Surgical Management for Intradural Spinal Lipoma in Adult Patients without Spinal Dysraphism

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ABSTRACT

Background: Spinal cord lipomas are benign lesions, accounting for less than 1% of all spinal tumors. Objective: To evaluate the outcome of debulking surgical management of intradural spinal lipoma without spinal dysraphism. Methods: The study included 6 adult patients; 4 males and 2 females with a mean age of 40.2±8.6 years. All patients underwent full history taking, complete general and neurological examinations and radiological evaluation including plain X-ray and MR imaging. All patients underwent generous internal decompression through removal of as much as possible of the lesions leaving only tissues adherent to the spinal cord. Results: Three patients had dorsal lipomas, 2 patients had lumber lipomas and only one patient had cervical lipoma. The lipomas were found extended through one-vertebral level in 4 patients, but 4-vertebral level lipoma was detected in 2 patients. Pain improved in all patients within the first two months after surgery. Motor weakness improved in 2 patients but foot drop did not improve. Parathesia and numbness improved in 4 patients; however, 2 patients still exhibited hypoesthesia. Urinary incontinence improved in one of 2 patients. Postoperative MRI showed some residual tumor tissue and a normal posterior subarachnoid space. Follow-up neurological examinations during two years revealed no abnormalities apart from hyposthesia. Conclusion: Despite intradural spinal lipomas are not a frequent spinal space occupying lesion, it is associated with varied neurological deficits and early surgical decompression without attempts for complete excision is an ideal therapeutic option associated with satisfactory neurological improvement and serial MR imaging for follow-up is mandatory. (Egypt J Neurol Psychiat Neurosurg 2010; 47(1): 207-213).

Key Words: Benign, intradural tumor, lipoma, spinal compression.

INTRODUCTION

Spinal cord lipomas are benign lesions, accounting for less than 1% of all spinal tumors. The most common site of involvement is the lumbosacral region, in which the lipoma is found as a component of a spinal dysraphic state.

Most spinal lipomas originate in the dorsal juxtamedullary region of the spinal cord; however, the embryologic defect that leads to the development of these tumors is unknown. Several hypotheses have been proposed to explain how spinal cord lipomas arise. The most widely accepted theory is that a developmental malformation occurs during the formation of the neural tube and leads to inclusion of embryonic crests of fat cells. Although the etiology is unclear, many characteristics of these tumors indicate that they are growing hamartomas. Specifically, they are relatively often associated with other spinal malformations such as spina bifida, and histological evidence also points to a hamartomatous origin.

The most widely accepted classification of spinal lipoma is 3 types; dorsal, transitional, and terminal lipoma, defined with regard to the connection with the cord, conus medullaris, or filum terminale. The terminal lipoma is contiguous from the terminal conus replacing the filum terminale. It has been previously reported that the terminal type shows good prognosis while the transitional type is very poor. However, it was suggested that even the terminal type could result in poor postoperative results when the terminal lipoma is attached to the conus, compared with good results when it is attached to the filum terminale.

Debate continues regarding the treatment for intradural lipoma. Lipomatous fat is metabolically similar to adipose tissue in the rest of the body, the onset of symptoms was associated with weight gain and histological examination of spinal canal lipomas reveals mature fat cells that are sometimes combined with other types of soft tissue. Such data enforced some researchers to suggest that these patients should be placed on aggressive weight loss and diet control programs; since the fat in lipomas is metabolically identical to normal body fat and the control of body weight may be an important factor in the conservative management of patients with lumbosacral spinal lipomas.
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There is controversy concerning the surgical indications and the most appropriate surgical techniques in cases of spinal lipoma; few authors have advocated aggressive surgical removal of spinal lipomas, Xu et al.\textsuperscript{11}, concluded that intramedullary tumors of the cervical spinal cord are amenable to total surgical removal and surgery is suitable when a patient presents with a moderate neurologic deficit, but proficient surgical technique for total tumor resection is necessary for good results and preoperative radiotherapy contributes to difficult surgery and poor prognosis, and is not recommended. However, this is usually impossible because separating the tumor from the neural tissue is associated with significant postoperative morbidity and the intimate relationship of the lipoma to the nerve roots and the absence of a distinct plane between tumor and spinal cord precluded a complete resection of this tumor, so early surgical debulking of the tumor to prevent further progression of symptoms and to offer the possibility of neurological improvement is mandatory\textsuperscript{12}.

