

Surgery versus conservative management of sciatica due to a lumbar herniated disc: a systematic review

Wilco C. H. Jacobs · Maurits van Tulder · Mark Arts · Sidney M. Rubinstein ·
Marienke van Middelkoop · Raymond Ostelo · Arianne Verhagen ·
Bart Koes · Wilco C. Peul

Received: 23 July 2010/Revised: 22 September 2010/Accepted: 29 September 2010/Published online: 15 October 2010
© The Author(s) 2010. This article is published with open access at Springerlink.com

Abstract The effectiveness of surgery in patients with sciatica due to lumbar disc herniations is not without dispute. The goal of this study was to assess the effects of surgery versus conservative therapy (including epidural injections) for patients with sciatica due to lumbar disc herniation. A comprehensive search was conducted in MEDLINE, EMBASE, CINAHL, CENTRAL, and PEDro up to October 2009. Randomised controlled trials of adults with lumbar radicular pain, which evaluated at least one clinically relevant outcome measure (pain, functional status, perceived recovery, lost days of work) were included. Two authors assessed risk of bias according to Cochrane criteria and extracted the data. In total, five studies were identified, two of which with a low risk of bias. One study

compared early surgery with prolonged conservative care followed by surgery if needed; three studies compared surgery with usual conservative care, and one study compared surgery with epidural injections. Data were not pooled because of clinical heterogeneity and poor reporting of data. One large low-risk-of-bias trial demonstrated that early surgery in patients with 6–12 weeks of radicular pain leads to faster pain relief when compared with prolonged conservative treatment, but there were no differences after 1 and 2 years. Another large low-risk-of-bias trial between surgery and usual conservative care found no statistically significant differences on any of the primary outcome measures after 1 and 2 years. Future studies should evaluate who benefits more from surgery and who from conservative care.

W. C. H. Jacobs (✉) · W. C. Peul
Department of Neurosurgery, Leiden University Medical Center,
Albinusdreef 2, PO Box 9600, 2300 RC Leiden, The Netherlands
e-mail: w.c.h.jacobs@lumc.nl

M. van Tulder · R. Ostelo
Department of Health Sciences, Faculty of Earth and Life
Science, EMGO Institute for Health and Care Research,
VU University, De Boelelaan 1085, 1081 HV Amsterdam,
The Netherlands

M. van Tulder · S. M. Rubinstein · R. Ostelo
Department of Epidemiology and Biostatistics, EMGO-Institute
for Health and Care Research, VU University Medical Center,
Amsterdam, The Netherlands

M. Arts
Department of Neurosurgery, Medical Center Haaglanden,
Lijnbaan 32, 2512 VA The Hague, The Netherlands

M. van Middelkoop · A. Verhagen · B. Koes
Department of General Practice, Erasmus MC,
University Medical Center Rotterdam, PO Box 2040,
3000 CA Rotterdam, The Netherlands

Keywords Sciatica · Conservative treatment · Surgery ·
Discectomy · Systematic review

Introduction

The prevalence of sciatic symptoms reported in the literature varies considerably ranging from 1.6% in the general population to 43% in a selected working population [8]. Although the prognosis is good in most patients [9], a substantial proportion (up to 30%) continues to have pain for 1 year or longer [18, 20]. In approximately 90% of the cases, sciatica is caused by a herniated disc involving nerve root compression. However, lumbar canal stenosis or foraminal stenosis and (less often) tumours or cysts are other possible causes [15].

The most important symptom of sciatica is lumbosacral radicular leg pain that follows a dermatomal pattern radiating below the knee and into the foot and toes [15, 17].

The pain worsens with coughing; patients may report sensory symptoms, limited forward flexion of the lumbar spine, gait deformity and unilateral spasm of the paraspinal muscles. However, most patients present with a less clear clinical picture. In acute sciatica, diagnostic imaging may only be indicated if there are indications of underlying pathology (e.g. infections, malignancies) other than disc herniation. In patients with persistent and severe symptoms who fail to improve following 6–8 weeks of non-surgical treatment, imaging might be useful to identify the presence or absence of a herniated disc with nerve root compression [15].

