Continuing Medical Education

Lumbar Disc Herniation

The Significance of Symptom Duration for the Indication for Surgery

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Summary

Background: Lumbar disc surgery is among the more common spinal procedures. In this paper, we report the current treatment recommendations for patients with symptomatic disc herniation.

Methods: This review is based on pertinent publications retrieved by a selective literature search in PubMed using the terms [timing] AND [lumbar disc herniation], supplemented by other relevant articles and guidelines.

Results: Symptoms resolve in 60% to 80% of patients with herniated discs in 6–12 weeks, and in 80% to 90% over the long term (≥ 1 year). According to the guidelines, 6–12 weeks of conservative treatment are recommended in the absence of significant neurologic deficits. Early surgery is indicated in case of worsening pain or new onset of neurologic deficits. Lumbar disc herniation associated bladder or bowel dysfunction (cauda equina syndrome) is considered an absolute surgical emergency that requires immediate decompression (within 24 to 48 hours). Patients with severe motor deficits (MRC ≤ 3/5) benefit from early intervention and should be offered surgery within three days, if possible, for the best chance of recovery. The degree of weakness and the duration of symptoms have been identified as risk factors for incomplete recovery. Early surgery can be considered in patients with mild paresis (MRC 4/5) in case of functional impairment (e.g., quadriceps paresis).

Conclusion: Longer symptom duration and lower motor scores are associated with worse outcome and a lower chance of neurologic recovery. The recovery rate for motor deficits ranges from 33% to 75%, depending on the timing and modality of treatment as well as the motor score.

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Degenerative changes of the spine and the associated symptoms are among the more common reasons for medical consultation in western industrialized countries (1). Disc herniation can cause mechanical and secondary inflammatory irritation of the nerve roots, triggering sciatica (alternative term: lumboischialgia) in the lumbosacral segments (2).

In the general population, the annual incidence of sciatica is 1–5%, and the overall lifetime prevalence is as high as 43% (e1, e2). The pain usually radiates from the low back along the distribution of the sciatic nerve into the leg, but affection of the upper lumbar segments can also cause pain along the distribution of the femoral nerve (ventral thigh).

Pain is generally the leading symptom; it can be accompanied by a sensory and/or motor deficit of the corresponding dermatome or myotome (2). Intervertebral disc surgery is one of the more common spinal operations and has become more common all over the world in the past 20 years (e3, e4).

Low back pain and sciatica due to lumbar disc herniation carry a high socioeconomic cost because of prolonged absences from work, expensive diagnostic evaluations, costly conservative treatments, and, above all, expensive interventional procedures and operations (1).

Incidence and prevalence
In the general population, the annual incidence of sciatica is 1–5%, and the overall lifetime prevalence is as high as 43%.

Lumbar disc surgery
Intervertebral disc surgery is one of the more common spinal operations and has become more common all over the world in the past 20 years (e3, e4). Low back pain and sciatica due to lumbar disc herniation, and its surgical treatment, carry a high socioeconomic cost.

This disease is, however, generally benign and self-limiting, with symptom resolution in 6–12 weeks in 60–80% of cases and long-term improvement in 80–90% (3, e5, e6).

The important exception to this rule is lumbar disc herniation with manifestations of cauda equina compression, i.e., bladder and/or rectal dysfunction. This situation is an absolute surgical emergency in which immediate surgery (i.e., within 24–48 hours) is needed to enable functional recovery; the earlier the intervention, the higher the chance that bladder and rectal dysfunction will recover (4, 5). In general, surgery is recommended for lumbar disc herniation with persistent radiculopathy, worsening pain, or neurologic deficits that cause functional impairment (6). Despite the commonness of this type of surgery, there is no consensus on the optimal timing of treatment for patients suffering "only" from persistent pain, or for those who have a motor deficit. We address this issue in the present review on the basis of up-to-date evidence retrieved by an an extensive literature search, in order to provide recommendations for treatment based on the particular clinical manifestations in the individual case (7).

We carried out a selective search in PubMed for articles including the search terms ("timing") AND ("lumbar disc herniation"), supplemented by other suitable or associated articles. The 124 retrieved articles were screened independently by two of the authors of this review independently for clinical relevance with the PRISMA criteria on the basis of the title, abstract, and full text (if available); in case the two screeners arrived at different conclusions, these were harmonized in a further discussion (e7). Randomized controlled trials (RCTs), reviews, meta-analyses, and both prospective and retrospective studies were selected for further analysis. The breadth of types of publication that were selected for analysis here is a result of the nature of the topic itself, the lack of RCTs concerning early treatment for patients with paresis, and the known methodological limitations of meta-analyses. The main publications on the timing of treatment of radiculopathy due to lumbar disc herniation are listed in the *Table*. Publications on paresis and bladder and/or rectal dysfunction are listed in the *eTable*. Only limited and low-level evidence for timing of treatment is available, derived mainly from retrospective analyses or small-scale prospective trials. On the other hand, there is high-level evidence from a large number of RCTs, reviews, and meta-analyses on the question of surgical versus conservative treatment for persistent sciatica. The interpretability of the results is impaired by high cross-over rates and intention-to-treat analyses.

