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A CASE OF SKELETAL TUBERCULOSIS IN A MAN FROM THE SITE OF ĐURINE ĆELIJE ON RUDNIK

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Abstract: *This paper presents the results of a bioanthropological analysis of human skeletal remains from grave no. 34 from the site of Đurine Ćelije on Rudnik. The remains of a small late medieval monastery, from the beginning of the 15th century until the end of the 17th century, were discovered and systematically researched. The monastery was destroyed and rebuilt in the time of the Turks and later abandoned. The burial of a deceased in grave no. 34 was performed in the second half of the 16th or during the 17th century. The deceased most likely belonged to the brotherhood of this monastery. A specific disease caused by the bacillus Mycobacterium tuberculosis was detected in the skeletal remains of this man. Pathological changes coexisting with this disease were present on the endocranial surface of the skull, and the thoracic vertebrae, and destructive lesions were detected on the ribs, shoulder joints, and sacroiliac joint.*

Keywords: *Rudnik, Đurine Ćelije, monastery, necropolis, grave no. 34, monk, bioanthropological analysis, skeletal tuberculosis, serpens endocrania symmetrica*

Introduction

Tuberculosis (TB) is a serious infectious disease that usually affects the lungs. It is caused by a small rod-shaped *Mycobacterium* germ. In 1882 Robert Koch discovered that the cause of tuberculosis was bacillus and established its presence in animals and humans (Ђурић-Срејић 1995, 325). One of the most common variants is *Mycobacterium tuberculosis*, which is transmitted between people e.g., by sneezing, and another type is *Mycobacterium bovis,* which is transmitted from infected animals to humans through by-products given by cattle, such as contaminated milk or meat (Живановић 1984, 291–292). The haematogenous route of infection is usually through the respiratory tract, which leads to the formation of a primary focus in the lungs, followed by a single or multiple foci in regional lymph nodes (Ortner and Putschar 1985, 141; Ortner 2003, 227). Besides affecting soft

tissue, it can also manifest on hard tissue in the advanced stage, but only in 3% of cases (Aufderheide and Rodríguez-Martín 1998, 133; Ortner 2003, 228).

Paleopathological research on tuberculosis is extremely rich in the world. The earliest archaeological cases of skeletal tuberculosis were recorded during the Neolithic (Canci et al. 1996; Hershkovitz et al. 2008; Köhler et al. 2012; Masson et al. 2013; Baker et al. 2017), followed by a few reported cases from the Antiquity (Lewis 2011; Hajdu et al. al. 2012), and mostly during the Middle Ages (Mays et al. 2001, 2002; Hajdu et al. 2012; Krznar and Novak 2013; Vargová et al. 2014; Bedić et al. 2015; Kyselicová et al. 2016)[1]. In neighbouring countries, researchers from Hungary have dealt with this issue using macroscopic and molecular methods, which were presented in numerous papers (Pálfi and Marcsik 1999; Haas et al. 2000; Marcsik et al. 2001; Molnar and Marcsik 2002; Marcsik et al. 2006; Pálfi and Molnar 2009; Evinger et al. 2011; Hajdu et al. 2012; Köhler et al. 2012; Pósa et al. 2013; Pósa et al. 2015). Unfortunately, for the territory of Serbia, very few papers mentioned skeletal tuberculosis in the past (Farkas et al. 1976; Живановић 1977; Živanović 1987, 1988; Hošovski and Mikić 1995; Lovász et al. 2010; Miladinović-Radmilović 2012; Šarkić and Branković 2020). The reason for that may be that this disease was either not significantly present in the territory of Serbia, or it is a consequence of an insufficient number of bioanthropological analyses, often due to the poor state of preservation of skeletal remains. Therefore, our idea on the prevalence of tuberculosis in this area is not clearly understood. It should be noted once again that tuberculosis manifests on skeletal remains only in the advanced phase, which limits the possibility of its detection in past communities.

At this stage of knowledge regarding skeletal tuberculosis in past populations of the territory of present-day Serbia, this study is not a modest contribution but represents rather a significant one. The deceased, who was infected with tuberculosis, likely belonged to the monastic fraternity of Đurine Ćelije, so his social status is known in this case. The cause of death of the individual has also been determined with a high level of probability.

Archaeological context

The site is located in the village of Manojlovci (municipality of Topola), on the northern slope of Rudnik. It is located on a narrow plateau (over 500 m above sea level) in the forest, above the mouth of two streams from which the

[1] Before the era of antibiotics, the death of an infected person was certain. However, tuberculosis is still among the top 10 deadliest diseases in some countries, with a mortality rate of 1.4 million annually (World Health Organization Report 2019; WHO 2020 gives a different report due to the presence of Covid 19).

