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# Incidence of vertebral osteomyelitis and benefits of spinal stabilization in infection. Retrospective analysis of 94 cases in 5 years

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## ABSTRACT

In order to evaluate the etiology, characteristics and outcome of the surgical treatment of vertebral osteomyelitis cases in our hospital, patients with vertebral osteomyelitis between January 2014 and December 2018 were included in the study. Clinical and paraclinical data of the patients were collected from the medical records of the patients. Of the 164 patients diagnosed with vertebral osteomyelitis in our clinic 94 underwent surgery and only these last ones were included in the study. Of these 94 patients, 18 cases were diagnosed with tuberculous osteomyelitis and 76 with nontuberculous osteomyelitis. The age of the majority of patients ranged from 40 to 80 years with a peak of incidence between 61-70 years. All of the patients had back pain and regional tenderness of the affected area and many cases presented neurological deficits. The most common involved area affected in our cases was the thoracic spine. Magnetic resonance imaging is the examination that reveals the degree of involvement and excludes other pathologies from the differential diagnosis. The majority of patients had several comorbidities which we included in the study. From all the patients included 76 % underwent surgery with decompression and spinal stabilization using titanium instrumentation and 24 % underwent surgery with only spinal decompression. We also evaluated number hospitalization days of the operated cases. An early diagnosis seems crucial for a fast recovery, lowering the hospitalization costs of both the patient and the hospital and preventing sequelae development.

## INTRODUCTION

The inflammation of the intervertebral disk and the surrounding vertebra is defined as vertebral osteomyelitis (VO) or spondylodiscitis. Etiologically it has been divided into 2 groups: tuberculous and nontuberculous osteomyelitis. Adults are the most affected in the general population, most patients diagnosed with this disease being over 50 years old. The clinical signs and symptoms are unspecific and this results in a late diagnose of this pathology. (1, 4, 12 )

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**Keywords**  
decompression,  
osteodiscitis,  
spinal fixation surgery,  
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vertebral osteomyelitis

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The lumbar vertebral bodies of the spine are the most often affected according to literature, being followed by the thoracic and cervical (rare) areas. The clinical presentation of VO is consisted of: acute, subacute or chronic. Tenderness and local regional pain are the most common symptoms in 90% of the patients. Fever is an inconstant sign, being present in 50% of the cases. Neurological deficits may exist when the spinal cord or nerve roots are affected through compression. (6)

The most isolated organism that causes vertebral osteomyelitis is *Staphylococcus aureus* (skin, invasive maneuvers and various percutaneous catheters may be an entry portal), being followed by *Escherichia coli*, Coagulase-negative staphylococci, *Propionibacterium acnes*. Gram-negative aerobic bacteria and *Candida spp* are common microorganisms are discovered in iv drug abusers and immunosuppressed patients. These represent various etiologies for nontuberculous osteomyelitis, while *Mycobacterium Tuberculosis* is the main factor for developing tuberculous (TB) vertebral osteomyelitis. (1, 7, 10, 13, 16)

Biopsy of the tissue has a high diagnostic accuracy. Leukocytosis is found in 50 % of cases and has a low diagnostic sensitivity. A raised erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) levels are highly sensitive. A good clinical response to treatment is noted by lowering of the CRP levels. (1, 4, 9, 16)

Imaging studies used for the diagnosis of VO are represented by radiography, scintigraphy, CT scan and MRI. The MRI has high diagnostic sensitivity and specificity. For obtaining an anatomopathological and microbiological based diagnostic CT-guided fine-needle aspiration biopsy (FNAB) is used and has a sensitivity of 50%. (1)

The aim of the treatment is to eradicate the infection, relieve the pain and restore the neurological status of the patient. (1)

Our purpose of the study was to describe a series of vertebral osteomyelitis cases in our hospital, to differentiate de factors that cause or predispose to the formation of this infection and show the benefits of a surgical stabilization treatment for axial stability and early mobilization.

## METHODS

### Type of study

We conducted a retrospective descriptive study, in

which we included patients operated for osteomyelitis / primary vertebral osteodiscitis in the neurosurgery clinic of the Emergency Clinical Hospital Bagdasar - Arseni for a period of 5 years (January 1, 2014 – December 31, 2018). The study is based on the experience of the Neurosurgery II and IV departments of the hospital. It is the only study conducted in our country over a longer period of time and on a large number of patients, with the theme of multimodal treatment of vertebral osteomyelitis.

