PERIOPERATIVE MANAGEMENT OF PATIENTS UNDERGOING SPINE SURGERY: A SURVEY OF SPINE SURGEONS AND A NON-SYSTEMATIC REVIEW OF THE LITERATURE

V.B. Lebedev, B.R. Kinzyagulov, D.S. Epifanov, A.A. Zuev
National Medical and Surgical Center n.a. N.I. Pirogov, Moscow, Russia

Objective. To assess trends in the management of patients after surgical treatment for degenerative diseases of the spine and to analyze literature data on perioperative management of this category of patients.
Material and Methods. An anonymous online survey of 55 spine surgeons was conducted on the specifics of management of patients operated on for spinal stenosis and intervertebral disc herniation using microsurgical and endoscopic methods. The results of the survey were analyzed along with relevant literature data to provide a comprehensive understanding of the current practices in this field.
Results. The analysis of questionnaires showed that there are significant differences and contradictions among surgeons regarding the use of antibiotics, restrictions on sitting after surgery, length of hospital stay, and use of a lumbar orthosis. A review of the world and domestic literature revealed a sufficient evidence of some studies to support their use as recommendations, while there is still a lack of evidence for most of the issues raised.
Conclusion. Existing statements and protocols for the treatment of patients undergoing spine surgery need to be improved; randomized studies are required to establish the optimal approach for perioperative management of this group of patients.
Key Words: perioperative management; spine surgery; intervertebral disc herniation; spinal stenosis.
Please cite this paper as: *Lebedev VB, Kinzyagulov BR, Epifanov DS, Zuev AA. Perioperative management of patients undergoing spine surgery: a survey of spine surgeons and a non-systematic review of the literature. Russian Journal of Spine Surgery (Khirurgiya Pozvonochnika). 2024;21(4):56–62. In Russian.*
DOI: http://dx.doi.org/10.14531/ss2024.4.56-62.

Lumbar pain is a great challenge facing today's healthcare system. More than 80 % of people over the age of 18 have experienced lower back pain at least once. Over the past two decades, the number of spine surgeries performed has increased significantly. The surgeries have been optimized, and the amount of equipment used during surgery has increased [1].

However, in modern spine surgery, much less attention is paid to the preoperative preparation of the patient, perioperative management, and postoperative period. The recommendations that patients are given after quite typical surgeries are extremely different. There is no unified opinion among spine surgeons on the volume and duration of antibiotic prophylaxis, the terms and degree of activation of a patient, the duration of inpatient treatment, and the recommendations given to patients at discharge. The proposed techniques for rehabilitation often do not reflect current views on optimizing the recovery process.

The objective is to assess trends in the management of patients after surgical treatment for degenerative disc diseases and to analyze literature data on perioperative management of this category of patients.

Material and Methods

An anonymous online survey of spine surgeons was conducted. The questionnaires were sent to members of the Russian Association of Spine Surgeons (RASS) and physicians who participated in the conference "Degenerative Spinal Canal Stenosis: Solved Problem or the Beginning" held on November 9–10, 2017, at the National Medical and Surgical Centre named after N.I. Pirogov. The respondents were asked to answer a questionnaire on the Google Forms platform. It was necessary to indicate specialization and experience in surgical treatment of spine diseases as general information. The main part of the questionnaire consisted of questions regarding the duration of perioperative antibiotic prophylaxis, the patient's motor activity patterns and restrictions after spine surgery, the duration of brace use and the duration of sitting position restriction, and the restriction of the patient's upright postoperative position. At the end of the survey, respondents reported the mean length of hospital stay and regularly used groups of medications in the postoperative period. The answers were divided according to the type of surgery: microsurgical and endoscopic removal of intervertebral disc herniation at the lumbar spine or decompression and stabilization surgeries for unextended lumbar spinal canal stenosis.

Statistical processing of data was performed using Jamovi software version 2.3.0. The methods of descriptive statistics were used.

The obtained data were compared with literature data from the Medline and the Russian Science Citation Index (RSCI) bibliographic databases, where we selected clinical studies, recommendations, and systematic reviews in English and Russian considering the issues of perioperative management of patients with spinal canal stenosis and intervertebral disc herniation. The following keywords were searched: "spine surgery", "spinal stenosis", "intervertebral disc herniation", "antibiotic prophylaxis", "lumbar orthosis", "length of the hospital stay", and "perioperative management." Five volumes of clinical guidelines, 11 clinical trials, and 4 systematic reviews met the inclusion criteria.

