

The Surgical Treatment of Spinal Cord Ependymomas

Omurilik Ependimomalarında Cerrahi Tedavi

ABSTRACT

OBJECTIVE: To determine the treatment modalities of spinal ependymomas.

METHOD: We report 33 patients with spinal cord ependymomas who had been operated on at the Department of Neurosurgery of Ankara University School of Medicine between 1990 and 2002.

RESULTS: The mean age of the patients was 43.6 (range: 13 to 74). Nineteen patients were female (57%) and 14 were male (43%). The mean postoperative follow-up period was 45 weeks (range: 30 to 122 weeks). Radical surgical resection was performed in 30 patients (91%) and conservative surgery in 3 (10%) patients. Postoperative radiotherapy was applied in 4 patients.

CONCLUSION: Although spinal cord ependymomas are mostly amenable to total resection, tumor locations and surgical techniques affect the morbidity. Surgical treatment in patients in whom the spinal tumor was diagnosed in early stages according to McCormick classification is useful to improve the neurological deficits. Radiotherapy must be reserved for the patients who underwent subtotal resection or in whom recurrence was detected.

KEY WORDS: Spinal cord, Ependymoma, Surgery

ÖZ:

AMAÇ: Omurilik ependimomalarda tedavi metodlarını belirlemek.

METOD: 1990-2002 yılları arasında Ankara Üniversitesi Nöroşirürji Departmanında opere edilen 33 omurilik ependimomu olan hastayı rapor ettik.

BULGULAR: Hastaların ortalama yaşı 43.6 idi. 19 hasta bayan, 14 hasta erkek idi. Ortalama postoperatif takip süresi 45 hafta oldu. Radikal cerrahi rezeksiyon 30 hastaya uygulandı. 3 hastaya konservatif tedavi uygulandı ve 4 hasta postoperatif dönemde radyoterapi gördü.

SONUÇ: Omurilik ependimomaları total rezeksiyona genellikle uygun olmakla birlikte tümör lokalizasyonu ve cerrahi teknik morbiditeyi etkilemektedir. McCormick sınıflandırmasına göre erken dönemde omurilik tümörü tanısı konulan hastalarda cerrahi tedavi nörolojik defisitlerin düzelmesinde faydalıdır. Radyoterapi subtotal rezeksiyon uygulanan veya rekürrens olan hastalara uygulanmalıdır.

ANAHTAR SÖZCÜKLER: Omurilik, Ependimoma, Cerrahi

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INTRODUCTION

Spinal cord ependymomas arise from the ependymal cells lining the central canal. There are the most commonly occurring intramedullary neoplasms and account for 65% of all intramedullary tumors [13,14]. These tumors are well circumscribed, mostly encapsulated and seldom pseudocapsulated or uncapsulated [10,15].

They usually show a benign pathological course, slow biological growth with little infiltrative potential and manifest with progressive myelopathy [10].

There is no consensus on the surgical treatment of this group of tumor. Some authors suggest radical resection [1,3,7,12] while others propose conservative treatment in association with radiotherapy [2,4,6]. We prefer radical surgical resection in our department.

PATIENTS AND METHODS

We treated surgically 33 patients who harbored spinal cord ependymomas between 1990 and 2002. The patient population consisted of 19 (57%) women and 14 (43%) men ranging in age from 13 to 74 years (mean age, 43.6 years). The location of the tumor was cervical (4 cases), cervico-thoracic (1 case), thoracic (2 cases), thoraco-lumbar (7 cases, 22%), lumbar (9 cases, 27%), lumbo-sacral (9 cases, 27%) and sacral (1 case, 3%). The main symptoms were as follows: motor weakness in 19 (57%) patients, paresthesia in 11 (33%), pain in 3 (9%), and urinary dysfunction in 3 (9%) patients. The positive straight leg raising (SLR) test was the most common finding among our patients (66%).

All patients underwent computed tomography (CT), magnetic resonance imaging (MRI) and myelography in the preoperative period. CT was used to determine possible bony invasions or destruction. MRI was preferred to assess the spinal cord and soft tissues. MRI was used in postoperative follow-up period. Patients were assigned a preoperative clinical grade according to the grading system presented by McCormick et al. [9].