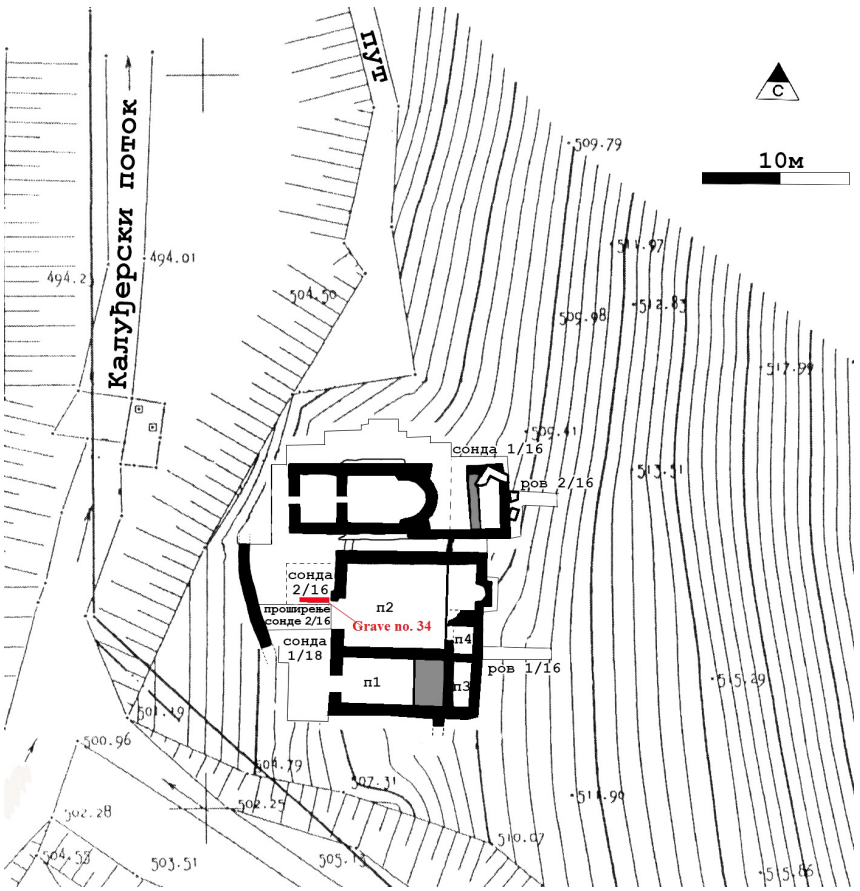

Fig. 1. Site plan of the site of Đurine Ćelije in 2018 with the position of grave no. 34

Сл. 1. Ситуациони план локалитета Ђурине ћелије у 2018. години са позицијом гроба бр. 34

stream of Kaluđerski Potok emerges, being a right tributary of the Jasenica river (Радичевић и Миливојевић 2013, 79–80, Fig. 1). Continuous archaeological excavations of this site have been conducted since 2013 by the National Museum Aranđelovac, headed by Dr. Dejan Radičević, assistant professor at the Department of Archaeology at the Faculty of Philosophy in Belgrade.

Remains of a small monastery, built in the first decades of the 15th century, were discovered at the site of Đurine Ćelije. During its existence, the monastery was destroyed and renovated, which was reflected not only in the stratigraphy and construction phases but also in the clearly separated burial horizons. It was abandoned in the end of the 17th century, probably during the Great Migration of the Serbs (Радичевић и Миливојевић 2013, 90–91; Радичевић и др. 2015,

Fig. 2. The site of Đurine Ćelije during archaeological excavations in 2021 (photo by: V. Milivojević, documentation of the National Museum Aranđelovac)

Сл. 2. Локалитет Ђурине ћелије у току археолошких истраживања 2021. године (фото: В. Миливојевић, документација Народног музеја Аранђеловац)

239, 252; Гордић и Ћирковић 2018, 221). So far, three buildings and a part of the monastery necropolis (39 graves)[2] have been researched almost completely (Figs. 1 and 2).

On the walls of a small one-nave monastery church, built of crushed stone, next to which a narthex was later added, a fresco-painting from the beginning of the 15th century, of enviable artistic quality, has been partially preserved. The interior of the narthex was not painted, but only plastered and painted white. East of the church, there is a poorly preserved building of unclear purpose, perhaps a cell. Research of the cell has not been completed yet. To the south from the church there are the remains of a large monastery residence, with two rooms on the ground floor and at least two on the first floor. The residence was built after the

[2] All human skeletal remains from the site of Đurine Ćelije taken from graves (35) are stored at the National Museum Aranđelovac. The bioanthropological analysis of osteological material was performed by the first author of this paper, as part of the master's thesis (Miljević 2018) and the remaining part as a bioantropological report (2019) for the National Museum Aranđelovac. Except for one separate grave unit (Miljević-Đajić 2021), the results of bioanthropological analysis of the skeletal remains haven't been published.

restoration of the Serbian Patriarchate of Peć in 1557 (Радичевић и Миливојевић 2013, 82–90; Радичевић и др. 2015, 235–248; Гордић и Ћирковић 2018, 209–213, 215–216, 219–221; Радичевић и Миливојевић 2022, *in print*).

Originally, the monastery necropolis stretched to the north, south, and west of the church. Later, with the construction of a large monastery residence, not far from the church, and the addition of a narthex, a part of the necropolis was destroyed, and some of the graves were found under the foundations of these buildings. Thus, in the second half of the 16th and in the 17th century, the space for burying the deceased was even more limited, having in mind the small area of the plateau on which the monastery is located. Burials at that time were still performed to the north and west of the church, i.e., in front of the narthex, while in the south, the cemetery occupied the remaining space between the residence and the bank of the stream of Kaluđerski Potok. It is a small plateau from which the ground floor rooms in the residence were accessed, bordered on the west side by a retaining / fence wall. So far, in the archaeological campaigns of 2016 and 2018, 15 grave units in two burial horizons (graves no. 16, 26–39) have been discovered on that surface, as well as a larger number of dislocated bones from disturbed graves. Nine graves (graves no. 29, 30, 32, 34–39) were attributed to the more recent burial horizon, which was marked with tombstones or smaller slabs (Радичевић и Миливојевић 2022, *in print*). Several graves from the same phase, also with tombstones, were excavated at one point (2015) in the area north of the church. An engraved inscription on the tombstone of grave no. 6 testifies about the death of Jovan the Sipahi in 1633 (Радичевић и др. 2015, 250; Радичевић и Миливојевић 2016, 38). Researchers, having in mind the portable archaeological finds from the graves under the tombstones, as well as the results of a bioanthropological analysis of these skeletons (presence of both sexes and one child), assumed that the area north of the church was used for burying secular people in the 17th century. Perhaps members of the Sipahi's family, or his close relatives (graves no. 4, 5, 6, 7, 11). On the other hand, only monks were buried on the plateau west of the monastery residence, most likely, because all the deceased were adult men, and the graves are without archaeological findings. During their burial, the existence of older graves was ignored (Радичевић и Миливојевић 2022, *in print*).

