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Research Paper Review

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Assessment of Hip Abductor Power in Patients With Foot Drop

A simple and useful test to differentiate lumbar radiculopathy and peroneal neuropathy

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ABSTRACT

Study Design

Prospective study on a diagnostic test.

Objective

To determine the usefulness of hip abductor power assessment in the differential diagnosis of foot drop due to lumbar radiculopathy and peroneal neuropathy.

Summary Of Background Data

Foot drop arises from various neuromuscular conditions. Differential diagnosis obvious in the typical case, however, is often inconclusive. There are few reports regarding the validity of hip abductor power in the differential diagnosis of foot drop.

Methods

Sixty-one consecutive patients who presented with tibialis anterior weakness Medical Research Council grade of less than 3 were included and underwent neurological examination including the assessment of hip abductor power. Patient demographics, mechanism and pattern of foot drop, neurological findings, and the diagnoses were recorded. Final diagnoses were established on the basis of clinical information, imaging studies, and electrophysiological study in limited cases. Validity and reliability of the hip abductor power assessment in the differential diagnosis of foot drop due to lumbar radiculopathy and peroneal neuropathy were evaluated.

Results
There were 44 men and 17 women, with a mean age of 46.8 years (19-77 yr). The final diagnosis was peroneal neuropathy in 28 patients, lumbosacral plexopathy in 9 patients, lumbar radiculopathy in 21 patients, and sciatic nerve disorder in 3 patients. Concomitant hip abductor weakness was found in 85.7% of lumbar radiculopathy and 3.6% of peroneal neuropathy. The sensitivity and specificity of hip abductor power in the differential diagnosis of foot drop due to the lumbar radiculopathy and peroneal neuropathy were 85.7% and 96.4%, respectively. The positive and negative predictive values were 94.7% and 90%, respectively.

Conclusion
Assessment of hip abductor strength is a simple and useful method in the differential diagnosis of foot drop due to lumbar radiculopathy and peroneal neuropathy.

ANALYSIS

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Background Information
Diagnostic impression is at the heart of clinical practice. As technology improves, diagnostic testing such Magnetic Resonance Imaging, diagnostic ultrasound and Computed Tomography scans has become cheaper and more accurate than ever before. But let's face it, unfortunately many clinicians and therapists don't have access to these advanced tests, not to mention the controversial value of many findings gleaned from this technology. Clinically, the findings don't always correlate, which can lead to inappropriate diagnosis and patient management. Furthermore, it still costs the patient, third party payer or government money and time to perform these tests. Clinical orthopedic tests have always been at the heart of clinical practice and will continue to be important in determining our diagnostic impressions and courses of treatment.

Foot drop, or dorsiflexion weakness, is one area of clinical practice that can sometimes be misleading. This clinical sign can stem from various problems including a lumbar disc herniation, pressure on the lumbosacral plexus, or compression of the fibular (peroneal) nerve. Weakness of the hip abductors can also stem from several sources, including muscular weakness and neurological compromise. The superior gluteal nerve, which is derived from the lumbosacral trunk and the L5 root, supplies the hip abductor muscles (gluteus medius, gluteus minimus, and tensor fasciae latae). The L5 nerve root also supplies the ankle dorsiflexors. Weakness of these muscles can be produced by the lesions proximal to the division of superior gluteal nerve.

One important study that led to linking the gluteus medius to foot drop was by Conrad and Benecke (1), who reported that 81% of patients with lumbar disc herniation and L5 radiculopathy had denervation potentials (obtained via EMG study) in the gluteus medius muscle.

This study aimed to determine the diagnostic validity and reliability of assessing hip abductor power for differentiating between lumbar radiculopathy and peroneal neuropathy as a root cause of foot drop. The

authors of this study hypothesized that concomitant weakness of hip abductor power and foot drop would be associated with lumbar radiculopathy.

PERTINENT RESULTS

- Unilateral foot drop involvement was found in 85.2% of the patients (the remaining patients had bilateral involvement). The most common etiology of foot drop was peroneal neuropathy (45.9%), followed by lumbar radiculopathy (34.4%), lumbosacral plexopathy (14.8%), and sciatic nerve disorder (4.9%).
- When considering all the manual muscle tests and sensory outcome measures evaluated, statistically, hip abduction power was the only significantly different measure between the lumbar radiculopathy and peroneal neuropathy groups ($P < 0.001$).
- In the foot drop patients associated with lumbar radiculopathy (21), hip abductor weakness (MRC grade of < 3) was found in 18 patients with 3 patients showing false-negative results. Meanwhile, in the foot drop patients with peroneal neuropathy (28), hip abductor weakness (MRC grade of < 3) was found in 1 patient, while 27 patients showed true negative results.
- Therefore, the sensitivity and specificity of hip abductor power in the differential diagnosis of foot drop due to lumbar radiculopathy and peroneal neuropathy were found to be 85.7% and 96.4%, respectively. The positive and negative predictive values were found to be 94.7% and 90%, respectively.
- The interobserver reliability of the hip abductor power assessment by the 3 orthopedic surgeons had ? (kappa) values of 0.85 to 0.91, indicating excellent agreement.