Results

A total of 55 respondents participated in the survey: 47 (85.5 %) neurosurgeons and 8 (14.5 %) orthopedic traumatologists. The majority of respondents (18 persons, 32.7%) had a surgical experience of 10 to 20 years. An equal number of respondents (14 persons in each group, 25.5 %) had more than 20 or less than 5 years of surgical experience; the remaining 9 (16.4 %) physicians had 5 to 10 years of surgical experience.

While answering the question on the antibiotic prophylaxis strategy, the majority of respondents noted that during surgeries for herniation removal (endoscopic – 61.7 %; microsurgeris – 60.0 %), an antibiotic is administered once 30 minutes before surgery. Meanwhile, in decompression and stabilization surgeries, the majority of physicians (56.0 %) continue to use antibiotics a day after surgery. 12.7 % of physicians performing endoscopic removal of intervertebral disc herniation completely refuse antibiotic therapy (Fig. 1).

There are significant differences in the recommendations that are given to patients concerning limitation of sitting position after surgery. Only 29.0 % of responding physicians do not limit the sitting position of patients during stabilization surgeries and microsurgical removal of intervertebral disc herniation; the majority of respondents (61.8 %) recommend excluding this position for two weeks or longer. Meanwhile, 2/3 of the respondents (66.0 %) after endoscopic surgeries do not limit patients or recommend supine-to-sitting position after 2 weeks (Fig. 2).

The similar results with significant differences in recommendations were obtained on the duration of brace use after microsurgery, decompression and stabilization surgery, or endoscopic surgeries. For example, 41.3 % of physicians do not recommend wearing braces after endoscopic removal of intervertebral disc herniation, while 74.1 % of respondents after microsurgery for herniated discs and 67.2 % after decompression and stabilization surgeries prescribe immobilization of the lumbar spine for 2 weeks or longer (Fig. 3).

Significant differences were found when comparing the length of hospital stay after endoscopic surgeries and microsurgeries. Almost 2/3 of the surveyed physicians keep patients after microsurgical herniation removal in the surgical unit for three days and longer, while in the case of endoscopic removal, more than half of the respondents noted that they discharged patients on day 1 or 2 after surgery. Patients' hospital stay after decompression and stabilization surgery was significantly longer: 90.0 % more than three days, 38.0 % more than five days (Fig. 4).

Discussion

One of the most controversial issues in the management of patients after lumbar spine surgery is the restriction of the sitting position. In studies published more than 30 years ago [2–4], it was noted that this position induces a higher load on the lumbar spine compared to the standing position, and thus prolonged sitting should be avoided in daily life and in the postoperative period. Later, Wilke et al. [5] found that sitting and standing have a similar effect on intradiscal pressure in the lumbar spine. In their study, they used a pressure sensor placed in the intervertebral disc. Rohlmann et al. [6] also used pressure sensors on implanted fixators and reported similar results. The vertebral body implant was placed to restore normal anterior spinal loading and to accumulate data on three degrees of freedom force data. Their results showed that the lumbar spine is more stressed in the standing position because the upright position increasing axial loads. Increasing lumbar lordosis in a standing position also increases the concave side compression force. This indicates that improvements in the measurement technique may result in a pronounced difference in the in vivo observed intradiscal pressure [6]. Since the 1990s, however, only three studies [7] have performed in vivo measurements of intradiscal pressure, involving 21 participants. These results should be interpreted with caution. Moreover, a rather significant variability in intradiscal pressure measurement is possible owing to the different types of transducers used. The earliest studies used a liquid transducer with a polyethylene tip: the data obtained were almost twice larger than in later measurements. It is also necessary to consider distorting factors such as muscle activation and ligament response and individual features of a patient (bodily constitution, height, weight). Another possible source of bias is the level of measurement, the change of which creates different results. In addition, there are currently no studies objectively confirming the difference in surgical outcomes between patients who were restricted to sitting and those who were not. All recommendations are subjective and depend on the preferences of surgeons, neurologists, and rehabilitation therapists and therefore require further study.

