Herniated lumbar disc

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QUESTIONS

INTERVENTIONS

Likely to be beneficial

Unknown effectiveness

Unlikely to be beneficial

Covered elsewhere in *Clinical Evidence*

Non-specific acute low back pain (see low back pain (acute), p 000) and chronic low back pain (see low back pain (chronic), p 000).

See glossary, p 10

Key Messages

- **Microdiscectomy (as effective as standard discectomy)** We found no RCTs comparing microdiscectomy and conservative treatment. Three RCTs found no significant difference in clinical outcomes between microdiscectomy and standard discectomy. One RCT found no significant difference in satisfaction or pain between video-assisted arthroscopic microdiscectomy and standard discectomy at about 30 months, although postoperative recovery was slower with standard discectomy. We found conflicting evidence on the effects of automated percutaneous discectomy compared with microdiscectomy.
- **Spinal manipulation** One RCT in people with sciatica caused by disc herniation found that after 2 weeks, spinal manipulation increased perceived improvement compared with placebo. A second RCT found no significant difference in improvement between spinal manipulation, manual traction, exercise, and corsets after 1 month. A third RCT found that spinal manipulation significantly increased the proportion of people with improved symptoms compared with traction.
- **Standard discectomy** One RCT found that standard discectomy increased self reported improvement at 1 year, but not at 4 and 10 years, compared with conservative treatment (physiotherapy). Three RCTs found no significant differences in clinical outcomes between standard discectomy and microdiscectomy. Adverse effects were similar with both procedures.

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- **Advice to stay active** One systematic review of conservative treatments found no RCTs on advice to stay active.
- **Automated percutaneous discectomy** We found no RCTs comparing automated percutaneous discectomy versus either conservative treatment or standard discectomy. We found conflicting evidence on the clinical effects of automated percutaneous discectomy compared with microdiscectomy.
- **Bed rest** One systematic review of conservative treatment found no RCTs on bed rest in people with symptomatic herniated discs.
- **Epidural corticosteroid injections** One systematic review found limited evidence that epidural steroid injections increased global improvement compared with placebo. However, one subsequent RCT found no significant difference between epidural steroid injections plus conservative treatment compared with conservative treatment alone in pain, mobility, or return to work at 6 months.
- **Heat or ice** One systematic review identified no RCTs of heat or ice for sciatica caused by lumbar disc herniation.
- **Massage** One systematic review identified no RCTs of massage in symptomatic lumbar disc herniation.
- **Non-steroidal anti-inflammatory drugs** One systematic review found no significant difference in overall improvement between non-steroidal anti-inflammatory drugs and placebo in people with sciatica caused by disc herniation.
- **Analgesics; antidepressants; laser discectomy; muscle relaxants** We found no systematic review or RCTs on these interventions for treatment of symptomatic herniated lumbar disc.

DEFINITION Herniated lumbar disc is a displacement of disc material (nucleus pulposus or annulus fibrosis) beyond the intervertebral disc space.[1] The diagnosis can be confirmed by radiological examination; however, magnetic resonance imaging findings of herniated disc are not always accompanied by clinical symptoms.[2,3] This review covers treatment of people who have clinical symptoms relating to confirmed or suspected disc herniation. It does not include treatment of people with spinal cord compression or people with cauda equina syndrome (see glossary, p 10), which often requires emergency intervention. The management of non-specific acute low back pain (see low back pain (acute), p 000) and chronic low back pain (see low back pain (chronic), p 000) are covered elsewhere.

INCIDENCE/ PREVALENCE The prevalence of symptomatic herniated lumbar disc is around 1–3% in Finland and Italy, depending on age and sex.[4] The highest prevalence is among people aged 30–50 years,[5] with a male : female ratio of 2 : 1.[6] In people aged between 25 and 55 years, about 95% of herniated discs occur at the L4–L5 level; in people over 55 years of age, disc herniation is more common above the L4–L5 level.[7,8]

AETIOLOGY/ RISK FACTORS Radiographical evidence of disc herniation does not reliably predict low back pain in the future or correlate with symptoms; 19–27% of people without symptoms have disc herniation on imaging.[2,9] Risk factors for disc herniation include smoking (OR 1.7, 95% CI 1.0 to 2.5), weight bearing sports, and certain work activities such as repeated lifting (lifting objects < 11.3 kg, < 25 times daily while twisting body, knees not bent, OR 7.2, 95% CI 2.0 to 25.8; lifting

objects < 11.3 kg, < 25 times daily while twisting body, knees bent, OR 1.9, 95% CI 0.8 to 4.8). Driving motor vehicles is also associated with increased risk (OR 1.7, 95% CI 0.2 to 2.7, depending on the vehicle model).[6,10,11] This may be because the resonant frequency of the spine is similar to that of certain vehicles.