Learning objectives

The purpose of this review is to provide an understanding of the main predictors of outcome in the treatment of lumbar disc herniation so that these can be integrated into routine clinical practice. After reading the article, readers should know:

- which patients with symptomatic disc herniation should be referred immediately for surgery;
- how soon a cauda equina syndrome due to lumbar disc herniation should be treated in order to enable recovery, or at least, improvement of bladder and rectal function;
- and what the risk factors are for incomplete recovery of paresis due to lumbar disc herniation

Symptom duration and outcome of sciatica

Sciatica is usually self-limiting: most patients with acute symptoms report marked improvement within 10 days, and 75% within one month. Nevertheless, around 30% of patients who do not undergo surgery still complain of intermittent pain one year after symptom onset (8). Conservative measures include physical rest including short-term bed rest, physiotherapy, and analgesic drugs according to the WHO scheme. Locally acting medications and periradicular infiltrations are available as well (9, e8). The AWMF guideline currently recommends sustained analgesic therapy in the acute stage through to the chronic phase, as well as short-term rest in the acute phase with the introduction of appropriate exercise therapy in the subacute stage. Back training, manipulation or traction if the affected segment, electrotherapy, ultrasound and massages should be avoided in the acute phase. Orthoses (corsets) should be considered on a case-by-case basis and should not be given to patients at risk of chronification.

Consideration of the potential indication for surgery is recommended at 6–12 weeks (3). Most of the studies that were examined in a systematic review published in 2014 found that longer symptom duration before surgery is associated with poorer outcomes, and that surgery within 6 months of symptom onset yields better results (10). The reported durations of conservative treatment are distributed over a wide range (2–12 months) (10). Accordingly, some studies have shown that surgery yields better outcomes when the symptoms have been present for less than 8 months (11, 12), while others have shown the same with a cutoff of 6 months (13, e9).

The well-known Spine Patient Outcomes Research Trial (SPORT) also identified six months as the critical duration of symptoms. In both the conservative and the surgical arm, patients with a shorter duration of symptoms (< 6 months) had a better long-term outcome, in particular a higher level of activity and less residual pain. Those who were treated surgically had better

Lack of consensus on the timing of surgery

Despite the commonness of this type of surgery, there is no consensus on the optimal timing of treatment for patients suffering "only" from persistent pain, or for those who have a motor deficit.

The duration of sciatica and the outcome of treatment

Sciatica is usually self-limiting: most patients with acute symptoms report marked improvement within 10 days, and 75% within one month.

Table

Studies with the highest level of evidence* evaluating the benefits of surgery for disc herniation and the importance of the timing of surgery

Author (year) Study design	Number of patients Parameters	Comparison groups	Outcome [95% CI]	Limitations
Liu (9) Meta-analysis	24 studies, 1711 patients; primary outcome: leg pain secondary outcome: back pain, disability, safety of treatment	OP vs. conservative therapy vs. ESI	benefit of disc surgery vs. conservative/ESI: immediate pain reduction (-12.1), short-term (-11.7) and medium/long-term relief (-6.5) of leg pain with negligible long-term effect (-2.3) similar effect size for ESI and for short-term improvement of functional impairment by surgery adverse events, 1.34 % [0.91; 1.98]	invalid for heterogeneous LDH population focus on sciatica symptom duration: 49 days – 5 years
Sabnis (10) Meta-analysis	21 studies on sciatica; effect of symptom duration on outcome	OP vs. conservative therapy	2 RCTs show no difference 10/12 studies with medium and 5/7 with low evidence showed better outcome after surgery for patients with shorter symptom duration risk factors for negative outcome: 6 months of sciatica, > 2 months of inability to work, compensation payments	no recommendation
Östermann (31) Randomized controlled trial	56 (20–50 years); sciatica (± deficit) primary outcome: leg and back pain	OP vs. conservative therapy	6 –12 weeks of initial conservative therapy; no significant difference after 2 years in primary outcome; better short-term data because of faster recovery after surgery; 11/28 cross-over; 12/29 with residual paresis at 1 year	exclusion of severe pain, CES, progressive deficits, longer duration of symptoms before surgery; unknown degree of paresis
Weber (32) Randomized controlled trial	126: 67 primary surgery, 87 conservative; sciatica	OP vs. conservative therapy	1, 4, 10 years FU: better outcome for surgically treated patients at 1 year, statistically insignificant thereafter	only sciatica, 30% cross-over rate, exclusion of patients with severe pain
Hofstee (19) Randomized controlled trial	250 (younger than 60 years); sciatica (< 1 month)	bed rest vs. physiotherapy vs. ADL	no significant differences between groups (at 1, 2, and 6 months) with respect to the pain scale or functional impairment in everyday life (Quebec Disability Scale)	6-month FU: cross-over rate: 17–25%
Peul (8) Randomized controlled trial	283; 141 early surgery vs. 142 conservative treatment	early surgery vs. conservative therapy	initially: in patients with sciatica of 6 –12 weeks' duration, earlier and faster recovery and pain relief in those who underwent early surgery (HR 1.97; [1.72; 2.22]; p < 0.001) at 1 year: convergence of outcomes	cross-over rate of 39% after only 19 weeks
Buttermann (20) Randomized controlled trial	100; radiculopathy ≥ 6 weeks (LDH > 25% of the spinal canal)	ESI vs. surgery	rapid clinical improvement after surgery (92–98%) relief from ESI in 42–56% outcome no worse with longer duration of symptoms	high cross-over rate, no data on motor deficits
Weinstein (21) Randomized controlled trial	RCT: 245 surgery vs. 256 conservative; observational study with 743 patients; radiculopathy ≥ 6 weeks	conservative therapy vs. surgery	surgery led to significantly better short- and long-term outcomes (as-treated analysis) for the primary parameters pain (45.6 vs. 30.7), physical performance level (44.6 vs. 29.7), and ODI (-38.1 vs. –24.9)	high cross-over rate (30% of the conservative cohort underwent surgery within three months, while only 50% of the "surgical" cohort did) initial intention-to-treat analysis (2006)
Rihn (14) Randomized controlled trial	1192; 927 vs. 265; LDH associated radiculopathy	duration of symptoms (≤ 6 months vs. > 6 months)	better outcome at 4 years for patients with shorter symptom duration: significant improvement in the pain and function domain of the SF-36 (48.3 vs. 41.9) and reduction in the ODI (41.1 vs. 34.6) after surgery (p < 0.001) in both cohorts	differences at baseline: in particular, type of LDH, distribution of neurologic deficits, depression rate
Bailey (22) Randomized controlled trial	128; 64 vs. 64; L4 – S1 LDH with sciatica for 4 – 12 months	microdiscectomy vs. conservative therapy	one-year follow-up: significantly less leg pain after surgery (2.8 vs. 5.2; [1.4; 3.4]; p < 0.001] 9/64 adverse events, 1 recurrence; two-year-follow-up: MCID not achieved	12.5% / 34% cross-over rate within 11 months, low FU rate