The prevention of surgical site infections is essential to prevent serious complications and improve patient safety. Antibiotic prophylaxis is an important step in this process. The results obtained in our survey showed a wide variation in the duration of use of antimicrobials in all patient groups. First of all, it is evident

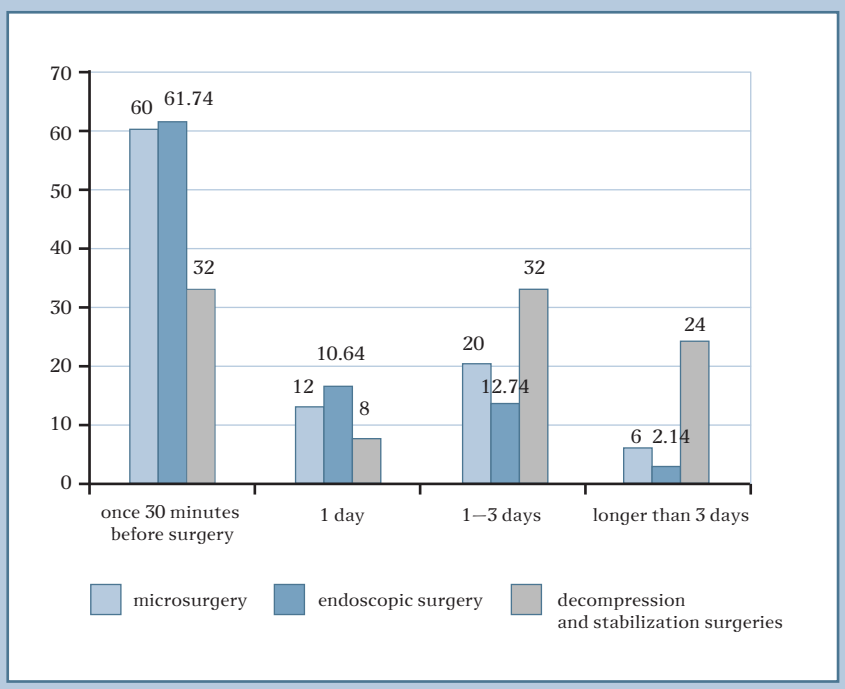

Fig. 1
Duration of antibiotic prophylaxis for different types of surgeries

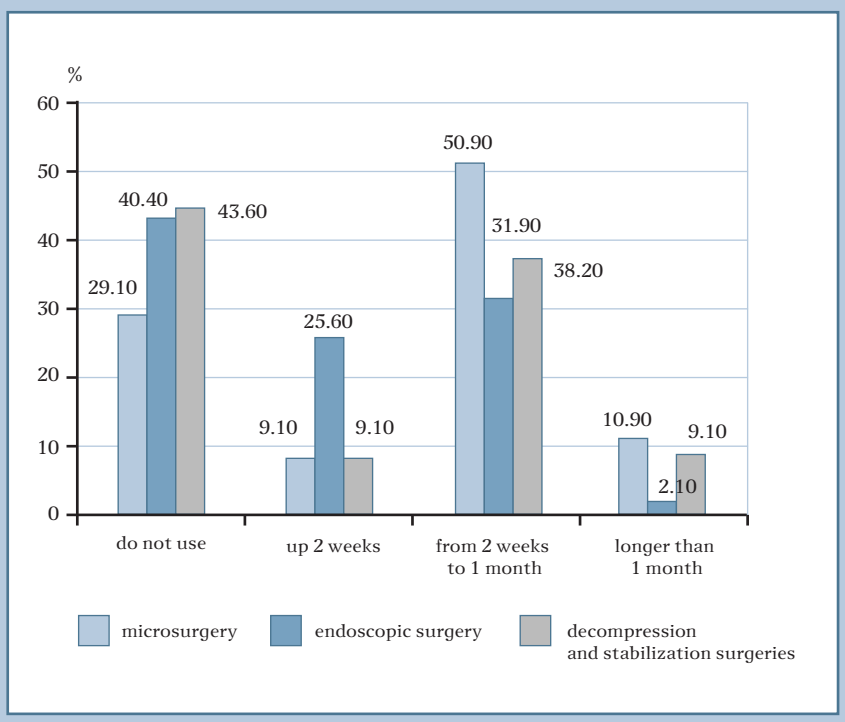

Fig. 2
Duration of sitting position restriction after surgery

when evaluating the duration of antibiotics use in patients after decompression and stabilization surgeries: they are used for more than one day in 56 % of cases. A number of respondents reported that they do not use antibiotics during surgery. It should be highlighted here that perioperative antibiotic prophylaxis is prescribed for clean surgeries when the development of complications after them is associated with a high risk of damage to the health and life of a patient. The purpose of prescribing antimicrobials is to reduce the risk of endogenous infection of the surgical site, primarily related to the spread of pathogens from the skin during relatively clean surgeries. Prevention of exogenous infection involves other activities, without the use of oral or parenteral antibiotics [8–10]. The current clinical guidelines (based on studies with a high degree of evidence) describe the time and dosage for preoperative administration of antibiotics, the use of which 30–60 min before surgery provides an effective tissue concentration of the antibiotics. In most cases, a single antibiotic administration is recommended; if prolongation of prophylaxis is necessary, the medicine is withdrawn no later than 24 h after surgery, even in the presence of drainage. In addition, Hellbusch et al. [11] in their prospective study showed no difference between single-dose and multiple-dose antibiotic administration for the prophylaxis of infectious complications in spine surgery. Current clinical guidelines restrict physicians from prescribing antibiotics adequately and standardize the approach to measures to prevent infectious complications [10].

The questionnaire survey did not reach a consensus on the prescription of immobilization devices postoperatively. There is considerable variability in the determination of appropriateness and duration of using orthopedic products. A number of respondents do not use braces after stabilization surgeries, assuming sufficient fixation with instrumentation. However, almost one third of the respondents prescribe external immobilization for a period of more than one month. After endoscopic herniation remov-