PROGNOSIS The natural history of disc herniation is difficult to determine because most people take some form of treatment for their back pain, and a formal diagnosis is not always made.[6] Clinical improvement is usual in most people, and only about 10% of people still have sufficient pain after 6 weeks to consider surgery. Sequential magnetic resonance images have shown that the herniated portion of the disc tends to regress over time, with partial to complete resolution after 6 months in two thirds of people.[12]

AIMS To relieve pain; increase mobility and function; and improve quality of life.

OUTCOMES **Primary outcomes:** pain, function, or mobility; individuals' perceived overall improvement; quality of life; and adverse effects of treatment. **Secondary outcomes:** return to work; use of analgesia; and duration of hospitalisation.

METHODS *Clinical Evidence* search and appraisal December 2002. The authors searched AMED and PEDro in January 2003.

QUESTION What are the effects of oral drug treatments?

OPTION NON-STEROIDAL ANTI-INFLAMMATORY DRUGS

One systematic review found no significant difference in overall improvement between non-steroidal anti-inflammatory drugs and placebo in people with sciatica caused by disc herniation.

Benefits: **Versus placebo:** We found one systematic review of medical treatments for sciatica caused by disc herniation (search date 1998, 3 RCTs, 321 people).[13] The RCTs compared non-steroidal anti-inflammatory drugs (NSAIDs) (piroxicam 40 mg daily for 2 days or 20 mg daily for 12 days; indometacin [indomethacin] 75–100 mg 3 times daily; phenylbutazone 1200 mg daily for 3 days or 600 mg daily for 2 days) versus placebo. The review found no significant difference between NSAIDs and placebo in global improvement at 5–30 days (pooled AR for improvement in pain 80/172 [46.5%] *v* 57/149 [38.3%]; OR for global improvement 0.99, 95% CI 0.6 to 1.7; see comment below).

Harms: The systematic review did not report the adverse effects of NSAIDs. NSAIDs may cause gastrointestinal complications (see NSAIDs topic, p 000).

Comment: The absolute numbers in the RCTs relate to the outcomes of improvement in pain (3 RCTs) and return to work (1 RCT).[13] However, the meta-analysis used the outcome measure of global improvement. The relationship between these measures is unclear.

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OPTION ANALGESICS

We found no systematic review or RCTs of analgesics to treat symptomatic herniated lumbar disc.

Benefits: We found no systematic review or RCTs.

Harms: We found no systematic review or RCTs.

Comment: None.

OPTION ANTIDEPRESSANTS

We found no systematic review or RCTs of antidepressants to treat symptomatic herniated lumbar disc.

Benefits: We found no systematic review or RCTs.

Harms: We found no systematic review or RCTs.

Comment: None.

OPTION MUSCLE RELAXANTS

We found no systematic review or RCTs of muscle relaxants to treat herniated lumbar disc.

Benefits: We found no systematic review or RCTs that assessed the effectiveness of muscle relaxants in people with herniated lumbar disc.

Harms: We found no systematic review or RCTs.

Comment: None.

OPTION EPIDURAL CORTICOSTEROID INJECTIONS

One systematic review found limited evidence that epidural steroid injections increased global improvement compared with placebo. One subsequent RCT found no significant difference between epidural steroid injections plus conservative treatment compared with conservative treatment alone in pain, mobility, or return to work at 6 months.