* meta-analysis, systematic review and randomized controlled trials
ADL, activities of daily living; CES, caude equina syndrome; CI, confidence interval; ESI, epidural steroid injection;
FU, follow-up; LDH, lumbar disc herniation; MCID minimal clinically important change (i.e., of at least some importance to the patient);
ODI, Oswestry Disability Index; OP, operation; pat., patient(s)

patient-reported outcome measures (PROMs) at all time points, independently of the timing of treatment (14).

Fisher et al., in their prospective study, stressed the importance of PROMs in modern spinal surgery and documented a significant clinical improvement in the first 6 months after surgery. The beneficial effect of the operation leveled off by 1 year (15). This can be explained by the generally self-limiting and benign course of sciatica due to lumbar disc herniation, but possibly also by late adverse effects of surgery.

A recent meta-analysis by Liu et al. confirmed the beneficial effect of surgery, demonstrating significant short- and medium-term relief of radicular pain in the surgical group compared to the conservatively managed control group. The evidence supporting the conclusion that surgery yields better outcomes than conservative treatment or epidural steroid injection (ESI) is on a low level. The benefit of surgery compared to ESI is over the long term; its benefit compared to conservative treatment is over the short to medium term, with a barely detectable difference at one year. The same holds for the effect of ESI, except for the disability score (9). The interpretability of the findings of this meta-analysis is lessened by the limitations of the included studies, the lack of information on symptom duration, and limited applicability to the heterogeneous population of patients with lumbar disc herniation.

Peul et al., in a landmark study, randomized patients with sciatica of 6–12 weeks' duration to early surgery or conservative treatment (for at least six months) and found that surgery led to faster recovery. Conservative treatment was also generally followed by recovery, but only after a delay; over the years following randomization, the outcomes converged. The high cross-over rate of 39% within 19 weeks is a critical limitation on the interpretability of the findings and leaves the actual predictive role of symptom duration before surgery unclear (16).

The German and Danish specialty societies recommend a 6– to 12-week trial of conservative treatment, except for patients with functionally impairing neurologic deficits or intractable pain, who should be offered early surgery (6, 17, e10). The NASS (North American Spine Society) points out the poor quality of the data supporting early surgery for patients with motor deficits and accordingly recommends surgery no later than 6–12 months after symptom onset for patients whose deficits are not highly acute (17, 18).

The high cross-over rate (17%–50%) in many RCTs markedly impairs the interpretability of treatment effects determined in an intention-to-treat analysis (8, 14, 19–23).

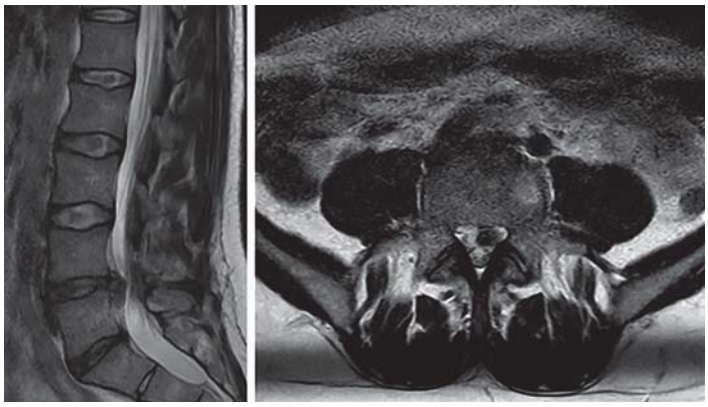


Figure 3: Left: Sagittal T2-weighted magnetic resonance image of the lumbar spine showing disc herniation at L4/5. Right: Axial T2-weighted image showing disc herniation, more pronounced on the left side, with compression of the L5 nerve root.

Risk factors for worse treatment outcomes

In most of the studies analyzed here, the duration of sciatica before treatment was found to be a negative predictor for the outcomes of both conservative and (usually) surgical treatment outcome. This conclusion is supported by high-level evidence from several RCTs as well as multiple prospective studies from single or multiple centers. The precise figures vary considerably, however, depending on the study design, population and control group: < 12 months (11), < 8 months (12), < 6 months (8, 14, e9, 24), < 3 months (e11, e12), < 2 months (25, e13), < 6 weeks (e14). In the meta-analysis by Sabnis et al., 15 out of 19 studies with low- and medium-level evidence showed a benefit from early surgery, but the two with high-level evidence did not; the latter two studies, however, had high cross-over rates and excluded patients with manifestations requiring acute treatment (e.g. cauda equina syndrome, high-grade paresis) and patients with severe pain (10). In a recent systematic review, Rutzen et al. concluded from 10 selected studies that early treatment is advantageous, but could not supply greater precision regarding timing (beyond simply early vs. late) or any concrete recommendation, because of the heterogeneity of the data (26).

