POLYSEGMENTAL AND MULTILEVEL LESIONS IN HEMATOGENOUS VERTEBRAL OSTEOMYELITIS: ASSESSMENT OF IMMEDIATE AND LONG-TERM RESULTS

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Objective. To analyze the results of treatment of disseminated (polysegmental and multilevel) forms of hematogenous vertebral osteomyelitis (HVO) as compared with those of monosegmental and monovertebral lesions.
Material and Methods. A retrospective analysis of a monocenter cohort of 266 patients with hematogenous osteomyelitis of the spine for 2006 to 2019 was carried out. Patients were divided into two groups: Group A (polysegmental and multilevel lesions) included 33 (12.4 %) patients and Group B (monosegmental and monovertebral lesions) — 233 (87.6 %) patients. The main examination methods were: clinical, radiological (standardized roentgenography, CT), MRI, microbiological, histological and statistical ones.
Results. Comparison revealed that involvement of the cervical ($p < 0.001$) and thoracic ($p = 0.014$) spine was more typical for polysegmental and multilevel lesions. There was a tendency to the predominance of type A lesions according to the Pola classification in patients with local forms ($p = 0.078$) and to the increase in type C lesions in polysegmental and multilevel processes ($p = 0.035$). The number of neurological complications was higher in polysegmental and multilevel lesions ($p = 0.003$). There were no significant differences in the treatment results, the number of relapses and mortality rate between the compared groups.
Conclusion. Lesions of the cervical and thoracic spine and the presence of a neurological deterioration are typical for multilevel and polysegmental HVO. The formation of a multilevel lesion in different regions of the spine with a gap of 2—4 weeks or more requires a separate implementation of the diagnostic algorithm, defining of classification criteria and differentiated treatment tactics for each focus.
Key Words: vertebral osteomyelitis, spondylitis, spondylodiscitis, multilevel lesion, polysegmental lesion.
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Hematogenous vertebral osteomyelitis (HVO) is one of the rare and hard to diagnose disorders associated with a high risk of complications, relapses and mortality. Intervertebral discs, vertebral bodies and their processes, facet joints and the contents of the spinal canal can be involved in the inflammation [1–3]. Inflammatory lesions of the spine may disguise as other diseases and syndromes. All patients with acute or worsening back pain, neurologic deterioration, or signs of spinal infection must immediately undergo an MRI examination [4].

According to the study of A.Y. Mushkin et al. [5], multilevel lesions are inflammatory processes involving at least two foci separated by an intact segment. Polysegmental processes are characterized by the involvement of more than one spinal motion segment (SMS). Monosegmental lesions, which account for up to 90 % of cases, are the most typical for HVO. Multilevel lesion is more often occurring in specific spondylitis, in particular in spinal tuberculosis and brucellosis, reaching 25 % and is one of the differential diagnostic criteria [6–10]. With the nonspecific nature of the disease, processes that go beyond one spinal motion segment and/or one spine region are relatively rare, occurring in no more than 9.8 % of cases in the age group under 75 years and more than 14.0 % in patients of 75 years and older [11]. Nevertheless, the extension of the inflammatory process and the involvement of several spinal regions necessarily increase the risk of complications and mortality. There are a small number of papers in the modern literature concerning multilevel and polysegmental forms of nonspecific spondylodiscitis. Meanwhile, the most frequently published data are on extended spinal epidural abscesses, surgery complications, and spinal procedures [12, 13]. There are few reports of extensive lesions associated with rare pathogens, such as *Coxiella burnetii*, or with equally rare diseases, such as Lemierre syndrome [14, 15]. Partially, this issue is covered as a description of individual clinical observations [16, 17]. In most papers, the authors use various terms to characterize disseminated forms of infectious lesions of the spine. Nevertheless, multilevel and polysegmental lesions may have significant differences in localization and number of affected levels [3, 5, 18].

Theologis et al. [19] described 19 observations; two or more levels were affected in all cases. All patients underwent surgery with the use of an anterior

or combined approach with resection of 2–4 vertebrae in the cervical spine. The authors state excellent recovery outcomes and a low rate of relapses, despite the high risk of neurological deficite (60 %) in this localization and 26.3 % of postoperative complications, most of which required repeated surgeries.