Benefits: We found one systematic review of medical treatments for sciatica caused by disc herniation (search date 1998, 4 RCTs of epidural steroids, 265 people)[13] and one subsequent RCT.[14] The review compared four different doses of epidural steroid injections (8 mL methylprednisolone 80 mg, 2 mL methylprednisolone 80 mg, 10 mL methylprednisolone 80 mg , and 2 mL methylprednisolone acetate 80 mg) versus placebo (saline or lidocaine [lignocaine] 2 mL) after follow up periods of 2, 21, and 30 days.[13] The review found limited evidence that epidural steroids increased participant perceived global improvement (which was not defined) compared with placebo. The result was of borderline significance (73/160 [45.6%] with steroid *v* 56/172 [32.5%] with placebo; OR 2.2, 95% CI 1.0 to 4.7). The subsequent RCT (36 people with disc herniation confirmed by magnetic resonance imaging) compared epidural steroids (3 injections of methylprednisolone 100 mg in 10 mL bupivacaine 0.25% during the first 14 days of hospitalisation) plus

conservative non-operative treatment versus conservative treatment alone.[14] Conservative treatment involved initial bed rest and analgesia followed by graded rehabilitation (hydrotherapy, electroanalgesia, postural exercise classes) followed by physiotherapy. It found no significant difference in mean pain scores at 6 weeks and 6 months measured on a visual analogue scale (at 6 months, 32.9 [range 0–85] with steroids *v* 39.2 [range 0–100] with conservative treatment). There were no significant differences in mean mobility scores (Hannover Functional Ability Questionnaire: 61.8 [range 25–88] with steroids *v* 57.2 [range 13–100]), in the number of people who had back surgery (2/17 [12%] with steroids *v* 4/19 [21%]; RR 0.56, 95% CI 0.09 to 2.17), or in people returning to work within 6 months (15/17 [88%] with steroids *v* 14/19 [74%]; RR 1.19, 95% CI 0.75 to 1.33).

Harms: No serious adverse effects were reported in the RCTs included in the systematic review, although 26 people complained of transient headache or transient increase in sciatic pain.[13] The subsequent RCT did not report adverse effects of epidural injections.[14]

Comment: None.

QUESTION What are the effects of non-drug treatments?

OPTION BED REST

One systematic review of conservative treatment found no RCTs of bed rest for symptomatic herniated discs.

Benefits: We found one systematic review (search date 1998) of conservative treatments for sciatica caused by disc herniation, which identified no RCTs of bed rest for treatment of symptomatic herniated discs.[13] We found no subsequent RCTs.

Harms: We found no systematic review or RCTs.

Comment: None.

OPTION ADVICE TO STAY ACTIVE

One systematic review of conservative treatments for sciatica caused by lumbar disc herniation found no RCTs of advice to stay active.

Benefits: We found one systematic review (search date 1998) of conservative treatments for sciatica caused by disc herniation, which found no RCTs of advice to stay active.[13] We found no subsequent RCTs.

Harms: We found no RCTs.

Comment: None.

OPTION MASSAGE

One systematic review identified no RCTs of massage in people with symptomatic lumbar disc herniation.

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Benefits: We found one systematic review (search date 1998) of conservative treatments for sciatica caused by disc herniation, which found no RCTs of massage.[13] We found no subsequent RCTs.

Harms: We found no systematic review or RCTs.

Comment: None.

OPTION HEAT AND ICE

One systematic review identified no RCTs of heat or ice for sciatica caused by lumbar disc herniation.

Benefits: We found one systematic review (search date 1998) of conservative treatments for sciatica caused by disc herniation, which identified no RCTs on the use of heat or ice for herniated lumbar discs.[13] We found no subsequent RCTs.

Harms: We found no systematic review or RCTs.

Comment: None.

OPTION SPINAL MANIPULATION

One RCT in people with sciatica caused by disc herniation found that after 2 weeks, spinal manipulation increased perceived improvement compared with a placebo of infrequent infrared heat. A second RCT found no significant difference in improvement between spinal manipulation, manual traction, exercise, and corsets after 1 month. A third RCT found that spinal manipulation significantly increased the proportion of people with improved symptoms compared with traction.

