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Case Report

Intraradicular disc herniations in the lumbar spine and a new classification of intradural disc herniations

M Mut*[,1], M Berker[1] and S Palaoğlu[1]

[1]*Department of Neurosurgery, Hacettepe University School of Medicine, Ankara, Turkey*

Study design: A case report of intraradicular disc herniation. Intraradicular disc herniation is a special type of intradural disc hernations. In this report, we present the tenth case of intraradicular lumbar disc herniation and suggest a new classification for intradural disc herniations.

Case report: A 32-year-old male was admitted to hospital having experienced pain in the lower back and right leg for 1 month prior to admission. Neurological examination revealed weakness of the extensor hallucis longus, positive Laségue's sign, decreased ankle reflex in his right lower extremity, and bilateral paravertebral muscle spasm. Magnetic resonance imaging (MRI) revealed a disc herniation with a posterolateral extruded fragment on the right at the level of the L5-S1 space. He underwent L5 laminectomy. During the operation, the right S1 root was found to be swollen and immobile. A longitudinal incision was made in the dura of the right S1 root and an intradural free disc fragment was removed, and the S1 root was relieved. The patient was free of pain postoperatively.

Conclusion: We suggest a new classification for intradural disc herniations with this unusual case presentation and review the literature for pathogenesis, clinical picture, diagnosis and treatment.

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Introduction

Rupture of intervertebral disc material into the intradural space is a rare event in lumbar disc disease but must be considered in the differential diagnosis of mass lesions causing nerve root or cauda equina syndrome. The pathogenesis of lumbar intradural disc herniation is most likely related to dense adhesions between the ventral dura mater and the posterior longitudinal ligament. The adhesions can apparently result either from repeated minor trauma or from prior surgery. This report presents the tenth case of intraradicular lumbar disc herniation and suggests a new classification for intradural disc herniations.

Case report

History

A previously healthy 32-year-old male patient was admitted to hospital with a history of low back and right leg pain for 1 month. The pain was exaggerated by the Valsalva manoeuvre. He did not respond to conservative treatment. He had no history of trauma or previous low back surgery.

Physical examination

Neurological examination revealed weakness of the extensor hallucis longus with muscle strength of 4/5, positive Laségue's sign at 30°, decreased ankle reflex on the right side and bilateral paravertebral muscle spasm.

Neuroradiological findings

Magnetic resonance imaging (MRI) showed right posterolateral disc herniation and an extruded fragment at the L5-S1 level (Figures 1 and 2).

Surgery

Right L5 hemilaminectomy and S1 foraminotomy were performed. During the L5-S1 disc space exploration, a supraligamental free (extruded) fragment was removed,

*Correspondence: M Mut, 1.cd 12.sk 18/3, Bahceli 06490, Ankara, Turkey

and an L5-S1 discectomy was performed. After the removal of the extruded fragment, no relief was observed and both the compression and the tension were persistent in the preganglionic S1 segment. Therefore, the L5 hemilaminectomy was converted to total laminectomy for intradural exposure of the S1 root, which provided complete removal of a sequestered disc fragment penetrating the dura. The nerve root was intact but compressed. The dura was closured primarily. The absence of adhesions between the dura and the surrounding ligament was noteworthy. He had a prompt recovery soon after the surgery with complete resolution of the pain.

Figure 1 T1 weighted MR image sagittal section of lumbar vertebra, posterolateral herniation of disc in L5-S1 (white arrow)

Discussion

Intradural disc herniation is a rare but important cause of radiculopathy and cauda equina compression. Intradural disc herniations have not been classified previously. We suggest the following classification for intradural disc herniations (Figure 3): Type A: Herniation of a disc into the dural sac; Type B: Herniation of a disc into the dural sheath in the preganglionic region of the nerve root.

