis was denied at a significance value of $p < 0.05$. If statistically significant differences were found as a result of group comparison, post hoc pairwise comparisons of quantitative variables were performed using the Mann – Whitney test; in terms of categorical ones, with the help of the Pear-

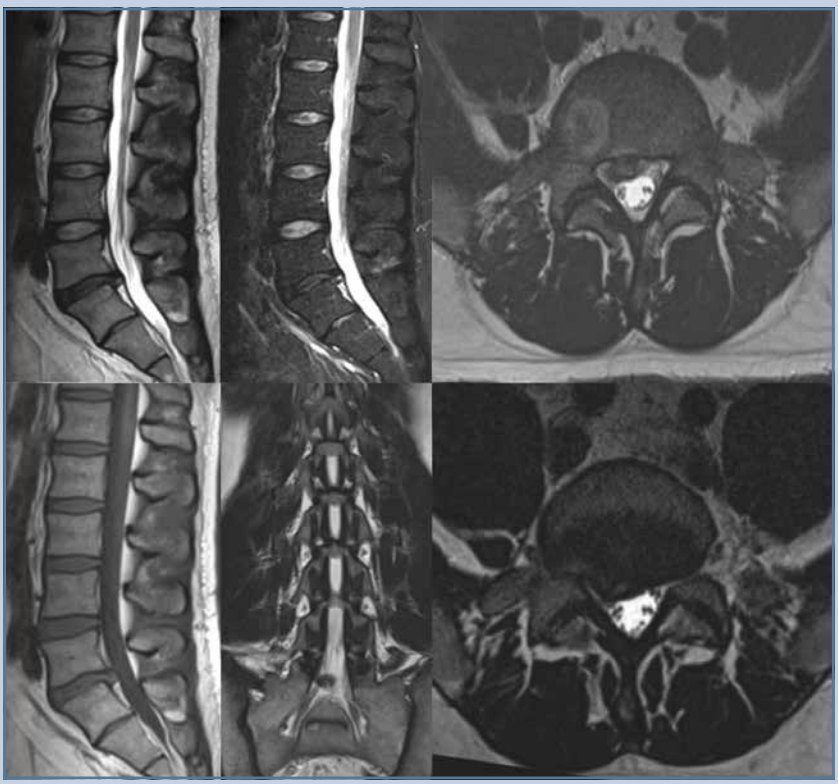

Fig. 1
Standard protocol for lumbar spine examination

son's chi-squared test or Fisher's exact test. In all cases, two-sided versions of statistical tests were used. In post hoc comparisons, the Bonferroni correction was used to correct for multiple comparisons. Modified p (padj) was calculated using the formula padj = p × m, where m is the number of hypotheses to be tested. The null hypothesis was denied at a significance value of padj < 0.05.

Results

There was a statistically significant difference in age (p = 0.016), the number of patients with moderate leg muscle paresis due to a greater proportion of such patients in the TEB group (p = 0.046), and the intensity of local lower back pain (p = 0.002) when initially comparing the groups by demographic and clinical indicators, MRI findings, and pain intensity.

The dynamics of the intensity indicators of VASl and VASr, as well as indicators of ODI and motor disorders in the leg, are presented in Table 1.

Comparison of short-term (one month) outcomes.

When comparing ODI indicators, there was no statistically significant difference between the TEB group (median 12 [4; 20]) and the ST group (median 12 [8; 20]) (p = 0.348).

There were also no statistically significant differences when comparing the indicators of VASl (p = 0.179) and VASr (p = 0.526; Fig. 3).

The comparison of the neurological examination outcomes did not reveal a statistically significant difference in the frequency of paresis regression in the groups (p > 0.05).

During the first month, 17 (24.3 %) patients in the TEB group underwent surgery due to recurrent or residual pain after the block.

Comparison of long-term (after 24 months) outcomes. The functional status of patients was statistically significantly higher in the TEB group than in the ST group: median ODI was 4 [0; 8] and 12 [4; 20], respectively; p < 0.001.

A significant difference between the groups was also observed when comparing the groups of TEB and ST in terms of VASl: 0 [0; 1] and 1 [0; 3], respectively (p < 0.001; Fig. 4), and VASr: 0 [0; 0] and 0 [0; 2], respectively (p < 0.001; Fig. 5).

A significant (by 50 % or more) reduction in the severity of VAS was found in 100.0% of patients in the TEB group, whereas in the ST group, this indicator was 88.8 %.

