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## Computed Tomography in the Diagnosis of *Myositis Ossificans* – Case Report

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### Background:

The term *myositis ossificans* refers to the formation of ossifications in the muscles, ligaments and fascias, usually as a result of trauma. *Fibrodysplasia ossificans progressiva* is a rare genetic disease in which heterotopic ossifications appear in early childhood and are accompanied by feet and spine defects.

### Case Report:

We present a case of a 31-year-old woman with massive heterotopic ossifications who suffered multiple injuries. We would like to emphasize the role of computed tomography in the exact localization of ossifications.

### Conclusions:

Thanks to the volume rendering techniques and 3D image reconstructions, it is possible to precisely determine the position of ossifications in relation to the internal organs and blood vessels, allowing to schedule the surgery to remove the lesions.

### MeSH Keywords:

Ossification, Heterotopic • *Myositis Ossificans* • Tomography Scanners, X-Ray Computed

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## Background

The term *myositis ossificans* (MO) refers to the formation of ossifications in the muscles, ligaments and fascias. The lesions are not malignant and usually occur as a result of trauma. They can be located throughout the body; however, they are predominant sites most prone to injuries, such as thighs, buttocks or elbows. The pathogenesis of the disorder has not been fully explained [1,2].

*Fibrodysplasia ossificans progressiva* (FOP) is a form of *myositis ossificans*. It is a rare genetic disease in which heterotopic ossifications appear already in early childhood and are accompanied by feet and spine defects [2,3].

Presented below is a case of a 31-year-old woman with massive heterotopic ossifications in lumbar spine and hip joint regions following multiple injuries.

## Case Report

A 31-year old female patient was admitted to the Orthopedics Clinic due to significant restriction in the

range of motion and pain within the right hip. Also restricted, albeit to a lesser extent, was the range of motion of the right knee, the left hip and the spine. The patient has suffered loss of consciousness and trauma in a traffic accident.

For about 7 years, the patient had been treated for catatonic schizophrenia, often experiencing syncope and injuries. During one of hospitalizations in a psychiatric ward, the patient was diagnosed with pulmonary embolism which led to immobilization lasting about three months. Following hospitalization, restricted function of the right hip was observed in the patient upon further diagnostics and rehabilitation. The patient was diagnosed with heterotopic ossifications and referred to the Orthopedics Clinic for consultation and attempted treatment.

## Imaging Diagnostics

To expand the range of diagnostic examinations, contrast-enhanced CT scan of the ilium was performed, revealing massive heterotopic ossifications on the right, spanning from the transverse processes of the L1 vertebra to iliac crest and the lesser trochanter of femur.

Visualized on the left were ossifications connecting the ischium rams with the posterior surface of the distal  $\frac{1}{3}$  of the femur, as well as another ossification band extending from the lateral massif of the sacrum to the of vault of the cotyloid cavity (Figures 1A–1C and 2A, 2B).

The CT assessment of the location of ossifications facilitated precise planning of the surgical procedure. Thanks to the volume rendering techniques and 3D image reconstructions, it is possible to precisely determine the position of ossifications in relation to the vessels and muscle attachment, which is very important before commencing the surgery [4,5].

Following precise analysis of the CT scans, the patient underwent two surgical procedures.

The first procedure involved the removal of ossifications from the right hip region.

Skin incision was made above the ossifications in the frontal part of the hip. Following muscle detachment and release of the proximal attachment of the rectus femoris muscle, ossifications were removed and the joint was mobilized, achieving flexion of up to about  $50^\circ$  and abduction of up to  $30^\circ$ .

After an interval of several months, the left hip was subjected to the surgery. Using lateral access at  $\frac{1}{2}$  of the femur, ossifications adhering to the posterior surface of the femoral bone and the posterior femoral fascia were removed.

## Discussion

The term *myositis ossificans* refers to the formation of bone tissue in muscles and soft tissues.

In 60–75% of cases, ossifications are due to trauma. Although ossifications may occur all over the body, they are observed predominantly at sites particularly prone to injuries, such as thighs, buttocks or elbows [1,6].