Material and methods

The bioanthropological material from grave no. 34, which is analysed in this paper, comes from the site of Đurine Ćelije on Rudnik. Grave no. 34, excavated in 2018 in the previously opened trench 2/16 (Fig. 1), belongs to the more recent horizon of burials, according to the existence of a tombstone (two larger

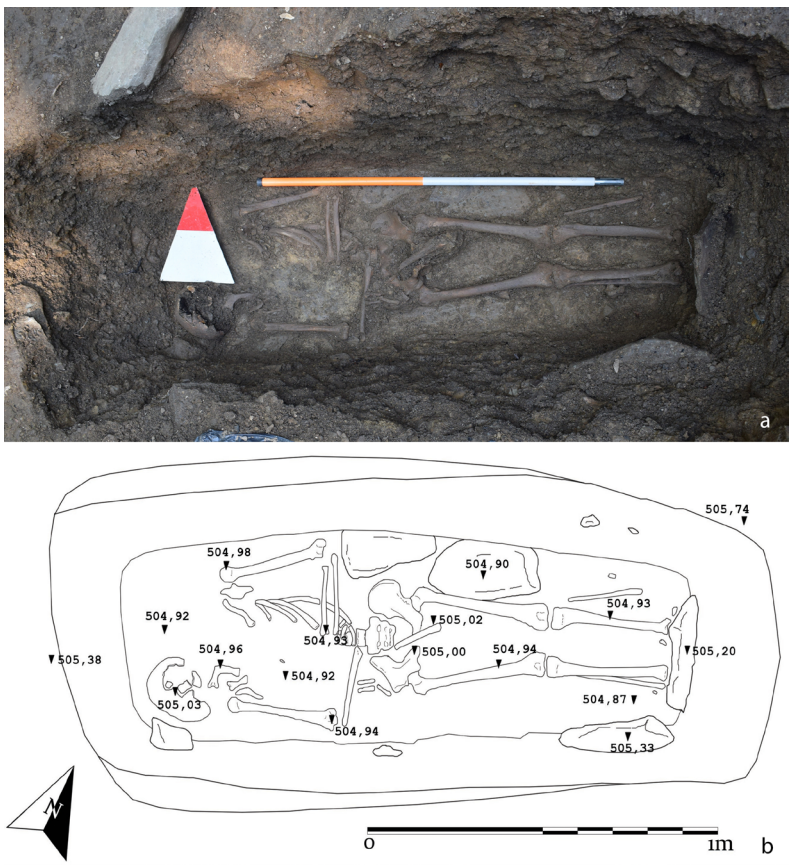

Fig. 3. Grave no. 34: a. photo by V. Milivojević, documentation of the National Museum Aranđelovac; b. drawing by D. Ćirković

Сл. 3. Гроб бр. 34: а. фото: В. Миливојевић, документација Народног музеја Аранђеловац; б. цртеж Д. Ћирковића

slab stones, irregular in shape, were placed next to each other), the depth of the tomb and the relationship with adjacent graves. The burial pit of this grave cut into the northern part of grave no. 33, from the older phase. The deceased in grave no. 34 was buried in a stretched position on his back, with his arms crossed on his stomach, orientation west–east, with a deviation to the south. Along the edges of the tomb, whose dimensions were 1.83 x 0.42-0.47 m, larger stones were lined up in places[3] (Fig. 3a, b). The deceased in grave no. 34 was obviously buried at the time when the monastery residence was in function, which is approximately the second half of the 16th or the 17th century. Given the fact that the tomb was

[3] Data is taken from the field documentation of the National Museum Aranđelovac.

positioned not far from the entrance to the ground floor room 2, it can be assumed that this burial was done at a time when the plateau in front of the residence was already occupied with graves, so the chronological framework could be narrowed to the 17th century or even the second half of that century. However, the absence of portable archaeological finds in this and other graves west of the residence does not allow for any certain conclusions in this regard.

The state of preservation of skeletal remains was observed according to a scheme of five categories proposed by Mikić (Mikić 1978)[4]. Determination of the sex was based on the morphological characteristics of the pelvic bones, as well as the morphological characteristics of the skull (Workshop of European Anthropologists 1980; Buikstra and Ubelaker 1994), also, attention was given to metric parameters (Bass 1995). In order to estimate the age at the time of death, the degree of obliteration of cranial sutures (Workshop of European Anthropologists 1980) and the degree of tooth-wear was used (Brothwell 1981). The standard tooth numbering system was used in the analysis of dentition (Federation Dentaire Internationale 1971). Metric analyses were applied in this paper to obtain data on stature based on the maximum length of long bones, according to the formulae of Trotter and Gleser (1958). The existing standard (Buikstra 2019) was used to identify and diagnose pathological changes. A modified scoring method of 23 entheses on the postcranial skeleton of Mariotti and colleagues (Mariotti et al. 2007) was used and the evaluation of a possible cause of death was performed.

