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Research Article

Extensor Digitorum Brevis Wasting-A Decisive Preoperative Clinical Indicator of Lumbar Canal Stenosis

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Abstract

Herein we highlight the clinical implication of observing for the wasting of bilateral Extensor Digitorum Brevis so as to aid in the diagnosis of lumbar canal stenosis in patients presenting with complaints of low back ache and features suggestive of intermittent neurological claudication. This simple bedside clinical pearl can help us in predicting the need of further imaging studies and also in taking right therapeutic decision.

Keywords: *Extensor digitorum brevis; Lumbar canal stenosis; Dural wasting*

Introduction

Degenerative lumbar spinal stenosis describes a condition in which there is diminished space available for the neural and vascular elements in the lumbar spine secondary to degenerative changes in the spinal canal, presenting with a history of gluteal or lower extremity symptoms exacerbated by walking or standing which improves or resolves with sitting or bending forward. Patients whose pain is not made worse with walking have a low likelihood of stenosis [1].

The extensor digitorum brevis muscle (EDB) arises from the distal part of the superolateral surface of the calcaneus.

Figure 1: *Normal EDB in a healthy person.*

It runs distally across the dorsum of the foot and finally divides into four slips [2]. Medial slip inserts onto the base of the proximal phalanx of the great toe. The other slips attach to the lateral sides of the tendons of the extensor digitorum longus for the second, third, and fourth toe.

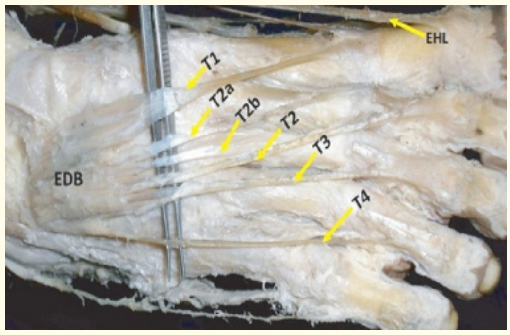

Figure 2: *Anatomical picture showing EDB muscle along with its slips*

Wasting of extensor digitorum brevis (EDB) has been taken as a marker for L5/S1 radiculopathy [3,4]. Herein we highlight the clinical importance of observing for evidence of bilateral EDB wasting as a marker for underlying lumbar canal stenosis. This simple bed side clinical observation can help us make correct surgical strategy and thereby prevent failed back syndrome by carrying out decompressive laminectomy rather than just tackling the disc in such groups.

Methods and Materials

All the patients presenting to the spine clinic in the Department of Neurosurgery, College of medical sciences, with complaint of low back ache were clinico-radiologically assessed for features of radiculopathy and canal stenosis. Members of the spine team assessed for the presence of EDB wasting in all the patients.

Figure 3: *Gross wasting of EDB in a case of lumbar canal stenosis.*

MRI study guideline included getting a thin (4-5 mm) MRI sections with a combination of T1 and T2 pulse sequences in both axial and sagittal planes with additional angled and stacked axial sections. Antero-posterior diameter (< 10 mm) and cross-sectional area (< 70 mm) of spinal canal and MRI finding of positive sedimentation sign were taken into account for diagnosing canal stenosis.

We also studied dynamic X-ray spine to see for any instability. In presence of instability based on Posner's criteria, patients were offered decompression with fusion if the stenosis was moderate to severe. We also stressed on the need of standing full-length lateral radiographs of the spine to check for sagittal balance of the patients which has a bearing of increasing instability after performing procedures like laminectomy.

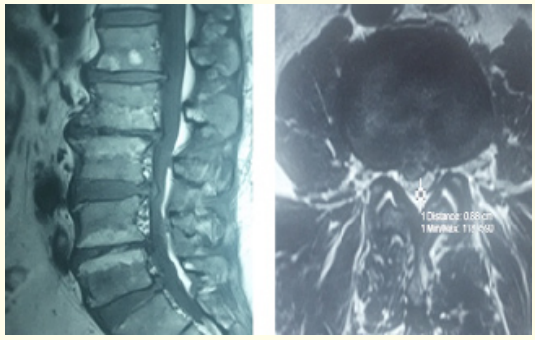

Figure 4: *MRI pictures in a case of canal stenosis with Modic changes within the endplates.*

Patients requiring surgeries where accordingly divided into three groups as those requiring minimally invasive disectomy, other requiring minimal laminectomy and disectomy and finally those subgroups requiring decompressive laminectomy. In the latter two groups, intra-operative findings of hypertrophied facets joints, narrow spinal canal and wasting of the Dura were noted.

