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LESSONS FROM THE MUSEUM

The possible reconstruction of a sharp injury to a skull

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Surprisingly, the founder of forensic pathology in Serbia was actually a Czech: born in 1864, in Rychlov of the Bohemian district of Kroměřiž, Dr Eduard Michel studied medicine in Prague and Vienna from 1882 to 1889. Upon completion of his studies, he joined his mother and father in Belgrade, who had been invited in 1858 by the Prince of Serbia Miloš Obrenović to establish a residency in the city. For the next 6 years, Dr Eduard Michel worked as a clinical physician in Belgrade. In order for him to specialize in forensic pathology under the famous Professor Eduard von Hofmann, he was sent to Vienna in 1895 for 3 years.

This is one of the first forensic cases of Dr Eduard Michel, where the skull under review is interesting from both an anthropologic and forensic point of view.

Skull findings and discussion

Unfortunately the autopsy record for this case is not in the Institute's archive. The skull measures 159 long and 139 mm wide with a bone thickness between 2 and 7 mm. Since only the calvarium has been retained, it is difficult to determinate the gender of the deceased [1]. It is accepted that at least some of the skull's suture lines are closed in the majority of adults and that this tends to become more widespread as one ages. Therein, only the skull's endocranial fusion is to be studied [1], and, in this case, its endocranial suture lines have almost completely merged, indicating that the deceased was probably a middle-aged adult.

The squamous portion of the occipital bone consisting of the interparietal part is sometimes divided by a transverse suture in the position of the highest nuchal line. The part above this transverse suture, i.e. the *Inca bone* or the *os interparietale*, was first described by Rivero and Tschudy in 1851 concerning a Peruvian cranium. In addition to the transverse suture at the highest nuchal line, one or more longitudinal or additional transverse sutures appear at some points, subdividing the Inca bone. These lead to bipartite, tripartite, or multipartite Inca bones. When the transverse suture is incomplete and occurs in combination with one or more longitudinal sutures limiting an area corresponding to a part of a partitioned Inca bone, the condition is called *a partial Inca bone* [2]. An incomplete symmetric bipartite Inca bone—*Os incae duplex symmetricum* (Fig. 1)—is present in this case. The formation and cause of the variation of the occipital suture has long been studied from an embryological standpoint [3–5]. It has been suggested that the Inca bone is inherited as a dominant trait, possessing approximately 50 % penetrance [6]. Also, a relationship between the incidence and the distribution of sutural bones in the occipital region and artificial cranial deformation has also been suggested, further suggesting that the phylogenetic significance of the Inca bone is difficult to discuss [2].

Here, in the skull, the lower, separation edge of the calvarium is irregular. It is hard to imagine exactly how Dr Michel prepared this autopsy in 1898, in a wooden-shed in the courtyard of the General State Hospital, founded and built in Belgrade in 1868, and how he opened the skull himself using sawbones. It is also hard to imagine him in a similar context from the May of 1903, in the cellar of the Serbian royal residence, as he was preparing the autopsies

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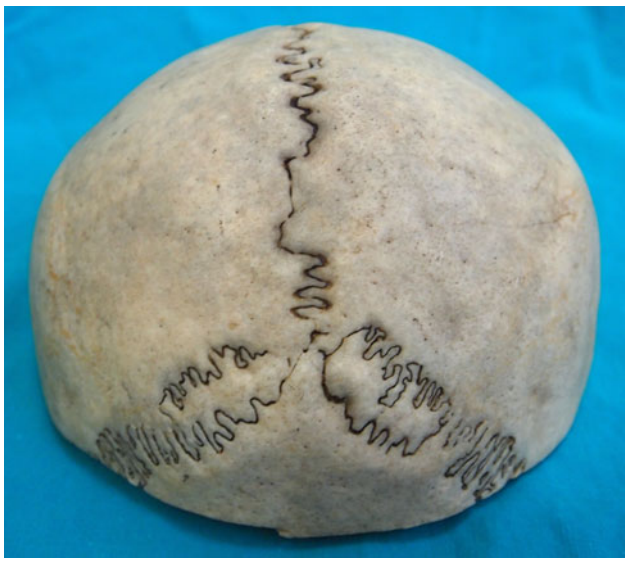

Fig. 1 The posterior aspect of the skull with an incomplete symmetric bipartite Inca bone—*Os incae duplex symmetricum*

of the assassinated royal couple King Aleksandar Obrenović and his wife, Draga Mašin, which he performed on a billiard-table in the presence of the foreign diplomatic representatives, while loudly dictating the autopsy findings to his adjutant. This was not at all that unusual given the circumstances: the first building with an actual, proper dissection-room was built in Belgrade in 1907 as a City Department for Prosections.

