Degenerative Disc and Discogenic Pain

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Definition

Chronic low back pain is a common problem that can pose a substantial economic burden and a major cause for work absences [1]. It is estimated that about 39% of low back pain can be reasonably attributed to the intervertebral disc [2] and that disc degeneration is part of the aging process and normally begins around the age of 30. The intervertebral disc is made of the exterior annulus fibrosis, which is firm and collagenous, and the nucleus pulposus, which is gelatinous [3]. The disc itself allows for dispersion of axial and torsional forces at each spinal level, and herniation occurs more commonly in the posterior aspect as the annulus is thicker anteriorly.

The first time that the disc was described as a primary source of low back pain was in 1941 by a Swedish radiologist, Dr. Lindblom. Since that time, countless studies have looked at the etiology of the disease as well as the efficacy of treatment options. There are three main causes of discogenic pain: (1) torsional injury, (2) disc infection, and (3) internal disc disruption (IDD) [1]. Torsional injury occurs from rotational forces around the zygapophysial joint leading to tears that occur circumferentially. A second cause of discogenic pain is from discitis, which can arise from bacteremia or hematologic spread of other infection such as tuberculosis. IDD is the development of radial fissures from the nucleus pulposus into the annulus fibrosis and is the most common cause for discogenic pain. It has been shown that discs with radial fissures have been shown to have pain-associated and inflammatory mediators, including TNF-alpha, substance P, and interleukins 1 and 6 [4]. The cause of pain is thought to be attributed to both the inflammation as well as the disruption of the disc itself.

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Diagnosis

Patient history typically includes dull, achy centrally located low back pain with or without radiation to the buttocks. The pain is often worse with sitting or driving and improves with standing or lying flat. Some patients may describe an injury from bending or lifting; however, many have no inciting event. The patient may also endorse a smoking history, a job with prolonged sitting, or a highly physical job with repetitive lifting and twisting of the lumbar spine. On physical examination there may be decreased range of motion in flexion. If the pain is solely attributed to the disc, then strength, sensation, and reflexes are usually normal. Maneuvers that increase intradiscal pressures such as Valsalva or coughing may also exacerbate pain. Repeated movement testing [5], as described by McKenzie, if it results in the centralization or progressive retreat of referred pain to the midline spine is thought to be highly suggestive of discogenic pain. Classically, standing extension relieves discogenic pain while forward flexion often reproduces symptoms. However, in some patients transitioning from the flexed to neutral position may be most painful [6]. Pain relief can also be seen in the reclining and supine position as it offloads the disc.

Differential Diagnosis

- Lumbar muscle strain/sprain
- Lumbar facet arthropathy
- Lumbar vertebral fracture
- Lumbar radiculopathy

Physical Exam

- Inspection looking for swelling, erythema, rash, scoliosis, kyphosis, or other boney abnormalities.
- Range of motion is intact; however, classically, there is pain with forward flexion and improvement of symptoms

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with extension. Patient may be noted to have pain with side and lateral movements along with pain with transitions. Pain is often improved with reclining or supine positions.
- Oblique extension of the lumbar spine can elicit pain.
- Palpation along the spine and adjacent musculature including paraspinals will generally not be painful in an isolated discogenic pain source.
- Manual muscle strength testing should be intact.
- All sensory modalities should be intact.
- Reflexes should be normal.
- Provocative maneuvers such as straight leg raise and seated slump should be negative in a strictly disc-related etiology.

Imaging

- Plain radiographs may initially be used for screening and can help identify fractures or bony disease; however, they are neither sensitive nor specific for discogenic pain [1].
- MRI can be ordered to help identify disc degeneration and annular tears. Tears may be seen on T2 imaging and appear as high signal of the posterior disc, also known as a high-intensity zone [7].
  - It is important to note, however, that the presence of a high-intensity zone does not correlate with pain.
- Discography has been used since the 1950s to diagnose discogenic low back pain but not without controversy. The test involves the injecting of contrast fluoroscopically into the nucleus and assessing for provoked pain, disc pressure, volume of injected contrast, and disc morphology.
  - Historically, a positive test would have reproduction of symptoms, and a negative test would have no pain or discordant pain. Typically, control discs were also assessed for better accuracy.
  - Criticism of discography started to arise secondary to a high false-positive rate leading to inappropriate surgeries, increased risk of lateral disc herniation, and increased rate of disc degeneration [8].