The current study aimed to evaluate the outcome of debulking surgical management of intradural spinal lipoma without spinal dysraphism in adult patients.

**PATIENTS AND METHODS**

Six adult patients with intraspinal cord lipoma without spinal dysraphism were treated at Neurosurgery Department, Cairo university hospitals through the period since Jan 2000 till Feb 2008. All patients underwent full history taking, complete general and neurological examinations and radiological evaluation including plain X-ray and MR imaging.

The clinical course of these cases was slow progression of symptoms including back pain that was radiating to the leg and was the main symptom, numbness and paraesthesia of both upper and lower limbs, wasting of muscles, foot drop, and bladder disturbance resulting in residual volume of urine and urinary incontinence that was reported in 2 patients. Neurological examination revealed mild paraparesis, hyperactive deep tendon reflexes, a positive Babinski’s sign and Achilles clonus bilaterally, and hypoesthesia below the T10 dermatome.

Plain X-rays demonstrated erosion of the lamina and pedicles of the vertebra at the affect level of the spine with expanded spinal canal and no evidence of spina bifida occulta. MR imaging of the spine showed intradural extramedullary mass lesion that appeared hyperintense on T1-weighted images (Figure 1), with variable intensity on T2-weighted images of these lesions compared to normal neural parenchyma and chemical shift mis-registration artifacts due to fat helped to diagnose a lipoma with high-field-strength unit. Relaxation times of fat on T2-weighted images were variable and appeared hyper-, iso- or hypointense compared to normal parenchyma. The mobility of cord was evaluated with dynamic MRI. MRI was used to define the infiltrative extension of the spinal lipomas and for postoperative assessing the residual tumor tissue.

**Surgical procedure**

Perioperative corticosteroids and broad spectrum antibiotics are routinely administered to all patients. Surgical procedure was conducted under general inhalational anesthesia; after induction of anesthesia and endotracheal intubation, the patient was prone

![Figure 1. Showing MRI T1 cervical spine sagittal and axial cuts of cervical intradural extramedullary lipoma extending from C2 to C6](image-url)
positioned with the chest was well padded. A Mayfield cranial clamp is used for cervical and upper thoracic lesions and intraoperative neurophysiological monitoring was used.

After a standard midline incision and subperiosteal reflection of the paraspinal muscles, a laminectomy was performed; the exposed dura appeared to be under significant pressure. Opening the dura revealed a typical extramedullary lipoma appeared as yellow fatty mass posterior to the spinal cord which appeared normal above and below the tumor which was displacing the cord anteriorly. The spinal canal in the region of the lesion was completely filled with tumor tissue which was extremely adherent to the cord with no clear plane of dissection between the lipoma and the cord. After midline dural incision, the arachnoid was incised at the midline, detached from the spinal cord by transection of trabeculae and anchored to the incised dura mater with stitches, which were removed at the time of the wound closure.

Generous internal decompression was performed using microforceps or microdissectors, operating microscope and an ultrasonic aspirator. During resection, nerve roots found within the tumor tissue were protected from injury. As much as possible of the lesion was removed leaving only tissues adherent to the spinal cord (Figure 2).

The dura was closed with a large dural patch graft and the excised mass was sent for histopathological examination.

All patients underwent postoperative MRI for evaluation of the extent of residual tumor tissue. Follow-up neurological examination was conducted for evaluation of neurological outcome.

Figure 2. Showing MRI T1 sagittal cuts of D12–L1 of intradural extramedullary lipoma (Top). Intraoperative appearance of the lesion as well-defined yellow glistening lesion located posterior to spinal cord (Middle). At the end of surgical procedure, the tumor was removed nearly total leaving only parts adherent to spinal cord, arrowed (Bottom).