We had the method of retrospective revision of the electronic observation sheets, of the patients' files taken from the hospital archive and the operative protocols of the patients with osteomyelitis / primary vertebral osteodiscitis operated in the previously mentioned period. Based on the information obtained, we created a database using the Microsoft Office Excel 2007 program. The statistical analysis was performed using the IBM SPSS Statistics 20 program. We created a database that can be taken as a starting point in establishing medical and surgical treatment protocols for patients with vertebral osteomyelitis.

On a national level, there is no evidence of reported cases of vertebral osteomyelitis and there are no protocols for unitary treatment of this condition.

As inclusion criteria, only patients with osteomyelitis/osteodiscitis operated between January 1, 2014 - December 31, 2018 were included in the study.

Patients with vertebral osteomyelitis who received only conservative treatment without surgery or patients with osteodiscitis secondary to operated disc herniation were excluded from our study.

The variables introduced in the statistical analysis were nominal, dichotomous (binary, bimodal), ordinal and quantitative (measurable) discontinuous (discrete). Depending on the variables studied, we performed uni, bi and multivariate statistical analyzes.

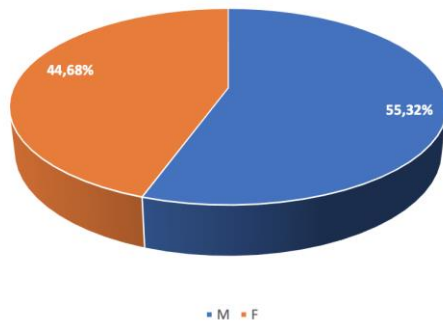
## RESULTS

Between January 1, 2014 and December 31, 2018, 164 patients were hospitalized and diagnosed with Vertebral Osteodiscitis in the Neurosurgery Clinic of the Bagdasar-Arseni Emergency Clinical Hospital. Of

these, 94 patients (57.31%) underwent surgery for vertebral osteomyelitis.

**Sexual distribution**

The distribution by sex was slightly in favor of males, 52 patients being male, representing 55% were operated for vertebral osteomyelitis, compared to 42 female patients, representing 42% operated for the same pathology. The sex ratio of M / F was 1.23 (Figure 1).

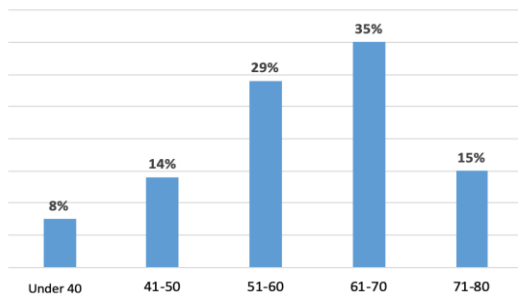


**Figure 1.** Sexual distribution of the patients.

**Age distribution**

In the studied group we distributed the patients by decades of age between 40 and 80 years. The vast majority of patients were in the age range of 51-70 years, respectively 27 patients (29% of cases) in the range of 51-60 years and 32 patients (35% of cases) in the range of 61-70 years. This is justified by the fact that these age groups include relatively active patients, who also perform physical exertion, but who have a personal history that may promote the occurrence of vertebral osteomyelitis.

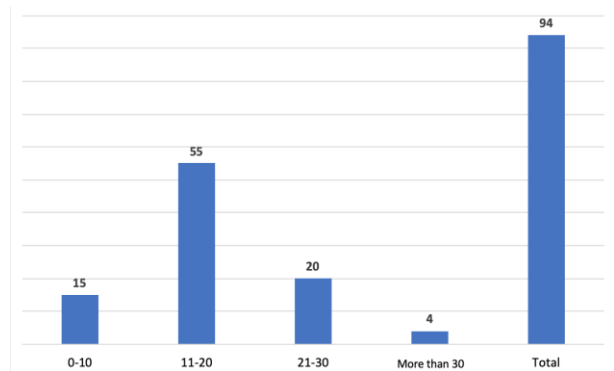
The rest of the patients are distributed in lower percentages in the interval under 40 years old being 7 patients (8% of cases), and between 41-50 years old and over 70 years old 14 patients (15% of cases) in each group (Figure 2).



**Figure 2.** Age distribution of the patients.

**Duration of hospitalization of patients in the study group**

On the studied group, the hospitalization period varied between 0-10 days, 11-20 days, 21-30 days and respectively hospitalized patients for a period of over 30 days. Among the patients studied, the highest percentage was represented by those hospitalized for less than 20 days, who opted for vertebral fixation with titanium instrumentation, in 55 cases (70%), followed by those hospitalized between 21-30 days, in a number of 20 cases (21%) and respectively those hospitalized for a period longer than 30 days, in a number of 4 patients (4%), in which only the vertebral decompression was practiced (Figure 3).