Miller et al. [20] submitted the results of retrospective analysis of surgical treatment of 50 patients with HVO; on average, three spinal motion segments were surgically treated. The percentage of patients with neurological deterioration was 42 %, those who underwent repeated surgeries were 26 %, and the mortality rate was 10 %. Overall, adverse outcomes were 60 %. The most important risk factors for them were immunodeficiency, a large number of operated levels, and the severity and duration of the disease before surgery.

The objective is to analyze the results of treatment of patients with disseminated (polysegmental and multilevel) forms of hematogenous vertebral osteomyelitis and patients with monosegmental and monovertebral lesions.

Material and Methods

A retrospective analysis of 282 medical charts of patients with HVO undergoing inpatient treatment at the Regional Clinical Hospital No. 2 of Tyumen was conducted.

Inclusion criteria: adult patients with nonspecific HVO who were treated in 2006–2019 (Fig. 1).

Exclusion criteria: specific lesions (tuberculosis and brucellosis spondylitis), postoperative osteomyelitis, and absence of prospective follow-up during one year.

Patients

A total of 266 patients were selected for the study and were divided into two groups: Group A (polysegmental and multilevel spinal lesions) – 33 (12.4 %); Group B (monosegmental and monovertebral) – 87.6 % (n = 233). In two cases, there was a multilevel polysegmental lesion, that is, more than one spinal motion segment was involved in the process at one of the levels.

Techniques

The main techniques of the study were clinical, a neurological status examination, radiological (standardized roentgenography, CT), MRI, microbiological, and histological.

The following indicators were used to assess the treatment results: pain relief; normalization of inflammatory markers in the complete blood count and blood biochemistry test; restoration of the supporting and motor functions of the spine, including the formation of a bone or fibrous block at the lesion level. Additionally, the pain intensity was evaluated according to VAS at the time of admission to the hospital and not less than one year after the initiation of treatment. The assessment of the quality of life according to the Oswestry Disability Index (ODI) and the SF-36 questionnaire was performed one year or more after the initiation of treatment.

The literature review was performed using the scientific databases MEDLINE/PubMed, eLibrary, and Google Scholar. The depth of the literary search was 2000–2021. The search for sources was performed using the following keywords: vertebral osteomyelitis (in Russian), multilevel (in Russian), polysegmental (in Russian), vertebral osteomyelitis, spondylitis, spondylodiscitis, multisegmental, and multilevel. The papers with the analysis of multifocal osteomyelitis localized outside the spine and isolated spinal epidural abscesses were purposefully excluded from the search.

Statistical analysis

Statistical analysis was performed in the IBM SPSS Statistics 21.0 and Statistica 6.0 software. Quantitative data are given in the form of mean and standard deviation (M ± SD) or in the form of median and interquartile range of Me [25–75 %]. The Kolmogorov – Smirnov test was used to verify the distribution of quantitative features. A comparison of data with a normal distribution was performed according to the Student's t-test for independent samples, with a distribution different from the normal one was performed according to the Mann – Whitney U test. the chi-squared test and the exact Fisher's f-test were used to identify the differences between the qualitative indicators. Differences in indicators were considered significant at a bilateral value of $p < 0.05$.

Results

The clinical material for the study was represented by a monocenter retrospective cohort of 266 patients, of whom 33.4 % (n = 89) were non-surgically treated. The percentage of surgically treated patients in the Group with disseminated forms of the disease was higher, and the mean age was 18 years less ($p = 0.595$). During the analysis of the timing of diagnosis and the duration of inpatient treatment, no differences were found. Multilevel lesions are characterized by a high percentage of acute forms of the disease. There is a tendency to increase the number of subacute inflammatory processes in Group B ($p = 0.085$).

The primary suppurative focus in Group A was revealed in 33.3% of cases in comparison with 24.2 % ($p = 0.261$) in Group B with the local type of lesion.

A detailed description of the clinical material is given in Table 1.

Involvement of the cervical spine ($p < 0.001$) and thoracic spine ($p = 0.014$) is more typical for polysegmental and multilevel lesions.

The analysis of lesion types according to the Pola classification revealed the following patterns: a tendency to predominate type A lesions in patients with local forms of the disease ($p = 0.078$) and a significant increase in type C lesions in disseminated processes ($p = 0.035$), which fully applies to subtypes B.3.2 ($p = 0.001$) and C.3 ($p = 0.003$).

