

## CURRENT PROBLEM CASE

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**Femoral neck fracture – the cause of death of Emperor Charles IV**

Received: 19 July 2000

**Abstract** We present the oldest documented case of femoral neck fracture of a particular person in the history of orthopaedic surgery. Examination of the skeleton of Charles IV, the King of Bohemia and Roman Emperor living in XIVth century has revealed a fracture of the left femoral neck. This fracture was most probably an indirect cause of his death as it resulted in pneumonia, the immediate cause of death. This fact has been confirmed by contemporary chronicles.

**Introduction**

Fracture of the femoral neck as a specific injury has been known since the time of Galen. In the Middle Ages it was reported by Ambroias Parré, the personal doctor of four French kings [3]. The modern history of the investigation of this injury started two centuries ago when Sir Astley Cooper [1] described the first cases and subdivided fractures of femoral neck into intracapsular and extracapsular ones. To our knowledge, there exists no specific description of an older case of a femoral neck fracture.

**Case report**

The senior author has been dealing for almost 40 years with the investigation of skeletal remains of the Bohemian royal dynasties, the House of Přemyslides and House of Luxemburg in particular. As part of this research, on the occasion of the 600th anniversary of his death, the skeletal remains of the most outstanding Bohemian ruler, the King of Bohemia and Roman Emperor Charles IV, were examined.

Charles IV, the son of John of Luxemburg and Eliška of the Přemyslides, was born on May 14, 1316. Since 1346 he had been

the Roman and Bohemian King, and in 1355 he was crowned Roman Emperor. For his political merits and the depth of his knowledge, he is considered one of the most prominent European rulers of the culminating Middle Ages. Among his most outstanding deeds was the foundation of a university in Prague in 1348 that still bears his name today. Charles IV died on November 29, 1378, in Prague.



**Fig. 1** The anterior aspect of the right and the left proximal femur



**Fig. 2** Xeroradiograph of both proximal femurs

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A detailed anthropological analysis of the almost complete skeleton of Charles compared with the skeletal remains of his ancestors and descendants has revealed remarkable facts complementing the historical image of the Emperor. Apart from the congenital skeletal anomalies inherited from the Přemyslides and Luxemburgers, the analysis revealed symptoms of a number of traumatic and degenerative changes. Among the most significant was a complicated fracture of the mandibula, a fracture-dislocation of the lower cervical spine, and symptoms of chronic gout. All these findings have been published before [7, 8, 9].

A surprising finding has been brought to light by the examination of his left femur (Figs. 1, 2), revealing a fracture of the femoral neck passing 1 cm on its superior surface and 3 cm on the inferior surface from the edge of the articular cartilage of the femoral head. On the posterior aspect a small triangular fragment (22 × 16 × 17 mm) was impacted in the lateral part of the neck. From the present viewpoint this is a clear case of an intracapsular fracture of the femoral neck with a posterior comminution and an almost vertical fracture line of Pauwels III type. Despite a careful examination which eliminated the post-mortem origin of this fracture (i.e. manipulation of the remains), no symptoms of healing have been found.

## Discussion

This finding suggests that Charles IV died of the fracture of the femoral neck which he sustained during a fall or jump (e.g. from stairs, horse). Most of the above-mentioned as well as other unmentioned injuries and degenerative changes may be correlated with historical sources and pictures of Charles IV, particularly the injury of the cervical spine and fracture of the mandibula. However, historical sources include only very general data about the causes of his death. On November 2, 1378, the Emperor issued the Minting Order together with his son Wenceslas IV, and his last letter dated November 25 was addressed to the Archbishop of Cologne [2]. From then until his death there are no other details. Only the Czech historian F. Palacký [4] writes that 'a mischievous fever too prematurely put an end to his blessed life in 63rd year of age...' Until

this latest research, historians considered the primary cause of the death of Charles IV to be the gout from which he had been suffering in the last years of his life and which made him bedridden [5, 6] and finally resulted in a fatal case of pneumonia. We can now document, however, that the death was beyond any doubt caused by the fracture of the left femoral neck sustained sometime after November 2, 1378.

Today we can only speculate to what extent this fracture influenced the historical development of Central Europe. However, in any case the Roman Emperor and King of Bohemia Charles IV is the first historically documented person to sustain a fracture of femoral neck and die as a result.

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