CLINICAL APPLICATION & CONCLUSIONS

The foot drop patient can present with vague and atypical signs. Clinically, it can be difficult to identify the exact location of the problem or the pathological structure involved. In this study, the majority of spontaneous foot drops that were difficult to diagnose were caused by fibular (peroneal) neuropathy and lumbar radiculopathy. Concomitant hip abductor weakness was usually present in foot drop cases that were due to lumbar radiculopathy, and rarely in those from peroneal neuropathy – this is the take home message from this study.

The electrodiagnostic test is useful and commonly used in the diagnosis of both peroneal neuropathy and lumbar radiculopathy. Unfortunately, the crucial findings in these tests do not appear until 2 to 3 weeks after the initial injury. Therefore, not only do you have to wait to get booked for the test and pay money to receive the test (government funded or out of pocket), but you also have to wait at least a couple of weeks before the test can give us the results we're looking for. In the meantime, the patient could have already started the treatment process and could be well on their way to recovery. The results from this study suggest that assessment of hip abductor power is a fast, simple, and valid test in determining the etiology of the foot drop when discriminating between peroneal neuropathy and lumbar radiculopathy as differential diagnoses.

Peroneal neuropathy at the fibular head is fairly common due to the proximity of the nerve to the skin with limited protection. Direct trauma, sustained pressure and a mass around the knee joint are common mechanisms of peroneal nerve injury. Lumbar degenerative disease, including herniated

nucleus pulposus and spinal stenosis, are very common lumbar related causes of foot drop. Since peroneal neuropathy and lumbar radiculopathy are two of the most common causes of foot drop that present in clinical practice, this simple hip abductor muscle test can help expedite the diagnostic and treatment process.

STUDY METHODS

61 consecutive patients who presented with foot drop at a hospital department of orthopedic surgery were included in the study. These participants did not have a paraplegic spinal cord injury, traumatic injury around the ankle joint or non-organic origins. Foot drop due to weakness of the tibialis anterior muscle was required to have been graded at less than 3 on the Medical Research Council (MRC) scale by the manual muscle testing. In other words, the muscle activity of the Tibialis Anterior would have been anywhere between "Moves through partial ROM against gravity OR Moves through complete ROM gravity eliminated and holds against pressure" to "No palpable or observable muscle contraction". Hip abductor strength was also evaluated by the manual muscle testing on the side-lying position (hip abduction with the leg straight, clinician contact just above knee on lateral aspect of the leg while other hand stabilizes the pelvis). The power of ankle dorsiflexion, great toe dorsiflexion, and ankle plantarflexion were also examined via manual muscle testing. In addition, sensory function on the first web space on the dorsum of the foot was graded as follows: 0 (absent), 1 (impaired), or 2 (normal).

The final diagnosis for each participant was determined on the basis of clinical information, physical examination, imaging studies, and surgical findings (in cases where surgical treatment was performed). Any cases with inconclusive findings had an electrophysiological study performed to confirm the diagnosis. Neurological findings between lumbar radiculopathy and peroneal neuropathy were compared. The validity of hip abductor weakness in discriminating between the lumbar radiculopathy and peroneal neuropathy was then evaluated.

A student t test, a X^2 test, and a Mann-Whitney U test were used to compare each demographic and measured parameter. Reliability of the measurement of hip abductor power among the 3 orthopedic surgeons was evaluated using ? value. Kappa values were: moderate (0.41 ? ? < 0.60), substantial (0.60 ? ? < 0.80), and excellent (0.80 ? ? ? 1.00). Statistical analysis was carried out using SPSS software. A P value of 0.05 or less was considered significant.

STUDY STRENGTHS / WEAKNESSES

An important strength of this study was the assessment of test reliability for the assessment of hip abductor power with manual muscle testing. As mentioned above, the interobserver ? (kappa) values demonstrated excellent agreement at 0.85 to 0.91 for the assessment of hip abductor power between the 3 orthopedic surgeons.

This study did have a couple limitations we should keep in mind. First, the study population was too small to analyze the parameters within each etiology and included only severe patients with foot drop (MRC grade of < 3). Furthermore, correlations with other neurological findings, such as sensory loss or motor power of the other muscles, were not assessed. For example, the tibial nerve (L4-5 roots) innervates the tibialis posterior muscle and therefore foot inversion could also have been tested.

Additional References

1. Conrad B & Benecke R. Electromyographic examination of gluteal muscles in the differential diagnosis of lumbar herniated discs. Arch Psychiatr Nervenkr 1979; 227: 333-339.