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SOME OF THE MAJOR PATHOLOGICAL AND TRAUMATIC FINDINGS IN THE MORAVIAN LUXEMBOURGS (PROKOP AND JOST OF LUXEMBOURG)

ABSTRACT: Last year, great attention was paid to the important anniversary of 650 years of the Luxembourgs' rule in Moravia. The City Museum of Brno organised in 2000 an exhibition dealing with the historic evaluation of the House of Luxembourg contribution and impact to the constitution of Moravian history and Czech statehood. One year earlier, anthropological-medical research of skeleton remains of two members of the ruling royal family was carried out – the brothers Jost and Prokop of Luxembourg (Dočkalová 1999, Cejnková 2001). The research was made by the Anthropos Institute – Moravian Museum in Brno, in cooperation with the Criminalistic Institute of Prague. The skeleton remains of Luxembourg brothers manifested identical genetic features, specific and pathological changes typical of the royal lineage dynasty.

KEY WORDS: Moravia – Middle Ages – Royal family members – Luxembourg brothers – Genetic features – Arthritis – Osteophytes – Osteoporosis – Harris' lines – Schmorl's nodes

INTRODUCTION

The history of Moravia in the 14th and early 15th centuries is connected with the rule of margraves John Henry and Jost of Luxembourg. The period represents the climax and utmost expansion of the Middle Ages in Moravia, when the country was ruled as an independent political entity by the House of Luxembourg (Mezník 2001).

The founders of the royal family, Czech king John of Luxembourg and Eliza Přemyslid, ruled in Bohemia in 1310–1457. Their first-born son Charles IV was King of Bohemia and Holy Roman Emperor (1346–1378). At the turn of 1349–1350 Charles IV conferred to his younger brother John Henry the Margraviate of Moravia. John Henry took the city of Brno as his residence, established there the margrave's court, and in 1350 he founded in Brno the Augustinian monastery with St. Thomas church. Establishing a church should also have provided a respectable burial place for this branch of the Luxembourg family (Flodrová 2001).

After the death of John Henry in 1375, the Moravian Margraviate was divided between his three sons – Jost, Prokop and John Sobeslav. In his testament, John Henry entrusted the rule over the country to his oldest son Jost, whose political abilities as well as ambitions outreached the territory of Moravia (Mezník 2001). Jost of Luxembourg, Moravian margrave, future Holy Roman king, ruled in Moravia in 1376–1411. Being a member of the House of Luxembourg, he was buried in St. Thomas church in Brno when he died in 1411.

His brother Prokop of Luxembourg founded in Brno (Královo Pole) a Carthusian monastery with the church of the Holy Trinity, and he was buried there in 1405 as the founder of the church (Cejnková 2001).

HISTORY OF RESEARCH

During the renovation of the building of the former Carthusian monastery in Brno (Královo Pole, today Brno University of Technology), archaeological and construction research of the whole complex was carried out. In 1975, a stone grave was discovered under the floor of the monastic church of the Holy Trinity, with skeletal remains of Prokop of

Luxembourg (Bukovský, Cejnková 1975). A brief historical and anthropological communication of research results has been published – Vlček, Flodrová 1987.

Archive materials document that the tomb with skeleton remains of margrave Jost of Luxembourg in St. Thomas church was first opened by the Augustinians in 1752. The Luxembourg crypt in St. Thomas church, with relics of margrave Jost, duke of Luxembourg, elector of Brandenburg and Holy Roman king, was opened a second time, on 20 January 1999, on the occasion of the 650th anniversary of the rule of Moravian Luxembourgs.

So that to carry out revision research, also the remains of Margrave Prokop of Luxembourg were taken out of the Carthusian monastery tomb in September 1999.

Jost of Luxembourg

The skull was mesocranial, chamaecranial, eurycranial, stenometopic, euryprosopic, mesene, hypsiconch and chamaerhine (Figure 1a). The maxilla showed, on its buccal side, partial enlargement resulting in a bone rim of the alveolar bone in the teeth area. Probably as a result of inflammation there occurred, on the maxilla's palatal side in the vicinity of a molar (M3 dex.), resorption of the bone of the alveolus, and development of protuberances (entesophytes). The frontal part of the maxilla was markedly flattened in the area of *fossa canina* (Figure 2a).

The mandible had enlarged edges of alveolar protrusions, creating a peripheral bone rim on both the labial and buccal sides (Figure 3). Resorption of the bone resulting from an inflammation process was obvious between the roots of molars M1–M3 (sin.). All teeth manifested greater or smaller degree of physiological abrasion that affected both incisive rims of frontal teeth, and masticatory faces of premolars and molars. Teeth enamel was strongly damaged, with dentine appearing on the teeth surface.