Results

The analysed human skeletal remains discovered in grave no. 34 belong to the III category of moderately preserved skeletons. Preserved bones of the cranial skeleton are the cranial vault (frontal, parietal, and occipital bone without the base part), fragmented temporal bones, and 1/2 of the mandible. Preserved bones of the postcranial skeleton are fragments of the left and right scapula, left clavicle body, seven fragmented ribs, four lumbar vertebrae (L2–L5), both humeri with fragmented heads, left radius without the proximal end, right radius, left ulna without proximal end, right ulna, both pelvic bones with fragmented iliac bones, upper 1/3 of sacrum, both femurs, both patella, both tibias and both fibulae. Preserved hand bones are left *scaphoideum*, left *lunatum*, left *capitatum*, left *hamatum*, right

[4] I complete and well-preserved skeleton; II well-preserved incomplete skeleton; III moderately preserved skeleton (the whole skeleton is present in the grave, but the bones are quite fragile and breakable during excavation); IV partial preservation of skeletal remains (only very fragile parts of the skeleton are found in the grave, they are difficult to excavate, lift, pack and transport); V poor preservation of skeletal remains (skeletal remains are found only in traces, it is impossible to raise them completely).

POSTCRANIAL SKELETON Grave no. 34					
HUMERUS (cm)	**L**	**R**	a-p subtrochanteric midshaft	2.9	2.8
Maximum diameter at midshaft	2.4	2.4	m-l diameter subtrochanteric midshaft	2.8	2.6
Minimum diameter middle	-	2.2	Maximum head diameter	4.5	4.6
Epicondylar breadth	5.8	5.9	Midshaft circumference	10.1	10.3
Articular breadth	-	2.7	Bicondylar breadth	8.1	8.2
ULNA (cm)	**L**	**R**	**TIBIA (cm)**	**L**	**R**
Maximum length	-	25.8	Length	-	3.3
Physiological length	-	23.9	Maximum diameter at the nutrient foramen	3.2	3.4
Minimum circumference	5.2	5.3	m-l diameter at the nutrient foramen	2.2	2.4
FEMUR (cm)	**L**	**R**	Circumference at the nutrient foramen	10.4	10.5
Maximum length	42.3	42.5			

Table 1. Measurements of the postcranial skeleton

Табела 1. Мере на посткранијалном скелету

Long bones	Maximum lenght (cm) Left	Maximum lenght (cm) Right	Stature (cm) Left	Stature (cm) Right
Ulna	-	25.8	-	170.24±4
Femur	42.3	42.5	163.66±4	164.13±4
Tibia	-	35.3	-	167.35±4

Table 2. Measurements of the long bones and estimated stature (grave no. 34)

Табела 2. Мере дугих костију и установљена телесна висина (гроб бр. 34)

MC1, MC2, MC4, MC5, right proximal phalanx (I, II, III, V), left proximal phalanx (II, III), left distal I phalanx, three fragmented medial phalanges. Preserved foot bones are the articular surface of the left calcaneus, right calcaneus, both tali, right navicular, right MS1, and seven fragmented carpal bones. Table 1 provides the skeletal measurements of the individual from grave no. 34.

Morphological characteristics of the skull and pelvic bones showed that the skeletal remains belong to a male individual. The sex of this individual was also estimated on the basis of metric parameters of the vertical diameter of the right femoral head (46 mm), and bicondylar width (82 mm). Both metrics showed that the skeletal remains belong to a male individual. His age at the time of death, based on the degree of closure of the cranial sutures, was between 30–40 years, and based on the degree of tooth-wear (III) of lower molars from 35–45 years.

Teeth analysis showed that tooth 47 and tooth 48 were preserved in the *alveoli* of the lower jaw, while tooth 18 was outside the *alveoli*, and teeth from 34–38 were lost *antemortem*. Carious lesions were present on tooth 18 and it was cervical caries.

According to the method of Trotter and Gleser (1958), the maximum lengths of long bones were measured, and his body height was calculated (Table 2). Stature values ranged from 163.65 cm for the left and 164.13 for the right femur and 167.35 cm for the right tibia, with an average value of 165.04 cm.

Specific skeletal lesions that are characteristic of the infectious disease caused by the bacillus *Mycobacterium tuberculosis* were observed on the skeletal remains of the individual buried in grave no. 34. Intense hypervascularisation and new bone mass surrounding the blood vessels' "maze-like appearance" were detected on the cranial skeleton, i.e., on the endocranial surface, on the right parietal, and on the right side of the frontal bone (Fig. 4a, b). On the ectocranial side of the skull, above endocranial changes, there was a rough surface with shallow longitudinal depressions, i.e., porosity due to infection. A pronounced *cribra orbitalia* was observed on both roof orbits. Porosity on the right and the left orbital roof is a mixture of active and healed porosity at the time of death. Additionally, there is a slight porosity above the supraorbital ridge with the union of pores, and a mixture of active and healed porosity at the time of death was noticed on other parts of the frontal bone (*porotic hyperostosis*).

Pathological changes were also present on the preserved lumbar vertebrae (from L2 to L5), which were directly exposed to the influence of tuberculous infection. On the ventral side of the body of the fifth lumbar vertebra, a healed inflammatory process was detected and the appearance of new bone mass that extends vertically upwards towards L4 (Fig. 5) was present. A small number of

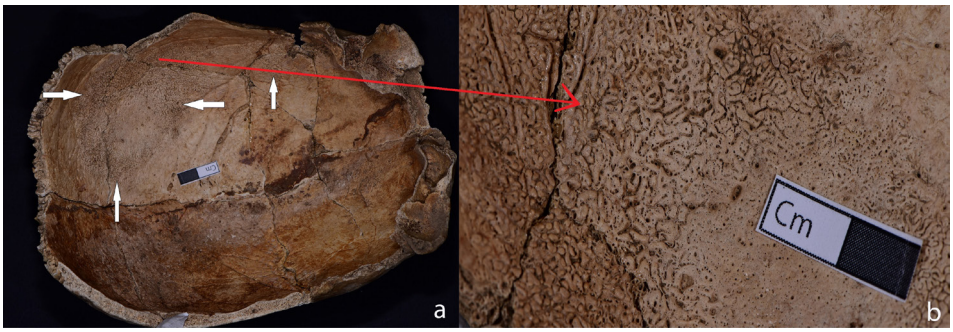

Fig. 4. a. Erosive changes in the endocranial surface of the skull (*serpens endocrania symmetrica*) (photo by: M. Miljević-Đajić); b. Endocranial alternation "maze-like appearance" in the inner surface of the right parietal bone (photo by: M. Miljević-Đajić)