Other risk factors for an unsatisfactory result include:

- older age (27) (> 40 years) (10, e13)
- inability to work for >2 months (10) or > 3 months (13)
- chronic pain (10)
- poor performance scores or neurologic deficits (10)
- a recurrent prolapse (27)
- the type of herniated disc (27, e14)
- social or relationship status and
- psychological factors (10, 14, e13, e15, e16) and
- current receipt of compensation payments (10, e16).

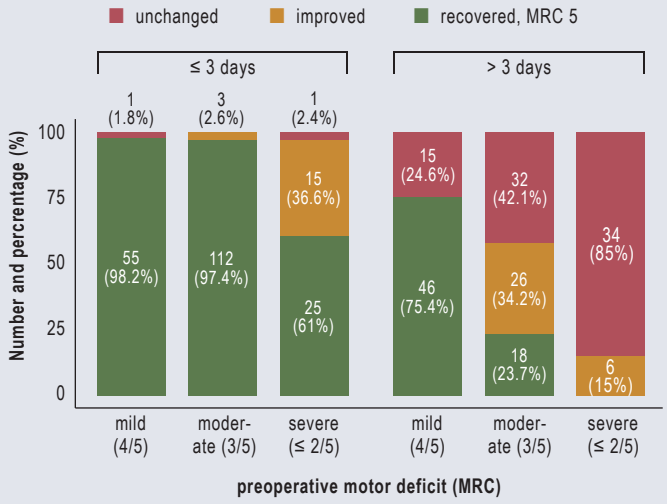
The evidence for surgical treatment

The evidence supporting the conclusion that surgery yields better outcomes than conservative treatment or epidural steroid injection (ESI) is on a low level. The benefit of surgery compared to ESI is over the long term; its benefit compared to conservative treatment is over the short to medium term.

Risk factors for poorer treatment outcomes

In most of the studies analyzed here, the duration of sciatica before treatment was found to be a negative predictor for the outcomes of both conservative and (usually) surgical treatment outcome.

Figure 1



Motor deficit at last follow-up: Bar chart of the recovery rate as a function of the timing of treatment and the degree of preoperative paresis. Modified from the study by Thomé et al. (13)

Disc surgery is generally considered safe, with an intraoperative complication rate of 2.7%. The revision rate is approximately 2.1%, and the rate of readmission rate within 90 days is 2.4%. Complications are more common in elderly patients and in patients with comorbidities (28).

The most common intraoperative complication is an incidental durotomy (dural opening or tear), which occurs most commonly in revision surgery in the setting of severe lumbar spinal degenerative changes in an elderly patient (29). The most common postoperative complication is symptomatic recurrent disc herniation, which occurs in 1% to 27% of patients depending on the type of herniation, the size of the annular defect, and the patient's age and sex.

The 27% figure applies only to the high-risk group in the study of Carragee et al. and is not to be taken as a general reference value (30, e5, e17). The reoperation rate within one year is approximately 6.4% (e18). Impaired wound healing, secondary spinal instability, and postoperative bleeding requiring treatment are rare.

Because outcomes are better with earlier surgery and the complication rate of these operations is low, surgery should be offered if pain persists after 12 weeks of conservative treatment.

The optimal timing of treatment for patients with motor deficits

Pain that lasts for several months because of spinal nerve root compression is not known to cause any long-term physical damage, but neurologists and surgeons who operate on the spine are concerned that motor deficits might persist if surgery is not performed soon enough. The more severe the paresis, the greater the inclination to provide early surgery in order to prevent permanent functional impairment due to persistent weakness, particularly in younger patients (e19). Nevertheless, no recommendation on the timing of surgery has yet been made for this cohort (10, 24).

As 30% to 50% of patients have paresis when they present, this is a very important issue (33, 34). Paresis is more common in patients with acute onset of symptoms, a free or migrated disc herniation, and/or pre-existing spinal canal stenosis (e20). Medium- to high-level of evidence supports the conclusion that the recovery rate is lower for higher degrees of paresis. Studies including the review by Sharma et al. have identified both the degree of paresis (33, 34) and the duration of symptoms (4, 34) as risk factors for incomplete recovery (strength less than 5 on the MRC scale); the operations in question, however, were performed over a broad time span of several weeks after the onset of paralysis (35, 36, e21–25).

Except for patients with cauda equina syndrome, the evidence on symptom duration as a negative predictor is only moderately strong. The recovery rate varies from 30% to 75% depending on the timing and modality of treatment and the degree of paresis, many patients are left with functional impairment, which may be severe (e25–29). Because of these poor outcomes, urgent or even emergency treatment of patients with a relevant degree of paresis (MRC ≤ 3/5) is increasingly being advocated, not least because of the short time window (≤ 48 h) for cauda equina syndrome. In a meta-analysis, Ahn et al. calculated an odds ratio (OR) of 9.1 for motor recovery when surgery is performed within 48 hours (4). Although this high value must be viewed critically, one must indeed ask whether acute paresis, analogously to cauda equina syndrome, should optimally decompressed just as rapidly to prevent a disabling residual deficit.

The lack of an existing recommendation on the timing of surgery motivated us to evaluate the utility of early surgery. In a registry study with 390 patients who underwent early surgery at a spinal center for lumbar disc herniation with associated paresis, the relation of the duration and degree of paresis to the long-term outcome was studied (follow-up interval ≥ 1 year; mean, 3.5 years). For this purpose, objectifiable cut-off values for treatment recommendations were determined with the aid of the Unbiased Recursive Partitioning Conditional Inference Tree (URP-CTREE) (7). This statistical method tests the independence of predictors with a predefined outcome; like a tree diagram, it involves partitioning at the lowest p-value (including a Bonferroni correction) (e30).

