

# A complex case of Neuro-Muscular rehabilitation with favorable evolution in a patient with incomplete paraplegia post thoracic osteomyelitis, surgically treated, with multiple pulmonary and reno-vesical determinations

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## Abstract

**Introduction:** Vertebral osteomyelitis refers to an infectious disease that affects the vertebral body, the intervertebral disk, or adjacent paraspinal tissue (2-7% of all musculoskeletal infections) and can determine severe or rather permanent sequels.

**Materials and Methods:** This paper presents the case of a 61-year-old obese patient (having the TEHBA Bioethics Committee approval no 9181/11.04.2018), with personal antecedents of arterial hypertension and chronic obstructive broncho-pneumopathy hospitalized at the Neurosurgery Clinic (NS) II of TEHBA in a critical condition, for incomplete AIS/Frankel C paraplegia with sphincter's discontrol and renal and respiratory failure. After complex paraclinical investigations, was discovered a T6-T7 osteomyelitis (probably with renal start point - the onset of the disease being with a urinary infection), left pleural empyema with left pleural chistic collection, emphysema bubbles in both hemi-thorax. After repeated thoracic surgery examinations, it was made a left pleural puncture and after 5 days a pleurostomy was decided with removal of 1000 ml sero-hematic fluid and subsequently a new incision was done, with partial evacuation, as a result of subcutaneous emphysema in the left hemi-thorax. When the patient became hemodynamic and respiratory stable it was decided a neuro-surgical intervention with T6 discectomy. In our clinic, the patient initially followed a complex nursing program and subsequently a rehabilitation adequate program. The patient's evolution was initially severe, requiring oxygen therapy for a long time and presenting an episode of swelling with macular eruption with urticaria in the lower limbs followed by an acute urinary retention (with removal of 3000 ml urine, followed by fixed urinary catheterisation – possibly autonomous disreflexia). After stabilizing the patient, her evolution was favourable with oedema and rash disappearance, with respiratory function improvement and quitting oxygen therapy. The patient was assessed functionally using the following scales: AIS / Frankel, modified Ashworth, Functional Independence Measure (FIM), Life Quality Assessment (QOL), FAC International Scale, Independence Assessment Scale in Daily Activities (ADL / IADL), Walking Scale for Spinal Cord Injury (WISCI). **Results:** The patient benefited from a complex neuro-muscular rehabilitation program, having a favourable evolution, with an increase in the evaluated scales scores and thus, with a final performance of walking without a support for short distances, including climbing/ descending stairs, as well as a sphincter re-education with the neurogenic bladder remission.

**Conclusions:** The paraclinical assessments followed by prompt thoracic- and neuro-surgery intervention, associated with complex nursing measures, with personalized rehabilitative kinethological programs, in an obese patient with post-osteomyelitis paraplegia determined the neuro-locomotor impairment and respiratory dysfunction improvement and sphincter re-education, thus enhancing including patient's quality of life.

**Key words:** *paraplegia, osteomyelitis, pleurostomy, neuro-muscular rehabilitation*

## Introduction

Vertebral osteomyelitis refers to an infectious disease that affects the vertebral body, the inter-vertebral disk, or adjacent paraspinal tissue (2-7% of all musculoskeletal infections) and can determine severe or rather permanent sequels [1]. 95% of spinal infections involve the vertebral body, and only 5% involve the posterior elements of the spine. The difference of involvement is due to blood supply which is more in vertebral bodies [2].

The incidence of vertebral osteomyelitis has been rising recently assumed to be due to aging society, increase in the number of immune compromised subjects [3,4]. The incidence has been reported to be 2.2 to 5.8 per 100,000 and highest in men aged 70–79 years [5] and the overall incidence increases with

aging. In the population older than 20 years, the male predominance in incidence increases until the age of 80 years [5]. Vertebral osteomyelitis is a compelling clinical entity for clinicians, because of its insidious start and indolent course, which make diagnosis difficult. As a consequence, patients often develop destructive lesions or neurological complications related to compression of the spinal cord or its roots [6]. A distant focus of infection provides an infective nidus from which bacteria spread by the bloodstream to the spinal column. The skin and the genitourinary tract are some important sites for spreading the infection. Septic arthritis, sinusitis, subacute bacterial endocarditis, and respiratory, oral, or gastrointestinal infection could be other sources of infective agents [1]. But an important percent (approximately 30-70%)

of patients with vertebral osteomyelitis still have no obvious prior infection [2].