Columna vertebralis

The position of *condylus occipitalis dx.* on the skull was duplicated, and to that corresponded also the duplication of *fovea articularis superior dx.* on the first cervical vertebra, the atlas (Figure 4). In cervical vertebrae



FIGURE 1a. Skull of Jost of Luxembourg, lateral view.



FIGURE 1b. Skull of Prokop of Luxembourg, lateral view.



FIGURE 2a. Maxilla with flattened frontal face in the area of *fossa canina* (Jost of Luxembourg).



FIGURE 2b. Maxilla with flattened frontal face in the area of *fossa canina* (Prokop of Luxembourg).



FIGURE 3. Mandible with bone rim of the alveolar protuberance (Jost of Luxembourg).



FIGURE 4. Cervical vertebra C1 – view of the duplicated *fovea articularis superior dex.* (Jost of Luxembourg).

C5 and C6 the *foramen transversarium sin.* was duplicated by a bony septum (Figure 5a). In thoracic vertebrae Th6–Th9, osteophytes developed on both vertebral bodies and faces; marked laminar spurs occurred on the places where *ligamenta flava* had been connected (Figure 6). On the cranial and caudal faces of the thoracic vertebrae bodies Th6–Th10, Th12, impressions were observed – Schmorl's nodes (Figure 8a). X-rays showed marked thinning of bone tissue in proximal parts of vertebral bodies Th8, Th9 and Th10. Osteoporosis in vertebral bodies reached level I/II, with the exception of osteoporotic changes in the area of Schmorl's nodes.

Lumbar vertebrae manifested important post mortem damage; impressions were found on cranial and caudal faces of vertebral bodies. Lumbar vertebra L5 had an asymmetrically developed body as a consequence of deformation scoliosis.

Os sacrum was preserved only in three vertebrae. In the dorsal part of the first sacral vertebra, in the area of *crista sacralis mediana* not completely closed a sacral canal was observed (Figure 9a).

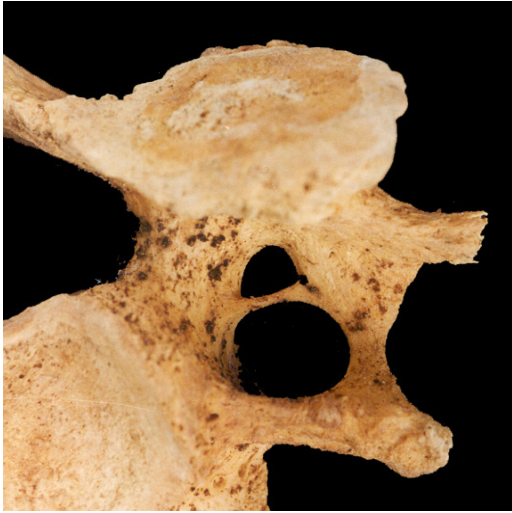


FIGURE 5a. Cervical vertebra C6 – detail of the bony joining in the *foramen transversarium* (Jost of Luxembourg).



FIGURE 5b. Cervical vertebra C6 – detail of the bony septum in the *foramen transversarium* (Prokop of Luxembourg).

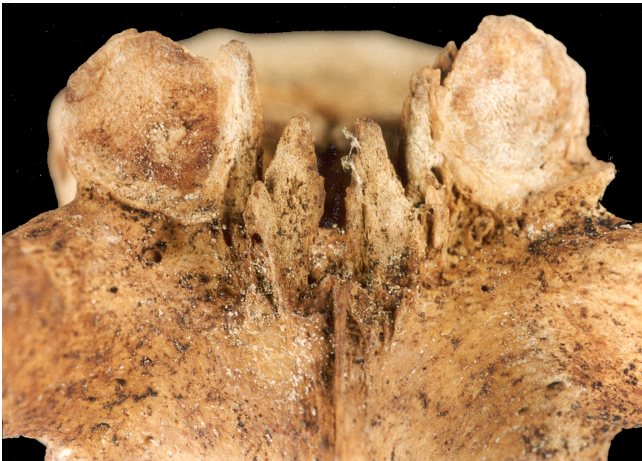


FIGURE 6. Thoracic vertebra Th7 – detail of laminar spurs (Jost of Luxembourg).