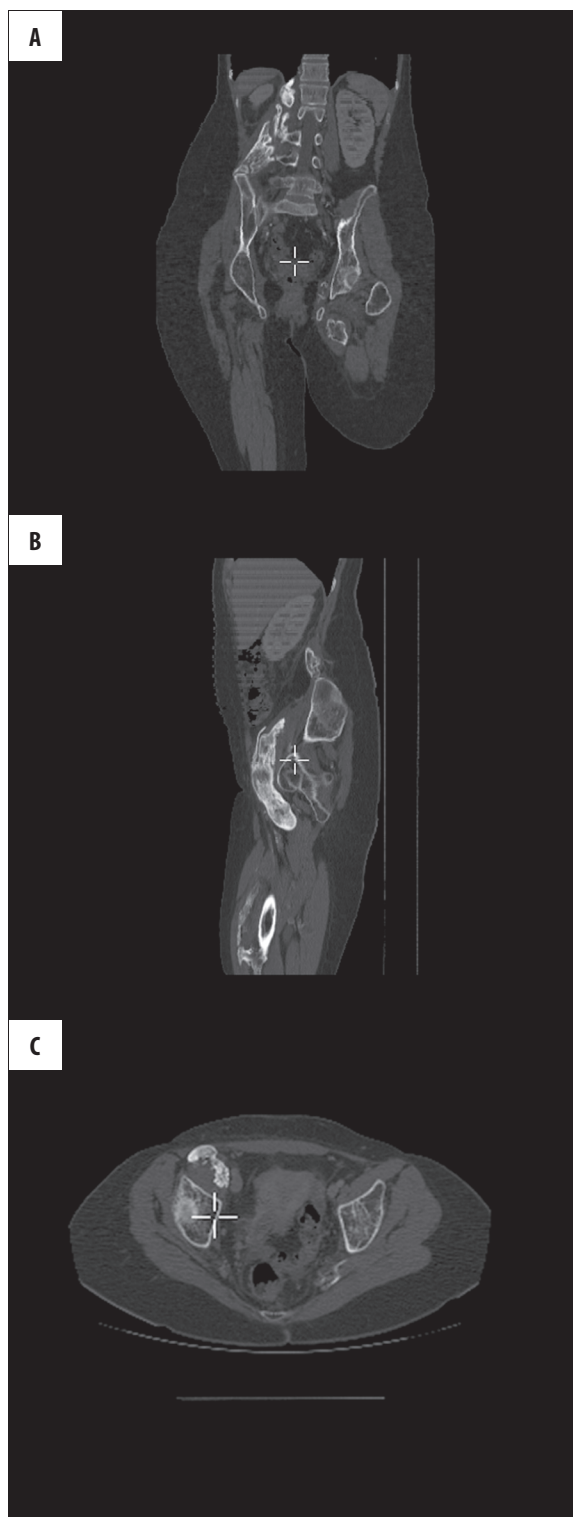
The presented patient reported a history of trauma in a traffic accident. Since the patient also suffered from catatonic schizophrenia, manifesting in periodic akinesia or hyperactive mobility, bodily injuries occurring in psychomotor agitation periods could not be excluded. In addition, patient has suffered multiple episodes of syncope which were also associated with accompanying injuries

There are several hypotheses regarding the pathogenesis of ossifications developing as a result of trauma.

One of these hypotheses involves the process of calcifications associated with the presence of hematomas due to the soft tissue injuries.

