Review Article

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Chondromas of the Lumbar Spine: A Systematic Review

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Abstract

Study Design: Systematic review and illustrative case.

Objectives: Lumbar spinal chondromas (LSCs) are rare spine tumors. The characteristics of these intraspinal lesions are not well described in the literature. The goal of this article is to describe the features of this rare spinal tumor.

Methods: A PubMed and Scopus search adhering to Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines was performed to include studies reporting patients with LSCs. The data gathered from this review was analyzed to characterize LSCs.

Results: The search yielded 14 cases of patients with LSCs. All studies were case reports (Level V of evidence). Different characteristics of LSCs are described, including demographics, clinical findings, imaging, and treatment.

Conclusions: The results of this review show that LSCs are almost exclusively seen in the extradural space and may adopt a dumbbell shape. LSCs frequently manifest in a very similar way to lumbar disc herniations; therefore, they should be considered in the differential diagnosis of sciatica, especially if magnetic resonance imaging with gadolinium shows peripheral rim enhancement of the lesion. Different degrees of improvement are usually observed after surgical treatment of these patients.

Keywords

lumbar spine chondromas, spinal chondromas, extradural spinal tumors, dumbbell tumors

Introduction

Cartilage-forming tumors are a group of benign lesions that includes chondromas, osteochondromas, chondroblastoma, and chondromyxoid fibromas. Chondromas mainly occur in the small bones of the hands and feet, but every bone is susceptible.[1] Chondromas in the spine are very uncommon. In a big series of benign bone tumors, 11.2% were chondromas and only 4% of them occurred in the spine.[2]

The identification of a chondroma within the lumbar spine is very unusual and is typically not included in the differential diagnosis of patients with radicular symptoms of the leg. Due to its rarity, lumbar spinal chondromas (LSCs) are not well known by spine surgeons; for this reason, we believe that a detailed review of this pathology is indicated.

The present article describes the case of a patient presenting with a LSC; furthermore, a comprehensive systematic review of the literature of this uncommon pathology is performed.

Methods

Study Selection

A comprehensive literature search of PubMed and Scopus was performed in accordance with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Also, a search was performed on Google Scholar to identify articles not reported in PubMed or Scopus. The search for publications was undertaken using the following keywords: "spinal chondromas," "lumbar chondromas," and "lumbar spine chondromas." The search extended to all available English language articles from 1960 to June 2019. All included articles were case reports, and according to the Oxford Centre for Evidence-Based Medicine table, they were labeled as Level V studies.

Inclusion and Exclusion Criteria

Cases were included in the final review only if patients had LSC corroborated in the histological study, and if the article showed adequate clinical and radiological information.

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The following studies were excluded: literature reviews, animal studies, correspondence or letters, articles not available in full text, articles reporting different pathologies to LSC, cervical or thoracic spinal chondromas, and articles with incomplete clinical information. Titles and abstracts were initially reviewed to identify articles with positive exclusion criteria. Furthermore, the references for all search-selected articles were also reviewed for potential cases.

Data Extraction

Extraction data was performed from eligible cases. Specific information was obtained from eligible articles. Collected data included (1) age, (2) symptoms, (3) evolution of symptoms, (4) spinal location, (5) radiographic findings, (6) treatment, and (7) outcome.

Not all articles provided information about each item; therefore, a comparative analysis was limited by the nature of the source data. Statistical analysis was not conducted for this review because comparative analyses could not be performed.

Results

Illustrative Case

The case is of a 57-year-old male who presented with a 2-week evolution with low back and left leg radicular pain. The following week, he developed urinary symptoms and progressive weakness in both feet. Neurologic examination showed hypoesthesia on the left L4-5 dermatomes. Weakness was observed in the dorsiflexors of both feet (2/5 left, 1/5 right) and big toe extensors (1/5 right, left 2/5). Myotatic reflexes were absent.

