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## SURGERY AT THE ORIGINS OF AGRICULTURE: THE CASE OF CENTRAL EUROPE

*ABSTRACT: Study of a case of trephination and a case of amputation in the population recovered in the necropolis of Vedrovice in Moravia which belongs to the ancient phase of Neolithic Central Europe, around 5 500 BC. In both cases, the circumstances of the surgery have been a significant open trauma in cases of emergency and in the 2 cases the patients have survived several years after the intervention. These cases of surgery, among the most ancient in the world, demonstrate the availability of the surgeon's presence immediately after an accident in this first community of farmers, the high technique and precision of their interventions, and especially their maturity in the area of medical decision and in the choice of the most appropriate intervention according to the state of the patient.*

*KEY-WORDS: Neolithic – Trephination – Amputation – Medical decision – Emergency*

### INTRODUCTION

In the world, the most ancient cases of surgery are essentially represented by trephinations and amputations. The former ones, as a surgical treatment, appear to have had a remarkable post-operative survival rate, testified by hundreds of skulls with healed wounds in the crania from many regions of the world, and especially from pre-Columbian America (Hrdlička 1897, Stewart 1958) and from Late Neolithic and Chalcolithic France (Broca 1876 a, b, c, Dastugue, De Lumley 1976). The latter are far rarer (Ortner, Putschar 1985), and are generally a consequence of traumatism (Trinkaus 1983). They demonstrate that prehistoric people knew how to operate in an efficient way on important traumas.

At present we do not know much about the origins of surgery in the Ancient World. The most ancient skeletons trephinated *in vivo* with survival of the patient (Dastugue 1959) are those from Taforalt (Epipalaeolithic, Morocco). Two other trephinations from the same period have been

reported in the CEI (Vallois 1971), but they seem questionable (Vallois 1971). With the beginning of agriculture in the Near East and in the Levant, the cases of trephination remain rare and often doubtful. Nevertheless, a case is known at Zawi Chemi (Shanidar, Iraq) in a population from the period (8920 BC) of the origins of agriculture (Ferembach 1970, Rathbun 1984), another has also been mentioned (Kurth, Rehner-Ertl 1981) from a site in Jericho (Israel). In Europe, it is with the first farmers that the trephinations seem to appear. Several cases have been reported in the linear ceramic culture of northern France, possibly dating from the end of the IVth millenium BC (Mordant 1989).

We will describe a case of cranial surgery and a case of amputation, both originating from one of the most ancient necropolises of Europe, that of Vedrovice in Moravia (Podborský 1993). The study of the skeletons has been directed by Professor Jan Jelínek. This necropolis belongs to the ancient phase of Neolithic Central Europe, around 5500 BC and more than a hundred subjects have





FIGURE 1. Vedrovice N° 15. The skull : superior view.



FIGURE 2. Vedrovice N° 15. The skull : antero-superior view.

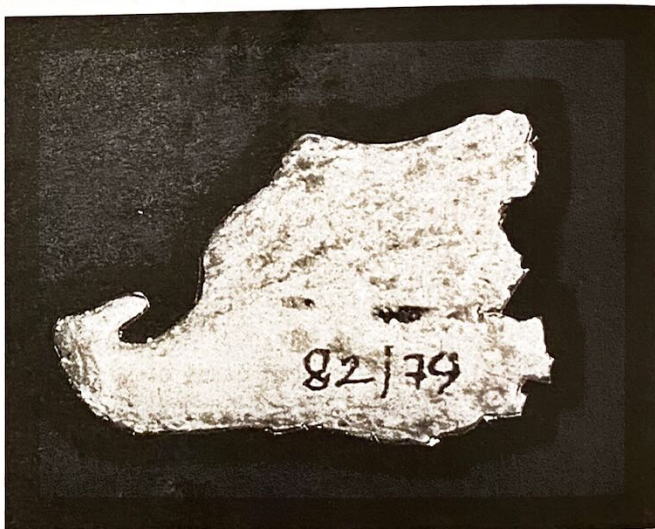


FIGURE 4. Vedrovice N° 82. Fragment of the left radius whose broken part should have been articulated with the fragment of radius seen in Figure 3.

FIGURE 3. Vedrovice N° 82. Proximal part of the left forearm, anterior view. Vedrovice N° 82. Proximal part of the left forearm, posterior view.



been recovered. For a better insight into prehistoric surgery, these interesting cases will be discussed.

## PRESENTATION OF CASES

**Vedrovice N° 15. Trephination.** It concerns a robust adult male which has been relatively well preserved. It presents, at the superior part of the frontal (*Figures 1, 2*), two distant holes separated by an area of bone and whose margins are formed of compact bone.

The oval-shaped anterior hole (length 26 mm, width on the outer table 15 mm, width on the inner table 7 to 8 mm) slightly oriented to the left, had in the continuation of its posterior extremity a 21 mm long split. The anterior margin shows an external bevel of approximately 45° with a bony spicule (15 mm width, 5.5 mm antero-posterior) which rises from the endocranial part. The posterior margin is vertical. These particularities explain the differences in measurements of the antero-posterior width between the endocranial and exocranial tables).

