DIAGNOSTIC VALUE OF PARASPINAL ELECTROMYOGRAPHY IN LUMBAR INTERVERTEBRAL DISC PROLAPSE

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Abstract: **Background and objectives**: Prolapse intervertebral disc (PIVD) is a pathological process resulting from disc or spine degeneration, leading to back pain, referred pain, radicular pain, sensory or motor symptoms or bladder involvement. Diagnosis is clinically based and the evaluation is by MRI, CT, EMG or NCS. This research work aims to study the diagnosing power of paraspinal muscles in lumbar intervertebral disc prolapse. **Methods**: Thirty clinically and radiologically confirmed cases were electromyographically evaluated in the dept. of Physiology in collaboration with dept. of Orthopaedics, Pt. B. D. S. PGIMS, Rohtak. **Results**: Four muscles screen identified 40% cases whereas five muscles screen including paraspinals increases the diagnostic value of electromyography to 70%.**Interpretation & conclusion:** Paraspinal muscles significantly increases diagnostic value of electromyography (EMG) in diagnosing lumbar prolapse intervertebral disc.

Key Words: electromyography, EMG, paraspinal muscles, PIVD, Prolapse intervertebral disc.

Abbreviations: EMG-electromyography, PIVD-prolapse intervertebral disc.

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Introduction:

Lumbar radiculopathy refers to a pathologic process involving the lumbar nerve roots causing radicular symptoms into a lower extremity. Intervertebral disc disease and disc herniation are most prominent in otherwise healthy people in the third and fourth decades of life[1,2]. It accounts for majority of cases of low backache seen by an orthopaedician in clinical practice and is major contributor of functional disability. Clinical examination is the mainstay of diagnosis, to be correlated by plain radiographs, computed tomographs, magnetic resonance imaging and invasive radiography like myelography and discography. In the last decade, non-invasive radiography such as computed tomography and magnetic resonance imaging has taken the onus of diagnosis of prolapsed intervertebral disc. Magnetic resonance imaging is considered highly sensitive and specific test for diagnosing prolapsed intervertebral disc. The diagnosis of a lumbosacral radiculopathy is clinical, and can usually be made based upon compatible symptoms and examination findings.

The sensitivities of CT and MRI are similar for compressive radiculopathies[3]. EMG and NCS have a high diagnostic accuracy for radiculopathy when neurologic weakness is present for at least three weeks[4].

Electromyography (EMG) is a technique for evaluating and recording the electrical activity produced by skeletal muscles. An electromyograph detects the electrical potentialgenerated by muscle cells when these cells are electrically or neurologically activated. The signals can be analyzed to detect medical abnormalities, activation level and recruitment order or to analyze the biomechanics of movements. It can be recorded by needle electrodes or surface electrodes. Back pain is thought to be associated with increased and/or asymmetrical activity measured by electromyography[5].

Material and Methods:

This prospective study was conducted in the Department of Physiology in collaboration with Department of Orthopaedics, PGIMS, Rohtak. The study included thirty clinically and radiologically confirmed patients, between 20 to 75 years of age of either sex with lumbar disc prolapse. Independent IEC permission is taken.

INCLUSION CRITERIA

Patients with prolapsed intervertebral discs at L4-L5 and L5-S1levels were included. Levels were confirmed by MRI and correlated with clinical findings.

EXCLUSION CRITERIA

- Patients of low back pain with causes other than prolapsed intervertebral disc like trauma, tumour, sprains, strains, infections, psychological pain, spondylolisthesis, facet joint degenerative arthropathy etc.
- Subjects suffering from comorbid conditions like diabetes mellitus, chronic renal failure, myxoedema, Vit. B_{12} deficiency anemia, myopathy and chronic alcoholism were also excluded.

A written consent was taken from each subject enrolled for the study. Detailed history, general physical examination and neurological examinations were carried out. Pain, duration, severity, radiation and sensory symptoms-paraesthesia/hyperesthesia were noted. All the clinically suspected cases underwent MRI study of LS spine and disc prolapse were evaluated as intraspongi-nuclear herniation, protrusion, extrusion and sequestration. Electromyographic study was done in Department of Physiology using an Aleron 401 model electromyography machine. Concentric needle electrode of a 24-26 gauge; bevelled tip exposed to give an oval recording area of 125×580 μm^2 was used[5].