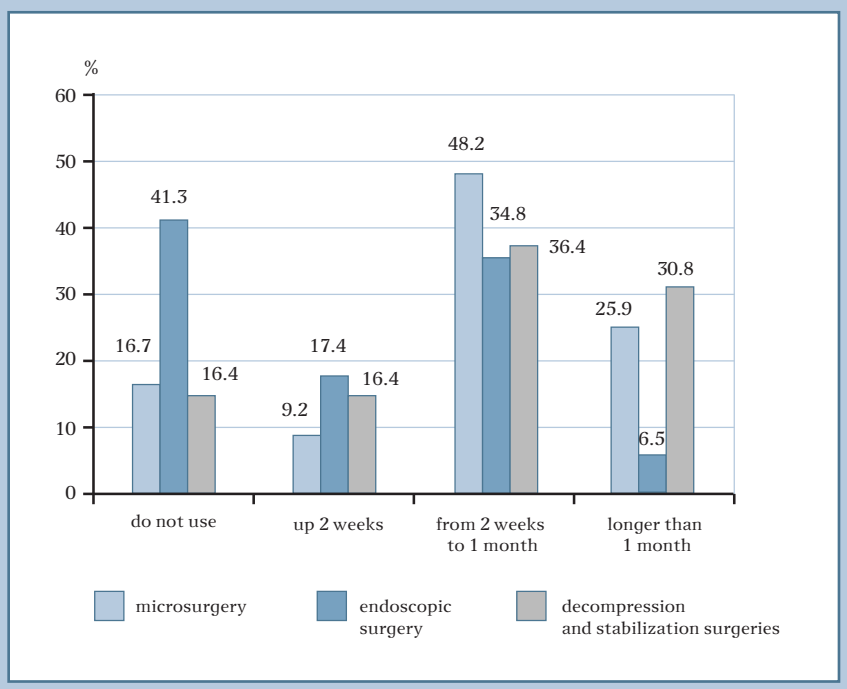

Fig. 3
Duration of brace use after surgery

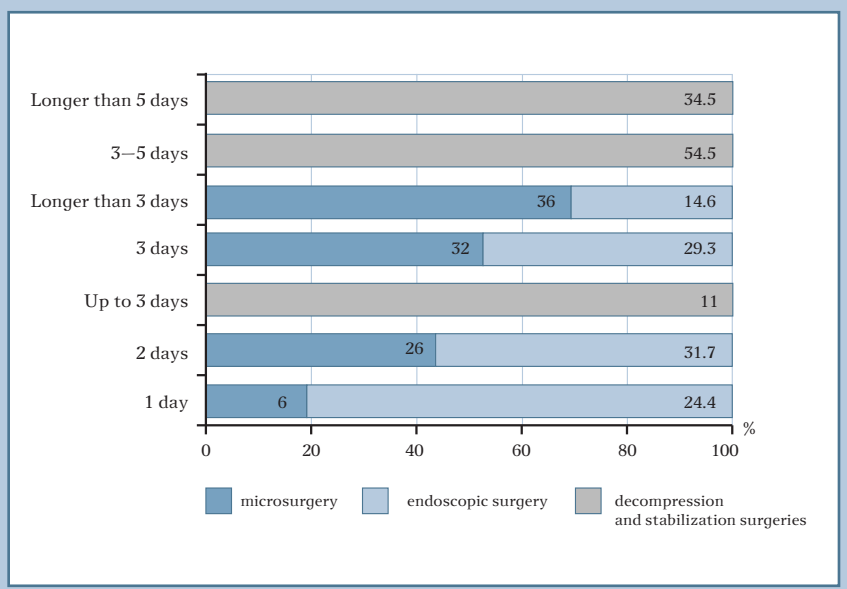

Fig. 4
Duration of postoperative treatment of patients in hospital

al, 41.3 % of the responding physicians do not recommend the use of a brace, whereas after microsurgical removal – only 16.7 %. Theoretical advantages of bracing include a reduction in intervertebral motion and biomechanical loading on the region of the spine being operated on, with subsequent expected improvements in functional outcomes and rate of bone block formation (e.g., in case of posterior or interbody fusion), as well as pain relief. On the contrary, back muscular atrophy associated with prolonged external immobilization, skin irritation, delayed rehabilitation, and discomfort are disadvantages of using a brace [12, 13]. Consequently, there is still no consensus on the necessity of wearing braces postoperatively in degenerative diseases of the lumbar spine. There are ongoing debates on this issue. Spine surgeons often prescribe a postoperative brace based on their experience and training rather than on current data [14].

In case of the use of braces after stabilization surgeries, the question of the level of load reduction on the fixation systems remains controversial. Rohlmann et al. [6] directly studied the issue by evaluating the load on in vivo implants with telemeterized internal spinal fixators while patients were wearing various braces. Their findings definitely indicate that none of the tested braces substantially reduced the load on the spinal fixators and sometimes even increased it. This conclusion was further confirmed by another study by Rohlmann et al. [15], which also found a minimal reduction in the load from braces on replaced vertebral bodies. In the systematic review, Nasi et al. [16] evaluated functional adaptation, pain, quality of life, frequency of bone block formation, complications, and the number of repeated surgeries in patients undergoing surgery for degenerative lumbar spine disease with or without postoperative brace wear. Based on four studies of grades I–II of evidence included in the analysis, the authors found moderate-quality evidence, indicating no significant benefit from postoperative brace wearing with respect to the degree of functional adaptation or pain relief compared with no brace. In addition, there was evidence, indicating lack of differences in fusion rates or complication rates between groups. Agabegi et al. [17] discussed the general use and efficacy