Сл. 4. а. Ерозивне промене на ендокранијалној површини лобање (*serpens endocrania symmetrica*) (фото: М. Миљевић-Ђајић); б. Ендокранијалне промене „изглед попут лавиринта" са унутрашње стране десне паријеталне кости (фото: М. Миљевић-Ђајић)

Fig. 5. Reactive new bone formation on the ventral surface in L5 (photo by: M. Miljević-Đajić)

Сл. 5. Реактивно формирање нове коштане масе са вентралне површине L5 (фото: М. Миљевић-Ђајић)

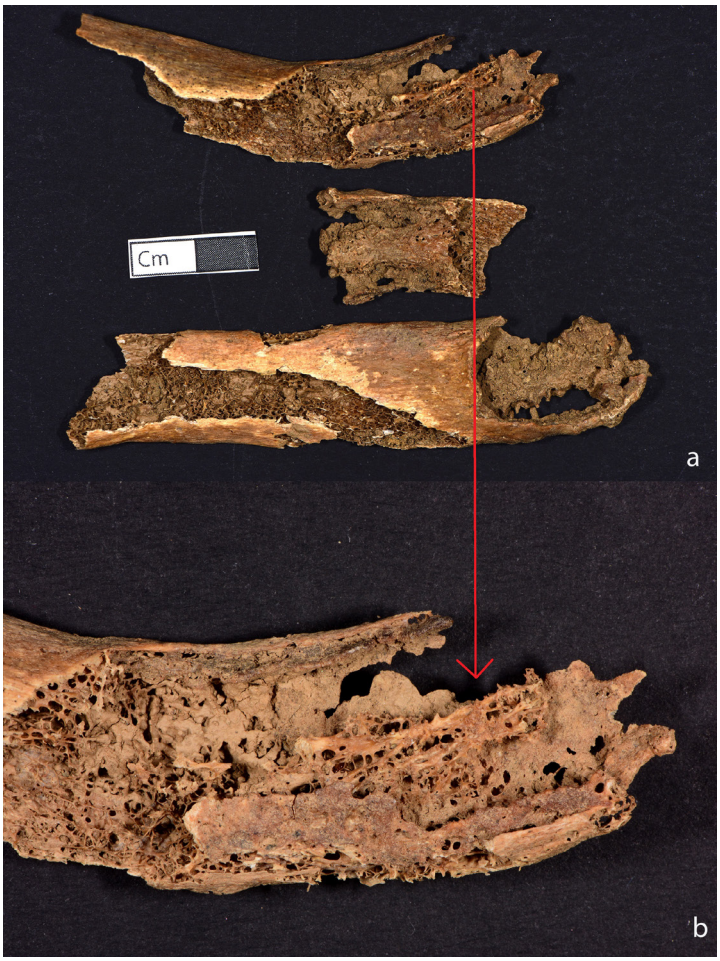

Fig. 6. a. Destructive lesions on ribs (photo by: M. Miljević-Đajić); b. Infection penetrated deep into the cortex of a rib (photo by: M. Miljević-Đajić)

Сл. 6. а. Деструктивне лезије на ребрима (фото: М. Миљевић-Ђајић); б. Инфекција је продрла дубоко у кортекс ребра (фото: М. Миљевић-Ђајић)

ribs were present in the material, which may be a consequence not only of the nature of the disease but also of the faster decay of that type of bone in the ground. Destructive lesions appear on some fragmented ribs on their sternal ends, on their bodies, and in the inner cortex (Fig. 6a, b). Pathological changes in the form of a new bone formation and lytic foci can be seen on the left humeral head and surgical neck of the humerus (Fig. 7), also on the right *tuberositas sacralis* (Fig. 8). Healed inflammatory process on the right sacroiliac joint (auricular surface and sacral tuberosity) is very possibly unilateral tuberculous sacroiliitis. Bilateral

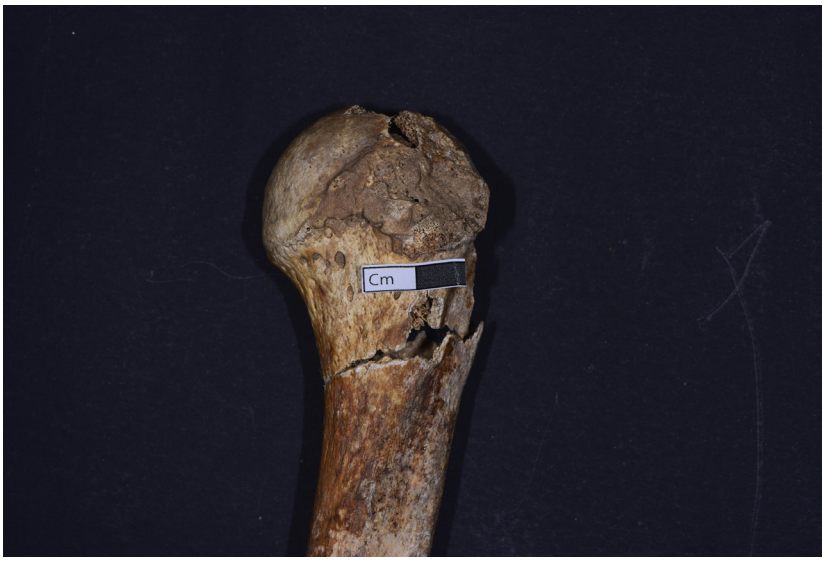

Fig. 7. Tuberculous granulation tissue and lytic foci on the humeral head and on the surgical neck (photo by: M. Miljević-Đajić)

