Management of Lumbar Radiculopathy Secondary to Lumbar Intervertebral Disc Herniation

ABSTRACT

Lumbar intervertebral disc herniations (IVH) carry a high lifetime prevalence and are the most common cause of sciatica. The vast majority of symptomatic lumbar IVH improve with conservative management though adjuncts such as physiotherapy and epidural steroid injections may play a role in short-term symptom relief. For patients with unresponsive lumbar IVH, discectomy reliably improves symptoms more rapidly than continued conservative care, though there is inconsistent evidence that clinical differences between operative and conservative care are no different at one-year after symptom onset.

KEYWORDS: lumbar radiculopathy, intervertebral disc herniation; lumbar intervertebral disc herniation; lumbar disc herniation; sciatica

CME Pre-test Quiz

Introduction:

The most common cause of sciatica, better termed lumbar radiculopathy is lumbar intervertebral disc herniation (IVH).[1,2] Lumbar radiculopathy is a common condition, carrying a lifetime incidence of 13 to 40%, with an approximate annual prevalence of 2%.[1,3,4] The most classic clinical presentation of lumbar radiculopathy follows a posterior/posterolateral leg pain distribution along the sciatic nerve distribution and may be accompanied by purely sensory and/or motor and reflex changes.[4,5] Lumbar intervertebral disc herniation refers to the displacement of intervertebral disc material beyond the normal confined margins of the disc space, exposing ruptured nucleus pulposus material to the lumbar neural elements.[2] In patients with symptomatic lumbar

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disc herniations, radiculopathy occurs via contact of the nucleus pulposus with a nerve root, which incites an inflammatory cascade that may be necessary for the creation of mechanical nerve root compression to cause pain.[2]

Most commonly lumbar IVH affects males in their fourth or fifth decade, with only about half of the patients recalling any inciting event.[4] Etiologic studies have shown correlations to strenuous activity and smoking while additional research has demonstrated a genetic predisposition.[6,7] The natural history of IVH is clinically favorable for the vast majority of patients, with 70% of patients resolving most leg symptoms by six weeks.[2,3,6,8,9] The lumbar radiculopathy can be expected to improve with conservative care in 90% of patients within four months of symptom onset.[6]

Diagnosis:

Clinical Examination

Lumbar radiculopathy is diagnosed primarily on history with confirmation with the physical examination, with IVH causing 90% of these presentations.[4] History and physical examination must rule out other less common causes of lumbar radiculopathy such as tumour or lumbar stenosis. The clinical picture of lumbar radiculopathy, secondary to intervertebral disc herniation, has a history of leg dominant pain radiating down one or both legs in a dermatomal pattern that can extend above or below the knee. There is usually accompanying back pain but the pain down the leg must be more intense.

A thorough neurologic examination is important to properly assess the patient. After a complete neurologic assessment for motor and sensory function in the lower extremities, special testing to assess for IVH is indicated. A Cochrane review by van der Windt *et al*. has demonstrated that most diagnostic tests perform poorly in isolation and that the most important factor in the decision for surgery was the agreement between the clinical picture and the imaging.[4,10] The straight leg raise test has been shown to have the highest sensitivity (the ability to correctly identify the condition) for a nerve irritated by a disc herniation, with a pooled sensitivity estimate of 92%.[10] The cross leg straight leg raise also shows high specificity with a pooled estimate of 90% and a reciprocally poor sensitivity (the ability to correctly identify the absence of the condition) of 28%.[10] While little data exists on the combined effect of multiple examinations, the literature suggests better clinical performance will be obtained with the use of multiple special tests.[4,10]

Diagnostic Imaging

Diagnostic imaging in symptomatic lumbar radiculopathy secondary

to a ruptured disc is only useful if the results will influence clinical management of a patient. Given the expected favourable clinical outcome, diagnostic imaging should be reserved for patients with "red flag" symptoms (perineal numbness, urinary retention, fecal incontinence, progressive motor dysfunction), concern for other underlying etiologies (malignancy, infection, trauma) or who have not improved after six to eight weeks of conservative management and/or are considered surgical candidates.[4,11] The most appropriate study is non-contrast lumbar spine magnetic resonance imaging (MRI).[1]

