

## Cranioplasty of an Extremely Large Cranial Defect Caused by Transitional Meningioma with a Knitted Polypropylen-Polyester Prothesis “Codubix”

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### Summary

The authors report a case of transitional cell meningioma of the convexity which destroyed a large portion of the calvarium and invaded subcutaneous tissue. The tumour was totally removed and a large cranial defect /430 cm<sup>2</sup> in size/ was filled with a polypropyleno-polyester knitted prothesis “Codubix” with an excellent result.

The problems of cranioplastic closure of such an unusually large skull defect and the advantages of the use of the material “Codubix” are discussed.

**Keywords:** Skull meningioma; cranioplasty; knitted polypropyloen-polyester prothesis “Codubix”.

Meningiomas are the most common benign tumours of the central nervous system and constitute about 20% of all primary intracranial tumours<sup>3,5</sup>. Bony involvement by meningioma is not unusual – meningioma cells invade adjacent bone and produce an osteoblastic response<sup>3,8,11</sup>. In the classic monograph of Cushing and Eisenhardt eight types of characteristic involvement of bone by underlying meningioma were described, one of them being an external mass between the skull and galea with the hyperostotic area replaced mainly by neoplastic tissue<sup>3</sup>.

In this paper we report a case of convexity meningioma which destroyed an extremely large part of calvarium, and discuss the possibilities of plastic closure of very large skull defects.

### Case Report

38-year old man was admitted to the Department of Neurosurgery, Medical Academy of Łódź because of a right fronto-parietal mass which deformed the skull. He was previously treated in the oncological ward where a biopsy of the subcutaneous mass revealed transitional cell meningioma. On admission, he complained of headache, but was intact on neurological examination. Also fundus examination of the eye was normal.

Skull X-rays revealed extensive hyperostosis of the calvarium with radial striations of diploic trabeculae (Fig. 1). CT scan showed large intracranial tumour located in the right fronto-parietal area with the bilateral expansion through the skull into subgaleal and subcutaneous fronto-parietal regions (Fig. 2). Angiography of the right external carotid artery revealed highly vascularized tumour, and during this procedure an embolization of right middle meningeal artery was performed (Fig. 3). 24 hours after embolization the patient was treated surgically and the intracranial tumour was totally excised. The tumour had extracranial expansion and destroyed the whole right parietal bone and large part of the frontal bone. The bone invaded by the tumour was excised. The tumour was prepared



Fig. 1. Plain skull X-ray reveals hyperostosis of the calvarium, located mainly on the right side with radial striations of the diploic trabeculae

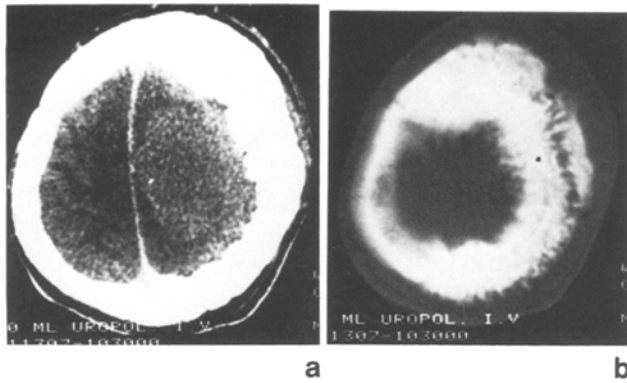


Fig. 2. a) CT-scan shows a large right fronto-parietal tumour with slight contrast enhancement. b) CT-scan (bone window) – extensive involvement of the skull by the tumour

histologically and showed the typical histological picture of transitional cell meningioma. However nests of neoplastic cells were seen in subcutaneous tissue (Fig. 4).