Primary suppurative focus, or sepsis, was found 6 months before the disease in 33.3 % (n = 11) of patients with multilevel and polysegmental lesions and in 24.2 % (n = 56) of patients with monosegmental lesions.

There were no significant differences between the comparison groups in the analysis of risk factors and the Charlson comorbidity index (CCI). Nevertheless, it should be noted that there is a tendency towards increase in the inflammatory processes of the urinary system associ-

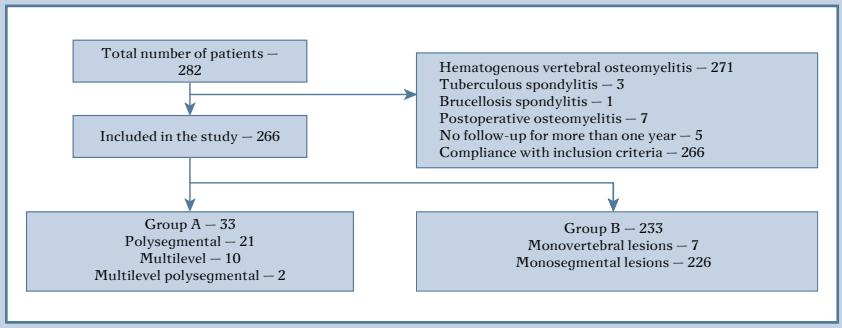

Fig. 1
Criteria for inclusion of patients in the study

ated with impaired urine efflux in benign prostatic hyperplasia with disseminated lesions (p = 0.092). The distribution of patients in the comparison groups, depending on the treatment technique and the obtained results, is presented in Table 2.

There was a significant increase in the performance of posterior debridement with stabilization (p = 0.029) and anterior debridement with anterior spinal fusion (p = 0.023) in polysegmental and multilevel lesions.

There is a change in the typical ratio of the affected departments and segments of the spine between the comparison groups. Fig. 2 and 3 show the frequency of vertebral lesions.

In group B, a total of 463 vertebrae were affected: 7.3 % in the cervical spine, 31.8% in the thoracic spine, and 60.9 % in the lumbar spine. Out of 34 cervical vertebrae involved in the osteomyelitis, the lesion was localized in the C5–C6 segment in 67.6 % (n = 23) of the cases. In the thoracic spine, 147 vertebrae were affected, the most frequently affected segments there were T7–T10 (63.9 %; n = 94). The largest number of affected vertebrae (282) was in the lumbar spine; L3–L5 were affected in 66.7 % (n = 191).

There is a more uniform distribution of inflammatory processes by spine departments in Group A. A total of 110 vertebrae were involved without a suboccipital lesion and with a single involvement of the upper thoracic spine. The lesion was localized in the cervical spine in 22 (20.0 %) vertebrae, in the thoracic spine – in 51 (46.4 %) vertebrae, and in the lumbar spine – in 37 (33.6 %) vertebrae. In the cervical spine, the C5–C6 segment was involved in 59.1 % (n = 13) of cases; in the thoracic spine, localization was most often noted in the lower thoracic vertebrae (T9 and more caudal) – 49.0 % (n = 25). In the lumbar spine, the maximum number of pathological processes was also observed in the two lower vertebrae – 45.9 % (n = 17).

The distribution of pathogens depending on the type of lesion and the method of isolation is given in Table 3.

In polysegmental and multilevel processes, a polymicrobial lesion was diagnosed in total in 24.2 % (n = 8) of the patients (six had more than one pathogen from the focus, and two had one pathogen from the focus and one from blood). In monosegmental and monovertebral lesions, a total of more than one pathogen was isolated in 14.6 % (n = 34) of patients (in 22 – more than one microorganism from the focus; in nine – one pathogen from the focus and one from blood; in three – two pathogens from blood).

Staphilococcus spp. accounted for 51.4 % of all isolated strains. Staphylococcus aureus prevailed in all groups (38.9 %), of which MRSA accounted for 4.3 %.

There were no significant differences between the comparison groups in the number of isolated gram-positive and gram-negative strains.

The presence of a neurologic impairment is mainly correlated with the lesion of type C.3–C.4 according to the Pola classification. Nevertheless, there are some patients in whom the monovertebral type of lesion (destruction of the vertebral arches, processes, and facet joints without the involvement of the spinal motion segment) is the cause of a secondary spondylogenic epidural abscess. The number of neurological deficite was 15.4 % in Group B; it was significantly higher in Group A – 36.4 % (p = 0.003), and 7 of them were characterized by involvement of the cervical vertebrae in the pathological process.

