Concomitant noncontiguous level (thoracic & lumbar) spinal stenosis

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Abstract Presented here is a prospective study assessing the efficacy of decompression of concomitant noncontiguous level (thoracic & lumbar) stenosis in accordance with neurological findings, nerve root blocks, and myelographically proven disease. The objective was to determine the efficacy, clinical outcome, and functional recovery in patients undergoing simultaneous decompression. No previous study has focussed on the clinical outcome of such simultaneous decompression. Twenty-one patients with neurological claudication, progressive gait disturbance, upper motor neuron symptoms, and findings of myelopathy in both the lower extremities underwent simultaneous decompression and were assessed. The average follow-up was 32 months (range, 24–40 months). At the last examination, 13 patients (82%) had excellent or good clinical results. Postoperative improvement correlated inversely with the duration of symptoms. The patients usually had satisfactory outcomes when the correct diagnosis was made and management was implemented. Functional recovery depends on early diagnosis and timely surgical intervention.

Résumé Une étude prospective permettant d'évaluer l'efficacité de la décompression concomitante pour canal lombaire étroit au niveau thoracique & lombaire à différents étages, avec signes neurologiques, a été réalisée. L'objectif était de déterminer l'efficacité et le devenir clinique et fonctionnel après cette décompression. Aucune étude de la littérature n'a analysé le devenir clinique pour de telles décompressions simultanées. 21 patients avec une claudication intermittente neurologique et une diminution du

périmètre de marche avec douleur radiculaire et des signes de myélopathie au niveau des deux membres inférieurs ont bénéficié d'une telle décompression simultanée. Le suivi moyen a été de 32 mois (de 24 à 40 mois). Au dernier examen, 13 patients (82%) avaient un excellent ou bon résultat. La récupération post-opératoire est inversement proportionnelle à la durée de la symptomatologie. Les patients ont eu un résultat satisfaisant, le diagnostic et le traitement ont été réalisés de façon correcte avec une bonne récupération fonctionnelle qui est dépendante d'un diagnostic précoce et de l'algorithme chirurgical.

Introduction

Patients often present to our consulting room for back pain with lower limb radiating pain and weakness. Only a lumbar MRI showing degenerative stenosis at lower lumbar level is performed. The patient is operated upon for complete decompression but the symptoms do not resolve and the patient tends to have the same complaints postoperatively. This confuses the surgeon and puts him in a dilemma in which he either tends to question his surgical skills about inadequate decompression or looks for something which he missed. Initial thorough clinical examination would have saved him from this entire ordeal.

Double level laminectomy is recommended as the procedure of choice for treatment of concomitant noncontiguous level (thoracic & lumbar) spinal stenosis. This procedure is indicated as the only one which permits exposure of the cord and roots and safe treatment of this double level stenosis.

Despite the growing use of imaging techniques, the literature on concomitant noncontiguous level (thoracic & lumbar) spinal stenosis is scanty. This paper reports our experience for the treatment of double level stenosis with double level laminectomy. Although the treatment of thoracic stenosis has been described in many case reports

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[1, 3, 7] the importance of concomitant noncontiguous level (thoracic & lumbar) spinal stenosis with its varied neurology has only recently been appreciated.

In this study, the results of decompression of the vertebral canal in a series of 21 patients with a degenerative type of thoracolumbar stenosis are reported.

Objective

Tandem stenosis is common in elderly. The objective of this study was to highlight the importance of clinical evaluation when dealing with a case of lumbar canal stenosis and the need for maintaining a high index of suspicion when a patient presents with varied neurology as thoracic stenosis may be easily missed [9]. This will also prompt the surgeons to additionally request screening of the whole spine when requesting a lumbar spine MRI. This study also emphasises the importance of decompressing both levels at the same sitting.

Material and methods

Inclusion criteria

Inclusion criteria for this study were symptomatic and radiologically proven concomitant noncontiguous level (thoracic & lumbar) spinal stenosis and degenerative aetiology. (Patients with stenosis due to congenital or developmental, metabolic or traumatic causes were excluded from the study).

The presenting complaints were thoracic myelopathy in seven patients, paraparesis in six patients, root weakness in three patients, and monoparesis in one patient. Complete patient profiles are presented in Table 1. The severity of pain graded before surgery was mild in three patients, moderate in seven, and severe in seven.

Seventeen patients (ten females, seven males) with symptomatic MRI diagnosed, double level stenosis of the thoracic and lumbar spinal canal were admitted in our unit between 2003 and 2007 and underwent surgical decompression at both levels. The average age of the patients was 52 years (range, 44–65 years). The symptom duration averaged 8.2 months (range, 4–16 months). Average preoperative JOA score was 2. The average total postoperative follow-up was 32 months (range, 26–48 months). When in doubt about the clinical significance of any level stenosis, proof was established with the nerve root blocks. Myelographically proven disease helped in confirming the diagnosis. Whole spine screening was done routinely to rule out any concomitant spinal stenosis, thus ruling out any cervical cause of the symptoms (cf. Figs. 1, 2, 3 and 4).