Management of sciatica varies considerably. Patients are commonly treated in primary care but a small proportion is referred to secondary care and may eventually undergo surgery if complaints remain present for at least 6 weeks. Conservative treatment for sciatica is primarily aimed at pain reduction, either by analgesics or by reducing pressure on the nerve root. There seems to be consensus that surgery is indicated in carefully selected patients for sciatica in presence of a herniated lumbar disc [6], or severe sciatica with serious or progressive neurologic deficits and imaging demonstrating lumbar disc herniation at the nerve root level correlating with the patient's examination findings [7, 9]. The primary rationale of surgery for sciatica is that surgery will relieve nerve root irritation or compression due to herniated disc material. The most common type of surgery is open microdiscectomy, surgical removal of part of the disc, performed with or without the use of an operating microscope or other magnifying tools. Other minimally invasive surgical techniques, such as endoscopic surgery have recently been developed [4]. In the absence of serious neurologic deficits or for persistent non-radicular low back pain, consensus whether surgery is useful or not has not yet been established. Furthermore, the timing of the intervention with respect to prolonged conservative care has not been evaluated properly.

At present, several randomised trials have been published that have compared surgery with conservative treatment. The objective of this systematic review is to compare and summarise the evidence regarding the effectiveness of surgery compared with conservative treatment for patients with sciatica due to lumbar disc herniation.

Methods

Search methods for identification of studies

A comprehensive search was conducted by an experienced librarian in several databases of medical literature: MEDLINE, EMBASE, CINAHL, CENTRAL (the Cochrane Central Register of Controlled Trials), PEDro, and ICL up

Table 1 Search strategy for Pubmed/MEDLINE for identification of primary studies on surgery versus conservative treatment for sciatica

1	randomised controlled trial.pt.
2	controlled clinical trial.pt.
3	randomised.ab.
4	placebo.ab,ti.
5	drug therapy.fs.
6	randomly.ab,ti.
7	trial.ab,ti.
8	groups.ab,ti.
9	or/1–8
10	(animals not (humans and animals)).sh.
11	9 not 10
12	dorsalgia.ti,ab.
13	exp Back Pain/
14	backache.ti,ab.
15	(lumbar adj pain).ti,ab.
16	coccyx.ti,ab.
17	coccydynia.ti,ab.
18	sciatica.ti,ab.
19	sciatica/
20	spondylosis.ti,ab.
21	lumbago.ti,ab.
22	exp low back pain/
23	Or/12–22
24	11 and 23
25	limit 24 to ed = 20080501–20081223

Search strategy was adapted for other databases

to October 2009. The search strategy is given in Table 1. References from the included studies were also screened and experts approached in order to identify additional primary studies not previously identified. Two review authors (MA, WP) working independently from one another examined titles and abstracts from the electronic search. Full articles were obtained if necessary. A third reviewer was consulted (MvT), if consensus was not reached.

Criteria for considering studies for this review

References were selected if they met all of the following selection criteria:

- The study was stated to be a randomised controlled trial.
- The study compared surgery to non-surgical interventions (i.e. epidural injections, conservative therapy).
- The patients included were adult (>18 years of age) subjects with sciatica due to a herniated disc.
- The outcome(s) evaluated included at least one of the main clinically relevant outcome measures (i.e. pain,

functional status, recovery, or sick leave) using a valid instrument.

- The follow-up was at least 1 day.
- The language was limited to English, Dutch and German.

The following self-reported measures were assessed and considered as the primary outcomes: leg pain and/or back pain, leg pain specific functional status, perceived recovery (e.g. subjective overall improvement, proportion of patients recovered), and lost days at work (e.g. return to work status, number of days off work or with sick leave). Any other outcome was considered as secondary (e.g. SF-36 reporting on bodily pain). Physiological variables, such as spinal flexibility and number of degrees of straight-leg raising were not assessed since it is believed that these outcomes correlate poorly with clinical status.

Assessment of risk of bias for the included studies

Two review authors (SR and MM) working independently of each other conducted the risk-of-bias assessment and data extraction. Risk of bias of the individual studies was assessed using the criteria list advised by the Cochrane Back Review Group (CBRG) [5], which consists of 11 items that assess internal validity. Items and operationalisation are given in Table 2. Items were scored as positive if they fulfilled the criteria, negative when bias was likely or marked as inconclusive if there was insufficient information. Differences in the scoring of the risk-of-bias assessment and data extraction were discussed during a consensus meeting. The item for compliance was not scored because this item was irrelevant for single-session interventions, such as surgery. A study with a low risk of bias was defined as fulfilling six or more of the validity items.