Posterior debridement with stabilization (p = 0.029) and anterior debridement with anterior spinal fusion (p = 0.023) as independent procedures were more often used in patients with disseminated HVO.

Surgical interventions due to the progression of the underlying disease, complications, and relapses were performed in 6 (18.2 %) patients in Group A and in 37 (15.8 %) patients in Group B.

All patients were prescribed a course of antibacterial therapy for at least six weeks, three weeks parenterally in a hospital setting. If the course of the disease was complicated or the pathogen was resistant and there were absolute contraindications to surgery, the duration of therapy was increased to 8–12 weeks. Mainly, inhibitor-protected aminopenicillins and/or fluoroquinolones were prescribed, followed by correction of therapy according to the findings of the microbiological study.

The pain severity according to VAS on the day of admission to the in-patient facility was 8.0 ± 1.4 points for multilevel and polysegmental lesions and 8.3 ± 2.1 points for local forms of the disease. A year or more after discharge, there was a significant reduction in the intensity of pain (1.8 ± 1.9 and 2.1 ± 1.9 points for disseminated and local forms, respectively). There were no significant differences between the comparison groups in the outcomes of the disease according to VAS, ODI, and physical and mental health according to SF-36.

Table 1
Characteristics of local and disseminated forms of hematogenous vertebral osteomyelitis

Indicator	Polysegmental and multilevel lesions (n = 33)	Monosegmental lesions* (n = 226)	p
General characteristics of groups			
Age, years	30.6 ± 27.2	48.6 ± 15.3	0.595
Time of diagnosis, months	2.8 ± 4.6	2.4 ± 2.4	0.303
Length of hospital stay	29.1 ± 15.7	30.4 ± 16.6	0.829
Acute osteomyelitis, n (%)	13 (39.4)	68 (30.0)	0.274
Subacute osteomyelitis, n (%)	5 (15.2)	67 (29.5)	0.085
Chronic osteomyelitis, n (%)	15 (45.5)	92 (40.5)	0.591
Primary purulent focus, n (%)	11 (33.3)	55 (24.2)	0.261
Localization			
Cervical spine, n (%)	9 (27.3)***	15 (6.6)	<0.001
Thoracic spine, n (%)	18 (54.5)**	74 (32.6)	0.014
Lumbar spine, n (%)	16 (48.5)	147 (64.8)	0.071
Comorbidity Index (CCI)	1 [1; 3]	2 [0; 4]	0.553
Patients with CCI ≥6, n (%)	1 (3)	29 (16.2)	0.144
Risk factors			
Diabetes mellitus, n (%)	2 (6.1)	25 (11.0)	0.384
Immunodeficiency (HIV), n (%)	6 (18.2)	52 (22.9)	0.542
Drug addiction, n (%)	7 (22.6)	58 (25.8)	0.701
Impaired urine elimination on the background of BPH, n (%)	3 (9.1)	6 (2.6)	0.092
History of trauma, n (%)	4 (12.1)	20 (8.8)	0.522
Pathogens			
Pathogen from the lesion focus, strains	24	131	–
Pathogen from blood, strains	5	25	–
Gram-positive, strains (%)	24 (86.2)	119 (83.3)	0.309
Gram-negative, strains (%)	4 (13.8)	37 (16.7)	
Total pathogen isolated, n (%)	19 (57.6)	115 (50.7)	0.459
Polymicrobial lesion, n (%)	6 (18.2)	25 (11.0)	0.233
Lesion type according to Pola, n (%)			
A	4 (12.1)	59 (26.5)	0.078
B	15 (45.5)	110 (48.5)	0.747
C	14 (42.4)**	56 (24.9)	0.035
A.2	3 (9.1)	40 (17.8)	0.211
A.3	0	16 (7.1)	0.114
A.4	1 (3.0)	3 (1.3)	0.455
B.1	5 (15.2)	60 (26.7)	0.155
B.2	7 (21.2)	36 (16.0)	0.454
B.3.1	5 (15.2)	15 (6.7)	0.089
B.3.2	2 (6.1)***	0	0.001
C.1	1 (3.0)	7 (3.1)	0.975
C.2	1 (3.0)	14 (6.2)	0.462
C.3	8 (24.2)***	13 (5.8)	0.003
C.4	4 (12.1)	22 (9.8)	0.682
Neurological deterioration, n (%)	12 (36.4)***	35 (15.4)	0.003

* Patients with monovertebral lesions are not classified according to Pola (n = 7); ** $p < 0.05$; *** $p \leq 0.001$; BPH – benign prostatic hyperplasia.