Spine osteomyelitis can affect any vertebra, but most vertebral body infections occur in the lumbar one because of the blood flow to this region of the spine. Location: lumbar (48%) most common, followed by thoracic (35%) and cervical (6.5%) [7]. Tuberculosis has a predilection for the thoracic spine, and drug abusers are more likely to contract an infection of the cervical spine [1]. The combination of mechanical compression of the spinal cord by pus or granulation tissue can result in ischemia with spinal cord infarction, which accounts for the rapid neurologic progression.

Patients with a spinal epidural abscess may progress to complete paralysis within minutes to hours, even while receiving optimal antibiotic therapy.

The damage of the spinal cord can be done by trauma or by other causes like: degenerative pathology, tumours, infections (discitis, osteomyelitis, spinal abscess, etc), multiple sclerosis, etc., and so, they can be split in two main categories: Traumatic Spinal Cord Injury (TSCI) and Non-Traumatic Spinal Cord Injury (NTSCI). From epidemiological point of view, the second group of such lesions, even if more frequently met, with higher incidence than TSCI, are less studied (possible because of the non-concordance on the definitions of NTSCI or what pathology should be covered by that diagnosis)[8].

Spinal cord injury is a neurological condition that usually determines important loss of basic functions (mobility, sensitivity, micturition and/or defecation etc) [8,9,10,11] being divided in two main types of lesion i.e. complete and incomplete and having often devastating sequels. The most common severe consequences of this condition are: tetraplegia and paraplegia.

**Some of the important risk factors for vertebral osteomyelitis are:** diabetes mellitus (most common cause) [7], malnutrition, immunosuppression (HIV, malignancy, chronic steroids or immunosuppressant medication use), spinal fracture, trauma or recent procedure, substance Abuse (alcoholism and intravenous drug use), presence of an indwelling vascular device, organ transplantation, elderly, surgical site infection [1].

#### **Ethio-pathogeny:**

Infection occurs by one of the routes:

- Hematogenous spread – secondary to infections of the genito-urinary, skin, soft

tissue and respiratory system, indwelling catheters or endocarditis

- Due to the bifurcated structure of the arterial supply, generally presents as infection of 2 contiguous vertebrae and the intervertebral disc
- Direct inoculation during trauma or spinal surgery
- Spread from adjacent soft tissue infection

#### **Common microorganism that can cause vertebral osteomyelitis are:**

- Staphylococci: most frequent is **Staphylococcus Aureus** (36-67% of cases)[13]
- Enterococcus species
- Pseudomonas aeruginosa
- Enterobacteriaceae
- Hemolytic streptococci
- Propionibacterium acnes
- Tuberculosis
- Fungus: blastomycosis, coccidiomycosis, histoplasmosis, aspergillosis
- Yeast
- Parasitic organisms [1]

**Clinical signs and symptoms:** back pain due to a spinal infection, often develops insidiously and over a long period of time. The pain gradually increases in intensity and eventually becomes severe and unrelieved by medication and rest. Neurological signs are often not present until late stages. However, the infection may move into the spinal cord and cause an epidural abscess, which can place pressure on the spine and cause a non-traumatic spinal cord injury, that can have severe consequences as: paraplegia or quadriplegia.

In addition to back pain, which is present in over 90% of patients with vertebral osteomyelitis, general symptoms may include one or a combination of the following constitutional symptoms: fever, chills, or shakes, unplanned weight loss, night-time pain that is worse than daytime, swelling and possible warmth and redness around the infection site. But most of the patients are as already mentioned above lack of systemic symptoms.

