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Original article

Spinal meningiomas: Surgical outcome and literature review

Méningiomes rachidiens : résultats chirurgicaux et revue de la littérature

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ABSTRACT

Background and purpose. – To evaluate the incidence, clinical presentation, operative techniques and long-term outcome of spinal meningiomas following surgery.
Methods. – Fifteen patients harboring spinal meningiomas were treated between 1998 and 2005 in our department. Diagnosis was made on magnetic resonance imaging and confirmed histologically. Microsurgical resection was carried out through a posterior approach in all cases.
Results. – Follow-up extended from 60 to 156 months (mean: 99 and median 105 months). The most common site of spinal meningiomas was the thoracic region. Tumors were strictly intradural and extramedullary in 14 patients (93%) and macroscopic resection was considered as complete in all cases. Neurological improvement was observed in 13 patients (87%). There was no operative mortality and morbidity was low (20%). No patient underwent radiotherapy and the recurrence rate is 8%.
Conclusion. – Spinal meningiomas are benign tumors for which advances in imaging tools and microsurgical techniques have yielded better results. The goal of surgery should be the total resection, which significantly reduces the risk of recurrence with an acceptable morbidity.

Mots clés :
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RÉSUMÉ

Objectifs. – Préciser les caractéristiques épidémiologiques et cliniques des méningiomes rachidiens. Rappeler les modalités techniques opératoires et évaluer le devenir à long terme des patients après un traitement chirurgical.
Patients et méthode. – Quinze patients atteints d'un méningiome rachidien sont traités chirurgicalement dans notre institution entre 1998 et 2005. Pour chaque malade, le diagnostic est confirmé par l'étude anatomopathologique de la pièce opératoire. Dans tous les cas, le traitement est effectué par une approche chirurgicale postérieure.
Résultats. – La moyenne et la médiane de suivi des patients est de 99 et 105 mois (extrêmes 60–156 mois). La topographie de prédilection est la région thoracique. La tumeur était strictement intradurale et extramédullaire chez 14 patients (93 %). Une résection jugée macroscopiquement complète était effectuée dans tous les cas. Une amélioration neurologique était observée chez 13 patients (87 %). La mortalité opératoire était nulle et la morbidité faible (20 %). Toutes les tumeurs étaient classées grade 1 de la classification de l'OMS et aucun patient n'a bénéficié d'une radiothérapie au cours de la période de suivi. Le taux de récidive était de 8 %.
Conclusion. – Les méningiomes rachidiens sont des tumeurs bénignes. L'objectif du traitement chirurgical est d'aboutir à une résection complète en réduisant au maximum la morbidité et celui d'une récidive. Les progrès technologiques tant dans le domaine diagnostique que thérapeutique permettent d'afficher de bons résultats et d'envisager une chirurgie y compris chez des patients très âgés.

1. Introduction

Spinal meningiomas account for 25 to 46% of primary spinal cord tumors (Roux et al., 1996; Gezen et al., 2000; Cohen-Gadol et al., 2003; Gottfried et al., 2003; Morandi et al., 2004; De Verdelhan

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et al., 2005; Haegelen et al., 2005; Hijiya et al., 2007; Cavanaugh et al., 2008; Dagain et al., 2009). Most spinal meningiomas occur in women older than 50 years (80%) and the most common location is thoracic (two thirds of cases). They are usually benign tumors with slow growth, occupying the intradural extramedullary space; purely extradural tumors are very rare (Solero et al., 1989; Roux et al., 1996; Gezen et al., 2000; Dagain et al., 2009).

The most frequent clinical findings are back pain, sensorimotor deficit and sphincter dysfunction. Magnetic resonance imaging (MRI) is the preferred imaging tool, allowing early diagnosis, operative planning and long-term follow-up (De Verdelhan et al., 2005; Schaller, 2005). Advances in surgical techniques (microsurgery, ultrasonic dissection, peroperative monitoring) increase the rate of complete resection. Prognosis of surgically treated patients is satisfactory, even when preoperative neurological status is poor (Levy et al., 1982; King et al., 1998; Klekamp and Samii, 1999; Gezen et al., 2000; Morandi et al., 2004; Yoon et al., 2007).

In the present retrospective study, we report on a single-center experience (Neurosurgery department at Montpellier Hospital, France) of spinal meningiomas operated on a 7-year period (1998–2005). Our primary objective is to assess clinical and radiological outcome in patients surgically treated. Secondary aim is to define potential prognosis factors associated with these lesions.