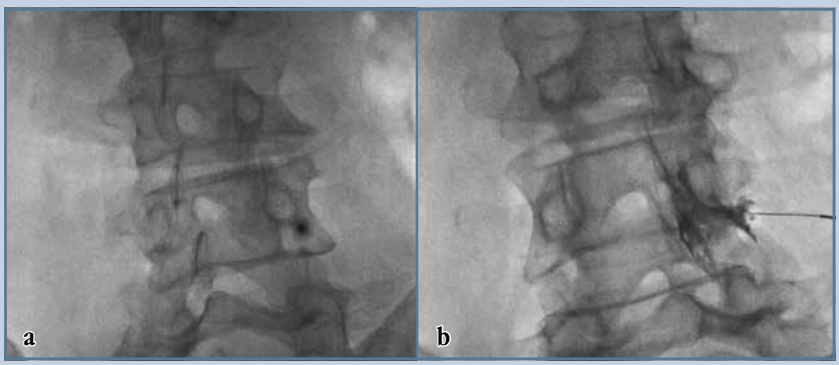

Fig. 2
Scottie dog radiological signs are determined on X-ray images made in a semi-oblique projection. The needle was injected according to the bull's eye technique in the projection under the pedicle of the vertebra **(a)**. After injection, a contrast agent spreads along the root with a transition to the epidural space cranially and caudally in relatively equal amounts according to the 50/50 type **(b)**

The number of patients with radicular pain of varying severity in the TEB group was also statistically significantly lower than in the ST group (p < 0.01; φ^*_{emp} = 4.728).

The chances of radicular pain exceeding 3 points on the VAS in the TEB group were 10 times lower than in the ST group, respectively (CI min = 1.506).

There was no significant difference in the frequency of regression of paresis of the leg muscles in the study groups (p > 0.05).

In 42 (60.0 %) patients in the TEB group, it was possible to achieve a persistent analgesic effect using block without resorting to surgery. Another 3 (4.3 %) patients refused surgical treatment and continued conservative treatment and follow-up with a significant positive effect on dynamics.

Only 25 (35.7 %) patients were initially operated on in the TEB group, and reintervention for recurrence was required in 2 (2.9 %) cases. Meanwhile, in the comparison group, all patients underwent primary surgery. Herewith, reintervention was performed in 15 (8.4 %) patients (Table 2).

Thus, the number of reoperations performed for various reasons was significantly lower in the TEB group (p < 0.001). Similarly, the frequency of recurrence of herniated discs among the operated patients who required reinterventions did not statistically significantly differ (p > 0.05).

There were no complications associated with the block or subsequent surgery in the TEB group. In the ST group there were 2 (1.1 %) cases of dura mater injury among intra- and postoperative complications.

The effectiveness of TEB in herniated lumbar intervertebral discs with intracanal localization (central, paramedian, and subarticular) was significantly lower than in foraminal localization (p < 0.01; φ^*_{emp} = 2.877).

Discussion

From 5 to 20 cases of herniated discs per 1000 adults are diagnosed annually,

most often in men aged 29–49. In 1–3 % of patients, symptomatic hernias of intervertebral lumbar discs are detected. Patients of 25–55 years old have a 95 % chance of disc herniation at the L4–L5 or L5–S1 level [18]. Additionally, a herniated intervertebral disc is the most common reason for the occurrence of radicular pain. Radicular pain is present in most patients suffering from lumbar spine pain [3, 4]. In 6 % of cases, it is the reason for disability, significantly increasing the costs of the healthcare system [19]. Most patients recover with conservative treatment for an average of 8 weeks. In addition, surgical treatment is an effective tool in cases when drug treatment is useless. Social and cultural preferences also define a significant variation in the frequency of surgeries [20]. For example, in the USA or the Netherlands, the frequency of surgeries is quite high. According to Dutch guidelines, if symptoms persist for 6 weeks, surgical treatment should be offered to the patient [21]. Domestic guidelines consider surgery as an option