Lumbar magnetic resonance imaging (MRI) showed an isointense mass located behind the L4 vertebral body on the left side, which was initially diagnosed as a migrated disk fragment; however, a second MRI with gadolinium showed partial enhancement of the lesion suggestive of a tumor; this lesion extended to the left foramen L4-5 and paravertebral area (Figure 1). The preoperative diagnosis was a nerve sheath tumor. A left L4 hemilaminectomy and partial facetectomy were performed and an epidural mass was found compressing the dural sac and nerve roots, and the L5 nerve root was severely deformed. The tumor was yellowish, soft, and was easily separated from the dura mater. Complete gross resection was performed of the intraspinal extradural tumor. The histological study of the tumor was reported as chondroma (Figure 2). Three months later, the patient showed significant improvement of symptoms.

Systematic Review

The literature search yielded 186 articles. After removal of duplicates, the title and abstract of 179 articles were screened, and based on exclusion criteria, 142 articles were eliminated. After this initial filter, 37 articles were assessed for eligibility, of which 23 were excluded for different reasons. Thus, 14 studies with a total of 14 patients were eligible for analysis (Figure 3). Table 1 shows the characteristics of these patients that were identified from previous publications[3-16] and also includes our patient, totaling 15 patients with lumbar spine chondromas.

The youngest patient was a newborn, and the oldest was 77 years old. The average age was 42.6 years. Sixty percent of cases occurred among individuals in the fifth and sixth decades of life. Sixty percent of the patients were male.

Forty percent of patients had clinical symptoms within 2 weeks of the diagnosis, and 16% presented with evolving symptoms over the ensuing 2 to 4 weeks. In 4 cases, the diagnosis was performed 1 year after the presence of initial symptoms. The most common level of the spine affected was L2-3, which was observed in 53% of cases. In the remaining patients, the tumor was located below the L3-4 disc space.

The most common clinical presentation was low back pain and sciatica, which was observed in 73% of cases. Less frequent symptoms observed were paraparesis and bowel/bladder disturbance.

In all cases, the tumor was found extradurally, and in 21% of cases, the tumor extended to the extraforaminal compartment adopting a dumbbell shape. In 2 cases, the tumor was mainly infiltrating osseous structures with minimal invasion to the canal.

The prognosis is usually good with a very low recurrence rate in cases of complete resection.

Discussion

Chondroma is the most common cartilaginous tumor and is equivalent to 5% of all bone tumors. It is reported that men are twice more likely to have a chondroma than women, and lesions typically present between the third and fifth decades of life.[1] Although chondromas occur predominantly in the small bones of the hands and feet, they can develop in any bone. They rarely occur in the spine, accounting for only 2% to 4% of all spinal tumors. Most of the spinal chondromas reported in the literature are located in the cervical spine.

Next, the data obtained from this review and other sources will be summarized to describe the characteristics observed in patients with LSCs.

Pathology

Chondroma is a benign tumor characterized by the formation of mature cartilage. Chondromas usually occur in a solitary fashion; however, they may affect many bones synchronously or sequentially in the setting of chondromatosis such as Ollier disease and Maffucci syndrome.[17]

According to their site of origin, chondromas can be subdivided as enchondromas, periosteal chondroma, or soft tissue chondromas. Enchondromas have an intraosseous location and may grow compressing the dura mater; periosteal chondroma arise from cortical bone surface, and when they are located at a