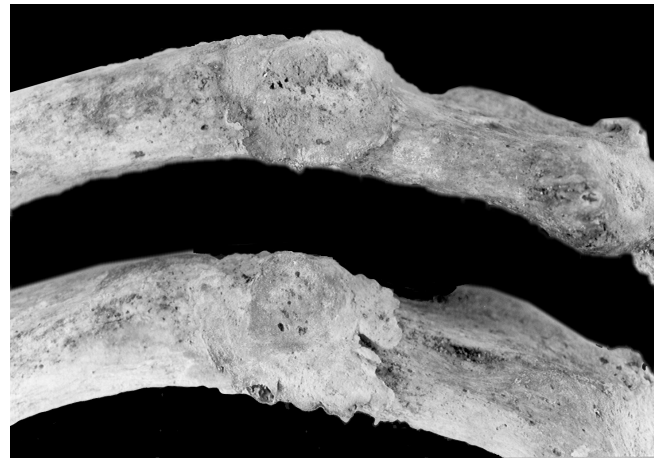


FIGURE 7. Costa – detail of the *facies articularis tuberculi costae* (Jost of Luxembourg).

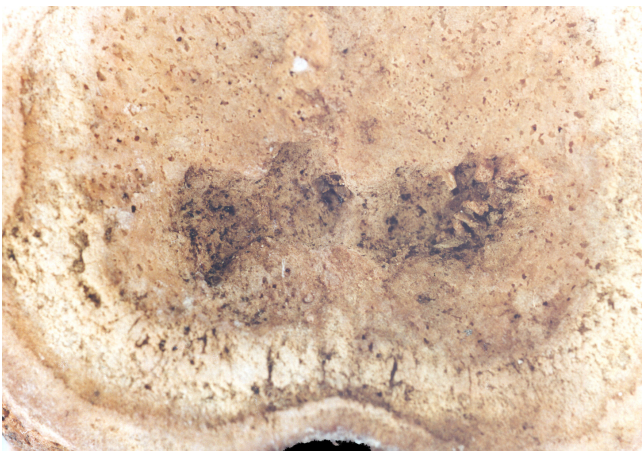


FIGURE 8a. Thoracic vertebra Th12 – detail of Schmorl's node (Jost of Luxembourg).



FIGURE 8b. Lumbar vertebra L2 – detail of Schmorl's node (Prokop of Luxembourg).



FIGURE 9a. *Os sacrum – spina bifida* (Jost of Luxembourg).



FIGURE 9b. *Os sacrum – spina bifida* (Prokop of Luxembourg).



FIGURE 10a. *Radius sin. dorsalis* – detailed view of the distal end (Prokop of Luxembourg).



FIGURE 10b. *Radius sin.* – detailed view of the septic inflammation of the joint face (Prokop of Luxembourg).

Thorax

With the exception of the first *costa dx.*, only parts and small rib fragments were preserved. Osteophytes developed on *corpora costae*, on the joint faces of *caput costae* as well as on *facies articularis tuberculi costae* (Figure 7).

Humerus

Osteophytic accumulations were apparent on proximal and distal epiphyses of both the right and left humeri. X-rays showed an important retreat of medullar cavity in proximal direction, reaching the *tuberculum majus et minus*. The compact on the humerus epiphysis was thinned, there was strong reduction of spongiosa bone.

Radius

The right radius bore small enthesophytes on the *tuberositas radii*; X-rays of both radii showed the existence of Harris' lines.

Os coxae

Pelvic bones *facies symphysiales* showed only remains of the original structure – on the edges and in different areas the smooth structure made

bone rims. X-rays of pelvic bones, especially of *acetabulum dx.*, showed apparent prolongation in vertical direction, marginal lesions, arthrotic changes and thinning of bone tissue in the area of both joints acetabuli.

Femur

Osteophytes were found mainly on both femoral proximal and distal epiphyses. More important arthritic changes were observed on the *caput femoris dx.* and *condylus lateralis sin.*

On X-rays, medullar cavity reached above the *trochanter minor*; in the *collum femoris* and *trochanter major et minor* there appeared small cavities in the spongiosa. The compact cortical is thinned, there are evident Harris' lines visible on X-rays of both femora.

A different length of the femora was discovered, with the left femur being longer by 15 mm. Prolongation of the femur corresponds with a more obtuse colodiaphyseal angle (Dürwald 1966, Breul 1974). This asymmetry had probably been compensated by body posture, which was then reflected on the vertebral face of the first sacral vertebra (*os sacrum*) and in the scoliosis of the lumbar part of the vertebral column. Partly differing length of limbs could have influenced the different configurations of iliac joints sockets.