Table 1

Dynamics of VAS and ODI values and motor disorders in a leg in study groups

Indicators	Transforaminal epidural block		Surgical treatment	
	+	-	+	-
After surgery				
VASl	–	–	–	–
VASr	54 (77.1 %)	16 (22.9 %)	–	–
ODI	–	–	–	–
Paresis	0	28	–	–
One week after				
VASl	–	–	–	–
VASr	48 (68.6 %)	22 (31.4 %)	169 (94.9 %)	9 (5.1 %)
ODI	–	–	–	–
Paresis	–	–	–	–
One month after				
VASl	64 (91.4 %)	6 (8.6%)	149 (83.7 %)	29 (16.3 %)
VASr	59 (84.3 %)*	11 (15.7 %)	167 (93.8 %)	11 (6.2 %)
ODI	67 (95.7 %)	3 (4.3 %)	177 (99.4 %)	1 (0.6 %)
Paresis	17 (60.1 %)	11 (39.9 %)	26 (55.3 %)	21 (44.7 %)
Six months after				
VASl	–	–	–	–
VASr	70 (100.0 %)*	0 (0.0 %)*	159 (89.3 %)*	19 (10.7 %)*
ODI	–	–	–	–
Paresis	–	–	–	–
12 months after				
VASl	62 (88.6 %)*	8 (11.4 %)*	142 (79.8 %)*	36 (20.2 %)*
VASr	69 (98.6 %)*	1 (1.4 %)*	161 (90.4 %)*	17 (9.6 %)*
ODI	–	–	–	–
Paresis	–	–	–	–
24 months after				
VASl	63 (90.0 %)*	7 (10.0 %)*	139 (78.1 %)*	39 (21.9 %)*
VASr	70 (100.0 %)*	0 (0.0 %)*	158 (88.8 %)*	20 (11.2 %)*
ODI	70 (100.0 %)*	0 (0.0 %)*	174 (97.8 %)*	4 (2.2 %)*
Paresis	27 (96.4 %)	1 (3.6 %)	39 (83.0 %)	8 (17.0 %)

VASl – intensity of local pain according to VAS; VASr – the intensity of radicular pain according to VAS.

The "+" columns indicate the number of patients with a decrease in the intensity of pain according to VAS by 50 % or more from the baseline, with any decrease in the ODI value and regression of paresis in the limb at various stages of follow-up.

The "-" columns indicate the number of patients with a decrease in the intensity of pain according to VAS by less than 50 % of the baseline, an ODI value equal to or greater than the baseline, and with no restoration of muscle strength in the limb (paresis) at various stages of follow-up.

A dash in the cells reflects the absence of data for this parameter at the corresponding stage of follow-up.

* Statistically significant differences.

in patients with pain syndrome after 4–12 weeks of ineffective therapy [17].

Currently, a large number of surgical techniques have been developed for herniated discs, which can be divided into three types: microsurgical, microendoscopic, and endoscopic. The vast majority of techniques are focused on the removal of a hernia, with or without magnifying devices and minimally invasive techniques [22]. Nevertheless, despite the exceptional technology of modern spinal surgery and its relatively high efficiency, a significant portion of patients are dissatisfied with the outcomes [23, 24]. This may be largely due to the high number of recurrences and degeneration of adjacent levels after discectomy, the frequency of which varies between 2 and 25 % [25–27]. Thus, it is still relevant to find ways of optimizing and improving the treatment quality of patients with herniated discs, as well as mechanisms for additional selection of patients for surgery.

According to the publications studying the efficiency of TEB [16, 28–30], as well as own positive experience of using this technique, it was decided to conduct this study.

In both groups, the age median was within the borders of the fifth decade of life (TEB: 49.5 [40; 58] years; RH: 43 [37; 55] years), which corresponds to most of the literature data [17].

Thus, when analyzing the treatment outcomes of 2,448 patients, including 1,307 (53.4 %) men and 1,141 (46.6 %) women with herniated intervertebral discs of the lumbar spine, the age median was 43 [35; 55] years [29].

According to Azemi et al. [31], patients with symptomatic herniated discs at the lumbar level were most often found in the age groups of 35–44 (30.9 %) and 45–54 (25.8 %) years.

Additionally, patients with moderate paresis of the leg muscles (40.0 %) were significantly more common initially in the TEB group, compared with ST group (26.4 %). Simultaneously, the intensity of local lower back pain is significantly higher in the ST group (median 7 [4; 9]). Nevertheless, it does not differ in the radicular pain assessment ($p > 0.05$).

To identify the efficacy of TEB, the dynamics of pain intensity indicators after one month are of considerable interest.

Therefore, in the TEB group, a significant reduction (50.0 % or more) in the radiculopathy intensity was detected with a lower incidence (84.3 %) than in the ST group (93.8 %). Nevertheless, there was no statistically significant difference ($p = 0.526$). There were also no significant differences when comparing the local low back pain intensity indicators and ODI indicators after one month.