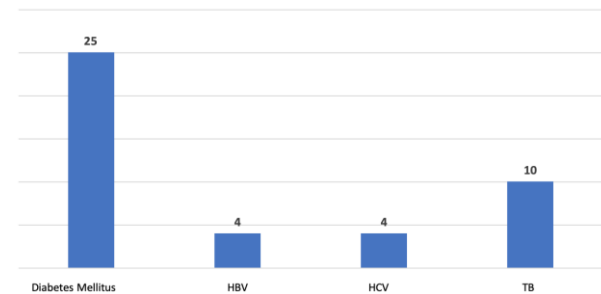


**Figure 3.** Number of hospitalization days of the patients.

**Secondary Diagnostics**

From the point of view of the pathology associated with patients operated for Vertebral Osteomyelitis, a number of 25 cases (26.6%) had diabetes, 10 cases had a personal history of pulmonary TB (10.6%), 8 cases had had hepatitis B or C virus infection (8.5%).

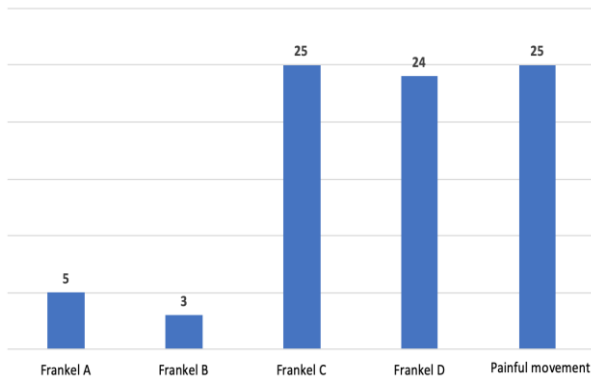
Out of the total number of patients, 43 cases (45.7%) were diagnosed and operated for Vertebral Osteomyelitis on the background of an immunosuppression already present due to the pathologies mentioned above (Figure 4).



**Figure 4.** Associated pathologies of the patients.

**Clinical Examination**

Lumbar back pain that translates to vertebral instability syndrome is present in all patients with vertebral osteomyelitis. The neurological syndrome occurs in 57 of patients with vertebral osteomyelitis in the study group (60.6%). Of these, Frankel C and D type paraparesis dominates the clinical picture, Frankel C 25 cases (26.5%) and Frankel D 24 cases (25.5%). 5 patients from the studied group were Frankel type A (5.3%), and 3 patients type Frankel B (3.2%) (Figure 5).

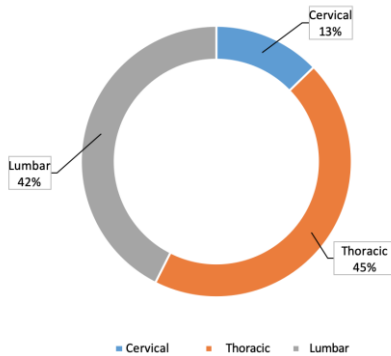


**Figure 5.** Preoperative status of the patients according to Frankel grading system.

**Localization of the vertebral lesion**

In the studied group, the vertebral seat of the inflammatory lesion predominates in the thoracic and lumbar region, thoracic osteomyelitis is found in 42 patients (45% of cases), lumbar localization in 40 patients (42% of cases) and cervical in the remaining 12 patients. (13% of cases). (Figure 6)

This is important in choosing the surgical approach and considering the importance of spinal fixation during surgery.



**Figure 6.** Incidence of the affected spinal region in the patients studied.

**SURGICAL TREATMENT**

The surgical treatment has as important objectives: evacuation of infection and debridement, decompression of the dural sac and spinal roots and vertebral fixation / fusion.

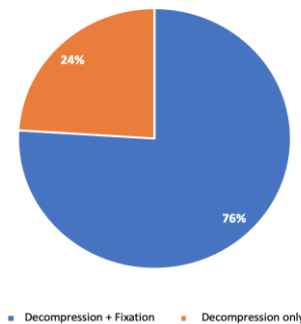
Surgical decompression involves debridement of the inflammatory focus and evacuation of pus from the intervertebral disc space, curettage of cartilaginous and bony necrotic-inflammatory tissue, evacuation of intra- and paraspinal abscesses, and decompression of the dural sac and spinal nerves.