Benefits: We found two systematic reviews[13,15] and one subsequent RCT.[16] The first systematic review (search date 1998), which did not perform meta-analysis, identified two RCTs of spinal manipulation for sciatica caused by disc herniation.[13] The second systematic review (search date not stated) identified no RCTs.[15] The first RCT (207 people) included in the review compared spinal manipulation (every day if necessary) versus placebo (infrared heat 3 times weekly).[13] It found that spinal manipulation increased overall self-perceived improvement at 2 weeks compared with placebo (98/123 [80%] *v* 56/84 [67%]; RR 1.19, 95% CI 1.01 to 1.32; NNT 8, 95% CI 5 to 109).[13] The second included RCT (322 people) compared four interventions: spinal manipulation, manual traction, exercise, and corsets, in a factorial design.[13] It found no significant difference among treatments in overall self-perceived improvement after 28 days (quantified results not available). The subsequent RCT (112 people with symptomatic herniated lumbar disc) compared pulling and turning manipulation versus traction.[16] It found that significantly more people were "improved" (absence of lumbar pain, improvement in lumbar functional movement) or "cured" (absence of lumbar pain, straight leg raising of > 70°, ability to return to work) with spinal manipulation compared with traction (54/62 [87.1%] with manipulation *v* 33/50 [66%] with traction; RR 1.32, 95% CI 1.06 to 1.65; NNT 5, 95% CI 4 to 16; timescale not stated).

Harms: The first systematic review did not report adverse effects.[13] The second systematic review identified one review of 135 case reports of serious complications after spinal manipulation published between 1950 and 1980.[15] The case review attributed these complications to cervical manipulation, misdiagnosis, presence of coagulation dyscrasias, presence of herniated nucleus pulposus, or improper techniques. The subsequent RCT found that two out of 60 people receiving traction had syncope; no adverse effects were reported in people receiving manipulation.[16] We found a third systematic review (search date 2001, 5 prospective observational studies).[17] The largest study included in the review (4712 treatments in 1058 people undergoing both cervical and lumbar spinal manipulations) found that the most common reaction was local discomfort (53%), followed by headache (12%); tiredness (11%); radiating discomfort (10%); dizziness (5%); nausea (4%); hot skin (2%); and other complaints (2%). The incidence of serious adverse effects is reported as rare, and is estimated from published case series and reports to occur in one in 1–2 million treatments. The most common of these serious effects were cerebrovascular accidents (the total number of people undergoing manipulations was not reported and the rate of this adverse effect cannot be estimated). However, it is difficult to assess whether such events are directly related to treatment

Comment: In the third review, which examined risks, the percentages include both cervical and lumbar spinal manipulations, which may overestimate the effect of lumbar spinal manipulations.[17] The authors of the review advise caution in interpreting these results, as they are speculative and based on assumptions about the numbers of manipulations performed and unreported cases. More reliable data are needed on the incidence of specific risks.

QUESTION What are the effects of surgery?

OPTION STANDARD DISCECTOMY

One RCT found that standard discectomy increased self reported improvement at 1 year, but not at 4 and 10 years, compared with conservative treatment (physiotherapy). Three RCTs found no significant differences in clinical outcomes between standard discectomy and microdiscectomy. Adverse effects were similar with both procedures.

Benefits: **Versus conservative treatment:** Two systematic reviews (search dates 1997[18] and not stated[19]) included the same RCT (126 people with symptomatic L5/S1 disc herniation), which compared standard discectomy (see glossary, p 10) versus conservative treatment (6 weeks of physiotherapy).[20] Each participant assessed and graded their improvement in terms of pain and function into four categories: "good" (completely satisfied), "fair", "poor", and "bad" (completely incapacitated for work because of pain). The RCT found that discectomy significantly increased the number of people reporting their improvement as "good" after 1 year compared with conservative treatment (intention to treat analysis: 39/60 [65%] with surgery *v* 24/66 [36.4%] with conservative treatment;