The optimal timing of treatment for patients with a motor deficit

The more severe the paresis, the greater the inclination to provide early surgery in order to prevent permanent functional impairment due to persistent weakness, particularly in younger patients (e19). Nevertheless, no recommendation on the timing of surgery has yet been made for this cohort (10, 24).

Risk factors for paresis

Paresis is more common in patients with acute onset of symptoms, a free or migrated disc herniation, and/or pre-existing spinal canal stenosis

Strength was measured with manual and functional testing and graded on the MRC scale (37).

Preoperative paresis was mild (MRC 4/5) in 118 patients (30.3%), moderate (MRC 3/5) in 191 (49.0%), and severe (MRC ≤ 2/5) in 81 (20.8%).

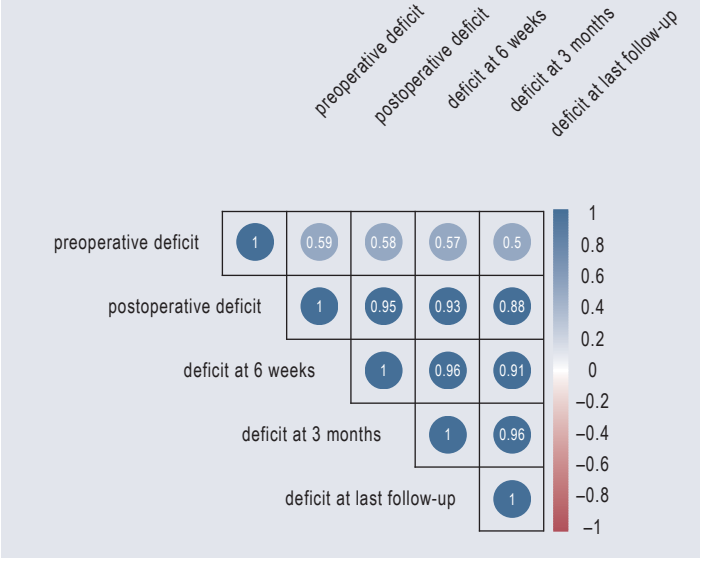
According to the URP-CTREE analysis, severe preoperative paresis ($p < 0.001$) was the main risk factor for incomplete recovery. The calculated time window from the onset of paresis to surgery for a significantly faster and complete recovery (= MRC 5/5) was 3 days ($p = 0.022$). Surgery within this time window also led to a significantly better outcome in patients with moderate paresis ($p < 0.001$), with a recovery rate of 97% versus 23% *(Figure 1)*. In the mild paresis cohort, early surgery (≤ 8 days; using URP-CTREE cut-off) also yielded a superior recovery rate (98% versus 75%) (7).

This study lacks a conservatively treated control group, but nevertheless demonstrates the advantage of early treatment with the statistics used and the precise information it contains on symptom duration and degree of paresis. The results are clearly superior to those of other studies in which treatment after multiple weeks or months is advocated (4, 33–35, e21, e23, e24). The authors advise against generalizing these findings to cases of paresis due to spinal stenosis, in which the pathophysiology is chronic rather than acute (34, e26). Although early surgery may intuitively seem preferable even without supporting evidence, its benefit needs to be properly studied, as the nonzero perioperative risk may be greater than the benefit for some patients. Thus, additional prospective studies to corroborate these findings would be desirable. Only on the basis of the data just cited, early (≤ 3 days) surgery is recommended for patients with acute moderate or severe paresis, as this yields a recovery rate of 97% versus 50%, according to the relevant RCT (33). Only Ahn et al. achieved a similar recovery rate with early required to be within 48 hours of symptom onset (4). Comparisons across studies are generally complicated by inconsistent definitions of the term "foot drop," varying meanings of the word "recovery" (does a partial recovery count?), and the subjectivity (sometimes) of the determination whether a paresis is mild, moderate, or severe.

To prevent permanent deficits, patients should be referred immediately to a center where spinal surgery is performed. The general practitioners and family physicians who see the patient first should rapidly assess the degree of paresis and refer the patient for surgery if it is moderate or severe. Isolated paresis of the extensor hallucis longus muscle (weakness of great toe dorsiflexion) is not necessarily a clinically relevant indication for surgery, even if severe; this issue should be critically considered by the examiner.

Mild (MRC 4/5) motor deficits are obviously less problematic, and the stated time window of 8 days to surgery should be considered only for patients with weakness causing functional impairment (e.g., quadriceps palsy making it impossible to climb stairs) (recovery rate of 98%). The literature implies a recovery rate of 75% in the later (> 8 days) cohort. Compensatory training of paretic muscle groups should lead to success, particularly the quadriceps; deficits in the muscles innervated by L5 and S1 are more likely to be permanent (e24). Treatment decisions must be made individually on the basis of the symptoms and signs, the affected myotome, the patient's age and personal requirements, and the degree of functional impairment. Regular follow-up at short intervals is needed at first, so that any neurological worsening can be detected and acted upon quickly. The patient should be informed about the natural course of the problem if untreated and the improved recovery rate in the event of surgical treatment. Marked improvement of weakness can be expected within 2–4 months after surgery (the interval varies depending on the publication) (e23, e24). Our experience is similar, with a strong correlation between strength at 6–12 weeks and final strength *(Figure 2)*. Strength at 3 months is thus a good surrogate marker for the ultimate degree of recovery (7).

Figure 2



Plot from the study by Thomé et al. (13) showing the correlation between strength on initial examination and long-term strength after treatment.

The timing of treatment for cauda equina syndrome

The current recommendation for immediate surgery (< 48 hr after symptom onset) for patients with cauda equina syndrome is based on the findings of the meta-analysis by

The benefit of early surgery

The benefit of early surgery must be critically evaluated in order not to expose patients excessively to the risks of surgery.