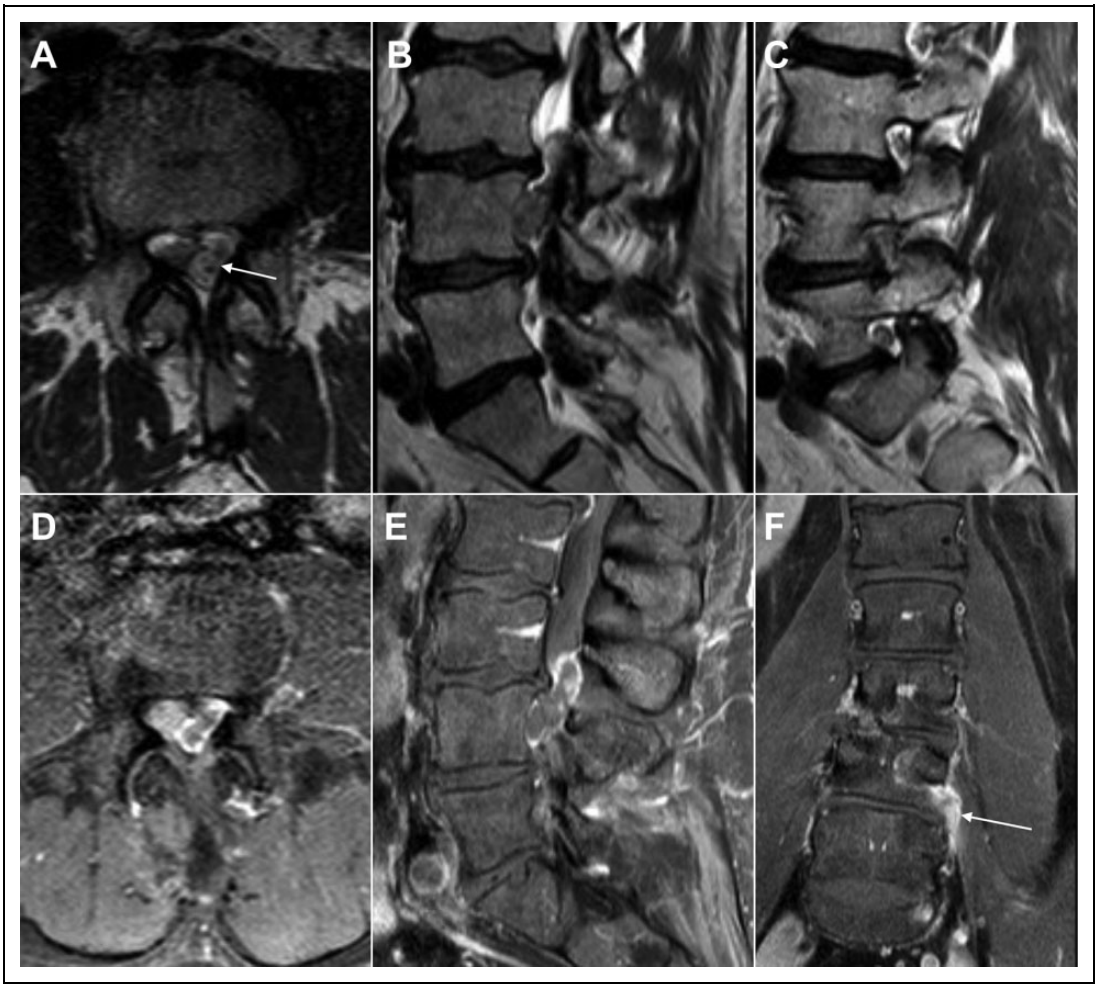

Figure 1. Lumbar spine MRI on T2 sequence (A-C) and T1 sequence after gadolinium administration (D-F). (A) Axial view showing an intraspinal mass located on the left side compressing the dural sac (arrow). (B) Sagittal view displaying a bilobulated intraspinal mass located mainly at level of the L4 vertebral body. (C) Parasagittal view through left spinal foramina, note the absence of perineural fat on the L4-5 foramen suggestive of a mass filling the foramen. (D-E) Axial and sagittal views showing peripheral rim enhancement of the tumor. (F) Coronal image displaying the intraspinal mass extending to the foraminal and extraforaminal area (arrow).