The vertebral fixation at the level of the thoracic and lumbar spine is performed using transpedicular screws and titanium rods, but also the reconstruction techniques of the anterior spine, with the help of fixed or expandable titanium cages. The use of titanium instrumentation in vertebral osteomyelitis is a method in continuous debate, but recent studies show the advantages of vertebral stabilization and the compatibility of titanium with infection.

The group we studied includes patients operated on 2 neurosurgery departments in the Bagdasar Arseni Emergency Clinical Hospital by several surgical teams. Some surgeons have chosen only surgical decompression alone as a method. In addition to decompression, others also opted for spinal fixation with titanium instrumentation.

Thus, in the studied group, 72 patients (24%) benefited from internal fixation with titanium instrumentation, while in the remaining 22 cases (76%) only the evacuation of the infectious outbreak and the decompression of the nervous elements were performed, without metal fixation. (Figure 7)

The aim of this study is to perform a comparative analysis of postoperative results in patients operated for vertebral osteomyelitis in which metal fixation was performed compared to those without metal fixation.



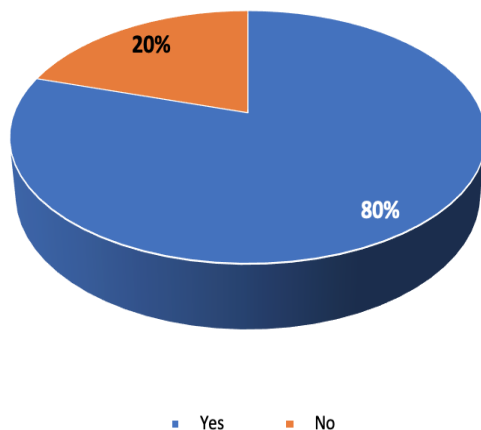
**Figure 7.** Type of surgical intervention performed on the studied patients.

### POSTOPERATIVE MOBILIZATION

Due to the improvement of the implantation techniques of the titanium fixing systems (stronger screws, more elastic rods), the period of postoperative immobilization of the patient decreased significantly. This refers to the degree of vertebral stability obtained after surgery, the degree of preoperative neurological injury and the general pathology associated with vertebral osteomyelitis (diabetes, chronic hepatitis, heart failure, COPD).

The period in which the postoperative mobilization took place varied between 5 and 14 days, this being possible in 75 of (80% of cases). In 19 patients (20% of cases) early mobilization was not possible, requiring postoperative bed rest, which ranged from 6 to 8 weeks. (Figure 8)

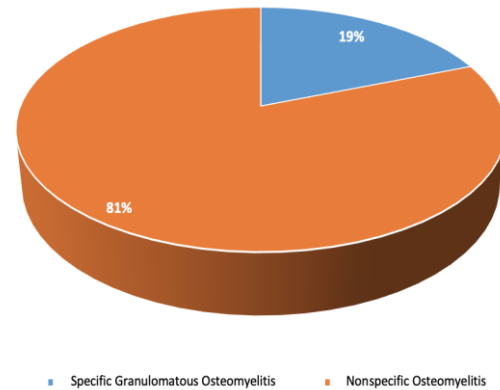
Early mobilization of patients was corroborated in particular with the achievement of spinal fixation at the same time as spinal decompression.



**Figure 8.** Early postoperative mobilization of the patients within 5 to 14 days.

### HISTOPATHOLOGICAL RESULTS

In absolutely all patients, biopsy was collected from the intervertebral disc, adjacent bone plateaus and evacuated spinal abscesses. The goal was to establish the etiology of the infectious outbreak for proper antibiotic therapy. Therefore, the diagnosis of specific granulomatous osteomyelitis (TB) was found in 18 patients (19% of cases), and that of nonspecific osteomyelitis in 76 patients (81% of cases) (Figure 9).



**Figure 9.** Incidence of Tuberculous Osteomyelitis in the studied cases.

### DISCUSSION

Vertebral osteomyelitis is a rare disease with an incidence of 5.3 cases per million in one year (3,11). The incidence is growing because of the increasing number of elderly patients with severe comorbidities. The invasive options used for the diagnosis and treatment of this disease (3,16). The diagnosis is in most of the cases delayed due to the prolonged onset of this disease (11).

