Eur Spine J (2007) 16:881–899
DOI 10.1007/s00586-007-0367-1

ORIGINAL ARTICLE

Effectiveness of conservative treatments for the lumbosacral radicular syndrome: a systematic review

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Received: 20 May 2006 / Revised: 3 January 2007 / Accepted: 10 March 2007 / Published online: 6 April 2007

Abstract Patients with a lumbosacral radicular syndrome are mostly treated conservatively first. The effect of the conservative treatments remains controversial. To assess the effectiveness of conservative treatments of the lumbosacral radicular syndrome (sciatica). Relevant electronic databases and the reference lists of articles up to May 2004 were searched. Randomised clinical trials of all types of conservative treatments for patients with the lumbosacral radicular syndrome selected by two reviewers. Two reviewers independently assessed the methodological quality and the clinical relevance. Because the trials were considered heterogeneous we decided not to perform a meta-analysis but to summarise the results using the rating system of levels of evidence. Thirty trials were included that evaluated injections, traction, physical therapy, bed rest, manipulation, medication, and acupuncture as treatment for the lumbosacral radicular syndrome. Because several trials indicated no evidence of an effect it is not recommended to use corticosteroid injections and traction as treatment option. Whether clinicians should prescribe physical therapy, bed rest, manipulation or medication could not be concluded from this review. At present there is no evidence that one type of treatment is clearly superior to others, including no treatment, for patients with a lumbosacral radicular syndrome.

Keywords Conservative treatment · Lumbosacral radicular syndrome · Randomised clinical trial · Sciatica · Systematic review

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Background

The lumbosacral radicular syndrome (LRS), also called sciatica, is a disorder with radiating pain in one or more lumbar or sacral dermatomes, and can be accompanied by phenomena associated with nerve root tension or neurological deficits [26, 27, 34, 43]. A prolapsed disc mostly causes LRS, but other causes include spinal or lateral recess stenosis, tumours or radiculitis [13, 34]. The incidence of LRS in general practice in the Netherlands is estimated between 60,000 and 75,000 a year [13].

Most patients with LRS are treated conservatively in the first 6–12 weeks (acute and subacute phase) [34]. However, the effectiveness of most of the conservative interventions has not yet been demonstrated beyond doubt. The review of Vroomen et al. [40] about conservative treatment of sciatica showed the lacking of evidence either for or against the efficacy of traction, exercise therapy or drug therapy for the management of LRS. They reported that epidural steroids

might be beneficial for subgroups of nerve root compression. Vroomen et al. searched literature between 1966 and March 1998. Several new RCTs have been published since, so an updated review on the whole spectrum of conservative management in LRS seems to be indicated. Also, recent developments in the methodology of systematic reviews are included in the present review and finally more specific physical therapy databases were searched.

Objectives

The aim of this systematic review was to assess the effectiveness of conservative treatments in the lumbosacral radicular syndrome when compared to placebo, inactive or no treatment and other forms of conservative care or surgery.

Criteria for considering studies for this review

Types of studies

Only randomised clinical trials (RCTs) published in English, Dutch, French and German languages were included. Excluded were abstracts of which full reports were not available and unpublished studies.

Types of participants

Included patients with an acute (less than 6 weeks), subacute (6-12 weeks) or chronic (12 weeks or more) lumbosacral radicular syndrome treated in a primary health care or occupational setting were included. Those patients with LRS, which focus on rarely occurring causes such as tumours and radiculitis were excluded.

Types of interventions

All types of conservative treatment such as oral medication (e.g. NSAIDs, muscle relaxants), injections, physical therapy, spinal manipulation, bed rest, traction and acupuncture were included. Comparisons investigated were: (1) conservative treatment versus placebo, inactive or no treatment, (2) conservative treatment versus other type(s) of conservative treatment, and (3) conservative treatment versus surgery.

Types of outcome measures

Studies were included that used at least one of the four primary outcome measures that we considered to be the most important [36]; that is an outcome of symptoms (e.g. pain), overall improvement (e.g. proportion of patients recovered, subjective improvement of symptoms), function (e.g. Roland Disability Questionnaire for sciatica, Oswestery Scale), and return to work (e.g. days off work).