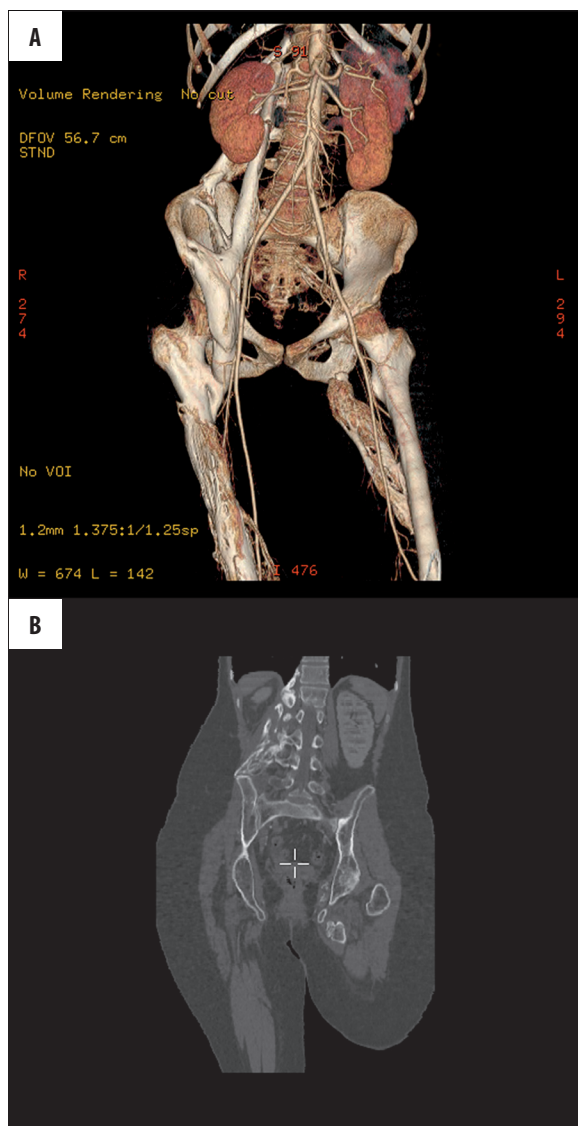
It is also supposed that mechanical injuries might lead to translocation of osteoblast-containing periosteum into the muscles, thus leading to the formation of ossifications.

Factors that might promote *myositis ossificans* also include organic diseases such as poliomyelitis, syringomyelia, paraplegia, tetanus and hemophilia.



**Figure 1.** CT scans of the abdomen and pelvis. Slices – (A) – frontal, (B) – sagittal, and (C) – axial – illustrate the massive ossifications in within the right-sided lumbar spine region and the right hip joint.

In such cases, MO may develop as a result of injuries resulting from passive movements. In rare cases, ossifications are observed as a result of burns, infections, or illicit drug abuse [1,7].



**Figure 2.** CT scans of the abdomen and pelvis. Frontal slices (A) 3D reconstruction, (B) bone reconstruction, show ossifications within the left-sided sacral region and the left hip joint.

*Fibrodysplasia ossificans progressiva* should also be taken into account in differential diagnostics.

FOP is a rare genetic disease inherited in autosomal dominant pattern. Patients with FOP have excess levels of

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BMP-4 – a protein that induces bone formation. BMP-4 is secreted by lymphocytes in wound formation. In addition, patients' bodies are characterized by significant deficiency of BMP-4 antagonists that inhibit bone development. Patients suffering from FOP must avoid all types of injuries [3,8].

The earliest clinical symptom is formation of painful nodules and tuberos masses within subdermal tissue, particularly in the head and neck region.

Subsequent manifestations include massive ossifications in muscles, ligaments and fascias, with predominant involvement of the head and neck region, paraspinal dorsal muscles, shoulder girdle and hips. Involvement of intercostal muscles leads to respiratory insufficiency due to chest tightness and further to death.

One of the characteristic features of the disorder, occurring already in infants after birth,, before soft tissue ossification occurs, is hallux valgus.

Additional symptoms may include agenesis and microdactyly of toes and fingers, abnormal position of the fifth fingers (clinodactyly), and shortening of fingers (brachydactyly) [2,3,5].

*Myositis ossificans* should also be differentiated from malignant tumors. Diagnostics of mature extraskeletal ossifications poses no problems due to characteristic radiological features, presenting as masses with clear circumferential mineralization, less pronounced in central parts. At early stages, when circumferential mineralization is poorly noticeable or absent, the lesion may resemble osteosarcoma, synovial sarcoma or fibrosarcoma [9,10].

## Conclusions

Extraskeletal calcifications can be visualized in X-ray images; however, CT scans permit precise assessment of ossifications and their location in relation to other internal organs and vessels.

This is particularly important before surgical removal of such lesions, as it allows to assess anatomical condition as well as to decide upon the access point for the surgery.

In addition, CT scans allow to visualize even small lesions that are not noticeable in traditional X-ray images.