Сл. 7. Туберкулозно гранулационо ткиво и литички отвори на глави хумеруса и на хируршком врату (фото: М. Миљевић-Ђајић)

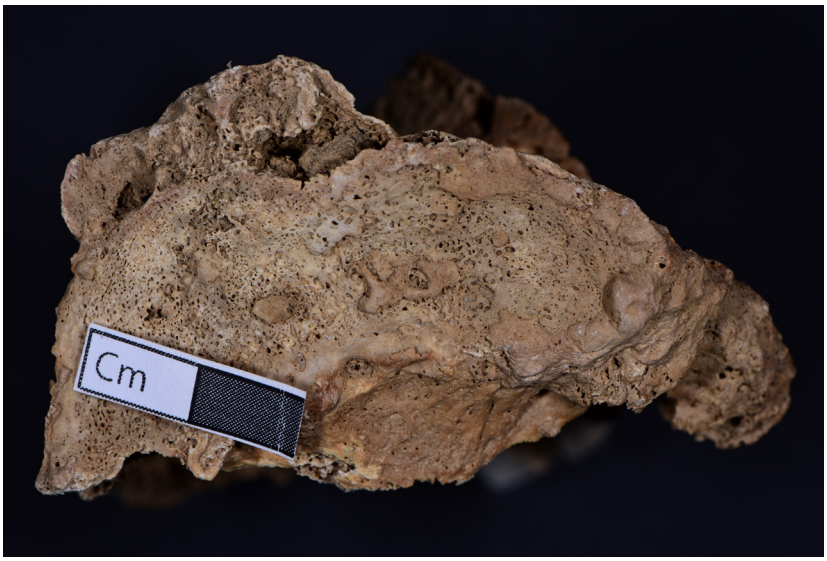

Fig. 8. Probable early-stage sacroiliitis on the right *tuberositas sacralis* of the sacrum (photo by: M. Miljević-Đajić)

Сл. 8. Могући сакроилитис у раном стадијуму на десном *tuberositas sacralis*-у сакрума (фото: М. Миљевић-Ђајић)

Bones	Muscle attachments
Humerus	*m.deltoideus*
Right	2
Left	1a
Humerus	*m. brachioradilalis*
Right	3
Left	-
Ulna	*m. triceps brachii*
Right	3
Left	-
Ulna	*m. brachialis*
Right	3
Left	-
Ulna	*m. pronator quadratus*
Right	2
Left	1a
Radius	*m. biceps brachii*
Right	3
Left	-
Radius	*m. pronator teres*
Right	1c
Left	1c

Table 3. Degree of musculoskeletal stress markers on the upper extremities

Табела 3. Степен израженост припоја мишића на горњим удовима

periosteal reaction is present in the diaphysis of both tibias. There was a thickening of the periosteum on the body of the right tibia, possibly due to a trauma observed in the upper half on the lateral side (dimensions: 9.58 mm). In addition, osteoarthritic changes have been detected in the left elbow, both hips, and the distal part of the femurs.

Musculoskeletal stress markers were observed on the postcranial skeleton and their developmental degree is presented in Table 3.

The curvature of both pelvic bones inwards was detected together with pronounced muscle attachments to both pelvic bones such as *m. obutarious internus*, and on the right pelvis *m. gluteus maximus* and *m. gluteus minimus*. Plaque (probably also on the right) and Allen's fossa were detected on the neck of the left

femur and flattening of the body in the mediolateral direction was present in both femurs in their upper thirds. On the talus, the *facies articularis calcanea media* and the *facies articularis calcanea* anterior are joined into one *facies articularis calcanea*, the same is with calcaneus, where the *facies articularis talaris media* and *facies articularis talaris* anterior were merged into one *facies articularis talaris*.

Discussion

Tuberculosis mostly affects the anterior edge of the vertebral body, most often the last thoracic and first lumbar vertebrae, but not more than a pair of vertebrae (Ortner and Putschar 1985, 144; Larsen 1997, 100). Inflammation of the spinal vertebrae due to tuberculosis is called Pott's disease (Живановић 1984, 294). However, other parts of the skeleton can also be affected by this disease, the first being the hip joint, knee, and foot bones, then other bones and the least affected is the skull. In the skull, the endocranial part is significantly more affected by erosive changes and attributed to tuberculous meningitis, and less often the outer part of the skull bone (Aufderheide and Rodríguez-Martín 1998, 134–140).

The bioanthropological analysis of human skeletal remains from grave no. 34 from the late medieval site of Đurine Ćelije on Rudnik provided important data on the health status of this individual. Traces of skeletal tuberculosis were present on the cranial and postcranial skeleton, while erosive changes on the endocranial surface are similar to changes that occur in other disorders. Pathological changes in the cranial and postcranial skeleton are presented while bearing in mind the differential diagnosis of endocranial changes, which are found in scientific literature under one common name *serpens endocrania symmetrica* (SES) (Hershkovitz et al. 2002, 201). To make sure that it was skeletal tuberculosis, a differential diagnosis was made. Disorders that leave similar or the same changes on the endocranial surface are the following: scurvy, syphilis, meningitis, anaemia, and tuberculosis (Hershkovitz et al. 2002; Lewis 2004; Mays 2008; Lei et al. 2019).