of spinal orthosis for various conditions. They noted that there are strong indications to study their use for traumatic spinal injuries rather than for postoperative support in degenerative disease.

A systematic review of the efficacy of brace use after lumbar spine surgery included 10 articles involving a total of 2,646 patients. The differences in the length of hospital stay and the number of postoperative complications according to VAS and ODI before and after surgery were not statistically significant. Moreover, the incidence of postoperative surgical site infections was lower in the group in which a lumbar brace was used postoperatively [18].

Therefore, there are differences between clinical practice, where lumbar braces are often used postoperatively, and the available academic data challenging their efficacy in improving patient recovery indicators such as pain relief and improved functional adaptation [3, 4]. Although some practitioners argue for the use of lumbar braces based on theoretical benefits related to stabilization of operated regions and accelerated healing [5], these claims remain unsupported by strict clinical trial data [16, 17].

There is currently no uniform opinion regarding the timing of discharge of patients to outpatient care after spinal surgery. Nevertheless, the most commonly recommended discharge criteria include pain control, ability to move independently, no signs of ongoing hemorrhage, ability to eat independently, and recovery of consciousness [19]. Such a wide spectrum of parameters gives the physician a great deal of flexibility in choosing the duration of patient follow-up in the postoperative period. This is attributed to the fact that the interpretation of the above criteria makes it possible to discharge both a few hours after microsurgery and to continue the inpatient phase until the sutures are removed. The questionnaire results confirm this.