The management of acute, moderate to severe weakness

On the basis of the data cited here, early (≤ 3 days) surgery is recommended for patients with acute moderate or severe paresis, as this yields a recovery rate of 97% versus 50%, according to a relevant RCT.

Ahn et al. In a long-term analysis of over 850 patients (20 retrospective and 2 prospective cohort studies), residual bladder, rectal and sexual dysfunction was found in 43%, 31% and 40%, respectively. Acute decompression (< 48 hr) led to the complete resolution of symptoms and signs in 76% of patients so treated (38). Patients who underwent surgery within 24 hours had a higher recovery rate (5). Sangondimath et al. reported improvement in all patients who underwent within 48 hours. Sexual dysfunction was still present after surgery in 70% of men and 60% of women with cauda equina syndrome (39). Other, retrospective studies, including urodynamic studies, confirmed that treatment within 48 hours leads to a favorable recovery, while the adverse consequences of delayed surgery are dramatic (e31-e33).

Take-home messages on the timing of surgery for lumbar disc herniation

- Surgery should be considered 6–12 weeks after the onset of symptoms if radicular pain persists despite conservative treatment.
- Emergency surgery (within 24–48 hr) is indicated for patients with bladder or rectal dysfunction.
- Surgery within 3 days is indicated for patients with moderate or severe paresis (MRC ≤ 3/5).
- Early surgery is indicated for patients who have mild paresis (MRC 4/5) causing functional impairment.

Conflict of interest statement
WL owns Novartis stock.
The other authors state that they have no conflict of interest.

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Saddle hypesthesia and bladder and rectal dysfunction
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Supplementary material:
eReferences, eTable, eCase illustration:
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Questions on this article

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The submission deadline is 27 June 2025. Only one answer is possible per question.
Please select the answer that is most appropriate.

Question 1

What is the annual incidence of sciatica in the general population?

a) 1–5%
b) 10–15%
c) 20–25%
d) 30–35%
e) 40–45%

Question 2

Which statement best describes the natural course of sciatica?

a) It is usually a self-limiting disease.
b) It is a secondary progressive disease.
c) 85% of patients undergo surgery because of symptoms.
d) Most patients' symptoms worsen after 10 days.
e) 90% of patients treated conservatively are asymptomatic a year later.

Question 3

According to the AWMF guideline, how long after the initiation of conservative treatment for lumbar disc herniation should the indication for surgery be considered if symptoms persist?

a) 1 to 7 days
b) 8 days to 2 weeks
c) 2 to 3 weeks
d) 4 to 5 weeks
e) 6 to 12 weeks

Question 4

What conclusion can be drawn from the meta-analysis by Liu et al. (2023)?

a) In case of severe back pain down the thigh dorsolaterally, surgery should be performed within one week.
b) Physiotherapy should be started in the acute phase of the disease.
c) There is little evidence that surgery yields better outcomes than conservative therapy or epidural steroid injection.
d) Surgery within 10 days increases the chance of pain relief (OR = 2.3 [95% CI: 1.7; 2.9]).
e) The risk of a neurologic deficit is twice as high if surgery is not performed within 12 weeks of the onset of severe pain.

Question 5

Which factor significantly limits the informativeness and interpretability of many RCTs on the treatment of patients with sciatica?

a) difficulties in the recruitment of study subjects
b) a drop-out rate of up to 50%
c) major differences in proficiency across surgeons
d) high cross-over rates from the conservative to the surgical treatment arm
e) small study sizes, so that statistical significance could not be achieved

Question 6

What is the most common intraoperative complication of lumbar disc surgery?

a) injury to major vessels
b) incidental durotomy
c) nerve root injury
d) bacterial contamination
e) a symptomatic recurrent herniation

Question 7

Which of the following is an important risk factor for the incomplete recovery of a motor deficit caused by a herniated disc?

a) a concomitant sensory deficit
b) moderate or severe paresis (MRC ≤ 3/5)
c) the patient's age
d) inability to work for 2 weeks or more
e) a mild foot drop

Question 8

Which of the following is/are <u>not</u> a risk factor for a worse clinical outcome?

a) chronic pain, older age
b) recurrent herniation, age > 50 years
c) inability to work for > 4 months, depression
d) ongoing compensation payments, neurologic deficit
e) male sex, BMI > 28

Question 9

Which of the following is a common postoperative complication of lumbar disc surgery?

a) secondary instability
b) inability to work for > 4 weeks
c) rectal dysfunction
d) depression
e) deep venous thrombosis

Question 10

What conclusion can be drawn from the registry study by Thomé et al.?

a) Early surgery should be recommended for acute and high-grade paresis (MRC ≤ 3/5).
b) Surgery should be performed within 48 h if spinal canal stenosis is also present.
c) An epidural steroid injection leads to a faster return to work than surgery.
d) Conservative therapy should be supported by massage and progressive muscle relaxation.
e) Early surgery is only indicated for patients with cauda equina syndrome.