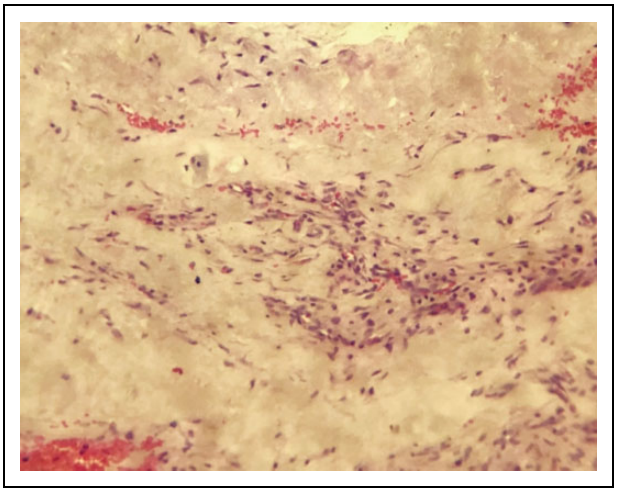

Figure 2. Photomicrography showing the tumor with a cartilaginous matrix, containing chondrocytes with hyperchromatic and uniform nuclei.

site distant from the bone they are referred to as soft tissue chondroma. Therefore, when a chondroma is located extradurally in the spinal canal, it may be difficult to differentiate between periosteal and soft tissue chondroma.

Histologically, chondromas are composed of neoplastic chondrocytes dispersed within an abundant hyaline or myxoid background.[1] Cells may reside in small nests referred to as isogenous groups and occupy lucent spaces within their myxoid matrix called lacunae. Macroscopically, the aspect of the tumor is usually yellowish, soft, and easily separated from the dura mater. The extradural location of the tumor may be observed in any position, either lateral, dorsal, or ventral to the dural sac.

In this review, all lumbar chondromas were localized in the extradural compartment with few cases infiltrating the osseous structure. This is different from cervical chondromas, which show a higher rate of bone infiltration and higher frequency of intradural localization.[18-20]