Table 2
Distribution of patients with disseminated and local forms of hematogenous vertebral osteomyelitis depending on the method of treatment and the obtained results

Indicator	Polysegmental and multilevel lesions (n = 33)	Monosegmental lesions (n = 226)	p
Treatment			
Non-surgical	8 (24.2)	80 (35.2)	0.212
Surgical:	25 (75.8)	147 (64.8)	
debridement anterior approach	6 (18.2)	31 (13.7)	0.487
debridement anterior approach + TPF	0 (0.0)	6 (2.6)	0.345
posterior debridement and stabilization	3 (9.1)*	3 (1.3)	0.029
posterior debridement	2 (6.1)	3 (1.3)	0.124
laminectomy	2 (6.1)	9 (4)	0.636
debridement (anterior) + anterior spinal fusion	10 (30.3)*	33 (14.5)	0.023
360° spinal reconstruction	1 (3.0)	28 (12.3)	0.113
extrafocal TPF	7 (21.2)	46 (20.3)	0.900
Results			
VAS before treatment, points	8.0 ± 1.4	8.3 ± 2.1	0.298
VAS after treatment, points	1.8 ± 1.9	2.1 ± 1.9	0.548
ODI one year or more after treatment	21.7 ± 20.8	21.9 ± 18.8	0.783
SF-36 physical health component	42.5 ± 6.1	41.2 ± 12.2	0.779
SF-36 mental health component	43.9 ± 6.8	46.1 ± 12.0	0.575
Recovery, n (%)	27 (81.8)	198 (84.6)	0.634
Relapse, n (%)	4 (12.1)	22 (9.4)	0.670
Hospital mortality, n (%)	2 (6.1)	14 (6.0)	0.939

* p < 0,05; TPF — transpedicular fixation.

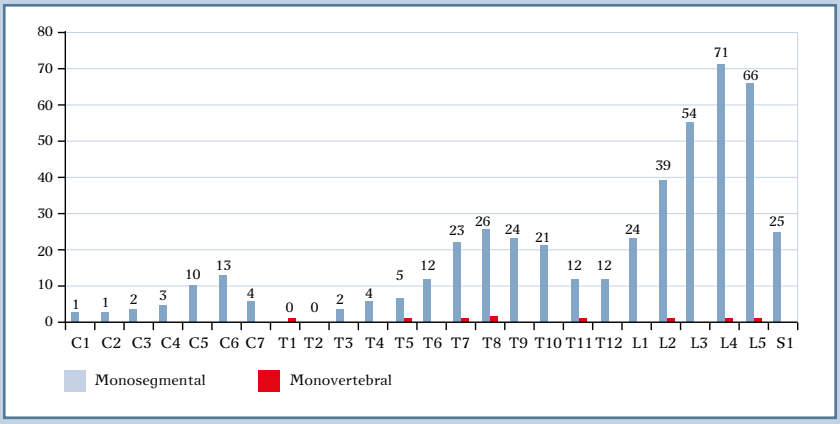

Fig. 2
Incidence of vertebral lesions in monosegmental and monovertebral lesions

Discussion

The most frequent cause of multilevel infectious spinal lesions is post-operative spondylitis. For example, provocative discography is followed by the development of this complication in 0.25 % of patients and in 0.14 % of the studied discs [12, 13]. Nevertheless, in the papers devoted to hematogenic lesions, their number reaches a maximum of 25.0 %. Kim et al. [21] report 37 (24.5 %) multilevel lesions in 151 patients, in which three or more vertebrae are involved in the process.

Multilevel processes account for 3 to 13 % of all cases of spondylodiscitis. The maximum number of polysegmental lesions reaches 68 %. Simultaneously, the largest number of patients were on constant intravenous administration of medications [18]. Polysegmental processes, as a rule, have one focus and do not require special approaches to each level of lesion. According to our observations, multilevel processes may be formed in different departments of the spine and at different time intervals. The treatment strategy and the amount of surgery for them can be defined separately.