Conservative Treatment

- Treatment should start with non-pharmacological strategies including physical therapy with a focus on extension-based exercises as well as truncal strengthening [9].
- Acupuncture has been shown to have some benefit in pain reduction [10].
- Osteopathic and chiropractic manipulation has been difficult to study because of the range of techniques and thus showed conflicting evidence of efficacy [11].
- Cognitive behavior therapy benefits are short term and minimal [12].
- First-line pharmacologic agent for back pain is acetaminophen because of its safety profile and efficacy [13].
- Muscle relaxants may be used to treat secondary muscle spasm.
- Tramadol has shown efficacy in low back pain and may be used to further NSAID dose reduction [14].
- Corticosteroids are often used in short course with tapering dosages; however, the data remains unclear on its efficacy [15].
- Opioids are discouraged as they may lead to dependence and tolerance, and studies have shown no significant reduction in pain or improvement in quality of life when utilized for discogenic back pain [16].

Interventional Treatment

- Lumbar epidural steroid injections have been utilized with the intention to decrease inflammatory mediators in the outer annulus [4]. However, studies evaluating the usefulness of epidural injections are not specific to discogenic lower back pain [17, 18].
- Intradiscal electrothermal annuloplasty (IDET) uses a fluoroscopic-guided catheter with a heating coil inserted into the annulus with the proposed effect of nociceptor destruction and collagen denaturation resulting in disc shrinkage and stabilization. Initial studies were promising; however, recent studies have not shown sufficient evidence supporting its use for discogenic back pain [19, 20].
- Radiofrequency ablation (RFA) is precise heat denervation through catheter introduction into the posterolateral annulus. There are few randomized controlled studies specifically targeting RFA for discogenic back pain, so the efficacy of RFA remains unclear [21].
- Percutaneous endoscopic laser discectomy (PELD) aims to ablate the nucleus pulposus with laser energy resulting in reduced intradiscal pressure and irreversible matrix changes with volume reduction. There are no large randomized controlled studies evaluating PELD, and thus its efficacy remains unclear [22].
- Cryoablation is the use of cooling energy causing tissue necrosis limited to the cellular more vascular marrow in the subchondral bone, thus avoiding changes to the collagen matrix. New literature is limited; however, pain relief has been shown to last weeks to months depending on nerve regeneration [23].

Surgical Treatment

- Surgical intervention may be indicated after the failure of conservative and interventional treatment options.
- Generally speaking surgical options are spinal fusions.

- Different types include (1) posterolateral (instrumented or noninstrumented), (2) anterior lumbar interbody, (3) posterior lumbar interbody, and (4) transarticular facet joint screws [24].

Referral

- Physiatry
- Pain management
- Orthopedics/neurosurgery
- Referral should be done after failed trial of conservative treatment