Data collection and analysis

Included studies were categorised under separate comparisons with clinically homogeneous characteristics. An a priori list of items was used for the data extraction, consisting of both descriptive data (e.g. study population, type of interventions) and quantitative data regarding the primary and secondary outcome measures. With sufficient clinically and statistically homogeneous and comparable reported outcomes, data was planned to be pooled with the aid of Revman 5. To identify publication bias, funnel plots were planned to be examined. In case meta-analysis was not feasible, a best evidence synthesis was anticipated using low-risk-of-bias studies. The overall quality of the evidence was graded as “High”, “Moderate”, “Low”, or “Very low”, according to the GRADE approach by Furlan et al. [5]. Single studies were considered imprecise (i.e. sparse

data) and provide “low quality evidence”, which could be further downgraded to “very low quality evidence” if there were also limitations in design or indirectness.

Results

Search and selection results

The search yielded 2,383 citations. In total, five studies were identified [2, 12, 13, 19, 22]. Three comparisons were evaluated: (1) one study compared early surgery with prolonged conservative care for 6 months followed by surgery if needed [13], (2) three studies contrasted surgery with “usual conservative care” [12, 19, 22], and (3) one study contrasted surgery with epidural injections [2].

Risk-of-bias assessment

The results for the risk-of-bias assessment are given in Table 3. Of the five identified studies, two were thought to have a low risk of bias, both of which also applied adequate allocation concealment [13, 22]. Although compliance was not formally evaluated because surgery is considered a single-session intervention, this nevertheless is an important item. In the study by Weinstein et al. [22], for example, adherence to the assigned treatment group was severely limited, i.e. 50% of the patients assigned to surgery actually received surgery within 3 months of enrolment, while 30% of those patients assigned to non-operative treatment received surgery in the same period. In the study by Butterman et al. [2], more than half of those patients assigned to epidural injections considered the treatment a failure and underwent subsequent discectomy, which on average was 4.5 months following the onset of symptoms. In another study, a substantial proportion of patients assigned to conservative care received surgery at follow-up [13]; however, that study was designed to evaluate the timing of surgery and part of the control group randomised to prolonged conservative care was expected to receive surgery during follow-up.

Effects of the interventions

Due to poor reporting of data in the studies of Weber et al. [19] and Osterman et al. [12], these studies comparing surgery with usual conservative care could not be pooled. The comparisons ‘surgery versus epidural injections’ and ‘early surgery versus prolonged conservative care’ were each investigated in only one trial. The characteristics of the included trials are given in Table 4. The results of the five included trials are given in Table 5. The few number

Table 2 Items from the risk-of-bias tool and criteria for operationalisation

Question	Criteria for “Yes”
Was the method of randomisation adequate?	A random (unpredictable) assignment sequence. Examples of adequate methods are coin toss, rolling a dice, drawing of ballots with the study group labels from a dark bag, computer-generated random sequence, pre-ordered sealed envelopes and sequentially-ordered vials. Examples of inadequate methods are: alternation, birth date, social insurance/security number and hospital registration number
Was the treatment allocation concealed?	Assignments are generated by an independent person not responsible for determining the eligibility of the patients. This person has no information about the persons included in the trial and has no influence on the assignment sequence or on the eligibility decision of the patient
Were the groups similar at baseline regarding the most important prognostic indicators?	The groups have to be similar at baseline regarding demographic factors, duration and severity of complaints, percentage of patients with neurological symptoms, and value of main outcome measure(s)
Was the patient blinded to the intervention?	The index and control groups are indistinguishable for the patients
Was the care provider blinded to the intervention?	The index and control groups are indistinguishable for the care providers
Was the outcome assessor blinded to the intervention?	<ul style="list-style-type: none"> • For patient-reported outcomes with adequately blinded patients • For outcome criteria that supposes a contact between participants and outcome assessors: the blinding procedure is adequate if patients are blinded, and the treatment or adverse effects of the treatment cannot be noticed during examination • For outcome criteria that do not suppose a contact with participants: the blinding procedure is adequate if the treatment or adverse effects of the treatment cannot be noticed during the assessment • For outcome criteria that are clinical or therapeutic events that will be determined by the interaction between patients and care providers, in which the care provider is the outcome assessor: the report needs to be free of selective outcome reporting
Were co-interventions avoided or similar?	There were no co-interventions or they were similar between the index and control groups
Was the compliance acceptable in all groups?	The compliance with the interventions is acceptable, based on the reported intensity, duration, number and frequency of sessions for both the index intervention and control intervention(s). For single-session interventions (for ex: surgery), this item is irrelevant
Was the drop-out rate described and acceptable?	The number of participants who were included in the study but did not complete the observation period or were not included in the analysis are described and reasons are given and are <20% for short-term and <30% for long-term follow-up
Was the timing of the outcome assessment similar in all groups?	Timing of outcome assessment was identical for all intervention groups and for all important outcome assessments
Were all randomised participants analysed in the group to which they were allocated?	All randomised patients are reported/analysed in the group they were allocated to by randomisation for the most important moments of effect measurement (minus missing values) irrespective of non-compliance and co-interventions