Statistical analysis

Obtained data were presented as mean±SD, numbers, ranges and percentages, and were analyzed using Chi-square (X²) test. Statistical analysis was conducted using the SPSS (Version 10, 2002) for Windows statistical package. P value <0.05 was considered statistically significant.
RESULTS

The study included 6 adult patients; 4 men and 2 females with a mean age of 40.2±8.6; range: 30-55 years. Three patients had dorsal lipomas, 2 patients had lumber lipomas and only one patient had cervical lipoma. The lipomas were found extended through one-vertebral level in 4 patients, but 4-vertebral level lipoma was detected in 2 patients. Postoperative histopathological examination confirmed the diagnosis of lipoma (Table 1).

Pain was improved in all patients within the first two months after surgery and by six months postoperatively, all patients were pain-free.

Motor weakness was improved in 2 patients but foot drop did not improve. Parathesia and numbness improved in 4 patients; however, 2 patients still exhibited hypoesthesia below the T10 dermatome but showed normal motor function.

Urinary incontinence was improved in one patient at 2-weeks after surgery, while the other patient was still incontinent (Figure 3).

Statistical analysis of the persistence of clinical manifestations at 2-months postoperative showed either no or non-significant difference compared to preoperative frequency. At 6-months, the frequency of muscle weakness was significantly decreased compared to both preoperative and 2-months frequency. Also, the frequency of paraesthesia and hypoesthesia was significantly decreased at 6-months compared to both preoperative and 2-months frequency. Urinary incontinence showed non-significant decrease at 2-months and 6-months compared to preoperative frequency (Table 2).

Lumbosacral MRI after surgery showed some sort of residual tumor tissue and a normal posterior subarachnoid space (Figure 4).

Follow-up neurological examinations during two years revealed no abnormalities apart from hypoesthesia.

Table 1. Patients’ characteristics and preoperative data.

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>40.2±8.6 (30-55)</td>
</tr>
<tr>
<td>Gender; M:F</td>
<td>4:2</td>
</tr>
<tr>
<td>Location</td>
<td>Dorsal 3 (50%)</td>
</tr>
<tr>
<td></td>
<td>Lumber 2 (33.3%)</td>
</tr>
<tr>
<td></td>
<td>Cervical 1 (16.7%)</td>
</tr>
<tr>
<td>Vertebral level</td>
<td>One-vertebral level 4 (66.7%)</td>
</tr>
<tr>
<td></td>
<td>Four-vertebral level 2 (33.3%)</td>
</tr>
</tbody>
</table>

Data are presented as mean±SD, numbers and ranges & ratios are in parenthesis

Table 2. Patients’ preoperative and postoperative clinical data.

<table>
<thead>
<tr>
<th>Clinical data</th>
<th>Pre-operative</th>
<th>Postoperative</th>
<th>Statistical analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2-months</td>
<td>6-months</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improved</td>
<td>No pain</td>
</tr>
<tr>
<td>Pain</td>
<td>Present</td>
<td>Absent</td>
<td></td>
</tr>
<tr>
<td>Muscle weakness Present</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Foot drop Present</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Parathesia, hypoesthesia Present</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Urinary incontinence</td>
<td>Present</td>
<td>Absent</td>
<td></td>
</tr>
<tr>
<td>Present</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Data are presented as numbers, ratios are in parenthesis.
P₁: significance of 2-month versus preoperative frequency.
P₂: significance of 6-month versus preoperative frequency.
P₃: significance of 6-month versus 2-months frequency.
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**DISCUSSION**

Congenital spinal lipomatous malformations constitute a diverse group of lesions. There is considerable confusion in the literature regarding their terminology and a proper classification is long overdue. Congenital spinal lipomatous malformations constitute a wide spectrum of lesions ranging from relatively simple lipomas of the filum terminale to complex malformations. These lesions differ from one another in their embryology, clinical presentation, operative strategies, complications and prognosis. Failure to differentiate between the different forms of congenital spinal lipomatous malformations may lead