#### **Paraclinical investigations:**

Blood tests:

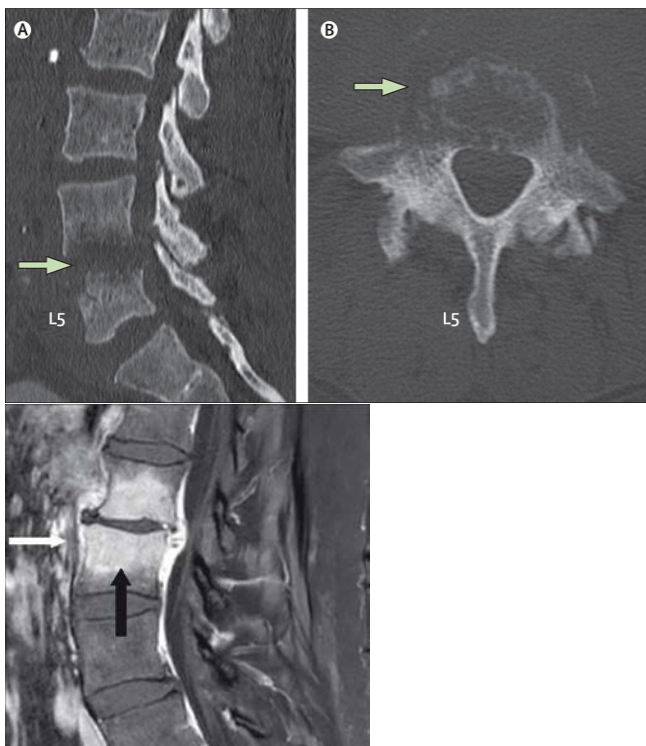
-Leukocytosis and Neutrophilia are poorly sensitive and highly non-specific [14]. The degree of elevation does not predict disease severity

- ESR and CRP are sensitive, yet not specific (CRP concentration rise and fall quicker than ESR, often used to guide treatment)

- Blood Cultures are an important element in management and treatment of the disease. Blood culture positivity often decides whether a patient will require a biopsy and cultured specimen narrows antibiotic coverage.

Urinalysis/ Urine Culture –UTI is a frequent missed source of bacteremia (especially in diabetic patients)[7]

Imaging tests that can be used for diagnosis of osteomyelitis are: an x-ray, MRI, or CT scan that can reveal any bone damage. Though, the damage may not be visible for 2 weeks on an X-ray, so more detailed MRI or CT scans are recommended if the injury is recent. MRI is the gold standard to diagnose the spinal infection with sensitivity, specificity, and accuracy of over 90% [15]. (images like destruction of endplate and marrow edema of the vertebral body results in decreased signal intensity of vertebral body [16]).



**Fig. 1** Examples of vertebral osteomyelitis [17]

### Treatment

Spinal infection may result in severe bone destruction and deformity, in which internal fixation of structural stabilization may be necessary. Recent studies focusing on this issue have reported the usefulness and stability of internal fixation in active

osteomyelitis [18, 19] Neurotrophic treatment can be useful in a patient with neurological deficits after a vertebral osteomyelitis.

### Case presentation

This paper presents the case of a 61-year-old obese patient (having the TEHBA Bioethics Committee approval no 9181/11.04.2018), with Personal Antecedents of: arterial hypertension and chronic obstructive broncho-pneumopathy hospitalized on 27.10.2017 at the Neurosurgery Clinic (NS) II of TEHBA in a critical condition (coming from Suceava Emergency Hospital), for incomplete AIS/Frankel C paraplegia with sphincter's discontrol and renal and respiratory failure. The patient presents in the admission in NS II Clinic division an acute urinary retention (1500ml – pyuria and hyperchromic urine) and a fixed urinary catheterisation was done. To be mentioned that the symptomatology was installed a month ago, initially with lumbar pain irradiating in left leg but the patient could walk independently. After complex paraclinical investigations, was confirmed: the T6-T7 osteomyelitis – with the collapse of superior T7 plate, inflammation and marrow oedema in vertebral body of T6 and T7

Epidural anterior collection T5-T7 and posterior collection T7-T9, with a depth of 7 mm that compress the bone marrow → T6-T9 myelopathy (having probably renal start point - the onset of the disease being with a urinary infection) initially discovered in Suceava Emergency Hospital.