of studies identified per outcome made a funnel plot unfeasible.

Early surgery versus prolonged conservative care

One large randomised trial ($n = 283$) with a low risk of bias compared early surgery to prolonged conservative treatment followed by surgery if needed in patients with severe sciatica for 6–12 weeks [13]. Of the patients, 89% randomised to early surgery underwent microdiscectomy after a mean of 2 weeks, while 39% of patients randomised to conservative treatment underwent surgery after a mean of 19 weeks. Relief of leg pain was faster for patients assigned to early surgery. Intention-to-treat analysis

showed statistically significant more leg pain relief in favour of early surgery as compared with prolonged conservative care at 3 months (MD -17.70 , 95% CI -23.1 to -12.3). There was no significant overall difference between the two groups in disability scores during the first year. The median time to recovery was 4.0 weeks [95% confidence interval (CI), 3.7–4.4] for early surgery and 12.1 weeks (95% CI, 9.5–14.9) for prolonged conservative treatment. During the first year, early surgery achieved a faster rate of perceived recovery with a hazard ratio of 1.97 (95% CI 1.72–2.22, $P < 0.001$). At 1 year of follow-up, however, 95% of patients in both treatment groups had experienced satisfactory recovery, and no subsequent differences were found. This lack of a difference between

Table 3 Overview risk of bias for surgical, including epidural injections versus conservative therapy

References	Randomisation adequate?	Allocation concealed?	Groups similar at baseline?	Patient blinded?	Care provider blinded?	Outcome assessor blinded?	Co-interventions avoided or similar?	Compliance acceptable?	Drop-out rate described and acceptable?	Timing outcome assessment similar?	Intention-to-treat analysis?	Total
Buttermann [2]	?	?	+	-	-	-	-	na	-	-	?	1
Osterman [12]	+	+	-	-	-	-	-	na	+	+	+	5
Peul [13]	+	+	+	-	-	-	-	na	+	+	+	6
Weinstein [22]	+	+	+	-	-	-	-	na	+	+	+	6
Weber [19]	+	+	?	-	-	-	?	na	+	+	?	4

na not applicable

? = Unsure

groups was maintained for the following year. In conclusion, one low-risk-of-bias study yielded a low level of evidence (GRADE) to the effect that early surgery was beneficial for pain relief as compared to prolonged conservative care in the short term, but not in the longer term with a faster recovery rate for early surgery.

Surgery versus usual conservative care

One old study ($n = 126$) with a high risk of bias compared long-term outcomes of discectomy to conservative management [19]. Both patient and observer ratings demonstrated that discectomy was significantly better than conservative treatment at 1 year. After 1 year, 24 of the 66 patients (36%) in the conservative care group versus 39 of the 60 patients (65%) in the surgery group reported a good outcome. No significant differences in outcomes were reported at 4 and 10 years follow-up.

One small trial ($n = 56$) with a high risk of bias compared microdiscectomy with conservative treatment in patients with sciatica for 6–12 weeks [12]. Overall, no significant differences were found for leg pain or back pain, and subjective disability throughout the 2 years of follow-up. VAS leg pain scores, however, improved more rapidly in the discectomy group; 6 weeks scores in the surgery group was 12 (SD 20) versus 25 (SD 27) in the conservative group. The per-protocol analysis demonstrated no statistically significant differences.

A large trial ($n = 501$) with a low risk of bias in patients with sciatica for at least 6 weeks and confirmed disc herniation showed that both the surgery as well as the conservative treatment group improved substantially over 2 years for all primary and secondary outcome measures [22]. The intention-to-treat analysis showed no statistically significant differences for any of the primary outcome measures. Of the patients randomised to surgery, 50% received surgery within 3 months of inclusion as compared with 30% who received surgery in the group randomised to conservative treatment. After 2 years of follow-up, 45% of patients in the conservative treatment group underwent surgery and 40% in the surgery group received conservative treatment.