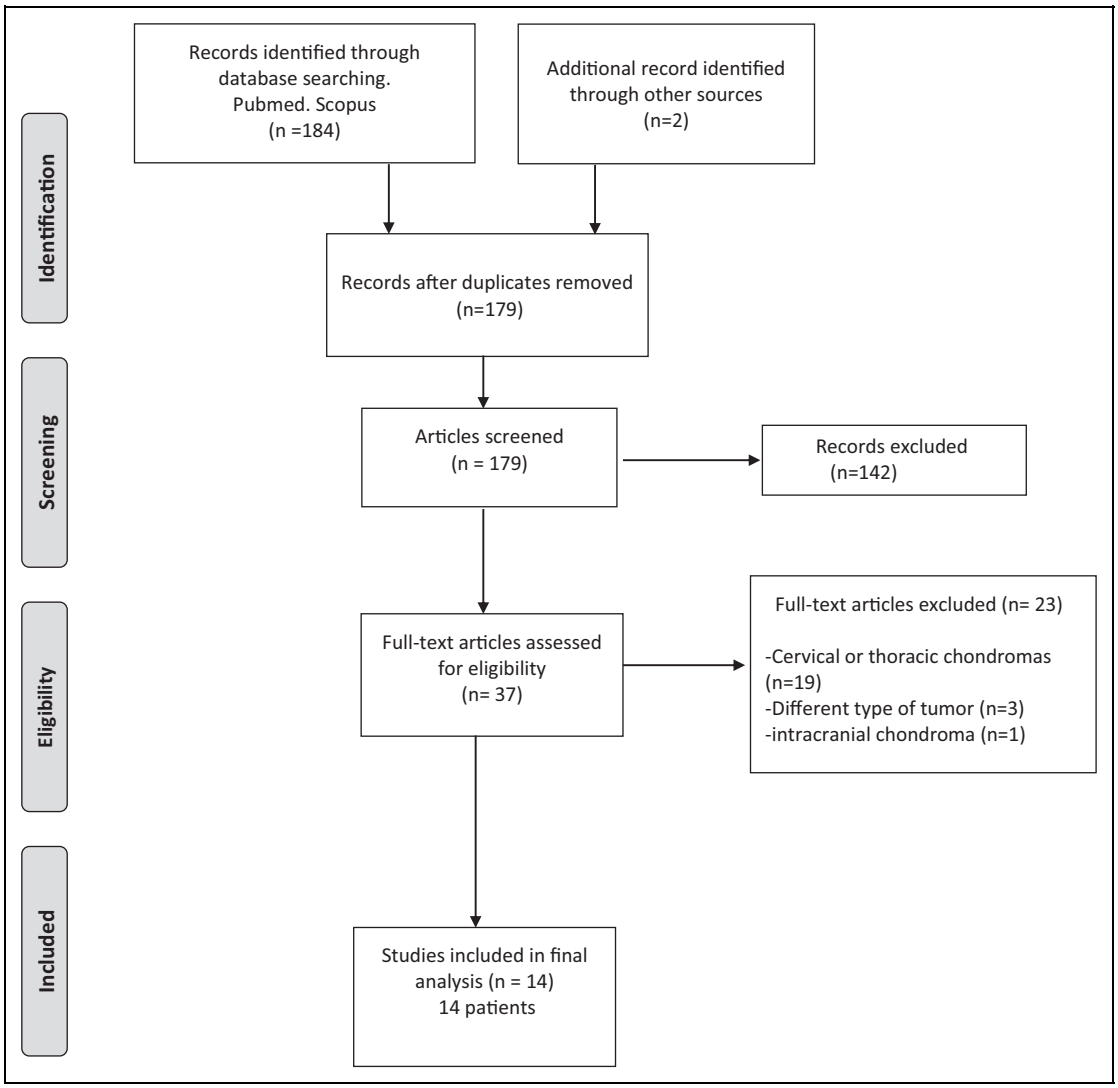

Figure 3. Flow chart of the literature search strategy and article selection for screening and analysis.

Clinical Presentation

As other intraspinal tumors, chondromas may manifest with back pain or compression of single or multiple nerve roots. In this review, 80% of patients presented with low back pain associated with radicular pain; this was the most common clinical manifestation. Twenty-six percent of patients manifested with multiple nerve roots being affected, some of them experiencing bowel/bladder dysfunction.

It has been reported that patients with spinal chondromas may manifest with a palpable mass[1]; however, only 2 patients of this review manifested with a progressive enlargement of a lumbar paraspinal mass. In these patients, the tumor was mainly infiltrating the osseous structure of posterior elements with no involvement of the spinal canal or nerve roots.

Duration of symptoms before the diagnosis of chondroma was variable ranging from days to years. In this review, half of the patients presented with evolution of less than a month previous to diagnosis.

The clinical characteristics of acute onset of low back pain associated with radiculopathy are very similar to cases of lumbar disc herniation; therefore, initially, it is very unlikely to think about a spinal chondroma in these patients.

Imaging

In the pre-MRI era, it was almost impossible to identify the characteristics of intraspinal tumors; the same situation occurs with spinal chondromas. In the past, the diagnosis of intraspinal tumors relied on myelography. Unless there is significant bone infiltration by the tumor, conventional radiographs are normal.

In this review, MRI was started to be used in this group of patients in the 1990s decade. The intensity and characteristics of the tumor observed on MRI may vary. In T1 or T2 sequences, the tumor usually is lobulated and maybe isointense or hypointense. The most constant and characteristic finding was observed on the MRI with gadolinium, consisting of a peripheral rim enhancement of the tumor. This imaging finding

Table 1. Summary of Patients With LSC.