Also was found in the thoracic TC from 27.10.2017 – right basal pleurisy, left pleural empyema with left pleural cystic collection, emphysema bubbles in both hemi-thoraxes.

After repeated thoracic surgery examinations, it was made a left pleural puncture, with evacuation of 10 ml of sero-hematic fluid that is sent for bacterial culture test and after 5 days a medium left pleurisy and minimum right pleurisy is diagnosed and a pleurotomy was decided with removal of 1000 ml sero-hematic fluid. Subsequently a new incision was done, with partial evacuation, as a result of subcutaneous emphysema in the left hemi-thorax.

After infectious diseases medical examination, it is initiated the antibiotic treatment with Meronem iv drug 3gr/day and Vancomycin 1 gr/day for 7-10 days. When the patient became hemodynamic and respiratory stable it was decided a neuro-surgical intervention with T6 discectomy and unilateral osteosynthesis T5-T8 (07.11.2017)



**Fig. 2 Thoracic TC (09.11.2017):** right basal pleuresy(2,5 cm), left pleural cystic collection with calcar pahipleuresy, a delicate line of left pneumo-thorax and **pleurostomy ducts left apical and basal**

**Anatomo-pathological examination:**

- macroscopic analysis: multifragmentary piece of 4 / 3,5 / 1,2 cm, white-yellow with large violaceous areas of elastic consistency inhomogeneous through the presence of bone tissue  
 - microscopic analysis: acute osteodisicitis with necrotic-suppurative composition

After an insidious evolution, with oxygen desaturation and tachypnea, including with a period of treatment in our hospital Intensive Care Unit, after her hemodynamic and respiratory stabilization, the patient is admitted in our Neuro-Muscular Clinic Division. In our clinic, the patient initially followed a complex nursing program and subsequently a rehabilitation adequate program.

The reasons for admission: motor deficit in lower limb, sphincter's discontrol, moderate deficit of locomotion and self-care.

General clinical examination: afebrile, Blood Pressure=110/70 mmHg, Pulse=80/min, SaO2=95% with oxygen-therapy, congestive teguments on both legs – glutei and calf region and on 1/2 inferior thorax, with important bilateral swelling, grade III obesity – especially with abdominal distribution, post-operative mild dehiscent plague at thoracic level, genital and inguinal erythema.

Neurological examination: temporal-spatial oriented, conscious, cooperative, motor deficit (according to AIS/Frankel Scale) of paraplegia type, with T6 neurological level



**Fig. 3 Clinical evaluation of our patient in TEHBA Neuro-Rehabilitation Clinic Devisiion**

The patient was assessed functionally using the following scales [20]: **AIS (American Spinal Injury Association Impairment Scale)** = 85 motor from 100 points, sensory = 204 from 224 points, spasticity = 1 on **Ashworth modified scale**, **FIM (Functional Independence Measure):**motor = 29 points; cognitive = 35 points, **QoL (Life Quality Assessment Quality of Life)** = 57 points, **Walking Scale for Spinal Cord Injury (WISCI)** = 0 points, **Functional Ambulation Categories(FAC) International Scale** = 0.

From functional point of view the patient was immobilized in bed.

**Fig. 4 American Spinal Injury Association (ASIA) Impairment Scale (AIS) scoring** (after: <http://www.scribd.com/doc/37064936/2006-Classif-Worksheet>) – with included/ adapted **Frankel's grading** semi-quantitative system – to describe/ assess the severity of cord lesion's consequent (neurologicand functional) impairment – with some main related clinical syndromes [20]