In conclusion, there is conflicting evidence as to whether surgery is more beneficial than conservative care for short- and long-term follow-up.

Surgery versus epidural steroid injections

One trial ($n = 100$) with a high risk of bias was identified that compared results following microdiscectomy with results after epidural steroid injection [2]. Patients undergoing discectomy had the most rapid decrease in their symptoms. The decrease in leg pain in the discectomy

Table 4 Characteristics of the included studies: Surgery including epidural injections, versus conservative care

References	Sample size	% Female	Average age (range)	Participants	Interventions	Outcomes	Follow-up
Buttermann [2]	169	?	40	Between 18 and 70 years Lumbar disc herniation [$>25\%$ of the CSA of spinal canal (MRI or CT)] (at least 6 weeks)	Exp: Epidural steroid injections Control: Lumbar discectomy	Neurological status Current and lower extremity pain (VAS, 0–10) ODI Type, frequency and change of medication Self-perceived recovery Satisfaction w/treatment Leg pain (VAS) (Pr)	1–3 months 4–6 months 7–12 months 1–2 years 2–3 years 6 weeks
Osterman [12]	56	39%	37.5 (20–50)	Below knee radicular pain of 6–12 weeks Intervertebral disc extrusion or sequester (CT) Positive straight leg raising test $<70^\circ$, muscle weakness, altered deep tendon reflex or dermatomal sensory change	Exp: Microdiscectomy (2 weeks) Control: Conservative management	Leg pain (VAS) (Pr) LBP and work ability (VAS) 15D QoL ODI Risk of depression Satisfaction with treatment Perceived recovery Clinical status	3 months 1 and 2 years
Peul [13]	283	44%	41.7/43.4	Aged 18–65 years Lumbosacral radicular syndrome diagnosed by an attending neurologist for 6 to 12 weeks Radiologically confirmed disc herniation Dermatomal pattern of pain distribution with concomitant neurological disturbances that correlated to the same nerve root being affected	Exp: Early surgery (Discectomy, 2 weeks) Control: Prolonged conservative treatment with delayed surgery, if necessary (19 weeks)	RMDQ (Pr) Leg pain (VAS) (Pr) Self-perceived recovery (Pr) Neurological status LBP (VAS) PROLO scale	2, 4, 8, 12, 26 and 38 weeks 12, 18 and 24 months

Table 4 continued

References	Sample size	% Female	Average age (range)	Participants	Interventions	Outcomes	Follow-up
Weinstein [22]	501	42%	42	18 years or older	Exp: Standard open discectomy Control: Non-operative treatment, consisting of conservative care	MOS SF 36 bodily pain and physical function (changes from baseline) (Pr) ODI (Pr)	6 weeks 3 months
				Radicular pain (below the knee for lower lumbar herniations, into the anterior thigh for upper lumbar herniations) at least 6 weeks Evidence of nerve root irritation with a positive nerve root tension sign (straight leg raise positive between 30° and 70° or positive femoral tension sign) or a corresponding neurologic deficit Advanced vertebral imaging		Sciatica Bothersomeness Index	6 months
Weber [19]	126	42%	41.6	Clinical signs/symptoms of 5th lumbar and/or 1st sacral nerve root lesion corresponding with radiculography (unknown duration)	Exp: Lumbar discectomy Control: continued conservative treatment	Satisfaction with symptoms Self-reported improvement Employment status Clinicians perception of recovery (working capacity, neurological deficits, pain, and mobility of the spine; relapse)	1 and 2 years

ODI Oswestry Disability Index, VAS visual analogue scale (in 100 mm, unless otherwise specified), LBP low back pain, RMDQ Roland and Morris disability questionnaire, MOS SF36 medical outcome study short form 36, Exp experimental therapy
? = Not reported

Table 5 Results of the included studies: Surgery, including epidural injections, versus conservative care