Study	Age	Symptoms	Level of Spine	Anatomic Location	Evolution ctime	RX	CT Findings	MRI Findings	Treatment	Outcome	Qx Findings	Histology
Current case	57 (male)	LBP Radic BBD	L4	Extradural Intrasp-extrasp Dumbbell	2 weeks	Normal	NA	T1-isoint T2-isoint T1 Gd-peripheral enhancement	Hemilam/ resection			
Esteves et al (2018)[8]	52 (male)	LBP Paraparesis BBD	L2-3	Extradural	1 week	Normal	Normal	T1-isoint T2-isoint T1 Gd-peripheral rim enhancement	Hemilam/ resection	Complete improvement	Yellowish mass Easy separated from dura	
Thien et al (2014)[15]	56 (female)	LBP Radic L-3	L2-3	Extradural Intrasp-extrasp Dumbbell	2 months	NA	NA	T1-hypoint T2-isoint T1 Gd-peripheral enhancement	L2 hemilamin/ resection	Complete improvement		Soft tissue
Pace et al (2014)[14]	46 (female)	LBP Radic	L3	Extradural Intrasp-extrasp Dumbbell	3 weeks	Normal	NA	T1-hypoint T1 Gd-contrast-homogenous enhancement		Complete improvement		
Kim et al (2013)[11]	47 (female)	LBP Radic	L2-3	Extradural	1 week	Normal	Normal	T1-Hypoint T2-hypoint T1 Gd-peripheral enhancement	L2-3Hemilam/ resection	Complete improvement	Yellowish Easily separated from dura	
Cho et al (2009)[6]	49 (female)	LBP L2-3 radic	L2	Extradural	2 weeks	NA	NA	T1-hypoint T2-isoint T1 Gd-peripheral enhancement	L2Hemilam/ resection	NA	Yellowish	
Cetinkal et al (2008)[5]	54 (female)	LBP Radic	L2	Extradural	3 years	Normal	NA	T1-isoint T2-hypoint T1 Gd-peripheral enhancement	Hemilam/ resection	Complete improvement	NA	
Ogata et al (2007)[13]	77 (male)	Multiple radic	L3	Extradural	1 month	Normal	NA	T1-isoint T2-hyperint T1 Gd-peripheral enhancement	L3 Lamin/ resection	Complete improvement	Yellowish Easily separated from dura	Periosteal chondroma
Erten et al (1999)[7]	35 (male)	LBP Radic	L5-S1	Extradural	2 years	NA	Disc herniation	T1-hypoint T2-hypoint	Lamin/ resection	Complete improvement	White-grayish	
Gaetani et al (1996)[9]	44 (male)	LBP Radic	L3-4	Extradural	1.5 years	NA	Intraspinal mass	T1-hyperint	Hemilam	Complete improvement	Not dural adherence	
Bland et al (1990)[3]	36 (male)	LBP Radic	L3-4	Extradural	NA		Calcified intraspinal lesion	NA	Hemilam/ resection	Complete improvement	Calcified lesion Not dural adherence	

(continued)

Table 1. (continued)

Study	Age	Symptoms	Level of Spine	Anatomic Location	Evolution ctime	RX	CT Findings	MRI Findings	Treatment	Outcome	Qx Findings	Histology
Waga et al (1979)[16]	5 days (male)	Local mass	L5-S2	Osseous tumor, associated with lipoma	NA	Osseous tumor	NA	NA	Mass resection	NA		
Bell et al (1971)[4]	25 (male)	Paraspinal mass, local pain	L2	Osseous tumor Lamina and pedicle	5 days	Osseous mass L2	NA	NA	Laminectomy/ resection	Recurrence	Hard mass	
Herndon et al (1970)[10]	11 (female)	LBP Radic	L3-4	NA	2 years	Scoliosis	Myelogram complete block	NA	Laminec/ resection	Complete improvement		
Nag et al (1966)[12]	50 (male)	Bilateral sciatica	L4	Extradural	NA	Normal	Myelogram, complete block	NA	Laminec/ resection	Complete improvement	Amber-colored mass	

Abbreviations: BBD, bladder/bowel disturbance; CT, computed tomography; Extrasp, extraspinal; GD, gadolinium; Hemilam, hemilaminectomy; Intrasp, intraspinal; Laminec, laminectomy; LBP, low back pain; LSC, lumbar spinal chondroma; MRI, magnetic resonance imaging; NA, not available; Radic, radiculopathy.

was observed in 87% of patients in whom gadolinium was administered. In some cases, the tumor extended into the foramen and extraforaminal area adopting a dumbbell shape. MRI showed that the tumor location was unilateral in 91% of cases. The above suggests that it would be worth administering contrast to rule out this pathology in patients with lumbar disc herniations with unusual characteristics such as disc migration and foraminal-extraforaminal location.