Outcomes of physiological or physical examinations (e.g. range of motion, spinal flexibility, degrees of straight leg raising or muscle strength), quality of life (e.g. SF-36, Nottingham Health Profile, Sickness Impact Profile) and psycho-social outcomes (anxiety, depression, pain behaviour) were considered as secondary outcomes. Other outcomes such as medical consumption and side effects were also considered.

The treatment outcomes were assessed at short-term follow-up (less than 3 months after randomisation), at intermediate follow-up (between 3 months and 1 year after randomisation) and at long-term follow-up (1 year or more after randomisation).

Search strategy for identification of studies

We used the search strategy recommended by the Editorial Board of the Cochrane Collaboration Back Review Group [36] The highly sensitive search strategies for retrieval of studies of controlled trials [30] were run in conjunction with a specific search for the lumbosacral radicular syndrome and conservative treatments. All relevant studies meeting our inclusion criteria were identified by: (1) searches in electronic database: PUBMED-MEDLINE (from 1966 to May 2004), EMBASE (from 1980 to May 2004), Cochrane Central Register of Controlled Trials (CENTRAL, 1800–2004) [10], Cinahl (from 1982 to May 2004), PsycINFO (psychological interventions from 1984 to May 2004), and PEDro (Physiotherapy Evidence Database to May 2004), and (2) screening the references of all studies selected from the electronic databases searches and relevant reviews.

Methods

Study selection

One reviewer (PL) performed the search strategy. Two reviewers (PL and TvO) independently selected the studies to be included in the systematic review. First, they screened the title, keywords and abstract for eligibility. Secondly, they assessed the full text papers to ascertain whether the study met the inclusion criteria regarding design, subjects, and intervention. Disagreements on inclusion are resolved by discussion, or through arbitration by a third reviewer (AV).

Methodological quality assessment

Two reviewers (PL and RO) independently assessed the methodological quality (MQ), using the Delphi list [38]. The Delphi list contains nine items relevant for the internal validity of each of the assessed articles. Each item was rated as 'yes', 'no', or 'don't know' (insufficient or no information presented). Equal weights were applied that resulted in a total score of each RCT, by adding the 'Yes' scores (range 0–9). A high quality (HQ) RCT was defined as a study that had a positive score (Yes) on five or more Delphi criteria. Disagreements were solved in a consensus meeting. When disagreements persisted a third reviewer (AV) was consulted.

Clinical relevance

Two reviewers (WP and BK) independently assessed the clinical relevance (CR). The Cochrane Collaboration Back Review Group recommends the following five questions used in judging clinical relevance [36]:

(1) Are the patients described in detail so that you can decide whether they are comparable to those you see in your own practice? (2) Are the intervention(s) and treatment setting (s) described well enough to allow you to provide the same to your own patients? (3) Were all clinically relevant outcomes measured and reported? (4) Is the size of effect clinically important? and (5) Are the likely treatment benefits worth the potential harms? Each question was rated as 'yes', 'no', or 'don't know' (insufficient or no information presented). Disagreements were solved in a consensus meeting. When disagreements persist a third reviewer (AV) was consulted. A study was considered clinical relevant if the questions 1, 2 and 3 scored 'Yes'.

Data extraction

One reviewer (PL) extracted the data of the included RCTs. In cases of uncertainly about the data extracted from the individual trials a second reviewer (AV) was consulted.

Data analysis

The inter-observer reliability of the quality assessments was calculated using Kappa (<0.5 means a poor level of agreement between assessors; between 0.5 and 0.7 a moderate level of agreement, and >0.7 a high level of agreement) [19].

The data of the effect measurements reported in each study are presented as relative risks (RR) with corresponding 95% confidence intervals for dichotomous data and effect sizes (ES) and 95% confidence intervals for continuous data.

Quantitative analysis

Statistical pooling (meta-analysis) of the study outcomes (using a random effect model) will be performed if the studies are considered clinically homogeneous.