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RR 1.79, 95% CI 1.30 to 2.18; NNT 3, 95% CI 2 to 9). However, at 4 and 10 years, there was no significant difference in the same outcome (at 4 years, AR for "good" improvement: 40/60 [66.7%] with surgery *v* 34/66 [51.5%] with conservative treatment; RR 1.29, 95% CI 0.96 to 1.56; at 10 years: 35/60 [58.3%] *v* 37/66 [56.1%]; RR 1.04, 95% CI 0.73 to 1.32). **Versus microdiscectomy:** One systematic review (search date 1997) identified three RCTs (219 people) comparing standard discectomy versus microdiscectomy (see glossary, p 10).[18] Meta-analysis was not performed because outcomes were not comparable. The first RCT in the review (60 people with lumbar disc herniation) found no significant difference between standard discectomy and microdiscectomy in the number of people who rated their operative outcome as "good", "almost recovered", or "totally recovered" at 1 year (intention to treat analysis: 26/30 [87%] with standard discectomy *v* 24/30 [80%] with microdiscectomy; RR 1.08, 95% CI 0.78 to 1.20).[21] There was also no difference between treatments in the change in preoperative and postoperative pain scores (visual analogue scale; P value not provided) or in the duration of time taken to return to work (both 10 weeks). The second RCT in the review (79 people with lumbar disc herniation) also found no significant differences between microdiscectomy and standard discectomy in pain in the legs or back (visual analogue scale, not specified) or in analgesia use at any point during the 6 week follow up (absolute numbers not provided).[22] The third RCT (80 people; in French) also found that clinical outcomes and duration of sick leave were similar at 15 months, but the review did not provide further details.[18]

Harms:

Versus conservative treatment: The RCT included in both systematic reviews did not report the complications of standard discectomy.[20] **Versus microdiscectomy:** One systematic review reported that there was no significant difference between standard discectomy and microdiscectomy in perioperative bleeding, duration of stay, or scar tissue (numbers not provided).[18] The first RCT included in the review reported one person in each group with a nerve root tear and, of the people undergoing microdiscectomy, one had a dural leak and one had suspected discitis.[21] The second RCT included in the review did not report on the complications of either procedure.[22] Complication rates were reported inconsistently in studies, making it difficult to combine results to produce overall rates. Rates of complications for all types of discectomy have been compiled (see table 1, p 12).[19]

Comment:

The RCT of standard discectomy versus conservative treatment had considerable crossover between the two treatment groups. Of 66 people randomised to receive conservative treatment, 17 received surgery; of 60 people randomised to receive surgery, one refused the operation.[20] The results presented above are based on an intention to treat analysis. One systematic review (search date not stated) of published reports found 99 cases of vascular complications following lumbar disc surgery since 1965.[23] Reported risk factors for vascular complications included: previous disc or abdominal surgery leaving adhesions; chronic disc pathology from disruption or degeneration of anterior annulus fibrosus and anterior longitudinal ligament or peridiscal fibrosis; improper positioning of

the patient; retroperitoneal vessels and operated disc in close proximity; and vertebral anomalies, such as hypertrophic spurs compressing vessels during operation. The systematic review did not state out of how many operations the 99 complications arose from, therefore we can not estimate the incidence of adverse vascular events from discectomy.[23]

OPTION MICRODISCECTOMY

We found no RCTs comparing microdiscectomy and conservative treatment. Three RCTs found no significant difference in clinical outcomes between microdiscectomy and standard discectomy. One RCT found no significant difference in self reported satisfaction or pain score between video-assisted arthroscopic microdiscectomy and standard discectomy after about 30 months, although postoperative recovery was slower with standard discectomy. We found conflicting evidence on the effects of automated percutaneous discectomy compared with microdiscectomy.

Benefits: We found no systematic review. **Versus conservative treatment:** We found no RCTs. **Versus standard discectomy:** See glossary, p 10. See benefits of standard discectomy, p 6. **Video-assisted arthroscopic microdiscectomy versus standard discectomy:** We found one RCT (60 people with proven lumbar disc herniation and associated radiculopathy after failed conservative treatment).[24] It found no significant difference between video-assisted arthroscopic discectomy and standard discectomy in the number of people who were "very satisfied" on a 4 point satisfaction scale after about 31 months (22/30 [73%] with microdiscectomy [see glossary, p 10] *v* 20/30 [67%] with standard discectomy; RR 1.10, 95% CI 0.71 to 1.34). There was also no significant difference in mean pain score (visual analogue scale from 0 [no pain] to 10 [severe and incapacitating pain]: 1.9 with standard discectomy *v* 1.2 with microdiscectomy). However, the mean duration of postoperative recovery was almost twice as long with open surgery as with microdiscectomy (49 days *v* 27 days; P value not stated). **Versus automated percutaneous discectomy:** See glossary, p 10. See benefits of automated percutaneous discectomy, p 9.