Nr.	Categorie	Caracterizare
0	Nefunctionalitate	Pacientul nu poate merge sau necesita ajutor de la 2 sau mai multe persoane
1	Dependenta - nivel 2	Pacientul necesita sprijin ferm și continuu din partea unei persoane
2	Dependenta - nivel 1	Pacientul necesita sprijin continuu sau intermitent din partea unei persoane pentru ajutor cu echilibrul sau coordonarea
3	Dependenta - supraveghere	Pacientul necesita coordonarea verbală sau ajutor potential din partea unei persoane fără contact fizic
4	Independenta - pe teren plan	Pacientul poate merge independent pe teren plan, dar necesita ajutor la scări, pante sau suprafețe denivelate
5	Independenta	Pacientul poate merge independent oriunde

**Fig. 5 FAC (Functional Ambulation Categories) international scale** – utilised in our clinic devisiion [20]

## FIM™ instrument

7 Complete Independence (Timely, Safely)		NO HELPER		
6 Modified Independence (Device)				
Modified Dependence		HELPER		
4 Supervision (Subject = 100%)				
3 Minimal Assist (Subject = 75%)				
2 Moderate Assist (Subject = 50%)				
Complete Dependence				
1 Maximal Assist (Subject = 25%)				
0 Total Assist (Subject = less than 25%)				
<b>Self-Care</b>				
A	Eating			
B	Grooming			
C	Bathing			
D	Dressing - Upper Body			
E	Dressing - Lower Body			
F	Toileting			
<b>Sphincter Control</b>				
G	Bladder Management			
H	Bowel Management			
<b>Transfers</b>				
I	Bed, Chair, Wheelchair			
J	Toilet			
K	Tub, Shower			
<b>Locomotion</b>				
L	Walk/Wheelchair			
M	Stairs			
<b>Motor Subtotal Score</b>				
<b>Communication</b>				
N	Comprehension			
O	Expression			
<b>Social Cognition</b>				
P	Social Interaction			
Q	Problem Solving			
R	Memory			
<b>Cognitive Subtotal Score</b>				
<b>TOTAL FIM Score</b>				

**Fig. 6 FIM (Functional Independence Measure) -Endorsed by the USA Department of Veterans Affairs, since 2003** Guide for the Uniform Data Set for Medical Rehabilitation, Version 5.1 Buffalo, State University of New York at Buffalo - from Uniform Data System for Medical Rehabilitation, UBFA - cited in Braddom R. L. et al.[20, 21]

During hospitalisation, the patient presents some short episodes of: hypoalbuminemia, hyponatraemia, acute kidney failure (with increased values of urea and creatinine), normochromic anaemia, relapsed urinary infections treated with specific antibiotics according to antibiograms.

ESR	FIBRINOGEN	LEUCOCYTES
23.11.2017	23.11.2017	23.11.2017
90 mm/h	181,615 mg/dl	12,25 /uL
30.11.2017	30.11.2017	30.11.2017
100 mm/h	615 mg/dl	8,15 / uL
11.12.2017	19.12.2016	19.12.2016
120 mm/h	608 mg/dl	8,89 /uL
28.12.2017	28.12.2017	28.12.2017
90 mm/h	321 mg/dl	7,94/uL
15.01.2018	15.01.2018	15.01.2018
90 mm/h	300 mg/dl	8,3/uL

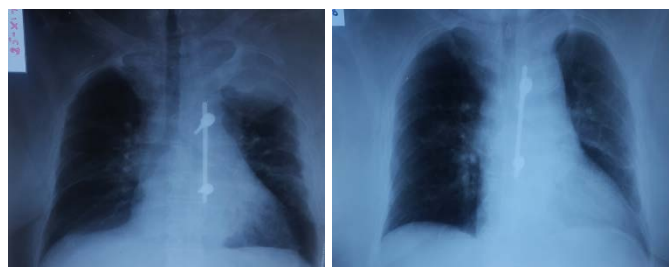
Tab. 1 Paraclinical evaluation in dynamic of three inflammatory factors