In multilevel processes, different chronologies and sequences of the

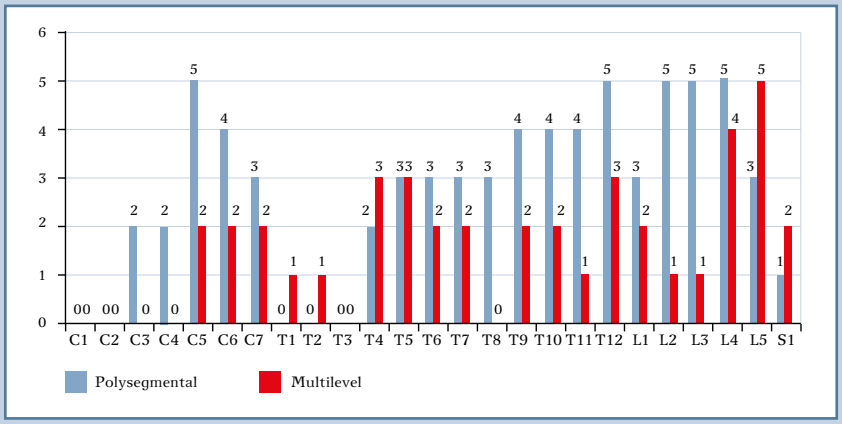

Fig. 3
Incidence of vertebral lesions in multilevel and polysegmental lesions

development of lesions are possible. For example, it may be a hematogenic infection with several seedings in different spine departments that have a temporary connection with the primary source, or different foci at a considerable distance from each other that occurred with a time interval of 2–4 weeks. In the second scenario, various primary foci and pathogens are possible, and different stages of the pathological process require independent identification of classification criteria, including separate implementation of the diagnostic algorithm and a differentiated approach in the treatment of each of them.

Thus, in clinical practice, both conservative therapy for all lesions or their surgical treatment and various combina-

Table 3
Distribution of pathogens depending on the type of lesion and method of isolation

Pathogens	Multilevel and polysegmental lesions, strains		Monosegmental and monovertebral lesions, strains	
	Lesion focus	Blood	Lesion focus	Blood
S. Aureus (MSSA)	10	1	48	5
S. Aureus (MRSA)	1	1	5	1
S. epidermidis	2	0	12	6
S. saprophiticus	0	1	2	0
Peptostreptococcus	3	1	23	1
Peptococcus	1	0	1	0
Clostridium sp.	1	0	5	0
E. faecium	1	0	3	1
E. Durans	1	0	2	0
Str. Haemoliticus	0	0	3	1
Bacterioides	1	0	10	1
E. Coli	1	0	4	1
P. Aeruginosa	1	0	2	2
A. baumani	0	0	6	2
Acinetobacter ewoffii	0	0	1	1
Klebsiella pneumoniae	1	0	1	1
Proteus morabilis	0	0	1	1
I. haemophilus	0	0	1	0
Enterococcus faecalis	0	0	1	0
Enterobacter cloacae	0	0	0	1
C. freundii	0	1	0	0
Total strains	24	5	131	25
Gram-positive	20 (83.3)	4 (80.0)	104 (79.4)	15 (60.0)
Gram-negative	4 (16.7)	1 (20.0)	27 (20.6)	10 (40.0)
Total patients, n (%)	18 (54.5)	5 (15.2)	108 (47.6)	22 (9.7)

tions of these techniques in one patient can be considered.

Usually, osteomyelitis caused by the hematogenous spread of the pathogen is monomicrobial [3]. However, polymicrobial processes can be detected [22]. According to our observations, polymicrobial infection was found in 42 (15.8 %) patients, including patients in whom different pathogens were isolated from the lesion focus and blood. The ratios for disseminated and local forms were 8 (24.2 %) and 34 (14.6 %), respectively. The proportion of isolated gram-negative strains in the blood sterility test was 36.7 %, while only 20.0 % of gram-negative pathogens were identified from the lesion focus, which indicates the initial severity of the disease in patients with this microbiota. There was an increase in the mean age in the subgroup with polymicrobial lesions to 51.4 ± 15.1 years.

In disseminated and local processes, drug addiction was found in 7 (21.2 %) and 58 (24.8 %) patients, respectively. However, there were no significant differences in the treatment outcomes.