**Figure 3.** Patients' distribution according to presence of clinical manifestations pre- and postoperatively.

**Figure 4.** Showing pre and post operative sagittal MRI of L1 lipoma.
to inaccurate assumptions regarding prognosis and inappropriate management.13

Throughout more than 8 years study 6 cases of spinal lipomas were detected, of which only one case of cervical lipoma was detected, while the other 5 cases were 3 dorsal and 2 lumbar lipomas. This finding goes in hand with Iwatsuki14, who reported that intradural spinal lipomas of the cervical and upper thoracic region are rarely encountered and unlike lumbosacral lipomas, cervical spinal lipomas not associated with dysraphism are even rarer. Moghaddam et al.15, presented a case reported of an 18-year-old female with intractable shoulder and neck pain and progressive weakness in the upper extremities, harboring a cervical intradural lipoma with intramedullary extension, along with concomitant scoliosis.

The lipomas were found extended through one-vertebral level in 4 patients, but 4-vertebral level lipoma was detected in 2 patients. This finding was in line with Kim et al.16, who through 10 years study detected 3 cases of spinal intramedullary lipoma; the lesion was located in the cervico-thoracic spine (foramen magnum to T1) in one case, thoracic spine (T9-T12) with the back swelling at L2-4 level in the second, and in the third, one mass extended from C6 to T11 and the other mass was located in the L1-2 level, separately.

All studied patients had presented with spinal cord pressure manifestations including back pain that was radiating to the leg and was the main symptom, numbness and paraesthesia of both upper and lower limbs, wasting of muscles, foot drop, and bladder disturbance and urinary incontinence. Patients were subjected to debulking surgery associated with duroplasty and postoperative evaluation revealed that pain was improved in all patients within the first two months after surgery and by 6 months postoperatively, all patients were pain-free. Motor weakness was improved in 2 patients but foot drop did not improve. Parathesia and numbness improved in 4 patients; however, 2 patients still exhibited hypoesthesia below the T10 dermatome but showed normal motor function. Urinary incontinence was improved in one patient at 2-weeks after surgery, while the other patient was still incontinent.

Such treatment policy and its subsequent outcome go in hand with Koyanagi et al.17, studied 58 patients with conus lipoma and reported motor deficits in 73% of patients with lipomas extending to the lumbar level, whereas 88% of patients with lipomas confined to the sacral level had only urinary deficits and through a follow-up period of 7.9 years, 27% of the asymptomatic patients developed urinary and/or motor deficits, and 28% of the symptomatic patients showed further neurological deterioration and thus recommended early prophylactic surgery as a treatment option. Moghaddam et al.18, who documented that radical removal of spinal intradural lipomas is not recommended since attempts at complete excision carry an unacceptable risk of postoperative morbidity and sufficient decompression with or without duraplasty generally provides a successful clinical outcome.

Muthusubramanian et al.19, presented a case of with concomitant cervical and lumbar intradural intramedullary lipoma improved symptomatically and was ambulant independently after subtotal resection of the lesion was performed at both levels, after which the patient and concluded that adequate decompression with subtotal removal is the treatment of choice for intradural intramedullary lipoma. Another case presentation by Chagla et al.20 of a large cervicomedullary intramedullary lipoma extending from the craniovertebral junction to the 6th cervical vertebra without spinal dysraphism underwent subtotal excision with primary dural closure, which produced an improvement in the patient's condition.

Kasliwal & Mahapatra21, reported a deterioration rate after surgical interference for symptomatic patients of 6%, and improvement rate of 44%, but complete resolution of symptoms was seen in only 14.2% and concluded that the reported low rate of postsurgical worsening indicates that surgeries for spinal lipomas are safe, surgeries done after the onset of symptoms seldom cure the patients and these two results support early untethering for any kind of spinal lipoma.

Conclusion

It could be concluded that despite intradural spinal lipomas are not a frequent spinal space occupying lesion, it is associated with varied neurological deficits and early surgical decompression without attempts for complete excision is an ideal therapeutic option associated with satisfactory neurological improvement and serial MR imaging for follow-up is mandatory.

REFERENCES

El-Azazi, et al.: Intradural spinal lipoma