Harms: **Video-assisted arthroscopic microdiscectomy versus open discectomy:** The RCT reported that one person undergoing open discectomy had leakage of spinal fluid from the dural sac 2 weeks after the operation.[24] No other postoperative complications or neurovascular injuries were observed in either the standard discectomy or the microdiscectomy groups. Complication rates were reported inconsistently in studies, making it difficult to combine results to produce overall rates. Rates of complications for all types of discectomy have been compiled (see table 1, p 12).[19]

Comment: None.

OPTION AUTOMATED PERCUTANEOUS DISCECTOMY

We found no RCTs comparing automated percutaneous discectomy with either conservative treatment or standard discectomy. We found conflicting evidence on the clinical effects of automated percutaneous discectomy compared with microdiscectomy.

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Benefits: **Versus conservative treatment:** We found no systematic review or RCTs. **Versus standard discectomy:** One systematic review (search date not stated) identified no RCTs comparing automated percutaneous discectomy (APD) (see glossary, p 10) versus standard discectomy (see glossary, p 10).[19] **Versus microdiscectomy:** One systematic review (search date 1997) identified two RCTs that were not directly comparable because there were differences in the equipment used.[18] One RCT (71 people with radiographical confirmation of disc herniation) was stopped prematurely, after an interim analysis at 6 months found that APD was associated with significantly lower success rate than microdiscectomy (see glossary, p 10) (overall outcome was classified as "success" or "failure" by the clinician and a masked observer [details not stated]: 9/31 [29%] with APD *v* 32/40 [80%] with microdisectomy; $P < 0.001$; CI not provided).[25] However, the other RCT (40 people with radiographical confirmation of disc herniation) reported similar improvements in the composite clinical score with APD versus microdiscectomy (scale 0–10, including back and leg pain, and sensory and motor deficit) at 2 years (preoperative scores: 4.55 with APD *v* 4.2 in microdiscectomy group; scores at 2 years: 8.23 with APD *v* 7.67 with microdiscectomy).[26] More people in the APD group rated their surgical outcomes as "excellent" or "good" than did those in the microdiscectomy group 2 years after surgery (14/20 [70%] with APD *v* 11/20 [55%] with microdiscectomy; $P = 0.33$).

Harms: The systematic review found that reoperations for recurrent or persistent disc herniations at the same level as the initial operations were reported more frequently with APD compared with either microdiscectomy or standard discectomy (APD 83%, 95% CI 76% to 88% *v* microdiscectomy 64%, 95% CI 48% to 78% *v* standard discectomy 49%, 95% CI 38% to 60%).[19] The first RCT did not report adverse effects.[25] The second RCT reported that no complications had occurred with APD, but did not comment on whether there had been any complications in the microdiscectomy group.[26] The mean duration of postoperative recovery was longer in people who had microdiscectomy compared with those who underwent APD (mean weeks of postoperative recovery [range]: 22.9 weeks [4 weeks to 1 year] for the microdiscectomy group *v* 7.7 weeks [1–26 weeks] for APD). Complication rates were reported inconsistently in studies, making it difficult to combine results to produce overall rates. Rates of complications for all types of discectomy have been compiled (see table 1, p 12).[19]

Comment: None.

OPTION LASER DISCECTOMY

Systematic reviews found no RCTs on the effects of laser discectomy on disc herniations.

Benefits: Three systematic reviews (search dates 1997,[18] not stated,[19] and 2000[27]) found no RCTs on the effectiveness of laser discectomy.

Harms: We found no RCTs.

Comment: None.