A bilateral study of four muscles (four muscle screen) and five muscles (five muscle screen) was performed. The muscles studied were paraspinal, tibialis anterior, extensor hallucislongus, vastuslateralis and vastusmedialis muscle. Spontaneous activity in these muscles was noted. The study identified the patient of PIVD (prolapse intervertebral disc) by the presence of spontaneous activity in two or more muscles innervated by the same nerve root level but different peripheral nerves. Spontaneous activity referred only to fibrillations or positive sharp waves.

Study analysis: The data hence obtained was analysed and represented in percentage.

Result:

When four muscle screen was performed; out of the total thirty patients analysed only twelve patients tested positive for PIVD. Four muscle screen included tibialis anterior, extensor hallucislongus, vastuslateralis and vastusmedialis muscles. When five muscle screen (including paraspinal muscle in addition) was employed twenty one persons tested positive for PIVD.

Table 1: Deficit found on electromyography.

Type of Test (no. of patients screened = 30)	Number (Percentage) of patients identified by EMG
Four muscle screen (tibialis anterior, extensor hallucislongus, vastuslateralis and vastusmedialis muscle)	12 (40%)
Five muscle screen (paraspinal, tibialis anterior, extensor hallucislongus, vastuslateralis and vastusmedialis muscle)	21 (70%)

Discussion:

In the present study thirty patients were clinically, radiologically and neuroelectrophysiologically investigated for lumbar prolapse intervertebral disc. Our study group comprised of clinically and radiologically confirmed patients of lumbar PIVD. Radiologically these patients were assessed by plain radiographs and magnetic resonance imaging (MRI). Radiological studies using MRI only revealed structural abnormalities, which may also be present in asymptomatic subjects or may be unrelated to the clinical findings. Electrodiagnostically, patients were assessed by performing electromyography. Electrodiagnostic study (EDX) including EMG, assesses the physiological and functional status of peripheral nervous systems rather than anatomical and structural evaluation, and provides information which is helpful in choosing appropriate therapeutic options. EDX revealed clinically relevant nerve dysfunction in patients whose radiological findings were normal or appeared to be irrelevant to the clinical findings[6,7].

In the present study, when four muscle screen (tibialis anterior, extensor hallucislongus, vastuslateralis and vastusmedialis muscle) was done, only forty per cent patients showed deficit on electromyography i.e. had presence of spontaneous activity in two or more muscles

innervated by the same nerve root level but different peripheral nerves. But when paraspinalmuscles were included in addition to above said muscles (five muscle screen) the diagnostic value reached seventy per cent. A prospective, multicenter study conducted by Dillingham et al analysed 102 patients with lumbosacral radiculopathy. They concluded that, when paraspinal muscles were one of the screening muscles, four-muscle screens identified 88% to 97% of radiculopathies, five-muscle screens identified 94% to 98%, and six-muscle screens identified 98% to 100%. When paraspinal muscles were not part of the screen, identification rates were lower for all screens, and eight distal muscles were necessary to identify 90% of radiculopathies. If only four muscles can be tested because of limited patient tolerance, and if one group of these muscles is the paraspinals, few electrodiagnostically confirmable radiculopathies will be missed. A large retrospective study noted consistent findings, concluding that the screening of five muscles identified most electrodiagnostically confirmable radiculopathies[8,9]. Dillingham et al also concluded that six muscle screens with paraspinal muscles yielded consistently high identification rates. Studying additional muscles produced no improvements in identification[10].

Our study reflected high diagnostic value of paraspinal muscles in diagnosing lumbar intervertebral disc prolapse. Our thirty per cent patients remained undiagnosed by EMG as some radiculopathies cannot be confirmed by needle EMG. Radiculopathies that exclusively cause sensory root involvement will not produce abnormal EMG findings. If rate of denervation is balanced by reinnervation in the muscle, then spontaneous activity is less likely to occur[11,12].

Limitations of the study: Skill of the physician performing and interpreting the study is the biggest factor in obtaining accurate results. Tolerance of the patients can also become a limiting factor.

Conclusion:

As EMG reliably diagnoses patients with lumbar disc prolapse, it can be used as a cheaper and more readily available alternate diagnostic tool. EMG setup can be established in remote areas with much ease and expertise as compared to other diagnostic alternatives like MRI. Electromyography will surely help to reduce diagnostic cost significantly on poor people in a developing country like India; without compromising with treatment planning. Moreover, a well-planned muscle screen can also identify the level of disc involvement in patients of radiculopathy[13,14].

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