References	Group	Cross-over	Pain	Recovery	Good outcome	Qualitative short term	Qualitative long term
Buttermann [2]	Epidural steroid injection	At 3 years: 58%	VAS leg pain [mean (SD)] (Inferred from graph)	NR	Successful treatment	Greater decrease in leg pain at 3 and 6 months for microdiscectomy	No differences at 1, 2 and 3 years for leg pain
		At 2–3 years: 8 (12)	At 2–3 years: 15 (17)	NR	Various: 42–56%		
		At 3 years: 4%	At 2–3 years: 15 (17)	NR	Various: 92–98%		
Osterman [12]	Conservative care	At 2 years: 39%	VAS Leg pain [ITT, mean (SD)]:	Recovered (number/total)	VAS Satisfaction	More rapid relief of leg pain at 6 weeks	No differences at 2 years leg pain, back pain and disability
		At 1 year: 9 (19)	At 1 year: 9 (19)	At 6 weeks: 0/26 At 1 year: 5/21	At 1 year: 85 (20)		
Peul [13]	Prolonged conservative care	At 2 years: 0%	At 1 year: 6 (11)	At 6 weeks: 5/26 At 1 year: 7/20	At 1 year: 89 (20)		
		At 1 year: 39%	VAS leg pain [ITT, mean (SE)]:	Time to recovery	Likert (ITT, mean (SE))	Better pain relief at 3 months for early surgery. No difference in disability. Faster time to recovery for early surgery	No differences at 1 and 2 years for recovery
		At 8 weeks: 27.9 (1.9)	At 8 weeks: 27.9 (1.9)	12.1 weeks	At 8 weeks: 3.1 (0.1)		
Weinstein [22]	Conservative care	At 1 year: 41%	SF 36 pain [mean (SE)]:	NR	At 1 year: 1.9 (0.1)		No differences at 2 years on any outcome parameters
		At 2 years: 45%	At 1 year: 36.9 (1.8)		SRP (% (SE)):		
		At 2 years: 37.1 (1.9)	At 2 years: 37.1 (1.9)		At 1 year: 66.7 (3.2)		
Surgery	At 1 year: 57%	At 1 year: 39.7 (1.8)	NR	At 2 years: 69.3 (3.3)			
	At 2 years: 40%	At 2 years: 40.3 (1.9)		At 1 year: 75.7 (3.0)			
Weber [19]	Usual conservative care	Constant: 26%	No pain (ITT, No pain/total):	NR	At 2 years: 76.3 (3.1)		No differences at 4 and 10 years
		At 4 years: 45/66 At 10 years: 65/66	At 4 years: 45/66 At 10 years: 65/66		SRP (ITT, % good):	Better patient and observer ratings at 1 year for discectomy	
Surgery	Constant: 2%	At 4 years: 45/57 At 10 years: 54/55	NR	At 1 year: 65% At 4 year: 70% At 10 year: 64%			

ITT: intention to treat, NR not reported, VAS visual analogue scale (in 100 mm, unless otherwise specified), SD standard deviation, SE self rated progress, SRP self rated progress, Likert Likert score for global perception of recovery

group was significantly greater than in the epidural steroid injection group at 3- and 6-month follow-up intervals, but not beyond 1 year. There were no significant differences between groups for back pain throughout the follow-up. Of the 50 patients, 27 who received a steroid injection had a subsequent microdiscectomy. Outcomes in this cross-over group were similar to those of the surgery group. In conclusion, there is very low quality evidence (high risk of bias) that discectomy was beneficial over epidural steroid injections for the short term only.

Discussion

In this review we identified five studies comparing surgery with conservative care. Only one low-risk-of-bias study compared early surgery to prolonged conservative care [13] and demonstrated more relief of leg pain up to 3 months for early surgery, but at 1 year the differences disappeared. The trials of surgery versus usual conservative treatment showed inconsistent findings. One low-risk-of-bias study compared surgery versus conservative treatment [22] and found no differences between the two treatments. We were unable to perform a meta-analysis of these three studies because of the poor data presented in two of the studies. An observational cohort study conducted alongside one trial included 743 patients that received their preferred treatment. Both groups improved substantially over time, but surgery showed significantly better results for pain and function as compared with conservative treatment [21].

Three of the five studies found an effect in the early postoperative period, which diminished during further follow-up. This is relevant because a faster recovery rate could, besides the clinical benefit, have an economic advantage in a relatively young patient population. A cost-effectiveness study performed alongside the trial of Peul et al. [13] showed that surgery is cost-effective with a willingness to pay 40,000 € as per quality-adjusted life years (QALY) [16]. In relation to this, timing of treatment is under debate, but for a reliable analysis of the effect of different timing, information about duration of symptoms is needed. The duration between onset of symptoms and actual treatment is described in four of the five trials [2, 12, 13, 19]. Equally important is the timing of the treatment after diagnosis by protocol or waiting list. This is only reported in two of the trials being 2 weeks [2, 13]. Heterogeneity in the duration of the symptoms or in the timing of treatments introduces a difference in timing of treatment since the onset of complaints and thus bias in the analysis of recovery rate.