Scurvy affects many organs and in severe cases leads to death. Pathological changes of scurvy are manifested on skeletal remains, most often in infants, and less often in adults. Scurvy affects the sternal ends of the ribs, the distal metaphysis of the femur, radius, and ulna, and the proximal metaphysis of the humerus (Ortner 2003, 383–384). In children, skull bones can be affected in the form of porosity on the temporal, zygomatic bones, sphenoid bones, and pronounced porosity in the *alveoli* of the teeth (Schlaus 2006, 167). Studies have shown that endocranial changes, in addition to lesions on other parts of the skeleton, may be associated with scurvy and are mostly seen in infants (Lewis 2004, 93; Brown and Ortner 2011, 205; Lovász et al. 2013, 176, 180; Радовић 2013, 147; Sinnott 2013, 2011; Lei et al. 2019, 72).

Acquired (venereal) syphilis on skeletal remains is manifested in the tertiary phase and is characterised by the formation of progressive destructive lesions on the bones, i.e., gummatous formation, non-gummatous periostitis, and non-gummatous osteomyelitis (Atanacković 1990, 77; Ђурић-Срејић 1995, 328, 32). Although every bone can be infected with the bacterium *Treponema pallidum*, there are certain bones that have greater predispositions: the tibia, the bones that surround the nasal opening, and the cranial vault. The gummatous lesions appear in the area of frontal and parietal bones in the form of large destructive lesions (*caries sicca*) on the calvary (Atanacković 1990, 78), while in rare cases new bone mass appears on the endocranial surface (Ortner and Putschar 1981, 184; Herskovitz et al 2002, 205).

In ancient populations, endocranial changes in meningitis show marked engravings like *serpens endocrania symmetrica*. Complications that occur on the inner surface of the skull can be the result of infections such as tuberculosis, but can also be caused by other non-infectious conditions, such as tumours or head injuries (Patterson 1993, 875).

Also, anaemia due to iron deficiency in the body can leave traces of porosity on the skull and postcranial skeleton (Ortner 2003, 374). On the skull, these traces appear in the form of small, perforated lesions on the roof orbits and the cranial vault. However, several factors can influence the occurrence of anaemia such as iron-poor diet, poor hygiene, lead poisoning, changes in nutritional habits, and chronic gastrointestinal and infectious diseases (Walker et al. 2009, 114).

Although porous lesions were present on the skull of the man from grave no. 34, their existence may first be linked to an infectious disease caused by the bacterium *Mycobacterium tuberculosis*. In archaeological and modern populations, it has been observed that SES (Hershkovitz et al. 2002; Mays et al. 2002; Pósa et al. 2015; Spekker et al. 2020) in both young and adult individuals can be associated with tuberculosis in many cases, rather than with other diseases if the present pathological changes in the postcranial skeleton indicate tuberculosis.

Skeletal lesions on the postcranial skeleton of this individual are those described in the scientific literature and attributed to tuberculosis (Ortner and Putschar 1985; Aufderheide and Rodríguez-Martín 1998; Ortner 2003; Palfi and Molnar 2009: Lovász et al 2010; Pósa et al. 2013; Spekker et al. 2018). When it comes to vertebrae, which are most often affected by tuberculosis infection, we can notice that in this man there is no destruction of the vertebral body in preserved vertebrae, except for osteolytic lesions on the ventral surface and reactive new bone formations. However, it is possible to see the appearance of a moderate amount of a reactive new bone formation that extends vertically upwards in L5

as well as lytic foci (Fig. 5). The similar appearance of new bone formations and bony ridges can be seen in other specimens who suffered from tuberculosis (Ortner 2003, 233, fig. 10-1,2; Spekker et al. 2018, fig. 2). As has been noted in scientific literature (Aufderheide and Rodríguez-Martín 1998, 140; Ortner 2003, 242), the shoulder can be affected too due to tuberculosis. On the humeral head of this individual, tuberculous granulation tissue is present, as well as lytic foci, on the surgical neck (Fig. 7). Infection on the ribs is most often manifested in the form of periostitis from the inner surface of the ribs (Aufderheide and Rodríguez-Martín 1998, 137). It can also penetrate deep into the body's cortex, as is the case here, leaving erosive lesions (Fig. 6a, b). Traces of probable early stage sacroiliitis can be observed on the right sacroiliac joint surface (Fig. 8). Although sacroiliac joint involvement occurs only in up to 2% (Aufderheide and Rodríguez-Martín 1998, 139) and it can be bilateral, this is not the case here. Only the right sacroiliac joint (auricular surface of the ilium and on sacral tuberosity) is affected in the form of abscess and a new bone formation. Also, tuberculosis affects the diaphyses of long bones, most often the tibia and other bones (Aufderheide and Rodríguez-Martín 1998, 137). We can notice that the diaphyses of both tibias of this man had an intense periosteal reaction due to the infection.

In conclusion, endocranial lesions had been noted on the inner surface of the cranial vault, and *cribra orbitalia* and *porotic hyperostosis* were present on the outer surface of the skull, all together with erosive lesions on ribs, osteolytic lesions, and a new bone formation on vertebrae (L2–L5) and signs of periosteal bone formation on both shafts of the tibia and joint involvements (humeral head, auricular surface, and sacral tuberosity), without doubt, are clear osteological signs of a TB infection.

We cannot know how and when this man got sick since historical sources in Serbia are rare and do not mention tuberculosis before the 19th century (Sretenovich 1922, 11). We can assume that some of the historical events and climate changes would lead to stressful situations due to the adaptation to a new environment and the spreading of infectious diseases. Lovász and colleagues (Lovász et al. 2010, 90) implied that the invasion of the Ottoman Empire and the "small ice age" in the 16th–17th century in Europe led to famine and had a negative impact on the human body. At the beginning of the 16th century, heavy snowfalls were recorded in Montenegro, which led the Turks to postpone the attacks. It is believed that the climate was the same in Serbia (Јанц 2017, 47). Also, hot and cold periods alternated throughout the 16th century, leading to food shortages (Јанц 2017, 54–58). Extremely cold periods were recorded in the first years of the 17th century in Europe and in our region, which led to famine. The cooling of the

earth may be related to the large eruption of the Huaynaputina volcano in southern Peru, whose ash played a significant role in the climate change (Јанц 2017, 64). These are some of the key factors that would cause the spread of infectious diseases, such as tuberculosis.