When considering the imaging results, it is important to remember that a lumbar spine MRI in asymptomatic adult patients has shown a high frequency of IVH, with results ranging from 20 to 76% of patients having some degree of herniation.[1] Patients with lumbar radiculopathy and MRI-demonstrated lumbar IVH still have a strong chance of spontaneous resorption of their disc herniation.[1,12,13] A recent meta-analysis, which pooled the results of 11 cohort studies, reported that at final follow-up the rate of spontaneous resorption was 67%.[13]

Clinicians will frequently encounter patients who wish to have an updated MRI to reassess their disc. At one-year, a cohort study of 283 patients undergoing either conservative or surgical care showed a visible disc herniation in 35% of patients with a favourable clinical outcome and 33% of patients with an unfavourable clinical outcome (p=0.7). The study highlights the limitations of MRI.[13] MRI at one-year follow-up could not distinguish between patients who clinically did well or did poorly.[13]

Non-Operative Management of Lumbar Intervertebral Disc Herniations:

While the recommended treatment course for patients with symptomatic lumbar IVH remains controversial, it is universally recognized that in the absence of red flag symptoms, a trial of non-operative management is an important and appropriate first-line treatment.[6,11] Indicative of the range of opinions there are 23 published guidelines including one recently published by the North American Spine Society (NASS), "Lumbar Disc Herniation with Radiculopathy" a high-level synthesis of the best available evidence and the expert consensus opinion on topics where concrete evidence is lacking.[11] These proposals are covered in the management sections but it is worth noting that analysis of the most widely cited study on the treatment of lumbar IVH, the Spine Patient Outcomes Research Trial (SPORT), has shown that patient expectations regarding the potential for improvement with nonoperative care is the strongest predictor of treatment prefer-

ence for conservative or surgical management.[14] Managing patient expectations is an important aspect of treatment. The patient's understanding and attitude highlight the importance of patient education and realistic goal setting at the initial contact with an acute lumbar radiculopathy patient.

Pharmacological Treatment

The use of pharmacological modalities has been extensively studied. Analgesics, non-steroidal anti-inflammatory agents, muscle relaxants and short-term oral or intravenous glucocorticoid therapies have not shown clinically significant benefits when compared to placebo.[4,8,11] In a 209 patient randomized controlled trial, compared to placebo, pregabalin, a neuromodulating agent frequently prescribed for lumbar radiculopathy, did not significantly reduce the intensity of sciatica at eight weeks post treatment induction.[5] Treatment in the pregabalin patient group had higher number of adverse events, primarily dizziness and dorsalgia.[5] The NASS clinical guideline concludes there is insufficient evidence to support any pharmacologic treatment for management of lumbar IVH and calls for further level one investigations.[11] The decision to prescribe an analgesic requires the clinician to differentiate between no evidence of benefit and evidence of no benefit. In the case of sciatica from a herniated disc, only the former applies.

Physiotherapy

The merits of physiotherapy for lumbar IVH management has been investigated extensively. Hahne *et al.* report a systematic review of a total of 1671 patients from 18 studies, two of high quality.[15] Meta-analysis of the high-quality investigations demonstrated in the short term that conservative management including rest and advice was less effective than surgical microdiscectomy. At one-year, however, the results were equivalent. There was moderate evidence favouring stabilization exercises (core strengthening) over no treatment and lumbar manipulation over sham manipulation. No benefit was found for lumbar traction therapies.[15] One small single-blinded, randomized controlled trial examined the role of core strengthening exercises alone versus exercises plus spinal decompression therapy.[16] Overall, both groups demonstrated significant functional improvement throughout the duration of the study but at the six-week end point only the group which included spinal decompression had a statistically significant benifit.[16] The NASS clinical guidelines concluded there was insufficient evidence to recommend for or against physical therapy as a an isolated treatment for symptomatic lumbar IVH.[11] However, in the absence of demonstrated harm and with some evidence of benefit in mild or moderately symptomatic patients,

a limited course of physical therapy along with advice to stay as active as possible seems a viable option for interested and motivated patients.[11]