Most of the patients were mobilized early from the next morning of the day of surgery. Post operative X-ray LS spine was taken for groups undergoing hemi-laminectomy and decompressive laminectomy so as to rule out spinal instability. Most of the patients were discharged within 72 hours of surgery. Improvement in the muscle groups and the improvement in the wasting of the muscles were routinely assessed for a period of one year in the outpatient department.

Both written and verbal consent were taken from all the patients. This study was cleared by the institution ethical committee.

Results

Clinical profile

Age range of the patients was from 20-70 years. Male female ratio was 1.5:1. Peak incidence of inter-vertebral disc prolapse was among the age group of 20-30 years and for canal stenosis was among the 50-60 years. In our study group ratio of canal stenosis and disc prolapsed was 60:40 among males and 40:60 among females respectively.

Clinical findings

EDB wasting was observed unilaterally in 72/120 (60%) and bilaterally in 36/120 (30%).Calf muscle wasting was seen unilaterally in 36/120 (30%) bilaterally in 18/120 (15%). Likewise weakness of extensor hallusus longus (EHL) was seen in 76/120 (64%), dorsalis flexors (DF) in 100/120 (84%), plantar flexors (PF) in 44/120 (36%) and knee flexors (KF) in 66/120 (55%) respectively.

Radiological investigations

L4-5/L5-S1 inter-vertebral disc prolapse (IVDP) was observed in 40/120 (34%), L4-5/l5-S1 IVDP and canal stenosis was seen in 44/120 (37%) and canal stenosis alone was observed in 36/120 (30%) of patients.

Preoperative canal stenosis

Diagnosis for L3-4 canal stenosis was made in 44/120 (37%), L5-S1 in 52/120 (44%) and L3-4-5 level in 48/120 (40%) of patients.

Per operative IVDP

Intra-operatively axillary variant of disc was seen in 16/120 (14%) and shoulder variant in 8/120 (6.67%) of patients. Pure disc entity was observed in 12/120 (10%) whereas combination of disc and canal stenosis was observed in 12/120 (10%).

Operative procedures

With regard to the mode of surgical intervention undertaken following clinico-radiological correlation, fenestration micro-disectomy was performed in 12/120 (10%), limited laminectomy and micro-disectomy in 12/120 (10%) and combination of laminectomy, hemifacectomy and foraminotomy was carried out in 96/120 (80%) of patients.

Morbidity among patients

The incidental durotomy in our study was seen in 8/120 (6.67%) of cases. Likewise post-operative CSF leak was seen in 2/120 (1.6%), discitis in 2/120 (1.6%) and pseudo-meningocele occurred in 2/120 (1.6%) of patients.

Follow up of patients

During follow up of our patients, no neurological deficits were seen in 114/120 (95%) of patients. Weakness of DF/EHL weakness persisted among 6/120 (5%) of patients. At 2 years of follow up, unilateral EDB wasting was seen in only 38/120 (32%) of patients compared to 72/120 (60%) preoperatively. Bilateral EDB wasting persisted in 22/120 (18%) of patients compared to 36/120 (30%) preoperatively.

Discussion

With the increasing longevity a continually climbing proportion of middle-aged and elderly persons, low back ache is surely going to be a ubiquitous and disabling disease of mankind [5]. Lumbar canal stenosis has significant negative impact to the quality of life in such subset of population [6].

Most of these patients present with features of intermittent neurological claudication [7]. The main dilemma in managing such patients lies in differentiating true disc disease from associated canal stenosis secondary to degenerative changes.