McCormick Clinical grading:

Grade 1: No motor and sensorial loss

Grade 2: Mild sensorial or motor loss

Grade 3: Clear neurological deficit

Grade 4: Severe neurological deficit

The patients were postoperatively graded according to the McCormick system at the time of admission, at the 24th hour (early postoperative)

and at the 16th week (late postoperative). The preoperative clinical grading of the patients were as follows:

Grade 1: 5 patients

Grade 2: 8 patients

Grade 3: 11 patients

Grade 4: 9 patients

All patients underwent surgical treatment with microsurgical technique following the diagnosis of spinal tumor. Five patients were operated in the sitting position and 28 patients in the prone position. After a midline incision, a total laminectomy or osteoplastic laminotomy was performed. The arachnoid was incised and detached from the spinal cord by transection of trabeculae following a midline dural opening. The arachnoid was anchored to the incised dura and the midline of the dorsal surface of the spinal cord was determined by noting penetrating vessels into the dorsal median sulcus. The myelotomy was performed by gentle spreading of the posterior columns using the microscope. The tumor, which was reddish-gray and soft, was identified in the depth of the spinal cord after minimal myelotomy. The tumor was well-demarcated and usually encapsulated. Feeding vessels of the tumors were found and coagulated gently. The tumors were removed with meticulous dissection. Total resection was limited due to factors such as close adherence to neural tissues, tight vascular structures, and changes in intraoperative monitoring. After the tumor removal, the dura was closed in a watertight manner using 4/0 and 5/0 sutures.

Radiation therapy was performed in patients who underwent subtotal tumor removal and who received a diagnosis of anaplastic ependymoma after the surgical treatment. The postoperative period of all patients was evaluated by changes in clinical grade and the patients were followed-up with MRI scans. The mean follow-up period was 45 weeks (range: 30 to 122 weeks).

RESULTS

The preoperative findings of the patients are summarized in (Table I).

Thirty-three patients were operated on in our department with the diagnosis of spinal cord ependymoma. Total resection was achieved in 30 patients (91%) and subtotal removal was performed in 3. Among these 3 patients, the tumors were located in the cervical region in 2 patients and the

Table I: The preoperative findings of the patients with spinal cord ependymomas.

Finding	Number of patients	(%)
Positive SLR test	22	66
Motor weakness	19	57
Paresthesia	11	33
Hypoactive reflex	17	51
Spasticity	13	39
Pathological reflex	8	24
Urinary-anal incontinence	1	3
Urinary incontinence	2	6

cervico-thoracic region in 1. Total resection was not performed in these patients to avoid damage to the spinal cord and dorsal medullary column.

In the histopathological examination of the specimens, non-anaplastic ependymoma was reported in 31 (94%) patients (papillary in 18, myxopapillary in 9 and subependymoma in 4 patients), and anaplastic ependymoma in 2 (6%) patients. The papillary ependymomas were mostly located in the thoracic and lumbar regions, the myxopapillary ependymomas in the cervical region and subependymomas in the thoraco-lumbar region. The histopathological diagnosis was anaplastic ependymoma in 1 patient, and non-anaplastic ependymoma in 2 patients among the 3 patients who underwent subtotal resection. These 3 patients, and 1 patient in whom anaplastic ependymoma was diagnosed, underwent radiotherapy following surgery. Recurrence was detected in 1 patient with subtotal resection and in 1 patient with anaplastic ependymoma.

The early postoperative clinical grading of the patients were as follows:

- Grade 1: 6 patients
- Grade 2: 8 patients
- Grade 3: 10 patients
- Grade 4: 9 patients

The late postoperative clinical grading of the patients were as follows:

- Grade 1: 8 patients
- Grade 2: 12 patients
- Grade 3: 6 patients
- Grade 4: 7 patients

Seventeen patients remained in the same grade in the early postoperative period, while 11 patients showed improvement and 5 patients deteriorated.

Eleven patients who improved in the early postoperative period were in Grade 2 and 3 in the preoperative period, while the 5 patients who deteriorated were in Grade 1 and 2 in the preoperative period. The tumor location was the thoracolumbar region in 3 of 5 patients who deteriorated in the early postoperative period, and the lumbar region in 2 patients. Individuals who had severe neurological deficits before the operation usually made no significant functional recovery after successful tumor removal. Increased leg weakness and urinary disturbances were the main types of deterioration in the early postoperative period. The preoperative and early postoperative clinical assessments of the patients were not statistically significant. The patients were crowded in grade 1 and 2 in the late postoperative period instead of grade 3 and 4 as in the preoperative and early postoperative period. This might be due to edema surrounding the tumor bed in the early postoperative period. The patients who were in grade 2 and 3 exhibited upgrading, but the patients with grade 4 in the preoperative period were in the same grade in the early and late postoperative period. At the end of follow-up period, clinical improvement was observed in 8 patients while the neurological status had not changed in 14 patients and worsened in 11 patients. Recurrence was observed in 2 patients and they were not reoperated. They are under close follow-up with serial MRI scans at the time of this writing.