Tuberculous osteomyelitis is a disease that can rapidly alter the patient's prognosis, especially if it becomes infected and coexists with pyogenic osteomyelitis (14,15). Non-granulomatous VO has a higher incidence than TB VO and this is concluded in our study as well. Specific granulomatous osteomyelitis was detected in 19% of cases, the rest having a nonspecific anatomopathological result (81% of cases).

Men are more affected than women by VO (1,11). The disease may be diagnosed at any age, but it has a higher incidence in elderly patients (14). In our study the sex ratio between males and females was 1.23. We showed that the average age was between 61-70 years. Age groups were dominated by the following percentages: patients between 61-70 years (35%), 51-60 years (29%), 71-80 years (15%), 41-50 years (14%) and under 40 (14%). This demonstrates the increased frequency of vertebral osteomyelitis in elderly patients.

In terms of patient characteristics, it is described in previous papers that diabetes mellitus and chronic



renal insufficiency are the most frequent comorbidities in patients with hematogenous related vertebral osteomyelitis (2, 5, 8). In our study, the most common personal pathologies were diabetes mellitus (26.6%), pulmonary TB (10.6%) and hepatic viral infections with HBV and HCV (8%). It has been shown in the study group that patients with a deficient immune system are prone to the appearance of vertebral osteomyelitis.

The lumbar spine is the most common affected level (45-50%), followed by the thoracic, cervical and sacral region. In our study we revealed that the location of the lesion is predominantly thoracic (45%), followed by the lumbar location (42%) and then the cervical location (13%). The thoracic spine is the most common site of vertebral osteomyelitis in the patients studied.

Back pain and muscle spasm of the paravertebral muscles are the most common symptoms of the patients. Fever is present in 10-45 % of the cases (3, 11). Other clinical findings are represented by: decreased spine motion, paresthesia, anorexia, alteration of the patient's general state, swelling of the affected region and tenderness at palpation. If the infection spreads into the epidural space this results in the manifestation of neurological deficits (11). In our study, the vast majority of patients have lumbar back pain and spinal instability in the clinical picture. Neurological syndrome occurs in 60.6% of all cases studied, this is due to the late presentation at hospital.

In the study we conducted, decompression of the dural sac and nerve elements, followed by spinal fixation with titanium instrumentation in the same surgery (76% of cases) shows a rapid postoperative mobilization and a shortening of the hospitalization period, compared to patients who underwent only for surgical decompression (24% of cases).

Postoperative mobilization was possible in 80% of patients being done from the first 5-14 days after surgery, which demonstrates the effectiveness of using titanium instrumentation for spinal fixation after spinal decompression.

The average length of hospitalization of patients was less than 20 days. Out of the total of 94 cases studied, a number of 70 cases had a hospitalization time of less than 20 days, 20 cases with hospitalization between 21-30 days and respectively 4 patients with a hospitalization duration of over 30 of days. In the study group, patients treated with

spinal fixation with titanium instrumentation had a shorter hospitalization time than those operated without titanium instrumentation.

Following the study we conducted, we can relate that titanium instrumentation vertebral fixation for instability caused by osteomyelitis allows early mobilization of patients, faster healing of the inflammatory outbreak, reduction of postoperative complications and decreased hospitalization days.

## CONCLUSION

Vertebral osteomyelitis occurs in both men and women, with a predisposition for the male population.

In addition to old age, other diseases, such as diabetes, chronic kidney failure with dialysis pose a risk for increased incidence. Although vertebral osteomyelitis is found in elderly patients, the infection is frequently reported, especially in patients over 60, who are associated with various diseases, such as diabetes, hepatitis or pulmonary TB.

The symptoms can be diverse, the dominant symptom is back pain. This translates the pain given by the infection / inflammation but also the spinal pain of vertebral instability. Neurological symptoms may range from radiculopathy to spinal cord or ponytail syndrome.

The site of the vertebral lesion can be anywhere on the spine, but the thoracic location predominates, then the lumbar one.

The surgical treatment aims at the debridement of the inflammatory focus and the evacuation of the pus, the decompression of the dural sac and of the nervous elements. The treatment of spinal instability using fixation-fusion and vertebral reconstruction techniques is a controversial topic, but studies in the literature show the compatibility of instrumentation with infection. The choice of surgical approach depends on the location of the lesion in the spine.

Early mobilization after surgery is an important goal that can be achieved in patients with metal fixation with titanium instrumentation, without postoperative vertebral instability. Early mobilization, especially in elderly patients with various associated pathologies, can significantly reduce the rate of complications associated with prolonged immobilization.

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