This classification is based on spinal dural anatomy.[1] In 1942, Dandy first reported an intradural disc herniation among 300 patients who underwent surgery for lumbar disc herniation.[2] The total number of reported lumbar intradural disc herniations was 79 until 1994.[3] Ninety-five per cent of the 79 reported cases had a history of back pain and one third had undergone prior surgery at the level of the subsequent intradural herniation. A large ragged dural tear was often identified intraoperatively. Pain and neurological findings were worse than in patients with an extradural lesion. Patients usually had positive neurological findings. The majority of intradural herniations occurred at the L4-5 levels.[4]

Intradural disc fragments can be palpated through the dorsal dura and removal should take place with magnification to facilitate separation of the fragment from the cauda equina.

The exact mechanisms of the dural tear by a herniated disc is not known. It is postulated that dense posttraumatic or postoperative adhesions be-

Figure 2 T1 weighted MR image axial section of lumbar vertebra L5-S1, sequestration of disc fragment posterior to S1 vertebral corpus (white arrow)

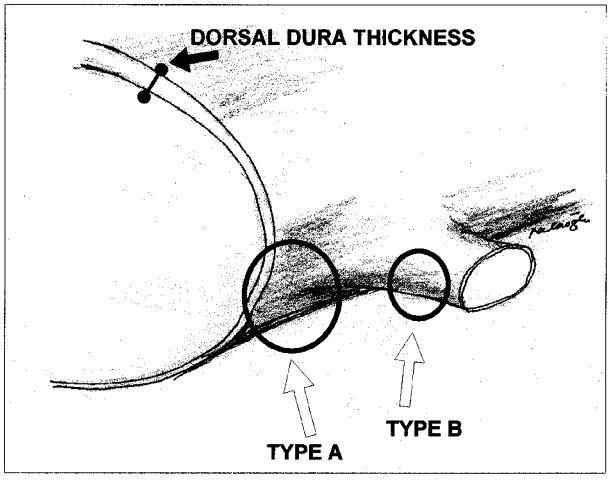

Figure 3 Classification of intradural disc herniations. Note the dorsal dural thickness compared to ventral dural one

tween the posterior longitudinal ligament and the ventral dura prevent the lateral migration of disc fragments and the ventral dura prevent the lateral migration of disc fragments and facilitate penetration of the tethered dura.[4] An anatomical investigation revealed dense non-separable adhesions of the ventral dura to the posterior longitudinal ligament at the L4-5 level in eight of 40 cadavers.[5] It was suggested that adhesions formed congenitally or caused by trauma, surgery, inflammation, osteophytes or disc protrusion fixed the dural sac. In those cases, the extruded fragment tore the ventral surface of the dura.[1,5] This theory only explains the intradural disc herniations at the L4-5 level. An anatomical study of 20 adult cadavers with no history of low back pain and 20 late abortions and newborn infants revealed that there were only loose connections between the posterior longitudinal ligment and the ventral dura at most

Table 1 Reported cases of intra-adicular disc herniations

Series	*Age (years)/Sex*	*Symptoms and duration*	*Neurological examination*	*Diagnostic imaging*	*Location*	*Operative findings*	*Prognosis*
Barbera *et al*[9]	34/M	LBP (2 years), LS (4 weeks)	left S1 root MMS, ↓Ankle reflex, (+) SLRT	myelography	left S1 root	dilated S1 root, dense adhesions between anterior spinal wall and root dura	↓pain postop, neurological improvement in 7 months
Lesion *et al*[12]	44/M	RS (7 years), LS (6 weeks)	↓Ankle reflex	myelography	left S1 root	hard axilla of left S1 root	↓ pain postop, neurological improvement in 6 months
Açikgöz *et al*[7]	30/M	LBP, RS (2 years)	right S1 root MMS, ↓Ankle reflex, (+) SLRT	myelography	right S1 root	swollen right S1 root	↓pain postop, neurological improvement in 2 years
Ergüngör *et al*[10]	44/F	RS (1 month)	right S1 root MMS, ↓Ankle reflex, (+) SLRT	myelography	right S1 root	swollen right S1 root, defect in posterior longitudinal ligament	↓pain postop
Tsuji *et al*[14]	38/M	LBP (2 years), LS	left S1 MMS, ↓Ankle reflex, (+) SLRT	myelography discography	left S1 root	dilated S1 root, dense adhesions between intervertebral disc and root dura	↓pain postop, neurological improvement in 6 years
Nazzal *et al*[13]	62/M	LBP, RS	absent DTR, (+) SLRT	myelography	right L5 root	bulging of right L5 root	↓pain postop
Süzer *et al*[6]	41/M	LBP (3 years), LS (4 weeks)	left S1 root MMS, ↓Ankle reflex, (+) SLRT	MRI	left S1 root	swollen, immobile left S1 root, defect in posteriort longitudinal ligament	↓pain postop, neurological improvement in 4 months
Akdemir *et al*[8]	60/M	LBP, RS	right S1 root MMS, ↓Ankle reflex, (+) SLRT	myelography CT	right S1 root	swollen, immobile right S1 root	↓pain postop, neurological improvement in 6 months
Finkel *et al*[11]	46/M	LS (2) days, LBP	left S1 root MMS, ↓Ankle reflex, (+) SLRT	MRI	left S1 root	left S1 root adherent to underlying disc space, swollen root	
This case	32/M	LBP RS (1 month)	right S1 root MMS, ↓Ankle reflex, (+) SLRT	MRI	right S1 root	swollen and immoble right S1 root	↓pain postop, neurological improvement in 2 months