DISCUSSION

Ependymoma is the most common intramedullary neoplasm in adults [11]. According to the literature, this tumor manifests in young adulthood (mean age 38.6 years) and tends to involve the cervical spinal cord frequently [3]. Neck pain is the most common presenting symptom, followed by motor and sensory deficits, and bowel and bladder dysfunction [3,8]. In our series, the lumbar and lumbo-sacral regions were most commonly affected in contrast to the literature. The determination and application of treatment protocols for spinal cord ependymomas are important because of its rarity but they take first place among the intramedullary tumors, are resectable and most commonly of benign nature. The tumor location and the surgical technique closely affect the morbidity.

Intramedullary ependymomas can be totally resected using a microsurgical technique without causing permanent neurological deficits. The majority of the patients with intramedullary ependymomas demonstrate increased neurological deficits during the early postoperative period according to some series [3,5,8,9]. This may be attributed to edema caused by surgical manipulations and transient interruption of spinal cord blood flow [5]. In our series, we encountered neurological deterioration in 5 patients in the early postoperative period. Increased leg weakness and urinary disturbances were the main types of deterioration in our patients. The neurological status of 17 patients did not change in the preoperative and early postoperative periods probably due to spinal edema. Moreover, the clinical grade of these patients improved gradually in the late postoperative and follow-up periods. These results suggest that total resection may be effective for the improvement of neurological status especially in the long term.

The value of radiation therapy as adjuvant treatment after surgical resection of intramedullary ependymomas has long been controversial [5,12]. Several reports show improved survival rates and decreased recurrences in patients treated with postoperative radiation therapy after partial or subtotal tumor removal [2,4,6]. Radiotherapy has also been shown to delay the progression of disease. Some authors suggest that radiotherapy has a role in the treatment of intramedullary ependymomas even when total resection has been achieved surgically [2]. We performed radiotherapy following surgery in 4 patients who underwent subtotal tumor removal and who received a diagnosis of anaplastic ependymoma after surgery. Tumor recurrence was observed in 2 of 4 patients who underwent radiotherapy postoperatively. One of these patients had anaplastic ependymoma and the other had non-anaplastic ependymoma. We did not perform radiation therapy in patients who underwent total tumor removal and who received a diagnosis of non-anaplastic ependymoma. We did not observe any recurrence among these patients.

We report a relatively large series of intramedullary ependymomas and describe in detail our surgical technique for safe and complete resection of these neoplasms. We also compare the

neurological status of the patients in the preoperative and postoperative periods using the McCormick clinical grading system. We request a clinical and radiological follow-up at 3-month intervals in all patients with spinal cord ependymomas. Our mean follow-up period was 45 weeks, which is a little shorter than other reports but our long-term results are similar. Ohata et al. [12] reported their experiences on intramedullary ependymomas in a series of 18 patients where they achieved total resection in 17 cases. They did not find a relationship between the histological malignancy and clinical course and concluded that intramedullary ependymomas should be removed radically as early as possible while taking great care to avoid posterior column injury. Hoshimaru et al. [5] reported a series of 36 cases in 18 years on the microsurgical treatment of intramedullary ependymomas. They achieved complete removal in 34 patients (94%) and the most common location for this tumor was the cervical region. They experienced neurological deterioration in 5 patients (14%) due to surgery. Lee et al. [7] investigated the results of surgical treatment of spinal cord ependymomas on their series of 19 patients in a period of 5 years. They achieved complete resection in 79% of the patients and radiotherapy was employed in 3 of 19 (15.8%) patients. The majority of the ependymomas were located in lumbo-sacral junction (cauda equina) and pain was the most common symptom in their series. In our series, the lumbar and lumbo-sacral regions (cauda equina) were the most common locations for spinal cord ependymomas. We achieved complete removal in 30 of 33 (91%) patients and did not experience clinical deterioration in any patient. Clinical improvement was observed in 8 patients who were in grade 2 and 3 in the preoperative period. The clinical status did not change in 14 patients, and got worse in 11 patients who were in grade 3 and 4 preoperatively, probably due to myelopathy, atrophy or delayed diagnosis and surgery.

In conclusion; intramedullary spinal cord ependymomas are mostly amenable to complete resection. Radiotherapy must be planned for those patients in whom complete removal was not possible or who had malignant potential histopathologically.

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