FIGURE 11. Harris' lines on the right proximal and distal tibia (Jost of Luxembourg).

Tibiae

Proximal and distal epiphyses of both tibiae showed evident osteophytic accumulations; large marginal osteophyte was found on the *tuberculum intercondylare laterale tibiae sin.* X-rays showed Harris' lines (Figure 11), localised on *tibia dx. et sin.* proximally in pairs, at a distance of 13 mm from each other.

Tarsus

On the left calcaneus bone there was a marked enthesophytic accumulation – inferior calcaneal spur, caused probably by repeated stress on the heel, walking on a hard support, repeated impacts on the hard support.

Prokop of Luxembourg

The skull was incomplete (Figure 1b). The maxilla showed a partial distension in form of bony rim on both the buccal and alveolar sides of the bone. All teeth manifested high degree of physiological abrasion with considerably damaged enamel. The frontal part of the maxilla was flattened at the place of *fossa canina* (Figure 2b) in a similar way as in his brother Jost.

Columna vertebralis

Also the cervical vertebrae C5 and C6 showed a *foramen transversarium dex. et sin.* duplicated by a bony septum into two openings of different size (Figure 5b). This variant of duplication in cervical vertebrae is one of heritable genetic features of the Luxembourg dynasty.

On the bodies of some thoracic and lumbar vertebrae there were impressions – Schmorl's nodes, developed as consequence of intraspongious herniation of intervertebral disc nucleus (Figure 8b). In the dorsal part of the first sacral vertebra, there was an asymmetric adhesion in the spinous vertebra.

The sacral canal extending through lumbar vertebrae L3–L5 was open, and *spina bifida* (Grimm 1959, Stloukal, Vyhnánek 1976, Barends 1997) developed (Figure 9b).

Humerus

X-ray of the right humerus showed retreat of medullar cavity in proximal direction, the compact on the epiphysis was thinned.



FIGURE 12. X-ray of the proximal parts of *femur dex. et sin.* (Prokop of Luxembourg).

Ulna, Radius

On both forearms, important changes of distal epiphyses were found – *ulna dex. et sin.* – the same changes were observed on joint faces as well.

Both radii had been affected, in their distal parts, by a probably septic process, with joint faces showing extensive arthritic changes (Figures 10a, b).

Femur

X-rays showed (Figure 12) that medullar cavity in both femori reached above the *trochanter minor*. In the *collum femoris* and *trochanter major et minor* there appeared cavities in the spongiosis, the interior *corticalis* was thinned (Szilvássy, Kritscher 1960).

Also the asymmetry in the length of femori was discovered, the left one being by 17 mm longer. Prolongation of the femur corresponds with a more obtuse colodiaphyseal angle. Discovered asymmetry in the length of the right and left femori is one of genetically conditioned features. It had probably been compensated in the same way by body posture when walking, and that caused changes in a section of the lumbar area of the vertebral column.

As to pathological manifestations, the skeleton showed productive degenerative changes in the form of osteophytes and enthesophytes. There were osteoporotic changes in vertebral bodies and long bones epiphyses. On the bodies of thoracic and lumbar vertebrae marked impressions (Schmorl's nodes) were found. The shape of distal epiphyses of forearm bones was changed due to arthrosis, possibly accompanied by a septic process.

Comparison of skeletal remains:

Jost of Luxembourg died at the age of 55 years	Prokop of Luxembourg ± 50 years old
	Facial part of the skull markedly flattened maxilla in the area of <i>fossa canina</i> <i>Vertebrae cervicales</i> variant of duplicated openings in the <i>processus transversarium</i> <i>Os sacrum</i> asymmetrical adhesion of <i>processus spinosus S1</i>
Asymmetry in the length of right and left femori left femur longer by 15 mm	longer by 17 mm

The left femur is longer and has a more obtuse colodiaphyseal angle. Asymmetry was compensated by body posture and by scoliosis in the lumbar area of vertebral column.

The bodies of some thoracic and lumbar vertebrae show impressions – Schmorl's nodes

CONCLUSION

Skeletal remains of Jost and Prokop of Luxembourg proved identical blood group "A", and several epigenetic features were confirmed:

- flattening of the maxilla,
- asymmetrical adhesions in the *os sacrum*,
- asymmetry in the length of lower extremities.

The results of the present study tally, or rather complement the information on the Luxembourg dynasty of Czech kings Charles IV and Wenceslas IV (Vlček 1999).

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