[a]M, male; F, female; postop, postoperative; MRI, magnetic resonance imaging; CT, computerized tomography; ↓, decreased; ↑, increased; LBP, low back pain; RS, right sciatalgia; LS, left sciatalgia; MMS, motor-sensory signs; SLRT, straight leg raising test. *Patient had been operated on for lumber disc disease previously

levels. However, dense adhesions were observed at certain levels, especially in the lower cervical and lower lumbar regions. Interestingly, the adult and newborn/abortion groups were similar in terms of levels of adhesions, suggesting a congenital origin. The dorsal dura of adult cadavers was thicker than the ventral dura (Figure 3) at the lower cervical and lower lumbar regions, due to strain, but they were equal in the newborn/abortion group.[2]

Type A intradural disc herniation rarely occurs in the cervical or thoracic spine; there are six cases of cervical and five cases of thoracic intradural disc herniations reported in the literature.[6]

Type B intradural disc herniation has been named intraradicular disc herniation. This terminology is confusing and actually indicates a special type of disc herniation through the dural sheath of the nerve root but not within the epineurium as a rule. Therefore, describing Type B as an intraradicular disc herniation is more specific and certain. Type B intradural disc herniations are much less frequent neurosurgical disorders. Nine cases have been reported, and all were in the lumbar region.[6–14] Our case is the tenth reported case of Type B intradural disc herniation. Clinical data regarding these patients are summarized in Table 1. The ages of these reported patients were between 30 and 62 years. Nine of them were male. Seven patients had chronic low back pain as well as leg pain, which increased with strenuous movement in four patients. Four patients had undergone previous operations for lumbar disc disease. Type B intradural disc herniations were only diagnosed during surgery in all patients. The S1 nerve root was involved in nine of the 10 reported cases. The dura was found to be densely adherent to the posterior longitudinal ligment in two cases. All patients were free of pain after surgery.

A fresh cadaver study in adults by Spencer demonstrated the existence of dural ligaments fixing the dura and nerve roots at their exit from the main dural sac to the posterior longitudinal ligament and vertebral body periosteum proximal to the intervertebral disc.[15] Distal fixation generally occurs at the intervertebral foramen where the epineural sheath of the spinal nerve is attached. These ligaments in certain cases also cause increased nerve root fixation, allowing penetration of a ruptured disc.

The pathophysiology of intradural disc herniations is not known clearly. The postulated mechanism is adhesions in both Type A and Type B. The reason why Type A herniations occur at the L4-5 intervertebral disc space and Type B herniations occur at L5-S1 is not known.

Conclusion

We suggest a new classification for intradural disc herniations.

The reason why the number of reported intradrual disc herniations is quite low may be that these cases are not documented or recognized. While treating lumbar disc disease, the possibility of an intradural disc herniation should be kept in mind for the success of the discectomy and the management of failed back syndrome.

Biomechanical studies, in addition to anatomical studies, may improve our understanding of the pathophysiological process in these patients.

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