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Transbasal approach to skull base tumors: evaluation and proposal of classification

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Abstract A clinical study of the TBA was performed in 22 patients harboring tumors of the skull base. The follow-up ranged from 3 to 89 months (average, 30.5 months). The main complications were intracerebral hematoma, ptosis, and infection. One patient died (4.5%) because of an extradural hematoma. Eight patients died during the follow-up because of tumor complications. Among the survivals, the median of the Karnofsky index was 96.4. Based on this study, we propose a classification for the TBA, according to its extension.

Keywords: Transbasal approach; Skull base tumors; Tumors of paranasal sinuses

Resumo Realizou-se estudo clínico de 22 pacientes submetidos ao acesso transbasal para tratamento de tumores da base do crânio. O seguimento variou de 3 a 89 meses (média: 30,57 meses). As principais complicações foram: hematoma intracerebral, ptose palpebral e infecção cutânea. Houve um óbito cirúrgico (4,5%) por hematoma extradural. Oito pacientes faleceram durante o seguimento em razão de complicações das lesões das quais eram portadores, ou por lesões associadas. Nos 13 que sobreviveram, o índice de Karnofsky médio por ocasião do último seguimento foi de 96,42, demonstrando ótima qualidade de sobrevida. Baseado nesse estudo propõe-se classificação do acesso transbasal de acordo com o tipo e a extensão da osteotomia.

Keywords: Acesso transbasal; Tumores da base do crânio; Tumores dos seios paranasais

1. Introduction

Skull base tumors been a great therapeutic challenge. They can be benign or malignant and originate from the paranasal sinuses, nasal pharynx, leptomeninges, cranial nerves, orbit, osteoblasts, chondroblasts, and muscular cells, as well as from the squamous cells or from the glands. Metastasis, mainly those from breast or kidney carcinoma, can also spread to the skull base. These tumors can destroy the bone or invade the skull through the foramina.

The TBA has been used to treat different lesions from the anterior fossa; frontal, ethmoidal, and sphenoidal sinuses; clivus; and upper cervical region. It is a subfrontal access, which can be performed by different techniques. Many authors have shown technical modifications and renominated this approach, generating several denominations to designate similar procedures.

In this article, an evaluation of the efficacy and the limitations of the TBA through the analysis of 22 patients with skull base tumors is made, and a classification of this approach according to the performed osteotomy and the extension of the approach are suggested.

2. Material and method

Twenty-two patients with tumors that involved the anterior, medial, and posterior fossa, extending to the paranasal sinuses, were studied and submitted to the TBA

Abbreviations: TBA, transbasal approach.

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at Biocor Instituto from 1996 to 2002. Ten patients were female (45.4%).

The postoperative follow-up ranged from 3 to 89 months (average, 30.5 months). The period of hospital stay was, on average, 9.5 days (4-23 days). The length of permanency at the intensive care unit ranged from 1 to 6 days (average, 1.5 days).

The patients were studied, retrospectively, through the analysis of the medical records and neurologic examinations during the follow-up period. All patients were submitted to the TBA according to the technique by Sekhar et al [20].

Frontal bilateral craniotomy was carried out on 4 patients. Frontal craniotomy and naso-orbital osteotomy were carried out on 3 patients. Fifteen patients were submitted to frontal bilateral craniotomy, naso-orbital osteotomy, and ethmoidal osteotomy. On 1 patient, the dura mater of the clivus was opened.

To assess the quality of life after surgery, the Karnofsky scale was quantified at the preoperative period and at the third month and 1 year after the surgical treatment.

3. Results

Total tumor removal was achieved in 5 patients. The pathologic diagnosis was confirmed by immunohistochemistry in 9 cases. The 22 studied patients had the following tumors: invasive pituitary adenoma (4), carcinoma (4), chordoma (2), chondrosarcoma (2), esthesioneuroblastoma (2), meningioma (1), osteoma (1), plasmacytoma (1), rhabdomyosarcoma (1), juvenile angiofibroma (1), and fibrous dysplasia (3).

Thirteen patients (59%) received complementary radiotherapy to the surgical treatment. On 4 of them, chemotherapy was also performed. One patient presented intracerebral hematoma, skin infection occurred in one, and palpebral ptosis occurred in two in one of them, it was transitory.

On 1 patient, the approach was performed in 2 stages because of excessive bleeding.

On 4 patients, other surgical procedures were necessary. One patient was operated on for palpebral ptosis correction; on one, a cranioplasty was performed for occluding a frontal burr hole; 2 patients were submitted to other approaches (pterional approach and transmaxillary approach) for the removal of remaining tumors.

The average Karnofsky index at the preoperative stage was 79.5. Among the surviving patients, the index was evaluated on the 3rd, 6th, and 12th month after surgery, which brought out the following average marks, respectively: 87.5, 93.5, and 96.4.

There was 1 surgical death in the present series (4.5%). It was a patient who had a chondrosarcoma on which the TBA was performed. This patient developed extradural hematoma on the second day after surgery.

All the patients improved the Karnofsky index, presenting good quality of life during the postoperative period.

During the follow-up, 8 patients died because of the lesions they harbored.

4. Discussion

Skull base tumors, including the paranasal sinuses tumors, represent less than 1% of the intracranial tumors. However, they bring great neurosurgical interest because of therapeutic difficulty. The precise origin of these tumors cannot always be detected, and they usually invade more than 1 skull base compartment. There is a great variety of histologic types of tumors. About 80% of the primary malignant tumors are from epithelial origin. The most common of them is the epidermoid carcinoma [1].

The development of the skull base surgery in the last 2 decades has made it possible to approach skull base tumors with safety. The knowledge of surgical anatomy, studied with the aid of the surgical microscope, has contributed to decrease in the rate of complications related to damages to vascular and nervous structures.

Surgery for skull base tumors should not only consider the necessity of histologic tumor diagnosis but also the possibility of symptom relief such as pain, visual acuity loss, diplopia, and nasal obstruction. Cure is not always possible, but the precise histologic diagnosis allows to establishment of the prognosis in a more accurate way. Furthermore, the reduction of the tumoral volume allows decompression vascular and neural structures, which relieves symptoms and improves the patient's living quality.

Although authors such as Raveh et al [16] defend the removal en bloc of skull base tumors, most authors agree that such removal is not feasible [2,9,18,21]. Colli and Al-Mefty [3] report that the radical removal of skull base chordomas and chondrosarcomas plays a fundamental role in the treatment and the prognosis. On the other hand, the extensive removal can be related to a greater morbidity. Tessier et al [23,24] introduced the systematic bases of what we call nowadays *TBA*. They suggested this approach for treatment of hypertelorism and craniofacial dysostosis and established the bases for the osteotomies and technical details.

Converse et al [4] described the ethmoidal osteotomy that made the preservation of the olfactory tract possible.

Derome [5-7] adopted the approach of Tessier et al [23,24] and coined the term *transbasal*. He used it for the removal of the skull base tumors placed at the clivus, extending to the sphenoidal and ethmoidal sinuses and compressing the optical nerves. With this approach, it was possible to reach the anterior border of the foramen magnum, the anterior arch of the first cervical vertebra, and even the body of the second cervical vertebra.

Lesoin et al [14] described the removal en bloc of a fronto-orbital flap to enlarge the surgical field and to perform lesser frontal lobes retraction. They used the vascularized pericranium for reconstruction. Kawakami et al [12,13] included the orbital rim in the frontal osteotomy.