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Surgical treatment of parasagittal and falicine meningiomas invading the superior sagittal sinus



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ABSTRACT

Objective: We present our experience with surgery of parasagittal and falicine meningiomas invading the superior sagittal sinus with special consideration of the surgical complications and the incidence of tumour recurrence.

Materials and methods: The analysis included 37 patients with parasagittal and falicine meningiomas invading the superior sagittal sinus. In 13 cases, the sinus was ligated and resected with tumour. In 14 cases, the sinus was entered with the goal of tumour resection and the sinus was reconstructed, while in 10 patients the sinus was not entered and the remaining residual tumour was observed for growth.

Results: Out of 13 patients after radical resection of the tumour and invaded part of sinus, 9 revealed haemodynamic complications: venous infarction (4), significant brain oedema (3) and hypoperfusion syndrome (2). 2 out of 14 patients after resection of the tumour from the lumen of the superior sagittal sinus with subsequent sinus repair developed venous infarction after surgery. Among 27 patients after radical tumour excision the remote follow-up revealed recurrence in 2 patients. There were no significant haemodynamic complications in none of 10 cases, in which the residual tumour was left after surgery in the superior sagittal sinus. In this group, 3 cases were subjected to early post-operative radiotherapy and local recurrence was observed in 4 patients.

Conclusions: The aggressive surgical treatment of meningiomas infiltrating the superior sagittal sinus is associated with a high surgical risk. The incidence of recurrence of these tumours increases significantly in the case of non-radical excision of the tumour.

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1. Introduction

Meningiomas are usually benign, slow-growing and macroscopically well-circumscribed tumours. Parasagittal and

falicine meningiomas are the second most common group of intracranial meningiomas and a frequent subject of the neurosurgical practice [1–3]. The most important feature of these meningiomas is their location in the immediate vicinity of the superior sagittal sinus and the presence of large

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cerebral veins that enter the sinus in the proximity of these tumours [1,3–5]. The infiltration of the superior sagittal sinus and the large veins draining the cerebral hemispheres and directing the blood into the superior sagittal sinus impede the safe and complete removal of the tumour. The high risk of damage to the cerebral venous system, when making an attempt to perform radical resection, results in the high percentage of cases of incomplete removal of the tumour and consequently, in some studies this group of meningiomas is described as the one having the highest percentage of tumour re-growth [6,7]. On the other hand, the attempt of radical resection of the tumour increases the risk of damage to the cerebral venous system and severe neurological complications [2]. The optimal surgical strategy in the treatment of meningiomas invading the superior sagittal sinus is still the subject of debate.

The aim of the study is to retrospectively evaluate the results of the treatment of parasagittal and falcine meningiomas invading the superior sagittal sinus with particular emphasis on the surgical complications and the risk of tumour recurrence, depending on the adopted management.

2. Material and methods

In the years 1991–2010, at our centre, 152 patients with a diagnosis of parasagittal and falcine meningiomas underwent surgery. 37 cases were diagnosed with the tumour invading the superior sagittal sinus and the above patients were analysed. The diagnosis of meningioma was based on the result of the histopathological examination. Table 1 shows the characteristics of meningiomas in the study group.

Table 1 – Location of tumours, tumour size, type of sinus invasion and tumour histology.

Parameter		No. of patients (%)
Location of tumours	Parasagittal	29 (78)
	Falcine	8 (22)
Location of tumours according to portion of sinus invaded	Anterior	11 (30)
	Middle	21 (57)
	Posterior	5 (13)
Tumour size	<3 cm	4 (11)
	3–5 cm	23 (62)
	>5 cm	10 (27)
Type of sinus invasion according to Sindou and Alwerntia classification scheme	Type II	11 (30)
	Type III	11 (30)
	Type IV	6 (16)
	Type V	3 (8)
	Type VI	6 (16)
Tumour histology	Meningioma, WHO Grade I	33 (89)
	Meningioma, WHO Grade II	3 (8)
	Meningioma, WHO Grade III	1 (3)

The characteristics of the tumour growth were based on the analysis of the pre-operative brain magnetic resonance imaging (MRI) and the intraoperative findings. There were 29 parasagittal meningiomas and 8 patients had falcine meningioma with bilateral growth overgrowing both blades of the falx; 21 meningiomas were located in the middle part of the superior sagittal sinus. The radiological diagnostics in all cases included MRI. Digital subtraction angiography (DSA) and magnetic resonance angiography (MRA) were performed in order to evaluate the patency of the superior sagittal sinus (DSA in 31 patients, MRA in 6 patients). The results of DSA and MRA in 9 cases showed occlusion of the superior sagittal sinus and in 28 patients the sagittal sinus was patent in varying degrees. A degree of the superior sagittal sinus invasion was evaluated according to the Sindou and Alwerntia classification scheme [8] based on the brain MRI, the vascular examinations (DSA and MRA) and the intraoperative findings.

Table 2 presents the patient characteristics. The patient age ranged from 19 to 73 years (mean 47 years). The study group consisted of 27 women and 10 men. Epileptic seizures and limb paresis were usually the first symptoms of the disease.

The management depended on the preference of a surgeon. 13 patients underwent resection of the superior sagittal sinus together with the tumour: the superior sagittal sinus was ligated at the proximal and distal ends of the involved sinus and then cut. In seven of above cases the flow through the superior sagittal sinus was still preserved, in 6 patients the superior sagittal sinus was completely obliterated by the tumour. In 14 cases, meningioma was excised from the lumen of the superior sagittal sinus with subsequent sinus reconstruction. In 10 patients, the part of the tumour was left in the invaded superior sagittal sinus.

The scope of resection was evaluated based on the intraoperative observation and the result of brain MRI imaging (made 3 months after the operation). The condition of the patients was assessed at discharge from the clinic and during the long-term follow-up (conducted in the hospital or outpatient clinic) based on the neurological examination and the MRI imaging studies. The postoperative outcome was analysed using the Karnofsky Performance Status (KPS) to measure the degree of disability [9]. The postoperative

Table 2 – Demographic data and first signs of tumour in studied patients.

Parameter		No. of patients (%)
Age	<40	8 (22)
	40–65	26 (70)
	>65	3 (8)
Sex	Women	27 (73)
	Men	10 (27)
First sign	Headache	3 (8)
	Limb weakness	11 (30)
	Epileptic seizures	14 (38)
	Visual disturbance	6 (16)
	Cognitive disturbance	3 (8)

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