After one month, 62.9 % of patients in the TEB group had a significant (50.0 % or more) persistent reduction of radiculopathy on the background of the block and without surgical treatment.

The absence of significant differences in the pairwise comparison of the outcomes of the TEB and ST groups after one month probably has two reasons. On the one hand, it is most likely due to the impressive performance indicators of the TEB efficacy. On the other hand, it is associated with a high short-term efficacy of surgical treatment, which provides for a rapid and significant reduction in pain in the vast majority of patients in the comparison group (ST) and in some patients ($n = 17$) with a negligible effect from the block in the TEB group.

After 24 months, the functional outcome was significantly better in the TEB group.

The greatest interest was generated by the treatment outcomes, in particular, the dynamics of pain intensity indicators, after 24 months. The incidence of local lower back pain among operated patients in the TEB group was significantly higher than in those who didn't undergo surgery ($p < 0.05$; $\varphi^*_{emp} = 1.95$). While evaluating the outcomes of the local pain intensity in the lower back, it was noted that in patients in the TEB group, the VAS indicators were significantly lower than in the ST group. This is due to the large number of operated patients in the comparison groups, which may be associated with a more frequent occurrence of the syndrome of an unsuccessfully operated spine as well as with cases of discogenic or joint pain associated with a decreased disc height.

While analyzing the radicular pain intensity after 24 months, statistically significant differences were revealed due to lower VAS indicators and a smaller number of patients with radicular pain in the TEB group.

During the assessment of the neurological status, no significant differences

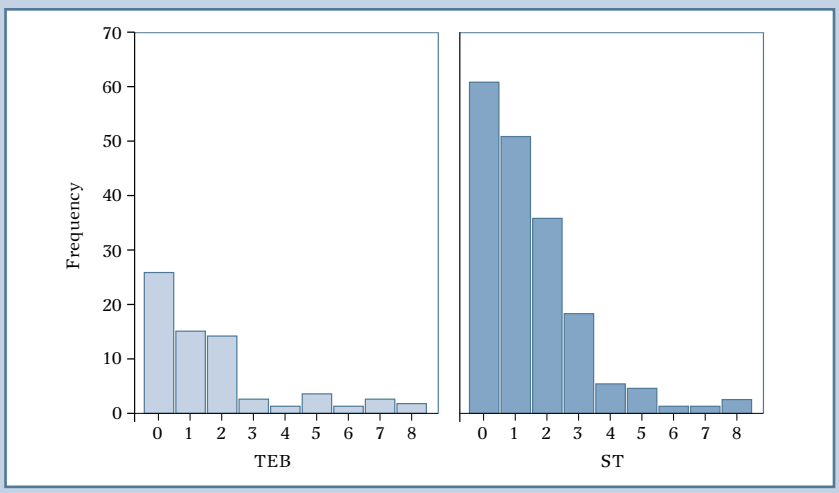

Fig. 3
Pattern of the intensity of radicular pain according to VAS in the studied groups after one month.

were found between groups ($p > 0.05$). 96.4 % of patients in the TEB group and 83.0 % in the ST group had a recovery of strength in the muscles of the lower extremities.

Therefore, 60.0 % of patients in the TEB group had a persistent long-term effect of the block that helps to avoid surgical treatment.

The main point of application of TEB is the rapid and effective relief of the acute stage of the disease. This provides the patient with the opportunity to recover independently in the future against the background of rehabilitation treatment, which consists mainly in correcting behavioral and motor stereotypes and achieving long-term remission without the need for surgical treatment.

There were no cases of intra- or perioperative complications during the block in the TEB group that corresponds to the literature data indicating a small number of complications during such procedures [32].

The obtained outcomes are comparable with the data from other studies of the efficacy of TEB [33–35]. This technique can be regarded as highly effective for the relief of radicular and local pain syndromes in patients with herniated intervertebral discs of the lumbar spine. Meanwhile, the high efficiency and safety of this technique are noted for both short-term and long-term follow-up. In our study, the efficacy of TEB was not associated with baseline clinical and demographic indicators.

Moreover, the efficiency of TEB in herniated lumbar intervertebral discs of intracanal localization (central, paramedian, and subarticular) was significantly lower than in foraminal ones ($p < 0.01$; $\varphi^*_{emp} = 2.877$). Other indicators collected from MRI findings, such as the level and size of the hernia, the degree of compression of the spinal root or the spinal canal, as well as the multilevel nature of the lesion and the presence of sequestrum, did not affect the effectiveness of TEB.