UREA	CREATININE	URIC ACID
26.11.2017	26.11.2017	26.11.2017
55 mg/dl	1,93 mg/dl	7,7 mg/dl
30.11.2017	30.11.2017	30.11.2017
40 mg/dl	1,46 mg/dl	6,9 mg/dl
11.12.2017	19.12.2016	19.12.2016
45 mg/dl	1,03 mg/dl	6,9 mg/dl
15.01.2018	15.01.2018	15.01.2018
36 mg/dl	0,88 mg/dl	5,9 mg/dl

Tab. 2 Paraclinical evaluation in dynamic of three indicators of renal function

### Pulmonary radiography evolution:

- 25.11.2017 - thoracic apico-lateral opacity - left pleural cystic collection and minimal right pleuresy
- 04.01.2018 - increasing of the peribronchial-vascular compartment bilateral peri hilarus



**Fig. 7** Pulmonary radiography of our patient in TEHBA Neuro-Rehabilitation Clinic Devison

Based on the anamnesis data, on the clinical and paraclinical examination, the diagnosis was:

- Incomplete AIS/Frakes C paraplegia with T6 neurologic level post thoracic osteomyelitis, surgically treated
- Left pleuresy postero-basal remitted
- Left thorax emphysema -evacuated
- Relapsed urinary tract infections
- Neurogenic bladder
- Blood Hypertension stage II
- Fatty Liver Disease
- Obesity stage III
- Chronic obstructive broncho-pneumopathy
- Respiratory and renal failure - remitted

During hospitalization, the patient received **complex drug treatment with:** injectable anticoagulants, neurotrophic vitamins, analgesics, NSAID, antibiotics, urinary antiseptics, hypotensors including diuretics, gastric protectors and antihistaminic drugs. also the patient benefitted from **kinotherapy**, initially only in bed (also limited by the needing of oxygenotherapy) with a personalised program: passive movement at the joints level, active ones, active with lower limb resistance, correct positioning in bed for prevention of vicious joints positions or thrombophlebitis.

The patient's evolution was initially severe, requiring oxygen therapy for a long time (a month) and presenting an episode of swelling with macular eruption with urticaria in the lower limbs followed by an episode of acute urinary retention (with removal of 3000 ml urine, followed by fixed urinary catheterisation - possibly caused by autonomous disreflexia).

After stabilizing the patient, her evolution was favourable with oedema and rash disappearance, with respiratory function improvement and quitting oxygen therapy. After neuro-surgical evaluation, the patient began kinotherapy in the gymnastic room (initially using a portable oxygenotherapy) with exercises for enhancing: the lower limb force (on the

trellis), joint mobility (on the bicycle), exercises for coordination and at last walking recovery program (during parallel bars, with walking frame, with crutches and at last walking independently, including climbing stairs). Also during hospitalisation the patient lost a considerable number of kilograms (~18 kg) and thus being an favorable factor in walk/autonomy regaining.

**Results:** The patient benefited from a complex neuromuscular rehabilitation program, having a favorable evolution, with an increase in the evaluated scales scores: **AIS/ Frankel score** from 85 **motor** to 100 points, and **sensory score** from 204 to 224 points → **from AIS/ Frankel C to D; Ashworth modified scale** from 1 to 0; **FIM motor** from 29 points to 76 points; **cognitiv** 35 points; **QoL** from 57 points to 86 points; **WISCI** from 0 points to 20 points; **FAC International Scale** from 0 to 4.

As a final performance, she could walk without a support for short distances, including climbing/descending stairs and benefitted from a sphincter re-education with the neurogenic bladder remission.

**Conclusions:** The incidence of vertebral osteomyelitis has been increasing lately, so although a rare condition, clinicians should consider it in patients with unremitting back pain and increase in inflammatory marker – as a take home message.

When vertebral osteomyelitis is suspected, MRI should be performed promptly and cultures to identify the causative micro-organism are very important and specific treatment should be applied according to culture results.

The paraclinical assessments followed by prompt thoracic- and neuro-surgery intervention, associated with complex nursing measures, with personalized rehabilitative kinesiological programs, in an obese patient with post-osteomyelitis paraplegia determined the neuro-locomotor impairment and respiratory dysfunction improvement and sphincter re-education, thus enhancing including patient's quality of life

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