GLOSSARY

Automated percutaneous discectomy Techniques using minimal skin incisions (generally several, all less than 3–5 mm) to allow small instruments to be inserted, using radiography to visualise these instruments, and using extensions for the surgeon to reach the operative site without having to dissect tissues.
Cauda equina A collection of spinal roots descending from the lower part of the spinal cord, which occupy the vertebral canal below the spinal cord.
Cauda equina syndrome Compression of the cauda equina causing symptoms, including changes in perineal sensation (saddle anaesthesia), and loss of sphincter control.
Laser discectomy The surgeon places a laser through a delivery device that has been directed under radiographic control to the disc, and removes the disc material using the laser. It uses many of the same techniques used in automated percutaneous discectomy.
Microdiscectomy Removal of protruding disc material, using an operating microscope to guide surgery.
Standard discectomy Surgical removal, in part or whole, of an intervertebral disc, generally with loop magnification (i.e. eyepieces).

Substantive changes

Spinal manipulation One systematic review added;[17] conclusions unchanged.

REFERENCES

1. Fardon DF, Milette PC. Nomenclature and classification of lumbar disc pathology: recommendations of the Combined Task Forces of the North American Spine Society, American Society of Spine Radiology, and American Society of Neuroradiology. *Spine* 2001;26:E93–E113.
2. Boden SD. The use of radiographic imaging studies in the evaluation of patients who have degenerative disorders of the lumbar spine. *J Bone Joint Surg Am* 1996; 78:114–125.
3. Borenstein DG, O'Mara JW Jr, Boden SD, et al. The value of magnetic resonance imaging of the lumbar spine to predict low-back pain in asymptomatic subjects. *J Bone Joint Surg Am* 2001;83-A(9):1306–1311.
4. Andersson G. Epidemiology of spinal disorders. In: Frymoyer JW, Ducker TB, Hadler NM, et al. eds. *The adult spine: principles and practice*. New York, NY: Raven Press, 1997:93–141.
5. Heliovaara M. *Epidemiology of sciatica and herniated lumbar intervertebral disc*. Helsinki, Finland: The Social Insurance Institution, 1988.
6. Postacchini F, Cinotti G. Etiopathogenesis. In: Postacchini F, ed. *Lumbar disc herniation*. New York: Spring-Verlag/Wien, 1999.
7. Friberg S, Hirsch C. Anatomical and clinical studies on lumbar disc degeneration. *Acta Orthop Scand* 1949;19:222–242.
8. Schultz A, Andersson G, Ortengren R, et al. Loads on the lumbar spine. *J Bone Joint Surg Am* 1982;64:713–720.
9. Jensen MC, Brant-Zawadzki MN, Obuchowski N, et al. Magnetic resonance imaging of the lumbar spine in people without back pain. *N Engl J Med* 1994;331:69–73.
10. Kelsey JL, Githens P, O'Connor T, et al. Acute prolapsed lumbar intervertebral disc: an epidemiologic study with special reference to driving automobiles and cigarette smoking. *Spine* 1984;9:608–613.
11. Pedrini-Mille A, Weinstein JN, Found ME, et al. Stimulation of dorsal root ganglia and degradation of rabbit annulus fibrosus. *Spine* 1990;15:1252–1256.
12. Deyo RA, Weinstein JN. Low back pain. *N Engl J Med* 2001;344:365–370.
13. Vroomen PC, de Krom MC, Slofstra PD, et al. Conservative treatment of sciatica: a systematic review. *J Spinal Disord* 2000;13:463–469. Search date 1998; primary sources Medline and Embase/Excerpta Medica.
14. Buchner M, Zeifang F, Brocai DR, et al. Epidural corticosteroid injection in the conservative management of sciatica. *Clin Orthop* 2000;375:149–156.
15. Shekelle PG, Adams AH, Chassin MR, et al. Spinal manipulation for low-back pain. *Ann Intern Med* 1992;117:590–598. Search date not stated; primary sources Medline and Index Medicus 1952 onwards, reference lists, and consulted experts.
16. Liu J, Zhang S. Treatment of protrusion of lumbar intervertebral disc by pulling and turning manipulations. *J Tradit Chin Med* 2000;20:195–197.
17. Stevinson C, Ernst E. Risks associated with spinal manipulation. *Am J Med* 2002;112:566–570. Search date November 2001; primary sources Medline, Embase, Cochrane Library, authors' files, experts consulted, and reference lists.
18. Gibson JN, Grant IC, Waddell G. Surgery for lumbar disc prolapse. In: The Cochrane Library, Issue 1, 2002. Oxford: Update Software. Search date 1997; primary sources Medline, Embase, Biosis, dissertation abstracts, Index to UK Theses, Cochrane Controlled Trials Register, reference lists, personal bibliographies, and hand searched *Spine* 1975–1997.
19. Hoffman RM, Wheeler KJ, Deyo RA. Surgery for herniated lumbar discs: a literature synthesis. *J Gen Intern Med* 1993;8:487–496. Search date not stated; primary sources Medline, reference lists, book bibliographies, and colleagues' files.