In the anterior aspect of the skull, there is a transversal healed fracture of the right parietal bone (Fig. 2a). Missing parts, it is covered by calcified connective tissue and new-growth bone (Fig. 2b, the grey-colored area). This grooved area is approximately 70 mm in length and 2–10 mm in width, and has rounded, thick, and smooth margins. In the section of this transversal healed fracture closer to the skulls midline, there are two visible retained bone-fragments, fused together with the following surrounding structures: the first fragment of the left parietal bone is a triangular shaped slight depression; the second is of the right parietal bone, pentangle-shaped, and localized slightly posteriorly and lateral from the first (Fig. 2b, marked with asterisks and black line). A somewhat larger triangle-shaped fragment of the right parietal bone is missing (Fig. 2b, the lateral part of the grey-colored area). From this point, the anterior fracture line, almost straight and parallel to the fronto-parietal suture, turns forwards and downwards (Fig. 2b, black line). This fracture had healed completely and is not visible on the inner table plate of the right parietal bone (Fig. 3). On the outer surface of the skull, a slight diastasis of the inter-parietal suture is clearly visible, which also makes this suture more visible than that of the fronto-parietal.

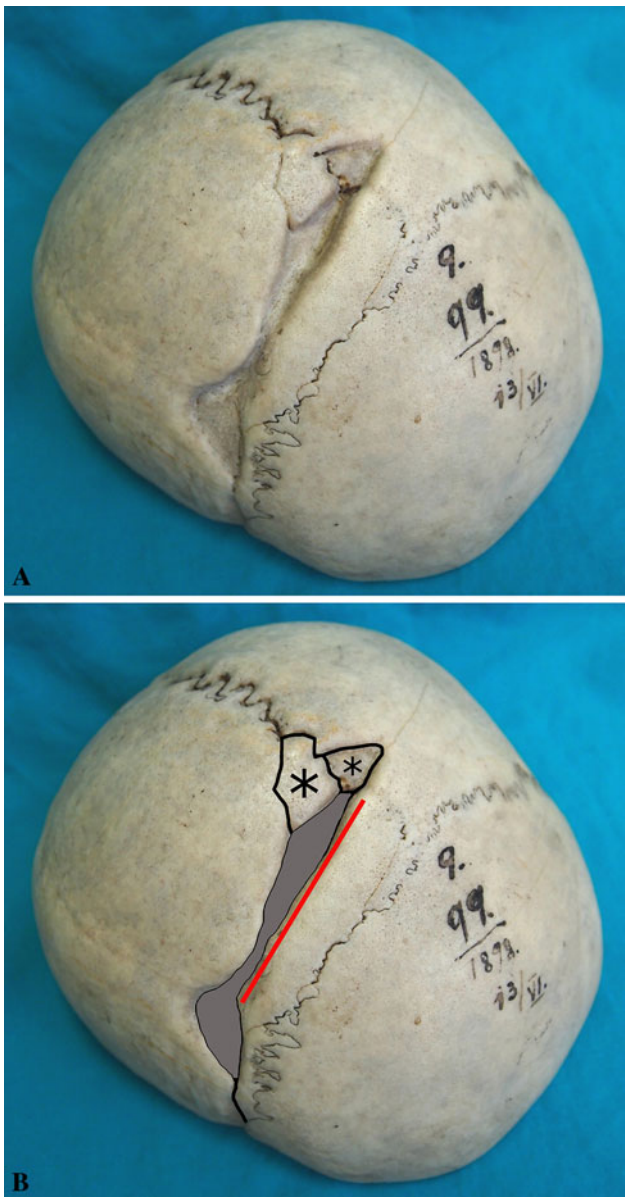

Fig. 2 **a** The outer aspect of the skull with the healed fracture. **b** Two bone-fragments retained, grown together and with the surrounding structures (*asterisk*); fracture lines (*black line*); a bone-missing groove area covered by calcified connective tissue and new-growth bone, possessing rounded, thick, and smooth margins (*gray area*); the presumed penetration site of the blade of the sharp object used in the injury (*red line*)

In the area of the missing and retained bones fragments, there is an over-growth of the inner table plate of the parietal bones. The margins of the parietal bones in the area of the inter-parietal suture are rounded, thick, and smooth, indicating a prior slight diastasis of this suture (Fig. 3).

It is possible that this fracture was inflicted by a sharp object, such as an axe, hatchet, or meat cleaver; i.e. a longer, sharp-edged but non-pointed weapon. Such weapons can produce this type of injury, characterized by a

Fig. 3 The inner aspect of the skull with the museum reference

straight sharp perforating defect of the skull along the course of the gash, which is often combined on the outer table with a narrow depressed fracture on one or both sides of the sharp defect, possessing bursting fractures from its ends [7]. These heavy cutting weapons can produce a characteristic lesion to bone. The initial impact slices cleanly through the bone on one edge, often burnishing the bone. However, the rebound or removal of the weapon or the relative movement between bone and blade is usually at a slightly different angle, causing an irregular fragment of the bone of the opposite face to crack, resulting in the residual defect having one smooth and one rough edge [1]. Bearing this in mind, it is possible that the sharp object used in the case presented here did not strike the skull in a perpendicular direction, rather at a forwards angle, producing a smooth anterior edge and a wedge-shaped irregular posterior edge due to the slight depressed-comminuted fracture. Therein, the two bone-fragments were retained, while others were lost, and were later covered during the healing process with calcified connective tissue and new-growth bone. Yet, the possibility still remains that the observed injury could have been produced by an asymmetrical wedge-shaped depressed fracture.