The paper by Stuer et al. [23] describes 15.4 % of patients with multilevel lesions. There are indications for the use of advanced surgical options, such as posterior cervical screw fixation or staged interventions, including anterior spinal fusion in multilevel lesions. In total, 19 (36.5 %) patients underwent anterior interventions. Relapses accounted for 3.8 % of cases, complications for 11.5 %, and hospital mortality for 3.8 %. Nevertheless, the authors do not point to comorbidities in different departments of the spine. The connection between an increase in the risk of mortality and an increase in the age of patients with polysegmental lesions has been found [24].

Some researchers used irregular solutions for the debridement of panspinal epiduritis with an approach to the spinal canal at the intact cervical level, which provided minimal surgical trauma and the volume of bone resection, while the main focus, located in the lumbar spine, was treated in a conservative manner [17]. In our practice, there were two opposite variants: the primary focus in the spine was successfully operated on, and the secondary one was treated with conservative measures. Although in a number of patients, the secondary focus also required debridement and/or stabilization.

Hahn et al. [13] report a series of 14 patients with cervical spine spondylitis. Five of these patients suffered from hematogenous osteomyelitis. Out of them, 50 % suffered from multilevel lesions; one of them had hematogenous osteomyelitis, two had tuberculous spondylitis, and four had postoperative spondylitis. Despite the fact that in cervical spine osteomyelitis, the anterior approach promotes solving most of the tasks set, the authors applied a staged treatment in one case: anterior spine fusion and posterior screw fixation in a patient with type B neurological impairment, according to ASIA.

Xu et al. [25] report 23 patients with multilevel lesions, 69.6 % of whom have hematogenous osteomyelitis. The authors proposed a technique of transforaminal endoscopic approach to the affected disc using intraoperative navigation. The technique is suitable for lesions of the thoracic and lumbar spine. The highest level on the presented radiographs is the T9–T10 disc. The surgery was completed by bilateral installation of irrigators in the intervertebral discs at all affected levels for debridement in the postoperative period. Criteria for the removal of irrigators are also proposed: relief of symptoms of the disease, clear fluid during flushing the disc cavity, and normalization of the level of C-reactive protein. The presence of two out of three criteria was an indication to stop irrigation.

Antibacterial therapy was performed in two stages: the first, in-patient (usually intravenously or intramuscularly), and the second, outpatient. We consider it advisable to transfer to tablet drugs in a hospital since complications in the form of antibiotic-associated diarrhea or an allergic reaction significantly complicate the selection of drugs at the outpatient stage, when the probability of relapse increases significantly. The duration of the in-patient course was 4.2 ± 1.6 weeks for disseminated forms and 3.8 ± 1.8 weeks for monosegmental lesions; the outpatient course was 7.2 ± 4.2 and 7.2 ± 3.9 weeks, respectively.

Five patients were diagnosed with the simultaneous development of two lesion foci in the spine. In one case, the interval between the development of foci of destruction in a multilevel lesion was not recorded. In six patients, complaints of back or neck pain beyond the existing focus of osteomyelitis in the spine appeared at intervals of 2–4 weeks. Moreover, in five patients, it was observed against the background of ongoing antibacterial therapy, which was the reason for the separate classification of the existing foci and the identification of differentiated treatment strategies.

Conclusion

When comparing groups of patients with multilevel, polysegmental lesions and monosegmental, monovertebral lesions, no differences in age, timing of diagnosis, risk factors, or comorbidity were detected. Involvement of the cervical spine ($p < 0.001$) and thoracic spine ($p = 0.014$) is more specific for polysegmental and multilevel lesions. There is a predominance of staphylococcal etiology of the disease in both groups (51.4 %), with an increase in the proportion of polymicrobial lesions to 24.2 % in Group A compared to 14.6 % in Group B ($p > 0.05$).

There is a tendency to the predominance of Pola type A lesions in patients with local forms of the disease ($p = 0.078$) and an increase in type C lesions in disseminated processes ($p = 0.035$). The number of neurological disorders is considerably higher in polysegmental and multilevel lesions ($p = 0.003$). There were no differences between the comparison groups in the treatment outcomes according to VAS, ODI, physical and mental health according to SF-36, as well as the number of relapses and mortality.

The formation of lesions in various departments of the spine with a time interval of 2–4 weeks or more requires a sepa-

rate diagnostic algorithm, the definition of classification criteria and differentiated treatment strategies for each of them.

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.

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