Two weeks after the first surgical procedure the next stage of surgery was undertaken – the left parietal and frontal bones, invaded by the neoplasm were excised and cranioplasty was performed. For

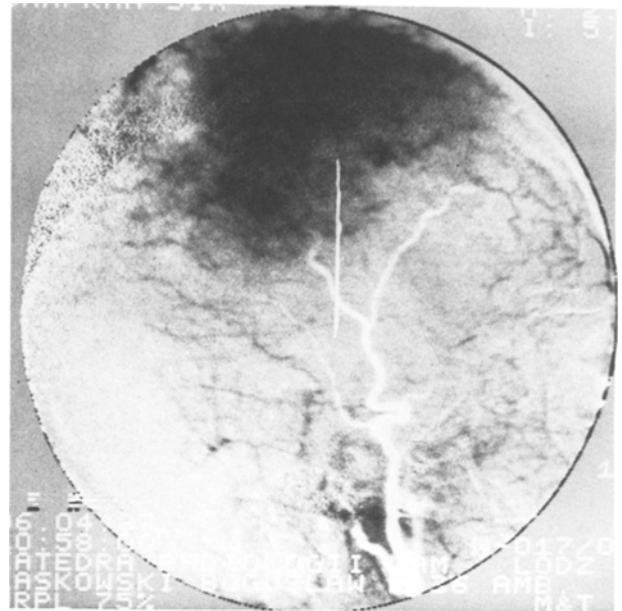


Fig. 3. Selective angiography of the right external carotid artery after embolization of distal branches of right middle meningeal artery

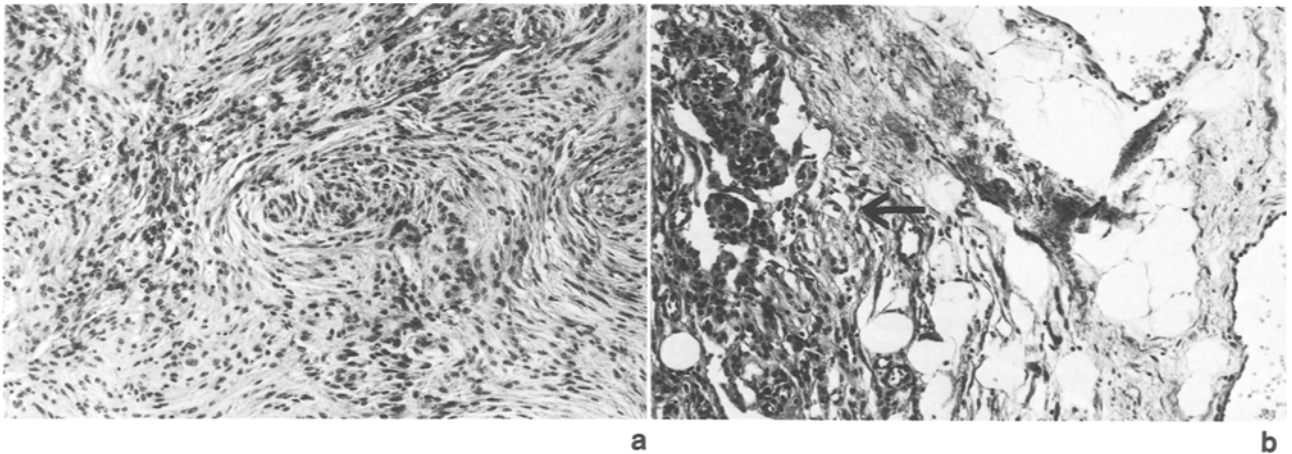


Fig. 4. a) Microscopic picture of the tumour cell (H&E, 150 $\times$ ) reveals typical structure of transitional cell meningioma. Neither atypical cells nor mitotic figures are seen. b) Meningioma cells seen within tela adiposa of subcutaneous tissue (H&E, 150 $\times$ )

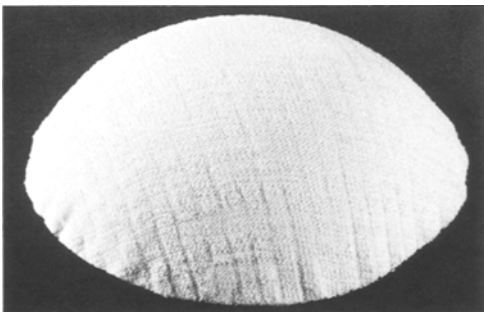


Fig. 5. A large prosthesis of the calvarium knitted from polypropylene and polyester yarns