The duration and intensity of the conservative treatment is poorly described in the included studies. There are many treatment regimens and modalities available for

conservative treatment of sciatica [18] varying from steroids [14] to traction [3] to physiotherapy interventions [10]. Evidence from systematic reviews of conservative interventions for sciatica fail to identify the effect of one intervention over the other, however, large studies with a low risk of bias are scarce [11]. In order to make an informed decision about the clinical homogeneity of the included comparisons, detailed information about the treatments is essential and the denomination “conservative treatment” is not sufficient.

Three narrative reviews which examined choice of surgery or conservative care concluded that surgery is indicated in presence of persistent neuromotor deficit [1, 7, 9]. Both Awad and Moskovich [1] and Legrand et al. [9] suggested to let the patient make an informed choice. The review of Awad and Moskovich [1] was published before publication of three of the studies included in this review [12, 13, 22]. Although the publication of Legrand et al. was in 2007, this study did not include two studies [2, 12] published before that date. Gregory et al. [7] promoted surgery with persistent neuromotor deficit or severe sciatica with a positive straight-leg-raise test and imaging demonstrating lumbar disc herniation at the nerve root level correlating with the patient’s examination findings. Although published in October 2008, this study did not include three studies [2, 12, 19] published before that date. Both reviews did not describe their search strategy, selection methods or quality assessments of the included studies and are therefore, potentially, prone to bias.

Strengths and limitations

There are some limitations in our present review. Firstly, the limited amount of studies, especially those with a low risk of bias, limits the strength of our recommendations. The GRADE approach needs consistent findings in separate studies to raise the level of evidence to ‘moderate’ or ‘high’. The overall quality of the evidence should not be misinterpreted as the quality of an individual study.

A more general problem lies within the methodology of research for the assessment of timing of interventions. Current research models, with the randomised clinical trial as the gold standard, do not allow for a proper analysis of the difference between the time from inclusion (or onset of symptoms) to intervention and prolonged control intervention. The design and analysis of studies is complicated by the difference in cross-over possibilities between the two interventions. Crossing over from conservative treatment to surgery is to be expected for a certain amount of patients. The reverse is also possible as shown in the study of Weinstein et al. [22]. The mechanism is however different as crossing over is only counted as surgery did not take place at all.

The clinical data seem to favour surgery slightly; however, the costs of surgery are likely to be higher than conservative treatment for patients or the health care system. Also, potential complications are probably more prevalent and more severe with surgery. Only from a societal perspective it might be more cost-effective because of lower cost of production loss [16]. Evaluating conservative treatment and surgical intervention requires a different set of outcome parameters, including complications, re-surgeries and economical information to allow for a balanced and informed cost-complication-effectiveness decision.

Conclusions

In general, there is evidence that early surgery in patients with sciatica provides for a better short-term relief of leg pain as compared to prolonged conservative care, but the evidence is low quality because of the fact that only one trial investigated this properly. No significant differences were found between surgery and usual conservative care in any of the clinical outcomes after 1 and 2 years, but the evidence is of very low quality. The scarcity of studies as well as the limited quality of the studies does not support the choice for any timing in our current guidelines.

Future studies should evaluate who benefits more from surgery and who from conservative care. Also economic evaluations should analyse the economical gain of the potential faster recovery against increased cost and complication rate of surgery.

Acknowledgments This study was supported by a grant from the Dutch Health Insurance Council.

Conflict of interest None.