Injection Modalities

Despite the lack of evidence for the long-term effectiveness of lumbar epidural steroid injection (ESI) for symptomatic lumbar disc herniation, the past decade there has shown a marked increase in the use of ESI.[17] In a non-blinded randomized trial, 169 patients with a failed course of a minimum of six-week conservative treatment, were randomized to either a surgical discectomy or epidural steroid injection.[18] At three years 56% of patients receiving ESI reporting the treatment to be effective compared to 98% of patients in the discectomy group. Patients who did not improve following the trial of ESI who subsequently received a discectomy, had equivalent outcomes to patients initially randomized to surgery.[18] Iversen *et al.* report a blinded randomized controlled trial of 79 patients with lumbar radiculopathy not responsive to a minimum of 12 weeks of conservative care.[17] Patients were randomized to either lumbar ESI or lumbar saline (sham) epidural injection. Both groups had the same statistically significant improvement in functional outcome at six-week, three-month and one-year follow-up. ESI did not appear effective in altering the symptom improvement for chronic lumbar radiculopathy.[17] The NASS clinical guidelines cite insufficient evidence to support continued use of steroid injections for patients with lumbar radiculopathy secondary to a herniated lumbar disc.[11] Although long term benefit is questionable, there is some evidence for short-term, 2 to 4-week, symptom relief after ESI, regardless of technique (interlaminar or transforaminal) provided placement is under fluoroscopic guidance to aid accuracy.[11]

Operative Management of Lumbar Intervertebral Disc Herniations:

Studies evaluating the benefit of surgery are frequently confounded by high levels of patient crossover from conservative to operative care and, to a lesser extent, from operative to conservative treatment. Given the high likelihood for spontaneous symptom resolution in this condition that is unsurprising but it does make it difficult to interpret the data and determine the most appropriate patients for early surgery.

The consensus regarding clinical management of patients with radicular pain from a herniated lumbar disc in the absence of red flag symptoms is a diligent trial of conservative care for at least six weeks. Patients who demonstrate severe. persistent symptoms past this threshold should be considered for surgical intervention.

The landmark randomized controlled trial, the SPORT study, is the most used investigational justification for operative intervention in patients with refractory lumbar radiculopathy secondary to a lumbar IVH.[9] Five hundred and one eligible study participants with a minimum of six-weeks lumbar radiculopathy at enrolment, were randomized to receive either microdiscectomy or continued conservative care. Significantly, patients were given the option to opt out of the randomized control trial but to remain within SPORT as a prospective cohort in which patients selected their preferred treatment, operative or non-surgical. At every time-point, six-weeks, three-months, one and two-year post enrolment, all patient groups demonstrated clinical improvement.[9] During the study period 30% of the patients in the conservative arm left the randomized group and crossed over to receive surgery. This required assessing the outcomes using a less rigorous, more conservative as-treated analysis that showed a trend toward functional improvements with surgery but failed to reach statistically significant differences. A European controlled study, performed and published at a similar time as the SPORT trial, randomized 283 patients experiencing 6-12 weeks of lumbar radiculopathy secondary to herniated lumbar disc to microdiscectomy or six months continuation of conservative care.[19] In contrast to SPORT, the focus was on early versus late surgery but similarly to the SPORT trial, 62 (44%) of patients in the conservative care arm crossed over to receive surgery during the study. Compared to those had a delayed intervention, leg pain improved significantly in the surgical group at the first postoperative follow-up, however there was no difference between cohorts at six months after surgery and this persisted to the end of follow-up at 24 months.[20]

Further studies have looked at the surgical outcome of patients with long-standing lumbar radiculopathy symptoms undergoing delayed surgery.[6,21,22] A long-term follow-up using an as-treated analysis of the randomized and prospective cohort arms of the SPORT trial assessed the difference in outcomes for patients with symptom duration greater than six months at time of enrolment in the trial.[22] There were 927 patients with symptoms of six months or less compared to 265 patients with symptoms longer than six months. At all follow-up intervals, regardless of whether the patient was treated surgically or non-operatively, those with a symptom duration of greater than six months at the start of the study reported more disability and decreased function.[22] The five-year follow-up in the European sciatica trial demonstrated, on multivariate logistic