In practice, the use of TEB does not affect the frequency of recurrences requiring reoperation. Nevertheless, it

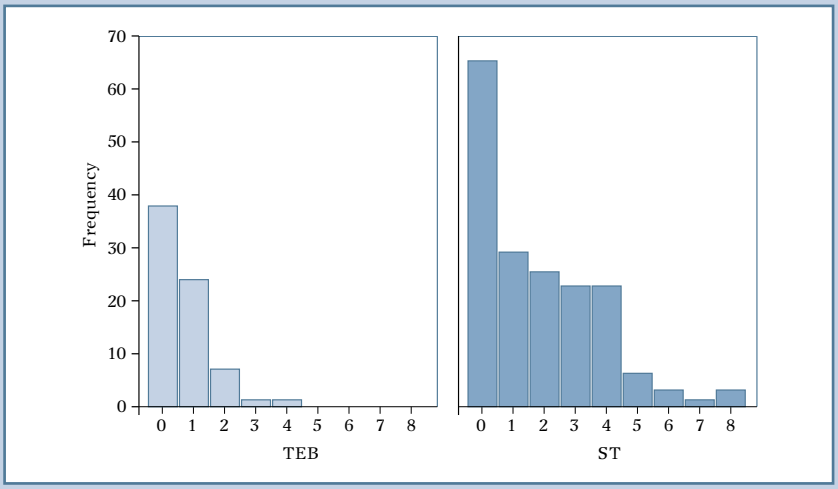

Fig. 4
Pattern of the intensity of local pain according to VAS in the studied groups after 24 months.

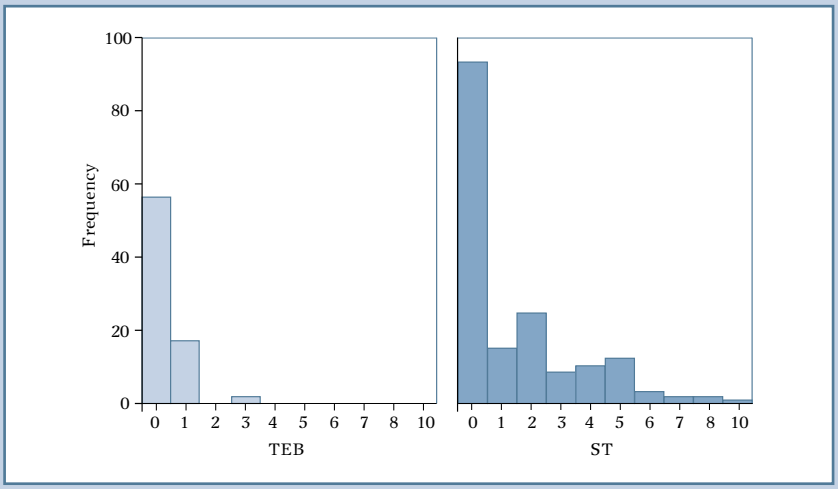

Fig. 5
Pattern of the intensity of radicular pain according to VAS in the studied groups after 24 months.

Table 2
Surgical interventions in the studied groups, n (%)

Interventions	TEB (n = 70)	ST (n = 178)
Primary	25 (35.7)	178 (100.0)
Repeated (recurrence)	2 (2.9)	13 (7.3)
Repeated (other reasons)	0 (0.0)	2 (1.1)
Repeated in total	2 (2.9)	15 (8.4)
Interventions in total	27 (38.6)	193 (108.4)

reduces the total number of necessary both primary and repeated spinal surgery.

Pain relief immediately after the procedure is highly likely to be associated with the injection of a local anesthetic solution. Therefore, 54 (77.1 %) patients in the TEB group had a significant (50.0 % or more) reduction in the radiculopathy intensity, and in 40 of them, the pain syndrome regressed to VAS values not exceeding 3 points. Meanwhile, these data did not correlate either with the long-term positive treatment outcome or with the effectiveness of subsequent surgical interventions, which does not enable us to confirm the prognostic significance of TEB.

Therefore, the use of TEB at the lumbar level verifies the high efficacy and safety of the technique. In this regard, the following algorithm for helping such patients is proposed (Fig. 6).