Differential Diagnosis

The differential diagnosis in these patients includes mainly nerve sheath tumors and herniated intervertebral discs.

Herniated Lumbar Disc. It is well known that different benign and malignant lesions can clinically mimic intervertebral lumbar disc herniation. This review shows that an important number of cases may show a clinical picture very similar to patients with disc herniation, particularly in cases of extruded/migrated disc fragments. By far, the most common cause of lumbar radiculopathy is a disc herniation causing nerve compression. The presence of an intraspinal mass in cases of spinal chondromas very likely will lead to the initial erroneous diagnosis of an extruded disc fragment. Because the use of gadolinium is not routinely used in cases of lumbar radiculopathy, this is the reason why spinal chondromas are not considered within the diagnostic possibilities in these patients. Indeed, in several patients of this review and our case, the initial diagnosis was a sequestered disc fragment. Although it is very difficult to initially think of a chondroma as the origin of the spinal mass, some specific details may help us consider the possibility of an intraspinal chondroma. The presence of a lobulated mass and peripheral rim enhancement of the lesion are findings that frequently are observed in cases of spinal chondromas, thus helping differentiate this tumor from a migrated disc fragment.

Dumbbell Tumors. The term dumbbell spinal tumor refers to a group of spinal tumors that have both a component within the canal and a component in the paravertebral space linked by tumor traversing the neural exit foramen. Nerve sheath tumors are the commonest dumbbell spinal tumors. In 2 big series of dumbbell spinal tumors (124 and 118 cases, respectively), the most common histological type was schwannoma followed by neurofibroma.[21,22] None of the tumors reported in those series corresponded to chondroma, thus confirming that spinal chondromas adopting a dumbbell shape is a very rare situation.

In this review, 20% of spinal chondromas showed characteristics of dumbbell tumor. Due to the rarity of dumbbell chondromas, this condition is not considered in a patient with a spinal dumbbell tumor.

Patients with nerve sheath tumors usually show an enlarged neuroforamen, which is not usually observed in chondromas; besides, schwannomas normally take up gadolinium homogeneously compared to the peripheral enhancement observed in chondromas.

Treatment and Outcome

Most patients of this review were treated with surgical resection of the tumor, performed through several techniques. Because LSCs are usually unilateral, the most common procedure was hemilaminectomy of one or several levels depending on the extension of the lesion, followed by removal of the tumor. During surgery, the tumor is usually soft and not adherent to the dura mater, so dissection and removal of the mass is usually not complicated.

In the majority of patients, the diagnosis of LSC was not initially considered and the condition was confirmed after histological analysis.

After surgery, patients normally showed an important degree of improvement. Because the follow-up period of patients in this review was usually not reported, there is no way to establish the recurrence rate of the tumor in these cases.

Limitations

Although this study shows relevant information about LSC, it has some limitations. All these patients were extracted from case reports, and therefore they are subject to reporting and description bias. In addition, only English language articles were included for review, and possibly we could have excluded articles published in a different idiom.

Even though the above limitations exist, this review still summarizes all the accessible pertinent cases and gives insights into this special disease.

Conclusions

LSCs are very rare tumors. Compared to cervical spinal chondromas, LSCs are almost exclusively seen in the extradural space and rarely show osseous infiltration; also, they are usually unilateral and may adopt a dumbbell shape.

The results of this review show that LSCs frequently manifest with low back pain and leg pain mimicking lumbar disc herniations; therefore, they should be considered in the differential diagnosis of sciatica. The typical MRI finding of these tumors is the presence of peripheral rim enhancement of the lesion after gadolinium administration.

Declaration of Conflicting Interests

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