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Supplementary material to accompany the article:

Lumbar Disc Herniation

The Significance of Symptom Duration for the Indication for Surgery

by Nikolaus Kögl, Ondra Petr, Wolfgang Löscher, Ulf Liljenqvist, and Claudius Thomé

Dtsch Arztebl Int 2024; 121: 440–8. DOI: 10.3238/arztebl.m2024.0074

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eTable

Studies of the effect of symptom duration and degree of paresis on the outcome of patients with motor deficits and bladder/rectum dysfunction related disc herniations*

Author / year / study design	Number of patients; intended analysis	Outcome	Limitations
(Ahn 2000) Meta-analysis	322 with cauda equina syndrome; symptom duration: < 24 hr, 24–48 rh, 2–10 days, 11 days –1 month, > 1 month	OP ≤ 48 hr vs. > 48 h; odds ratios (OR) 2.5 for urinary incontinence; 9.1 for motor deficits; 9.1 for rectal dysfunction, 3.5 for sensory deficits	statistical design (binomial/categorical), data pooling with partly unknown information on timing; no MRC scale; range of incontinence
(Kumar 2022) Meta-analysis	22 studies, 852 with CES, symptom duration < 48 h vs. ≥ 48 h; minimum FU: 1 year	outcome: 43% residual urinary incontinence, 31% residual rectal dysfunction, 40% sexual dysfunction; 53% sensory and 38% motor deficits; OP ≤ 48 h vs. > 48 h: 24.6 % vs. 50.3 % residual urinary incontinence	diverse pathologies included
(Schoenfeld 2015) Systematic review	11 studies, effect of symptom duration before disc surgery on functional outcome	9 of 11 studies: negative correlation between symptom duration and outcome majority of studies: 6 months cut-off	study selection, no details on symptom severity, heterogeneous symptom duration 2 –12 months
(Sharma 2012) Systematic review	review on the effect of the timing of treatment and the degree of paresis on the outcome	30 – 50 % LDH-associated motor deficits, 45% improve spontaneously, 25 – 76% recovery rate, OP: better short-term outcome. Earlier tends to be better. High grade paresis (MRC ≤ 2/5) is associated with poor functional outcome.	SCS and LDH associated paresis, study selection (recovery: MRC ≥ 4/5), baseline characteristics (conservative vs. surgery) different. Wide range of symptom duration or degree of paresis, cross-over rate, no definition of "early"
(Overdevest 2014) Subgroup analysis, randomized controlled trial	150 patients with motor deficits (6–12 weeks); early surgery (1.8 weeks) vs. delayed surgery (15 weeks); 126 moderate (MRC 4/5), 24 severe deficits (MRC 3/5)	53% had motor deficits; faster recovery in early operated cohort; recovery rate 87% vs. 84 % with initial MRC 4/5 and 58% vs. 50% with initial MRC 3/5); RF: > 25% of the spinal canal	cross-over rate 40%, no precise symptom duration, no definition of early surgery, „severe" = MRC 3/5, where patients with MRC ≤ 2/5, worsening symptoms, and CES were excluded; 6–12 weeks of sciatica before surgery
(Thomé 2022) Prospective registry study	390; prospective registry study of acute LDH with associated motor deficits: 118 (30.3%) mild, 191 (49%) moderate (3/5), 81 (20.8%) severe (≤ 2/5); unbiased recursive partitioning, conditional inference tree (URP-CTREE)	MRC ≤ 2 predicts worse outcome (p < 0.001), surgery within 3 days: superior outcome for MRC 3/5 and MRC ≤ 2/5, 61 % vs. 0 % (severe ≤ 2/5), NNT 1.4; 97.4 % recovery rate for early treated moderate paresis (surgery < 3 days) Early surgery predicted better result for patients with mild paresis ≤ 8 days (98%)	no conservatively treated control group; strength: precise strength grading and symptom duration, objective statistical method, large cohort, 1–5 years FU
(Dubourg 2002) Multicenter, prospective cohort study	LDH with associated MRC ≤ 3/5 foot drop (< 1 month); outcome of motor deficits (conservative vs. operative)	53% improved (incl. 30% recovery rate); surgery vs. conservative: 53% vs. 56% improvement rate	baseline characteristics (type of prolapse, more muscle groups affected, symptom duration); FU up to 6 months
)Sangondimath 2020) Rretrospective study	43 CES, (27 LDH) ≥ 1 year FU; effect of symptom duration; urodynamic analysis including sexual dysfunction analysis	age and duration of urinary incontinence with postoperative sexual dysfunction (SD) 70% in men, 60% in women. CES recovery associated with shorter symptom duration	retrospective analysis, missing data (especially preoperative details), mixed clinical pictures, average duration of saddle hypesthesia was 24 days, number of patients
(Beculic 2016) Retrospective study	25 with CES; outcome after surgery (within 24 hr after hospitalization)	Overall: recovery of 36% of urinary and 44% of fecal incontinence, 48% of motor and 64% of sensory deficits. 89% recovery (< 48 h) vs. 16.7% (2–5 days)	few patients, no precise information on symptom duration
(Nielsen 1980) Retrospective study	22 with CES, outcome after surgery, including urodynamic analysis; symptom duration: < 48 hr, 9 patients 2–8 days, 4 patients with CES ≥ 10 days	50% were able to urinate by detrusor contraction (better outcome if surgery < 48 h), 6/7 who were able to urinate with effort had symptoms for > 2 days	small cohort, no details on sensorimotor deficits (13/22 postoperatively), strength: urodynamic analysis supports clinical outcome
(Krishnan 2017) Retrospective study	140 (70 motor deficits vs. 70 neurologically intact); motor deficit defined as MRC ≤ 3/5; descriptive, RF for neurological deficits	RF for neurological deficits: acute onset of symptoms, free sequestrum, cranial luxation, median herniation, DM, L3/4 segment, pre-existing SCS	retrospective, no information on outcome
(Aono 2007) Retrospective study	46 patients with foot drop (24 LDH), defined as MRC < 3/5 (3-/5 = incomplete ROM in sitting), surgical outcome after 1 year	30% recovery rate, 70% of which within 1 year; better recovery rate MRC 2–3-/5 vs. MRC 0–1 (0.047); better outcome if shorter symptom duration (undefined) and in younger patients (p = 0.027; OR 1.48)	mixed cohort: LDH, LSS, spondylolisthesis, multilevel in > 33%, symptom duration 4–720 days
(Macki 2016) Retrospective study	71 (45 LDH) with paresis; outcome after 1and 6 weeks, 3 and 6 months, 1 year	73% improve, association with timing (HR 0.67, p = 0.004), inverse correlation between grade and recovery rate (p = 0.010), 95% improve within 3 months	partly only by telephone. FU, LSS and LDH patients, foot drop in 28% (MRC 4-/4/4 +); foot drop for 6 weeks on average; < 20% treated within 1 week