2. Material and methods

We found 15 patients harboring a spinal meningioma that were surgically removed at our institution over the predefined period. Medical records were retrospectively reviewed in order to collect clinical and radiological data. Demographic characteristics, neurological status, postoperative complications, neurological outcome and recurrence were noted. All patients underwent a preoperative MRI with injection of gadolinium: spinal levels were determined using sagittal T1 or T2 sequences; topography, tumor insertion and extradural extension were assessed on axial sequences.

All patients had a clinical and radiological follow-up: neurological and MRI evaluation was performed at 3 months postoperatively, annually after this point. Extent of surgical resection was assessed using the 3-month MRI and was considered as complete when all the tissular part of the tumor was removed, regardless of the insertion site. Indeed, Simpson's score, frequently used for intracranial meningiomas, is not validated in spinal meningiomas. Evidence of tumoral calcifications were classified as either complete, partial or absent.

3. Results

3.1. Demographic and baseline data

Mean age was 67.6 years (min: 28; max: 85; median: 61). There were 13 females for two males (sex ratio = 6.5), showing a clear predilection for women. Clinical presentation was mostly slow spinal cord compression, with a mean interval between onset of symptoms and imaging diagnosis of 11 months (min: 2; max: 48). Mean and median follow-up were respectively 99 and 105 months (min: 60; max: 156). A preoperative sensorimotor deficit was noted in 80% of the cases: gait disability involved 93% of patients, 33% were not independent; 60% of the patients reported back pain (Table 1). Spinal levels were mostly thoracic (Table 1), while insertion site was respectively: antero-lateral (46%) to the cord, postero-lateral (27%), lateral (20%) and posterior (7%).

Table 1
Preoperative clinical presentations and meningiomas distribution along spinal levels.
Présentations cliniques préopératoires et niveaux de distribution des méningiomes le long de la colonne vertébrale.

	Number of patients ($n = 15$)
Symptoms	
Gait disability	93% (14)
Motor deficit	80% (12)
Paraparesia	73% (11)
Radiculopathy	7% (1)
Sensory deficit	80% (12)
Pain	60% (9)
Back pain	47% (7)
Radiculopathy	13% (2)
Pyramidal signs	60% (9)
Sphincter dysfunction	60% (9)
Localization	
Cervical	14% (2)
Thoracic	72% (11)
Lumbar	14% (2)

3.2. Surgery

A median posterior approach was performed in all patients. Under fluoroscopic guidance, a laminectomy exposing the superior and inferior poles of the tumor was made. After a regular midline dura opening, tumor was removed under operating microscope through either ultrasonic dissection and/or fragmentation. Insertion site was coagulated or resected. Gross total resection of the tissular part of the tumor was performed in all patients, and confirmed subsequently on MRI at 3 months. Dural plasty was performed in two patients, while insertion site was coagulated in all other patients (87%).

3.3. Pathology

Partial intra-tumoral calcifications were observed in two cases (13%). Histological examination concluded to meningothelial meningioma in 53% of the cases ($n = 8$) and psammomatous meningioma in all other patients ($n = 7$). There was no sign of malignancy found in any specimen and all lesions were classified as grade 1 of the World Health Organization (WHO). None of the patients underwent adjuvant radiotherapy.

3.4. Clinical outcome

There was no postoperative mortality. At one year after surgery, sensitive and/or motor improvement was noted in 87% of the patients, while it remained stable in two patients (13%). Eighty-five percent of the patients who presented with gait disability were able to walk without assistance. The McCormick functional classification of spinal cord tumors at initial care and at follow-up is represented in Table 2.

Six out of nine (67%) patients who had preoperative sphincter dysfunction achieved complete resolution 2 years after surgery. Morbidity rate was 20% (three patients): one patient presented a neurological deterioration due to a compressive epidural hematoma, which was surgically evacuated leading to complete resolution; one patient sustained deep venous thrombosis requiring anticoagulation, and the last patient developed a cerebrospinal fluid (CSF) fistula, successfully managed with medical treatment (bed-rest, diuretic, acetazolamide).

3.5. Recurrence

There was only one recurrence (6%), at 8 years after initial surgery, in a patient who had a duro-plasty. Given to the fact that this recurrence was asymptomatic, no surgical treatment was undertaken.