The penetration depth of the weapon which caused the injury to the skull should be considered. Given the localization of the retained bone-fragments, as well as the change of direction in the anterior fracture line (Fig. 2b), it could be assumed that the site of the penetration of the sharp injuring object might well have been shorter than would otherwise be assumed. The penetrating area could have been of a length of no more than approximately 50 mm (Fig. 2b, marked in a red line). Observing the presumed penetration site from the inner aspect of the skull and considering the convexity of the inner table-plate, it could be suggested that the blade, most likely slightly curved, would have not been able to penetrate more than 3–5 mm into the skull. At the ends of the site of penetration there are bursting fractures with bone-fragments, as well as an inter-parietal diastasis.

The focal impact to the skull caused the outer table to be driven inwards, and, unless absorbed in the diploë, the inner table would have also intruded into the cranial cavity (as is usual) [1], yet without any obligatory laceration of the dura. The appearance of the fracture site in the presented case demonstrates that the bones subsequently healed: the victim surviving this head injury for quite some time afterwards. Therefore, it can be concluded that there was no severe direct damage to the skull's contents at the time the injury was inflicted, such as an air embolism due to damage of the sinus sagittalis, or any hemorrhage, or infection [1, 7, 8]. However, chronic growing post-traumatic hygroma due to intracranial hemorrhage, traumatic epilepsy, or neurological abnormalities due to brain contusions at the site of impact may have been some of the later effects of such a head injury [1, 7, 8]; although the presence of some of these side-effects may only be assumed.

Throughout his career, Dr Eduard Michel wrote approximately 40 medical articles, most of which were on the interaction of injury and disease in the process of dying, or the delayed effects and sequelae of injury. He was of the opinion that the manner of death in a case, whether it be natural or violent, must be expressed fairly to the public after the completion of an autopsy. In 1896, during his specialization in Vienna, he published a paper on post-traumatic intra-cerebral hemorrhage in the *Wiener klinische Wochenschrift* [9]. In 1890, he became the associate-editor of the *Serbian Archives of Medicine*, the official journal of the Serbian Medical Society, both of which were founded in 1872 and have remained active to this day. In 1898, he wrote a touching obituary to Prof. Eduard von Hofmann—to *his teacher* and *honorary member* of Serbian Medical Society—in this same journal [10]. In 1910, after finishing his medical studies in Vienna, Dr Milovan Milovanović joined Dr Michel as an assistant, and they worked together for 4 years, until the outbreak of the First World War.

Self-inflicted penetrations of the skull by sharp-edged objects are quite rare [8]. Thus, it is intriguing to assume that the presented case could represent an attempted homicide, perhaps between a married couple or even a homicidal attack during a robbery. Unfortunately, as the

autopsy report does not exist for this museum exhibit, this must remain speculation. This is because during the Habsburg occupation of Serbia and of Belgrade in First World War, the building of the City Department for Prosections was demolished completely [11]. Only a few examples of the fruitful professional career of Dr Eduard Michel have survived. Among them are several autopsy reports, a number of personal medical text-books and journals, as well as this museum exhibit. In the new building, erected for the newly-founded Institute of Forensic Medicine, as part of the University School of Medicine in Belgrade, Professor Milovan Milovanović established a small forensic museum in 1924. He marked this preserved skull on its inner surface as follows: "L No 99, M No 2, Date: the 13th of June 1898" (Fig. 3). Still, this museum exhibit was also marked by another hand, in different handwriting, by no-other than Dr Eduard Michel himself. On the outer surface of the skull there is written: "9, 99, the 13th of June 1898." (Fig. 2), probably meaning: the 9th forensic case of the 99th autopsy for the current year, with the date of when the autopsy was performed.

Postscript

Life is unfair. In 1915, Dr Eduard Michel died of typhoid fever at the age of 51, while providing care for wounded Serbian soldiers during the First World War. Born as a Czech, he was loyal to his adopted country his entire life. Professor Milovan Milovanović later ordered a photo-portrait of his teacher Dr Eduard Michel which now resides in the meeting-room of the Institute of Forensic Medicine. *Good words without deeds are rushes and reeds*. The work of Dr Eduard Michel became the firm foundations of forensic medicine in Serbia, and this noble Czech has not been forgotten.

Notice

The data about the professional and private life of Dr Eduard Michel has been taken from the book *Chronicles of Forensic Medicine in Belgrade*, written by Professor Snežana Veljković and published in Belgrade in 2009.

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