The postoperative period after intervertebral disc herniation removal varies significantly between endoscopic and microsurgical removal. It is quite challenging to imagine that the intraoperative imaging technique for these surgeries and a 1.5–2.0 cm difference in the length of the musculocutaneous incision make such a big difference in the patients' ability to move independently, take pain medication, and recover their level of consciousness in the postoperative period. The inpatient treatment period described in scientific studies is largely subjective and often influenced by the traditions established in this or that hospital, bed space, patient features, and other factors that are not directly associated with the technique and volume of surgery.

Conclusion

The conducted survey of surgeons, as well as a review of the current literature, revealed that many issues of perioperative management of patients remain to be resolved. In most cases, physicians are guided by subjective feelings or institutional practice. Some of the statements and guidelines need randomized trials to determine the optimal perioperative management strategy for patients after spine surgery.

The study had no sponsors. The authors declare that they have no conflict of interest.
The study was approved by the local ethics committee of the institution. All authors contributed significantly to the research and preparation of the article, read and approved the final version before publication.

References

1. **Aganesov AG, Arestov SO, Asyutin DS, Badalov NG, Borodulina IV, Vershinin AV, Vershinina NS, Grin AA, Gushcha AO, Dreval MD, Kashcheev AA, Kolesov SV, Konovalov NA, Kordonsky AYu, Korolishin VA, Krotenkova IA, Krotenkova MV, Krutko AV, Kurochkina NS, Martynova MA, Nazarenko AG, Nizametdinova DM, Petrosyan DV, Poltorako EN, Yusupova AR.** Surgery for Degenerative Spinal Lesions: National Guidelines. Moscow, 2019.
2. **Majeske C, Buchanan C.** Quantitative description of two sitting postures. With and without a lumbar support pillow. Phys Ther. 1984;64:1531–1535. DOI: 10.1093/ptj/64.10.1531.
3. **Nachemson A.** Measurement of intradiscal pressure. Acta Orthop Scand. 1959;28:269–289. DOI: 10.3109/17453675908988632.
4. **Nachemson A.** The load on lumbar disks in different positions of the body. Clin Orthop Relat Res. 1966;45:107–122.
5. **Wilke H, Neef P, Hinz B, Seidel H, Claes L.** Intradiscal pressure together with anthropometric data – a data set for the validation of models. Clin Biomech (Bristol, Avon). 2001;16 Suppl 1:S111–S126. DOI: 10.1016/S0268-0033(00)00103-0.
6. **Rohlmann A, Bergmann G, Graichen F, Neff G.** Braces do not reduce loads on internal spinal fixation devices. Clin Biomech (Bristol, Avon). 1999;14:97–102. DOI: 10.1016/S0268-0033(98)00056-4.
7. **Li JQ, Kwong WH, Chan YL, Kawabata M.** Comparison of *in vivo* intradiscal pressure between sitting and standing in human lumbar spine: a systematic review and meta-analysis. Life (Basel). 2022;12:457. DOI: 10.3390/life12030457.
8. Surgical Site Infections: Prevention and Treatment. NICE Guideline [NG125]. Published: 11 April 2019. Last updated: 19 August 2020. [Electronoc resource]. Available at: https://www.nice.org.uk/guidance/ng125.
9. **Swanson T, Ousey K, Haesler E, Bjarnsholt T, Carville K, Idensohn P, Kalan L, Keast DH, Larsen D, Percival S, Schultz G, Sussman G, Waters N, Weir D.** IWII Wound Infection in Clinical Practice consensus document: 2022 update. J Wound Care. 2022;31(Sup12):S10–S21. DOI: 10.12968/jowc.2022.31.Sup12.S10.
10. **Briko NI, Bozhkova SA, Brusina EB, Zhedaeva MV, Zubareva NA, Zueva LP, Ivanova EB, Kazachek YaV, Kvashnina DV, Kovalishena OV, Kuzmenko SA, Pavlov VV, Pasechnik IN, Popov DA, Tsigelnik AM, Tsoi ER, Shmakova MA, Shubnyakov II, Yakovlev SV.** Prevention of Surgical Site Infections: Clinical Guidelines. Nizhny Novgorod, 2018]. DOI: 10.21145/clinical_guidelines_naski_2018.
11. **Hellbusch LC, Helzer-Julin M, Doran SE, Leibrock LG, Long DJ, Puccioni MJ, Thorell WE, Treves JS.** Single-dose vs multiple-dose antibiotic prophylaxis in instrumented lumbar fusion – a prospective study. Surg Neurol. 2008;70:622–627. DOI: 10.1016/j.surneu.2007.08.017.