SUMMARY OF KEY POINTS

1. The natural history of lumbar intervertebral disc herniations causing lumbar radiculopathy is favourable with conservative care in the vast majority of patients.
2. Advanced imaging for patients with lumbar radiculopathy is indicated only in the setting of "red flag" neurologic symptoms or a concerning clinical history for infection, neoplastic or traumatic etiology or the absence of symptom improvement after six-weeks of conservative care.
3. Long-term follow-up demonstrates most patients with lumbar intervertebral disc herniation causing lumbar radiculopathy achieve comparable clinical improvement with surgery or conservative management, with surgery leading to earlier symptom resolution.
4. The high-quality evidence for surgery is weak given the high cross over rate but observational studies show a benefit of surgery after failed non-operative care.

regression, that 8% of patients with sciatica failed to show any long-term recovery, with at least 23% of patients, regardless of treatment type, suffering ongoing intermittent sciatica complaints.[23] They found that prolonged conservative care can reduce pain but that a significant number of patients (21%) will receive delayed surgery. Age above 40 years, severity of leg pain and a higher affective McGill pain score predicted unsatisfactory recovery.[23]

Extensive wait times for elective surgery in the Canadian health care system present a unique challenge to Canadian clinicians and their patients.[21] A Canadian cohort study examining the effects of wait time for microdiscectomy to treat radiculopathy found patients with a greater than three month wait time from consent to surgery were 70% more likely to experience increased pain six-months postoperatively.[21] A recent Canadian-led randomized control trial published in the New England Journal of Medicine examined the effect of surgery versus conservative care for persistent lumbar radiculopathy lasting four to 12 months.[6] A total of 128 patients were enrolled in the study, with 22 (34%) of patients in the conservative arm crossing over to receive surgery a median of 11 months after enrolment. The primary outcome was the effect on the intensity of the patient's leg pain. Patients undergoing microdiscectomy demonstrated a statistically significant improvement—beyond the minimum clinically important difference—in leg pain six months postoperatively compared to patients who received conservative care.[6] There is a clear benefit to

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Post-test Quiz

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surgical intervention in the chronic lumbar radiculopathy population who fail to improve with conservative care.

The patient who presents with a significant or progressive associated true motor deficit warrants an MRI and a spine surgeon consultation. Spine surgeons tend to intervene earlier in cases with a genuine motor deficit accompanying radicular pain.[6,24] In the European trial, a subgroup analysis of patients with motor deficits associated with sciatica demonstrated significantly faster motor recovery in the early surgery group.[24] However, in both the surgical and conservative care arms 81% and 80% of patients respectively recovered motor function at one-year post enrolment.[24]

Conclusion

Lumbar radiculopathy secondary to lumbar interverbal disc herniation is a common and debilitating pathology. Given the generally favourable outcome, reassurance is essential. Sciatica is extremely painful and patients are understandably frightened. They need to understand that in the large majority of cases there is significant clinical recovery within six-weeks of conservative care measures and only a small subset will fail to improve and may require surgery. The primary benefit of surgical intervention is rapid symptom relief of symptoms and at one year there is equivalent functional outcome. Identifying those few patients who require operative intervention to avoid protracted disability is a challenge. Deviation from the anticipated course of improvement merits further consideration and possible surgical referral.

CLINICAL PEARLS

1. The diagnosis is made on the patient's history including leg dominant pain and confirmed by the physical examination.

2. A combination of a detailed motor and sensory neurologic examination, including supine straight leg raise in addition to cross leg straight leg raise, increases the clinical sensitivity and specificity of a diagnostic examination for lumbar radiculopathy.

3. Analgesics should be used to manage function and not just to reduce pain, taking into account response to the specific analgesic on an individual basis including the known side effect profiles.

4. Microdiscectomy surgery for patients with refractory lumbar radiculopathy lasting greater than four months can lead to a significant reduction in leg pain compared to continued conservative management.

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