The oval-shaped posterior hole (large axis 32 mm) has a very irregular contour (small axis 14.5 mm to 11.5 mm). It encroaches partly on the medial segment of the right coronal suture. The anterior margin shows an external bevel, the posterior margin an internal bevel. Some thin bony spicules rise from the endocranial part of the anterior margin.

Between the two holes there is an area of bone (27 mm medio-lateral × 28 mm antero-posterior) very thin (the maximum thickness of the cranium at the level of the traumatism is approximately of 7 mm, but in this area it is approximately of 3 mm). It presents tiny marks of scraping near the posterior hole.

**Vedrovice N° 82. Amputation.** Again it concerns a relatively well preserved robust adult male. The proximal part of the left forearm, especially the radius, has been destroyed *post-mortem* and only two fragments have been found:

– One (*Figure 3*) consists of the superior part of the ulna whose extremity (antero-posterior diameter 9 mm) widened in paddle (width 31 mm), presenting a net section whose surface is covered with compact bone. Fused to it sideways (on 18 mm), is the middle part of the radius whose posterior part presents thin and non-active periosteal reactions and its inferior part (with a posterior orientation), a new articular surface (2 cm in diameter). The usual relief of the ulna diaphyses is absent and, between its proximal and middle parts, there is a badly deformed callus with a notch on the posterior part of the bone.

– The other one (*Figure 4*) consists of a fragment of bone (38 mm long, 23 mm maximum width), broken *post-mortem* at one extremity. The intact extremity had very irregular margins, and notably with a fragment in a hook-like form (cf. *Figure 4*). It seems to be a fragment of radius whose broken part should have been articulated with the fragment of the radius fused to the ulna.

## INTERPRETATION

**The trephination.** The irregular contours of the holes and especially the split associated to the first one, suggest that they are the sequels of an important trauma which had fractured and sunk the bone in at least two places. Margins of these two holes and the split associated to the former one are covered with a layer of compact bone which is a sign of perfect healing. It could have had a remarkable post-operative survival period, maybe of several years, as proved by the bony spicules rising from the endocranial part.

The tiny marks which are indications of ancient scraping, and the regular margins of these holes, demonstrate that a surgical intervention had regularized the margins of the trauma and had removed bony fragments. Concerning the anterior hole, the oblique and sharp bevel of the internal table signals scraping or abrasion methods (Broca 1876c). Concerning the posterior hole, it seems to have been done by scraping, which could be at the origins of the large thinned bone area and at the origins of the tiny marks. The posterior margin of the anterior hole had been subject to scratching, aiming to regularize a traumatic section. The irregular and internal bevel of the posterior margin of the posterior hole seems to have been related to the initial trauma.

**The amputation.** It seems that these lesions are the result of a traumatism that had crushed the left forearm. There had been a tear off of the inferior part of the forearm, more marked in its medial than in its lateral part, with a fracture of the middle part of the radius and of the proximal part of the ulna. The fracture of the proximal part of the ulna had consolidated in badly deformed callus, while that of the middle part of the radius presents a pseudarthrosis. This condition is the result of an open fracture and an infection witnessed by the periosteal reactions. The fusion of the two bones had occurred due to the importance of the trauma and the associated hematoma. The good consolidation of bone demonstrates that this traumatism may have occurred several years before the death of the individual. Furthermore, the new articular surface of the pseudarthrose is so much developed that it is probable that the man continued to use his stump throughout his life. The section of the ulna is so sharp and regular that it has to be considered as a surgical intervention.

The inferior fragment of the radius is so shapeless that it is quite probable that initially it was in crushed muscle. Confronted with this important traumatism, the surgeons have undertaken a partial amputation of the forearm at the same time as the treatment of the wound.

## DISCUSSION

Concerning the trephination, it seems that confronted with an important cranial traumatism with a wound of the scalp and a lot of bony fragments, the prehistoric surgeons

delimited a large area between the two large fragments and they cautiously proceeded with scraping. Once the lesions were well surrounded, the intervention was finally delimited (some areas having not been affected by the surgery) and adapted (bevel or vertical regularization). Concerning the partial amputation, the intervention was yet again particularly prudent and technically perfect, surgeons having been very conservative.

In the two cases of this necropolis the circumstances of the surgery had been the same – important traumatism in cases of emergency. Even today it represents risky surgery, where what matters first and foremost is the rapidity of the intervention and that it has to be the least impairing. In these two cases, the surgeons had made proof of great professionalism, their interventions are technically perfect, and it is obvious that they would have been able to realize a vast trephination of the skull or a complete amputation of the forearm. However, in such context of emergency, it is probable that their patients would be deceased. In Vedrovice, the surgical intervention was adapted to the state of the patients.

## CONCLUSIONS

These two cases of surgical interventions, among the earliest in the world, are an open traumatism of the cranium and an open traumatism that crushed the left forearm. In this early community of farmers they prove the available surgeon's – surgeons' presence immediately after an accident, and the high technique and precision of their interventions. Even more surprising is their maturity in the area of medical decision and in the choice of the most appropriate intervention according to the state of the patient. Their survival during several years after the interventions demonstrate that the choices of the surgeons were the most appropriate.

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