12. **Zhu MP, Tetreault LA, Sorefan-Mangou F, Garwood P, Wilson JR.** Efficacy, safety, and economics of bracing after spine surgery: a systematic review of the literature. Spine J. 2018;18:1513–1525. DOI: 10.1016/j.spinee.2018.01.011.
13. **Dailey AT, Ghogawala Z, Choudhri TF, Watters WC 3rd, Resnick DK, Sharan A, Eck JC, Mummaneni PV, Wang JC, Groff MW, Dhall SS, Kaiser MG.** Guideline update for the performance of fusion procedures for degenerative disease of the lumbar spine. Part 14: Brace therapy as an adjunct to or substitute for lumbar fusion. J Neurosurg Spine. 2014;21:91–101. DOI: 10.3171/2014.4.SPINE14282.
14. **Bogaert L, Van Wambeke P, Thys T, Swinnen TW, Dankaerts W, Brumagne S, Moke L, Peers K, Depreitere B, Janssens L.** Postoperative bracing after lumbar surgery: a survey amongst spinal surgeons in Belgium. Eur Spine J. 2019;28:442–449. DOI: 10.1007/s00586-018-5837-0.
15. **Rohlmann A, Zander T, Graichen F, Bergmann G.** Effect of an orthosis on the loads acting on a vertebral body replacement. Clin Biomech (Bristol, Avon). 2013;28:490–494. DOI: 10.1016/j.clinbiomech.2013.03.010.
16. **Nasi D, Dobran M, Pavesi G.** The efficacy of postoperative bracing after spine surgery for lumbar degenerative diseases: a systematic review. Eur Spine J. 2020;29:321–331. DOI: 10.1007/s00586-019-06202-y.
17. **Agabegi SS, Asghar FA, Herkowitz HN.** Spinal orthoses. J Am Acad Orthop Surg. 2010;18:657–667. DOI: 10.5435/00124635-201011000-00003.
18. **Jones JJ, Oduwole S, Feinn R, Yue JJ.** Postoperative bracing on pain, disability, complications, and fusion rate following 1–3+ level lumbar fusion in degenerative conditions: a meta-analysis. Clin Spine Surg. 2021;34:56–62. DOI: 10.1097/BSD.0000000000001060.
19. **Tong Y, Fernandez I, Bendo JA, Spivak JM.** Enhanced recovery after surgery trends in adult spine surgery: a systematic review. Int J Spine Surg. 2020;14:623–640. DOI: 10.14444/7083.

Address correspondence to:
Kinzyagulov Bulat Rustemovich
Pirogov National Medical and Surgical Center,
70 Nizhnyaya Pervomayskaya str., Moscow, 105203, Russia,
bkinzyagulov@yandex.ru

Received 05.08.2024
Review completed 02.10.2024
Passed for printing 11.10.2024

Valeriy Borisovich Lebedev, MD, PhD, orthopedic surgeon, National Medical and Surgical Center n.a. N.I. Pirogov, 70 Nizhnyaya Pervomayskaya str., Moscow, 105203, Russia, ORCID: 0000-0002-3372-2670, horizont_vbl@mail.ru;
Bulat Rustemovich Kinzyagulov, neurosurgeon, National Medical and Surgical Center n.a. N.I. Pirogov, 70 Nizhnyaya Pervomayskaya str., Moscow, 105203, Russia, ORCID: 0000-0001-8736-2335, bkinzyagulov@yandex.ru;
Dmitriy Sergeyevich Epifanov, neurosurgeon, National Medical and Surgical Center n.a. N.I. Pirogov, 70 Nizhnyaya Pervomayskaya str., Moscow, 105203, Russia, ORCID: 0000-0001-8895-3196, doc.neuros@gmail.com;
Andrey Aleksandrovich Zuev, neurosurgeon, National Medical and Surgical Center n.a. N.I. Pirogov, 70 Nizhnyaya Pervomayskaya str., Moscow, 105203, Russia, ORCID: 0000-0003-2974-1462, mosbrain@gmail.com.