Conclusion

Therefore, we believe that the man from grave no. 34 suffered from tuberculosis, which spread from soft tissue to the bones after some time. Considering that he was buried inside the monastery complex and that no traces of this disease were found on skeletons of other individuals, although its existence, which did not manage to manifest on the bones, is not excluded, the question arises as to how this person became infected. Tuberculosis can develop at a younger age and manifest itself only after a certain time, which mostly depends on the social status of the individual, age, lifestyle, and immune system (Roberts and Buikstra 2003, 44). If the meninges are inflamed, as in this case, death is inevitable after a few weeks (Roberts and Manchester 2010, 404). The data that we have do not allow us to conclude where and how the man from grave no. 34 from Đurine Ćelije got infected with tuberculosis. Apparently, he was a monk of this monastery, whose brotherhood was small. It is not possible to determine whether he became sick before or after he entered the brotherhood. What remains as a certain conclusion is that in the 16th and 17th centuries, people in Serbian monasteries were sick and died of tuberculosis, even in such small and isolated communities as was the one at Đurine Ćelije.

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СЛУЧАЈ СКЕЛЕТНЕ ТУБЕРКУЛОЗЕ КОД МУШКАРЦА СА ЛОКАЛИТЕТА ЂУРИНЕ ЋЕЛИЈЕ НА РУДНИКУ

Кључне речи: *Рудник, Ђурине ћелије, манастир, некропола, гроб бр. 34, монах, биоантрополошка анализа, скелетна туберкулоза, serpens endocrania symmetrica*

У овом раду су представљени резултати биоантрополошке анализе људских скелетних остатака из гроба бр. 34 са Ђуриних ћелија на Руднику. Локалитет се налази у близини села Манојловаца (општина Топола) на северној падини Рудника. Систематска археолошка истраживања овог локалитета од 2013. године спроводи Народни музеј у Аранђеловцу, под руководством доцента др Дејана Радичевића на Одељењу за археологију на Филозофском факултету у Београду. Током археолошких истраживања откривен је манастирски комплекс са некрополом. Позносредњовековна манастирска црква изграђена у 15. веку била је уништена и обновљена у време Турака, и коначно је напуштена на крају 17. века. Јужно од цркве се налазе остаци великог манастирског конака подигнутог након обнове Пећке патријаршије 1557. године. Сахрањивање покојника се обављало северно, западно и јужно од цркве. Приликом изградње конака и дозиђивања припрате, део некрополе је уништен, а део гробова се нашао под темељима ових грађевина. Гроб бр. 34 истражен је 2018. године. Покојник у овом гробу био је сахрањен у испруженом положају на леђима, са рукама прекрштеним на стомаку, оријентације запад–исток, са девијацијом на југу. Уз ивицу гробне раке местимично је поређано веће камење, а надгробно обележје било је у виду два већа плочаста камена, неправилног облика, постављена један до другог. Сахрана у овом гробу обављена је у време када је манастирски конак био у употреби, односно у другој половини 16. или у 17. веку. Покојник је, вероватно, припадао братству овог манастира, тако да је његов друштвени статус познат.

Биоантрополошка анализа ове особе укључивала је степен очуваности скелетних остатака, утврђивање полне припадности и старости у тренутку смрти, идентификацију и дијагнозу патолошких промена, метричке

анализе и анализу макроскопског прегледа мишићно-скелетних маркера окупационог стреса и испитивање могућег узорка смрти.

У гробу бр. 34 био је сахрањен мушкарац, старости 30–40 година. На скелетним остацима ове особе детектовано је специфично инфективно обољење које узрукује бацил *Mycobacterium tuberculosis*. Патолошке промене коегзистентне са овим обољењем уочене су на кранијалном (ерозивне ендокранијалне промене) и на посткранијалном скелету (деструктивне лезије на лумбалним пршљеновима, ребрима, левом раменом зглобу и десном сакроилијачном зглобу). Са ендокранијалне стране лобање примећене су ерозивне лезије и нова коштана маса „maze-like appearance". Пажња је посебно посвећена ерозивним променама са ендокранијалне површине које се јављају и код других обољења. Стога је спроведена диференцијална дијагноза. Болести које остављају сличне или исте ендокранијалне промене јесу: скорбут, сифилис, менингитис, анемија и туберкулоза. У литератури су ерозивне ендокранијалне промене познате и као s*erpens endocrania symmetrica*. Диференцијална дијагноза је показала да је овај мушкарац оболео од туберкулозе, која се с временом са меког ткива проширила и на његове кости, што је, несумњиво, довело до његове смрти.

Подаци којима располажемо нам не омогућавају да сазнамо како и где се овај мушкарац разболео. Историјски извори за територију Србије у којима се спомиње туберкулоза не појављују се пре 19. века. Можемо да претпоставимо да су неки догађаји, попут инвазије Османлија на Балкан и промене у клими, играли значајну улогу у ширењу заразних болести. Поред тога, са ратовима долази глад, а исто тако услед великих суша или обилних падавина може доћи до несташица хране. Такође, почетком 16. века се спомиње и „мало ледено доба" које је захватило Европу, а које је и те како имало негативан утицај на организам човека. Да ли се овај, по свему судећи, монах заразио пре или после уласка у братство манастира, то није могуће утврдити. Оно што можемо знати са сигурношћу јесте то да се у српским манастирима током 16. и 17. века боловало и умирало од туберкулозе, па чак и у тако малим и изолованим заједницама каква је била на Ђуриним ћелијама.