Technique

The levels included in decompression had radiological evidence of neural element compression that correlated with the patient's clinical symptomatology. All the patients underwent decompressive laminectomies at both the levels. The levels were confirmed by fluoroscopy.

The operation was carried out in the prone position with the patient under general anaesthesia. The patient was

Table 1 Data sheet showing complete patient profile

Patient no.	Gender	Age	Thoracic level	Lumbar level	Symptoms duration (months)	Motor deficit
1	F	51	D 10, 11	L 2,3,4	9	Thoracic myelopathy
2	F	60	D 9,10	L 3,4	6	Root weakness
3	M	58	D 9,10	L 2,3,4	4	Paraparesis
4	F	55	D 11,12	L 2,3	12	Monoparesis, hyperreflexia
5	M	61	D 11,12	L 4,5,S1	12	Paraparesis
6	M	56	D 10, 11	L 4,5	6	Root weakness
7	F	59	D 8	L 3,4,5	9	Thoracic myelopathy
8	F	61	D 10, 11	L 3,4,5	7	Root weakness
9	F	64	D 9,10	L 5, S1	5	Paraparesis
10	M	64	D 11,12	L 3,4,5	8	Thoracic myelopathy
11	F	58	D 10, 11	L 3,4,5	4	Paraparesis
12	F	62	D 9,10	L 5, S1	9	Thoracic myelopathy
13	M	50	D 11,12	L 3,4	8	Paraparesis
14	F	44	D 10, 11	L 4,5,S1	16	Thoracic myelopathy
15	M	57	D 10, 11	L 4,5,S1	7	Thoracic myelopathy
16	M	58	D 8	L 3,4,5	9	Thoracic myelopathy
17	F	65	D 11,12	L 3,4,5	8	Paraparesis

Fig. 1 T2 axial image showing compression at D10–D11 level

draped, and a midline incision was made. The fascia was opened and the paravertebral muscles were detached from the spinous process, ligamentum flavum, and laminae. Under optical loupe magnification a limited laminectomy was performed with a 5 mm osteotome using a special technique taking care to extensively remove the ligamentum flavum of the upper and lower interlaminar space. Laminectomy was done with a sharp small osteotome which was used with oblique strokes so that the resultant vector force pushes the piece out rather than in. This allows a gain of at least 1 cm more for the final exposure. Generally, it is not necessary to remove part of the articular process. The final dural exposure is a rectangle of about 2×3 cm. In some cases, to obtain adequate exposure, bone removal was extended cranially and caudally by another 1–1.5 cm. The roots were exposed and decompressed. The duration of the operation averaged 2.6 hours (range, 2–3.2 hours).

Fig. 2 T2 sagittal showing concomitant thoracic and lumbar stenosis

Fig. 3 T2 sagittal showing whole spine screening ruling out any cervical compression

Results

The scoring system of the Japanese Orthopaedic Association (JOA) was used for evaluation of the results of the surgery with a rating system as follows:

Motor dysfunction of the lower extremity

0	Cannot walk
1	Needs cane or aid on flat ground
2	Needs cane or aid only on stairs
3	Can walk without cane or aid, but slowly
4	No disability

Surgical outcome	Change of JOA score
Excellent	JOA score improved more than 3 points
Good	JOA score improved 1–2 points
Fair	No JOA score change
Poor	Worsening of JOA score

Surgical outcome according to symptom duration of patients in this study was as follows:

	Excellent	Good	Fair
<6 months	3	1	–
6–12 months	–	10	2
>12 months	–	–	1

According to our surgical outcome criteria, the difference of JOA score, there were excellent results in three patients, good results for 11 patients, and fair results for three patients (Table 2). All patients who were ambulatory preoperatively walked on the second or third day and were discharged on the fourth or fifth day. No complications (general or due to the procedure) were observed. There was no neurological deterioration and preoperative pain improved or disappeared in all the patients. None of the patients required major drugs for postoperative pain. The patients with preoperative motor deficit recovered in a few weeks and currently have good neurological function. None of the patients required external orthopaedic devices.

Fig. 4 Myelogram showing compression at dorsal and lumbar level

The patients that suffered from myelopathy for less than 6 months had excellent and good results after surgical decompression. The follow-up ranged from 26 to 48 months. All patients returned to their normal activities within 3–4 weeks. None of them experienced severe pain and/or signs of spinal instability.

Discussion

Most of the patients showed the typical features of thoracic myelopathy, that is, sensory and motor deficits in the trunk and lower extremities, sphincter disturbance, and exaggerated tendon reflexes. Stenosis at the thoracic level is the more severe and patients initially present with posterior column disturbances that are followed by progressively increasing spastic paraparesis.