Open Access This article is distributed under the terms of the Creative Commons Attribution Noncommercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

References

- Awad JN, Moskovich R (2006) Lumbar disc herniations: surgical versus nonsurgical treatment. *Clin Orthop Relat Res* 443:183–197
- Buttermann GR (2004) Treatment of lumbar disc herniation: epidural steroid injection compared with discectomy. A prospective, randomized study. *J Bone Joint Surg Am* 86-A:670–679
- Clarke J, van TM, Blomberg S, de VH, van der Heijden G, Bronfort G (2006) Traction for low back pain with or without sciatica: an updated systematic review within the framework of the Cochrane collaboration. *Spine (Phila Pa 1976)* 31:1591–1599
- Foley K, Smith MM (1997) Microendoscopic discectomy. *Tech Neurosurg* 3:301–307
- Furlan A, Pennick V, Bombardier C, van Tulder M (2009) 2009 Updated method guidelines for systematic reviews in the Cochrane Back Review Group. *Spine* 34:1929–1941
- Gibson JNA, Waddell G (2007) Surgical interventions for lumbar disc prolapse. *Cochrane Database of Systematic Reviews* CD001350. doi:10.1002/14651858.CD001350.pub4
- Gregory DS, Seto CK, Wortley GC, Shugart CM (2008) Acute lumbar disk pain: navigating evaluation and treatment choices. *Am Fam Physician* 78:835–842
- Konstantinou K, Dunn KM (2008) Sciatica: review of epidemiological studies and prevalence estimates. *Spine (Phila Pa 1976)* 33:2464–2472
- Legrand E, Bouvard B, Audran M, Fournier D, Valat JP (2007) Sciatica from disk herniation: medical treatment or surgery? *Joint Bone Spine* 74:530–535
- Luijsterburg PA, Verhagen AP, Ostelo RW, van den Hoogen HJ, Peul WC, Avezaat CJ, Koes BW (2008) Physical therapy plus general practitioners' care versus general practitioners' care alone for sciatica: a randomised clinical trial with a 12-month follow-up. *Eur Spine J* 17:509–517
- Luijsterburg PA, Verhagen AP, Ostelo RW, van Os TA, Peul WC, Koes BW (2007) Effectiveness of conservative treatments for the lumbosacral radicular syndrome: a systematic review. *Eur Spine J* 16:881–899
- Osterman H, Seitsalo S, Karppinen J, Malmivaara A (2006) Effectiveness of microdiscectomy for lumbar disc herniation: a randomized controlled trial with 2 years of follow-up. *Spine (Phila Pa 1976)* 31:2409–2414
- Peul WC, van Houwelingen HC, van den Hout WB, Brand R, Eekhof JA, Tans JT, Thomeer RT, Koes BW (2007) Surgery versus prolonged conservative treatment for sciatica. *N Engl J Med* 356:2245–2256
- Price C, Arden N, Coglán L, Rogers P (2005) Cost-effectiveness and safety of epidural steroids in the management of sciatica. *Health Technol Assess* 9:1–58, iii
- Valat JP, Genevay S, Marty M, Rozenberg S, Koes B (2010) Sciatica. *Best Pract Res Clin Rheumatol* 24:241–252
- van den Hout WB, Peul WC, Koes BW, Brand R, Kievit J, Thomeer RT (2008) Prolonged conservative care versus early surgery in patients with sciatica from lumbar disc herniation: cost utility analysis alongside a randomised controlled trial. *BMJ* 336:1351–1354
- van Tulder M, Peul W, Koes B (2010) Sciatica: what the rheumatologist needs to know. *Nat Rev Rheumatol* 6:139–145
- Vroomen PC, de Krom MC, Slofstra PD, Knottnerus JA (2000) Conservative treatment of sciatica: a systematic review. *J Spinal Disord* 13:463–469
- Weber H (1983) Lumbar disc herniation. A controlled, prospective study with ten years of observation. *Spine (Phila Pa 1976)* 8:131–140
- Weber H, Holme I, Amlie E (1993) The natural course of acute sciatica with nerve root symptoms in a double-blind placebo-controlled trial evaluating the effect of piroxicam. *Spine (Phila Pa 1976)* 18:1433–1438
- Weinstein JN, Lurie JD, Tosteson TD, Skinner JS, Hanscom B, Tosteson AN, Herkowitz H, Fischgrund J, Cammisa FP, Albert T, Deyo RA (2006) Surgical vs nonoperative treatment for lumbar disc herniation: the Spine Patient Outcomes Research Trial (SPORT) observational cohort. *JAMA* 296:2451–2459
- Weinstein JN, Tosteson TD, Lurie JD, Tosteson AN, Hanscom B, Skinner JS, Abdu WA, Hilibrand AS, Boden SD, Deyo RA (2006) Surgical vs nonoperative treatment for lumbar disc herniation: the Spine Patient Outcomes Research Trial (SPORT): a randomized trial. *JAMA* 296:2441–2450