References

1. Pai S, Sundaram LJ. Low back pain: an economic assessment in the United States. Orthop Clin N Am. 2004;35:1–5.
2. Zhang YG, Guo TM, Guo X, Wu SX. Clinical diagnosis for discogenic low back pain. Int J Biol Sci. 2009;5:647–58.
3. Simon J, McAuliffe M, Shamim F, Vuong N, Tahaei A. Discogenic low back pain. Phys Med Rehabil Clin N Am. 2014;25:305–17.
4. Kepler CK, Ponnappan RK, Tannoury CA, Risbud MV, Anderson DG. The molecular basis of intervertebral disc degeneration. Spine. 2013;13:318–30.
5. Donelson R, Aprill C, Medcalf R, Grant W. A prospective study of centralization of lumbar and referred pain. A predictor of symptomatic disc and anular competence. Spine (Phila Pa 1976). 1997;22:1115–22.
6. Laslett M, Aprill C, McDonald B, Oberg B. Clinical predictors of lumbar provocation discography: a study of clinical predictors of lumbar provocation discography. Eur. Spine J. 2006;15:1473–84.
7. Aprill C, Bogduk N. High-intensity zone: a diagnostic sign of painful lumbar disc on magnetic resonance imaging. Br J Radiol. 1992;65:361–9.
8. Carragee EJ, Don AS, Hurwitz EL, Cuellar JM, Carrino JA, Herzog R. ISSLS Prize Winner: does discography cause accelerated progression of degeneration changes in the lumbar disc: a ten-year matched cohort study. Spine. 2009;34(21):2338–45.
9. Adams MA, May S, Freeman BJ, Morrison HP, Dolan P. Effects of backwards bending on lumbar intervertebral discs. Relevance to physical therapy treatments for low back pain. Spine. 2000;25:431–8.
10. Furlan AD, van Tulder M, Cherkin D, Tsukayama H, Lao L, Koes B, et al. Acupuncture and dry-needling for low back pain: an updated systematic review within the framework of the Cochrane collaboration. Spine. 2005;30:944–63.
11. Zylbergold RS, Piper MC. Lumbar disc disease: comparative analysis of physical therapy treatments. Arch Phys Med Rehabil. 1981;62:176–9.
12. Ostelo RW, van Tulder M, Vlaeyan JW, Linton SJ, Morley SJ, Assendelft WJ. Behavioural treatment for chronic low-back pain. Cochrane Database Syst Rev. 2005;1:CD002014.
13. Chou R. Pharmacological management of low back pain. Drugs. 2010;70:387–402.
14. Schnitzer TJ, Kamin M, Olson WH. Tramadol allows reduction of naproxen does among patients with naproxen-responsive osteoarthritis pain: a randomized, double-blind, placebo controlled study. Arthritis Rheum. 1999;42:1370–7.
15. Friedman BW, Holden L, Esses D, Bijur PE, Choi HK, Solorzano C, et al. Parenteral corticosteroids for emergency department patients with non-radicular low back pain. J Emerg Med. 2006;31:365–70.
16. Alford DP. Chronic back pain with possible prescription opioid misuse. JAMA. 2013;309:919–25.
17. Manchikanti L, Falco FJ, Pampati V, Cash KA, Benyamin RM, Hirsch JA. Cost utility analysis of caudal epidural injections in the treatment of lumbar disc herniation, axial or discogenic low back pain, central spinal stenosis, and post lumbar surgery syndrome. Pain Physician. 2013;16:E129–43.
18. Benyamin RM, Manchikanti L, Parr AT, Diwan S, Singh V, Falco FJ, et al. The effectiveness of lumbar interlaminar epidural injections in managing chronic low back and lower extremity pain. Pain Physician. 2012;15:E363–404.
19. Pauza KJ, Howell S, Dreyfuss P, Peloza JH, Dawson K, Bogduk N. A randomized, placebo-controlled trial of intradiscal electothermal therapy for the treatment of discogenic low back pain. Spine. 2004;4:27–35.
20. Freeman BJ. IDET a critical appraisal of the evidence. Eur Spine J. 2006;15:S448–57.
21. Leggett LE, Soril LJ, Lorenzetti DL. Radiofrequency ablation for chronic low back pain: a systematic review of randomized controlled trials. Pain Res Manag. 2014;19(5):e146–53.
22. Greenberg M. Handbook of neurosurgery. New York: Thieme; 2010.
23. Singh K, Ledet E, Carl A. Intradiscal therapy: a review of current treatment modalities. Spine. 2005;30(17):20–6.
24. Nachemson A, Zdeblick TA, O'Brien JP. Lumbar disc disease with discogenic pain. What surgical treatment is most effective? Spine. 1996;21(15):1835–8.