The rate of degenerative and spondylotic processes of the spine increases with age. Spondylotic processes of the spine commonly affect the lumbar region and very rarely the thoracic area. Hypertrophy of the posterior spinal elements is a well-recognised pathological entity affecting the lumbar or cervical spine. Pathological changes occurring in the thoracic region in the facet joints and ligamentum flavum hypertrophy are responsible for the development of spinal stenosis leading to compromise of the spinal canal and its neural elements. Such stenosis of the thoracic spine is generally considered to be rare. MRI is the best way to define the specific abnormality as well as the effect on the adjacent spinal cord.

The spectrum of neurological dysfunction documented in this study can be explained, in part, by the fact that the caudal end of the thoracic spinal canal contains both the lumbosacral cord enlargement and portions of the lower thoracic through first sacral nerve roots. Compressive pathology in this region of the spine can produce mixed upper and lower motor neuron lesions due to compromise of both the conus medullaris and caudal nerve roots. Coexistent lumbar stenosis accounts for lower motor neuron deficits and masks some of the signs of cord compression.

The chronic severe myelopathy caused by thoracic spinal stenosis is reversible by appropriate timely decompression, and the surgical outcome was reported to depend on the initial symptom duration and sufficient decompression. Early diagnosis and treatment are important for the postoperative functional prognosis. It is reported that the persistence of residual spasticity at follow-up may be due to irreversible changes within the cord that are caused by the significant cord compression and the delay between the onset of initial symptoms and surgical decompression. In

Table 2 JOA scores

Sensory changes	Pain	Pre op JOA score	Post op JOA score	JOA at last follow-up	Follow-up (months)	Surgical outcome
+	Severe	2	2	3	48	Good
–	Mild	3	3	4	39	Good
+	Severe	1	1	4	38	Excellent
–	Moderate	3	3	3	36	Fair
–	Mild	2	2	2	36	Fair
–	Mild	3	3	4	34	Good
+	Severe	2	2	3	34	Good
–	Moderate	3	3	4	34	Good
–	Moderate	1	1	4	32	Excellent
+	Severe	2	2	3	30	Good
–	Moderate	1	2	4	29	Excellent
+	Moderate	2	2	3	29	Good
+	Moderate	1	2	3	28	Good
–	Severe	3	3	3	28	Fair
–	Severe	2	2	3	28	Good
–	Severe	2	3	3	26	Good
–	Moderate	1	1	2	26	Good

this study a shorter duration of symptoms was associated with a favourable outcome.

The rationale for double level laminectomy rather than single level laminectomy is to address the compressive pathology at both levels simultaneously. Each level dealt with via separate incisions to preserve the spinal stability. Thanks to the diagnostic accuracy of MRI imaging and per operative fluoroscopy, the decompression level can be reached and removed via minimally invasive procedures. Whole spine MRI evaluation and a careful and complete neurological evaluation should be performed preoperatively for all patients with lumbar canal stenosis.

Spinal canal stenosis in the thoracic region is much less common than in the cervical and lumbar spine. Isolated cases of thoracic stenosis have been described in the literature [1, 2, 4, 5, 7], but double level stenosis has rarely been described. Thoracic stenosis has been described in multiple case reports but only four long-term follow-up studies have been reported. The two series by Marzluff et al. [4] and Barnett et al. [1] with an average follow-up of less than 2 years have documented early satisfactory results of surgery. The reports with longer follow-up periods by Yamamoto et al. [10] and Okada et al. [6] showed satisfactory early results with a more guarded prognosis due to late deterioration after initial improvement due to recurrent stenosis/deformity/instability at the thoracolumbar junction or both. These cases of late deterioration in outcome suggest the need for an overall more aggressive approach in selected patients and demon-

strate the necessity for long-term follow-up evaluation of this patient population.

In a study by Sato [8] selective decompression only at the neurologically responsible level improved neurogenic intermittent claudication in all his patients. The asymptomatic levels at which the stenotic condition was left unchanged at surgery did not become symptomatic at follow-up. However, in this study decompression was done at both levels.

Conclusion

Concomitant noncontiguous level (thoracic & lumbar) spinal stenosis is a relatively uncommon finding that produces myelopathy in the thoracic area. The thoracic stenosis has problems of relatively high surgical risk and unpredictable surgical outcome. Prompt recognition of thoracic stenosis as a cause of neurological compromise proved difficult.

According to the results of our study, a complete preoperative evaluation including thorough clinical examination and radiological findings provides valuable assistance in predicting surgical outcome for double level stenosis. Nevertheless we feel that this limited double level laminectomy is suitable for all double level compressive pathologies and it should be the procedure of choice. This procedure reduces the chances of a second admission for the patient, which reduces hospital stay and therefore overall costs.

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