The diagnosis of the spinal stenosis is aided by the radiological studies [8, 9]. Computerized tomogram of lumbar spine shows characteristics trefoil appearance of the canal. In the Magnetic resonance Imaging of the spine, there is loss of CSF surrounding the canal. Guideline suggest getting a thin (4-5 mm) MRI sections with a combination of T1, proton density and T2 pulse sequences in both axial and sagittal planes with additional angled and stacked axial sections [1]. Meta-analysis has shown sensitivity of MRI in the diagnosis of adult spinal stenosis to be 81-97%, of CT 70-100% and myelography 67-78% [10]. Besides the antero-posterior diameter (< 10 mm) and cross-sectional area (< 70 mm) of spinal canal, MRI finding of positive sedimentation sign is a good positive sign to rule in lumbar spinal stenosis with high specificity and sensitivity [11].

However, in the developing countries like ours, the financial aspect of the patients and the limitations of resources in many hospitals may play a pivotal role in limiting ourselves to clinical diagnosis.

The management aspects of lumbar disc disease ranges from conservative, epidural steroids injection, minimally invasive approaches to decompressive laminectomies [12-17]. However, failure to correctly diagnose and then treat the canal stenosis may invariably lead to failed back syndrome in the patients [18].

Preservation of the posterior elements is the most important factor in the success of decompression surgery for lumbar canal stenosis, but occurrence of postoperative instability and re-stenosis has been a shortcoming of laminectomy [19,20]. Despite affording a wide decompression, laminectomy can result in segmental instability and paravertebral muscle atrophy [21]. Fenestration has been developed to solve this problem of laminectomy but there is limited access and insufficient decompression in the lateral recesses and added risk for neural injury in a small working space [22, 23].

There is also need of dynamic x ray study to see for any instability. In presence of instability based on Posner's criteria, patient should be offered decompression with fusion if the stenosis is moderate to severe [1]. In particular, 3 measures are of vital importance:

(1) global sagittal balance (C7 plumb line [C7PL], C7/sacro-femoral distance ratio and spino-sacral angle), (2) spino-pelvic morphology (pelvic incidence, sacral slope, and pelvic tilt), and (3) spinal parameters (lumbar lordosis and thoracic kyphosis). Jeon et al. have found posterior migration of the C7PL and increase lumbar lordosis following decompressive laminectomy, in their evaluation of 40 patients over 2 years [24].

In one hand under-doing can lead to failed back syndrome and on the other hand over-doing leads to instability.

Therefore simple assessment of the bulk of the EDB muscle on both sides can predict the underlying canal stenosis and thereafter help make correct therapeutic decisions.

EDB being a muscle with smallest bulk in foot is clinically very sensitive for L5 radiculopathy. There are earlier reports in cases of spina bifida or tethered cord syndrome where late manifestation has led to EDB weakness [25].

However North American Spine Society (NASS) in their recommendation, have found insufficient evidence to make a recommendation for or against certain physical findings for the diagnosis of degenerative lumbar spinal stenosis including an abnormal Romberg test, thigh pain exacerbated with extension, sensorimotor deficits, leg cramps and abnormal Achilles tendon reflexes [1].

The need of comprehensive clinical evaluation of spine and neurological function before embarking on surgical management of low back ache or radiculopathy. This is becoming ever vital as incidence of failed back syndrome is on a rise, a major causative factor being incomplete clinical evaluation of patient [18].

The positive aspects of our study are the observation for the EDB wasting by the members of the spine team only so as to reduce the observation bias in the study. The limitation of the study is the learning curve in assessing the wasting of the EDB muscle.

Conclusion

Focal canal stenosis revealed isolated marked wasting of EDB in addition to EHL/DF/PF/KF weakness. Pure disc prolapsed on the contrary revealed EHL/DF/PF/KF weakness without wasting. EDB wasting is a decisive clinical indicator of significant canal stenosis as opposed to pure disc prolapsed. In the era of micro and endoscopic procedures this assumes importance for planning the type of procedure and a word of caution for the novices in the vast realms of lumbar spine procedures.

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Conflict of interest- Nil

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