Conclusion

The use of TEB in the treatment of patients with herniated intervertebral discs at the lumbar level and persistent radiculopathy avoids the need for surgery both in the short term (62.9%) and in the long term (60.0 %), while maintaining a high quality of life.

The outcomes allow us to recommend the inclusion of TEB in the domestic guidelines for the care of patients with herniated intervertebral discs of the lumbar spine.

The study had no sponsors.

The authors declare that they have no conflict of interest.

The study was approved by the local ethical committees of the institutions.

All authors contributed significantly to the research and preparation of the article, read and approved the final version before publication.

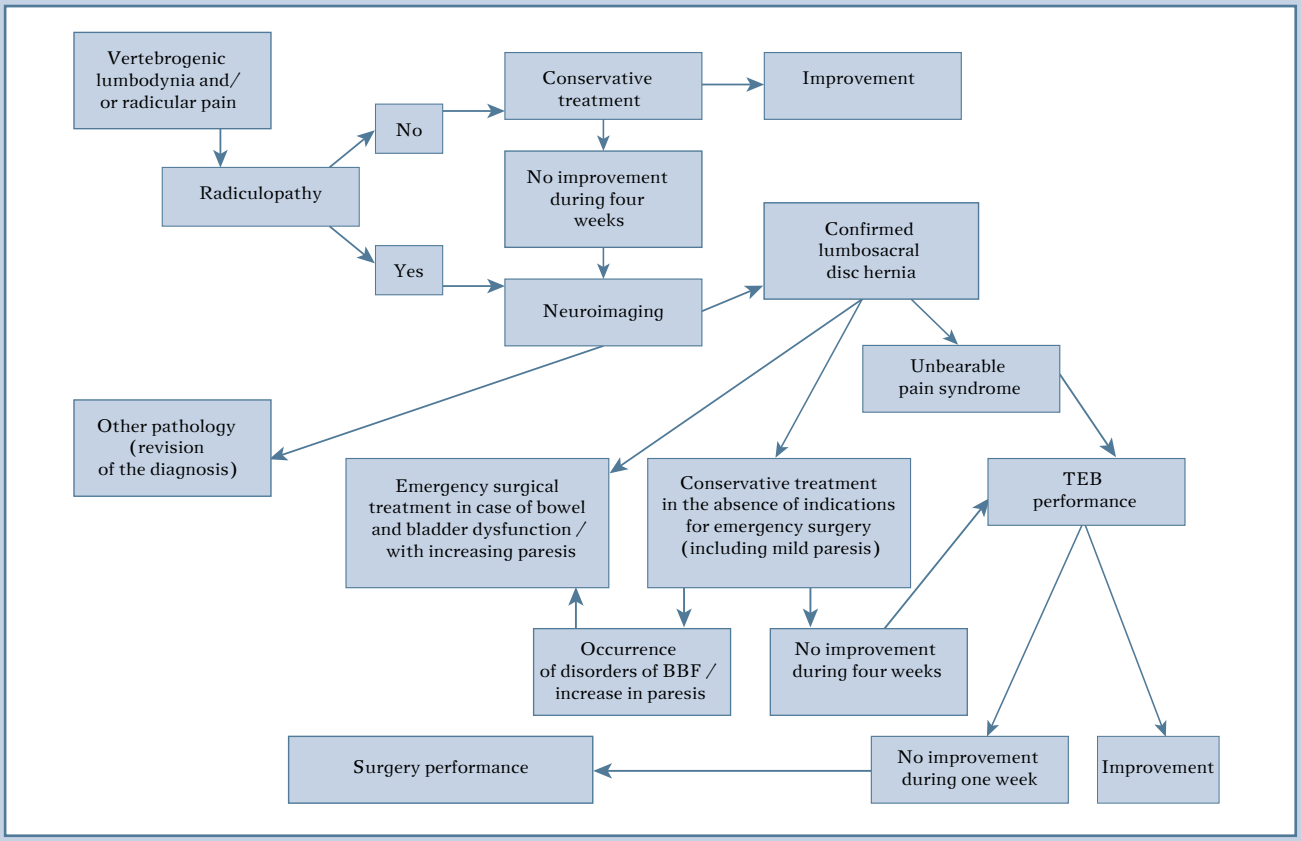

Fig. 6
Algorithm for providing care to patients with herniated intervertebral discs of the lumbar spine: TEB – transforaminal epidural blockade; BBF – bowel and bladder function

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