(Takenaka 2017) Retrospective study	102; surgical outcome after foot drop (MRC ≤ 3-/5); good ≥ 3/5, excellent ≥ 4/5	longer symptom duration (> 30 days), worse paresis grade (MRC ≤ 1/5) associated with poor outcome (< 0.001); age, soft disc herniation and leg pain are negative predictors; 84% of MRC 2–3/5 (< 30 days) improve to MRC ≥ 4/5	retrospective, 72% FU rate, diverse pathologies, statistical model, average symptom duration 106 days
(Ghahreman 2008) Retrospective study	56 (88 % LDH); surgical outcome for foot drop ≤ MRC 3-/5 (66%): 27% with MRC 3/5, 7% with MRC 4/5	41% recovery rate (27% in ≤ 2/5), RF: degree of paresis (p < 0.001), and older age (p = 0.03) are negative predictors	retrospective, diverse pathologies
(Postacchini 2002) Retrospective study	116 patients with LDH-associated paresis (= 27% of the overall cohort); outcome of motor deficits depending on duration and degree of paresis; 67% mild (MRC 4/5), 21% severe (MRC 3/5), 12% very severe (MRC ≤ 2/5)	76% recovery rate (84% of mild and 61% of severe deficits), incomplete especially in L5 and S1 nerve root involvement, 83% recovery achieved after 2–4 months; shorter symptom duration associated with higher recovery rate, inverse correlation of the degree of paresis with recovery (p = 0.0046)	retrospective, definition of plantar flexion paresis (MRC 2/5 = tiptoe standing < 2 cm, MRC 3/5 = 2 cm); duration of paresis 7–730 days
(Lonne 2012) Retrospective study	91 with 1 year FU, outcome of surgically treated motor deficits	recovery rate: 55% (MRC (0–3) vs. 84% (MRC 4/5) (p = 0.003); no effect of symptom duration; HRQL, pain and functional status improved in all (p < 0.001), recovery led to better outcome and fewer compensation payments	retrospective, multiple examiners, 18 symptomatic recurrences excluded, no conservative control group, limited data on riming
(Masuda 2020) Retrospective study	87 patients with foot drop; outcome of motor deficits (purely surgical cohort)	32% complete recovery, age, degree of paresis, and symptom duration (> 2 months) were RF for incomplete recovery	diverse pathologies (46 LDH-associated paresis) and heterogeneous surgical treatments; symptom duration 0 – 60 months; recovery = MRC ≥ 4/5
(Girardi 2002) Retrospective study	55 patients with foot drop (MRC 2–4/5 [average: 3]); outcome of motor deficits (purely surgical cohort)	71% recovery ratefor foot drop and 64 % for big-toe drop	diverse pathologies (LDH and LSS), few cases, foot drop defined as MRC 4/5, missing subanalysis

* with high-level evidence (meta-analysis, systematic review and RCTs), medium-level evidence (prospective studies with large numbers of cases, small RCTs), and low evidence (small cohort studies, retrospective analyses)

CES, cauda equina syndrome; FU, follow-up; HR, hazard tatio; LDH, lumbar disc herniation; LSS, lumbar spinal stenosis; MRC, Medical Resaerch Council; OR, odds ratio; pat., patient(s); RCT, randomized controlled trial; RF, risk factor

CASE ILLUSTRATION

A 43-year-old man presents to the emergency room with low back pain of two weeks' duration that began when he changed the tires on his car. He took non-steroidal anti-inflammatory drugs (NSAIDs) insufficient pain relief. The pain in the low back improved slightly one day before presentation, but he then developed marked sciatica radiating dorsolaterally down the left thigh and leg into the left great toe.

When the patient enters the examining room, the physician notices a mild Trendelenburg sign. Neurological examination reveals that the patient cannot walk on the left heel. Strength testing with the patient supine reveals weakness of foor dorsiflexion (3/5) and of great toe dorsiflexion and foot eversion (2/5) on the left side. The Lasègue sign is positive on the left. Hypesthesia is noted along the left L5 dermatome. The patient denies bladder or bowel dysfunction, and residual urine measurement yields a value of 0 mL. Saddle hypesthesia is not present.

The remaining medical history is unremarkable, except for surgical repair of a cruciate ligament and an appendectomy in childhood. There is no history of a tick bite, a recent infection, or B symptoms.

The physician tells the patient that he has an L5 nerve root syndrome that is probably due to lumbar disc herniation.

Magnetic resonance imaging (MRI) of the lumbar spine without contrast, ordered acutely to confirm the suspected diagnosis, reveals a mediolateral, partially caudally dislocated herniated disc at the L4–5 level on the left, with compression of the L5 nerve root (see *Figure 3*).

The findings are discussed in detail and the treatment options explained. The patient is offered hospitalization for sequestrectomy because of the marked paresis and the associated functional impairment. He requests prompt surgery, which is performed the next day without complications. The paresis improved immediately. Except for persistent mild (4/5) weakness of great toe dorsiflexion, the motor deficits were found to have recovered completely one year after surgery.