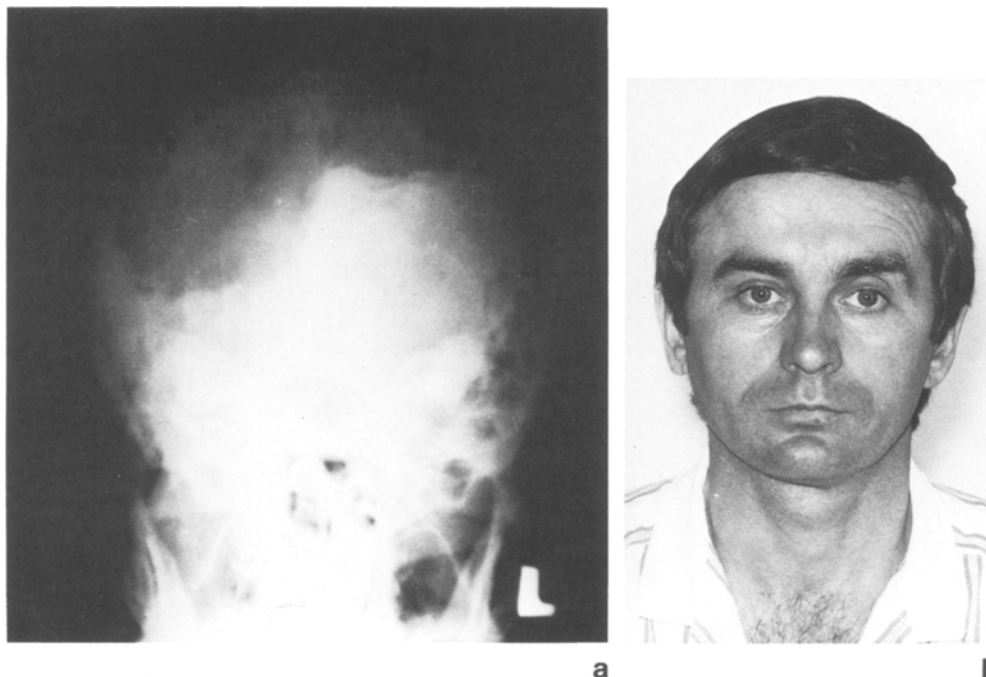


Fig. 6. a) Skull X-ray performed 3 years after surgery showing the extent of the defect – note the radiolucency of the prosthesis. b) The photograph of the patient 3 years after surgery – the cosmetic result is excellent, the right frontal branch of the facial nerve was damaged during surgery

cranioplasty, a prosthesis “Codubix”, knitted from polypropylene and polyester yarns, (manufactured by Centralny Ośrodek Badawczo-Rozwojowy Przemysłu Dziewiarskiego “Tricomed” 90-361 Łódź, Piotrkowska 270, Poland) and specially shaped was used (Fig. 5). The overall size of the defect was 430 cm<sup>2</sup>. The postoperative wounds healed without any complications. Postoperative CT revealed no pathological mass. Three years after surgery the patient is absolutely well, with no symptoms of recurrence on CT examination. The cosmetic result is excellent (Fig. 6).

## Discussion

The invasion by meningioma of the adjacent bone is not unusual, and in fact the hypostasis of the bone is the most common specific sign of meningioma on plain skull radiographs<sup>5</sup>. However, the tumour rarely has an extension through the skull into the subgaleal and subcutaneous area<sup>11</sup>. In the case reported, the tumour, although histologically benign, revealed a very extensive growth and totally replaced a very large part of the calvarium. After its excision the size of the defect was 430 cm<sup>2</sup>. In order to avoid large blood loss, we at first embolized the middle menigeal artery and then performed a two-stage operation.

Cranioplasty of large cranial defects is still difficult to perform because of lack of suitable materials. Prosthesis “Codubix” has many advantages – high strength, low specific weight, shows lack of water absorbing power, is totally radiolucent, and can be easily shaped with scissors to fit the defect. In our 10 years experience with the use of this material for cranial defect repairs we found it much more suitable for cranioplasty than

acrylic or tantalum plates (unpublished data). In this case, it was impossible to use other materials, like acrylic, tantalum, coral, ceramic, or hydroxylapatite implants, because they do not have enough strength to protect the brain in case of a very large skull defect<sup>1, 6, 7, 9, 12, 13, 14, 15, 16, 17</sup>. For obvious reasons, methods of autogenic grafts<sup>2, 4, 10</sup> were also impossible to use. The prosthesis “Codubix” proved its great usefulness and in our opinion is superior to any other method of cranioplasty of large cranial defects.

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