20. Weber H. Lumbar disc herniation: a controlled, prospective study with ten years of observation. *Spine* 1983;8:131–140.
21. Tullberg T, Isacson J, Weidenhielm L. Does microscopic removal of lumber disc herniation lead to better results than the standard procedure? Results of a one-year randomized study. *Spine* 1993;18:24–27.
22. Henriksen L, Schmidt V, Eskesen V, et al. A controlled study of microsurgery versus standard lumbar discectomy. *Br J Neurosurg* 1996;10:289–293.
23. Papadoulas S, Konstantinou D, Kourea HP, et al. Vascular injury complicating lumbar disc surgery. A systematic review. *Eur J Vasc Endovasc Surg* 2002;24:189–195. Search date not stated; primary source Medline 1965 onwards.
24. Hermantin FU, Peters T, Quartararo L, et al. A prospective, randomized study comparing the results of open discectomy with those of video-assisted arthroscopic microdiscectomy. *J Bone Joint Surg Am* 1999;81:958–965.
25. Chatterjee S, Foy PM, Findlay GF. Report of a controlled clinical trial comparing automated percutaneous lumbar discectomy and microdiscectomy in the treatment of contained lumbar disc herniation. *Spine* 1995;20:734–738.
26. Mayer HM, Brock M. Percutaneous endoscopic discectomy: surgical technique and preliminary results compared to microdiscectomy. *J Neurosurg* 1993;78:216–225.
27. Boult M, Fraser RD, Jones N, et al. Percutaneous endoscopic laser discectomy. *Aust N Z J Surg* 2000;70:475–479. Search date 2000; primary sources Medline, Current Contents, Embase, and The Cochrane Library.

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TABLE 1 **Reported complications from surgical procedures (see text, p 6).[19]**

	Standard discectomy		Microdiscectomy		Percutaneous discectomy	
Complications	**Mean (% [95% CI])**	**Studies (n)***	**Mean (% [95% CI])**	**Studies (n)***	**Mean (% [95% CI])**	**Studies (n)***
Operative mortality	0.15 (0.09–0.24)	25	0.06 (0.01–0.42)	8	–	3
Total wound infections	1.97 (1.97–2.93)	25	1.77 (0.92–3.37)	16	–	2
Deep wound infections	0.34 (0.23–0.50)	17	0.06 (0.01–0.23)	8	–	2
Discitis	1.39 (0.97–2.01)	25	0.67 (0.44–1.02)	20	1.43 (0.42–4.78)	8
Dural tear	3.65 (1.99–6.65)	17	3.67 (2.03–6.58)	16	0.00	2
Total nerve root injuries	3.45 (2.21–5.36)	8	0.84 (0.24–2.92)	12	0.30 (0.11–0.79)	6
Permanent nerve root injuries	0.78 (0.42–1.45)	10	0.06 (0.00–0.26)	8	–	6
Thrombophlebitis	1.55 (0.78–1.30)	13	0.82 (0.49–1.35)	4	Not reported	0
Pulmonary emboli	0.56 (0.29–1.07)	14	0.44 (0.20–0.98)	5	Not reported	0
Meningitis	0.30 (0.15–0.60)	5	Not reported	0	Not reported	0
Cauda equina syndrome	0.22 (0.13–0.39)	3	Not reported	0	Not reported	0
Psoas haematoma	Not reported	0	Not reported	0	4.65 (1.17–15.5)	5
Transfusions	0.70 (0.19–2.58)	6	0.17 (0.08–0.39)	11	Not reported	0

*81 studies were included; 2 RCTs, 7 non-randomised controlled trials, 10 case control studies and 62 case series.