Qualitative analysis

If the studies are considered to be heterogeneous, the factors possibly underlying this phenomenon are considered. The results are summarised using a rating system that consists of following five levels of scientific evidence which have been used in previous systematic reviews in the field of back pain, based on the overall quality and the outcome of the studies [36]: (1) strong evidence—consistent findings in multiple high quality RCTs, (2) moderate evidence—consistent findings among multiple low quality RCTs and/or one high quality RCT, (3) limited evidence—one low quality RCT, (4) conflicting evidence—inconsistent findings among multiple RCTs and (5) no evidence—no RCTs. Consistent findings mean that 80% of the findings are in the same direction.

Results

Description of studies

The search strategy in the electronic databases selected 794 titles to be screened by two reviewers (PL and TvO). Disagreements were discussed and solved; 30 RCTs were included which were published in English and in French. Figure 1 shows the flow chart of the selection process.

The 30 publications included in total 2,780 patients with LRS and evaluated injections (n = 14), traction (n = 9), physical therapy (n = 4), bed rest (n = 2), manipulation (n = 2), medication (n = 2) and acupuncture (n = 1). In 18 RCTs the sample size was small, meaning less than 30 patients in one study arm.

Methodological quality of the included studies

The two reviewers (PL and RO) agreed on 230 of the 270 item scores (85.2%). The inter-observer reliability of the MQ assessment (kappa = 0.70) was moderate. Disagreements were solved in consensus for most cases, the third reviewer (AV) had to decide five times (1.8%). Detailed results of the MQ assessment are presented in Tables 1, 2, 3, 4, 5, 6 and 7. Twelve studies (40.0%) of the 30 included RCTs were considered to be of high quality. The overall MQ score ranged from two to nine out of maximal nine points. The following are the most prevalent shortcomings of the studies concerned: no adequate description of

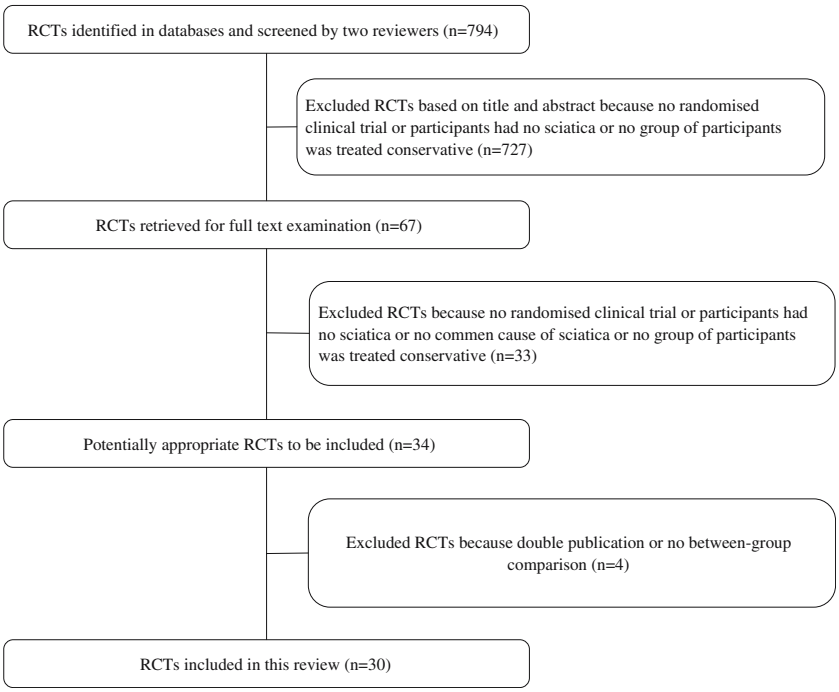

Fig. 1 Flow chart of the selection process

treatment allocation concealment (n = 27), no attempt to blind the care provider (n = 26) or the analysis did not include an intention-to-treat analysis (n = 23).

Clinical relevance

The two reviewers (WP and BK) agreed on 125 of the 150 item scores (83.3%). The inter-observer reliability of the clinical relevance assessment (kappa = 0.67) was moderate. Disagreements were solved in consensus for all cases. Detailed results of the clinical relevance assessment are presented in Tables 1, 2, 3, 4, 5, 6 and 7. The overall clinical relevance score ranged from 0 to 5 out of maximal 5 points. Ten studies (33.3%) were considered clinically relevant because a 'Yes' was scored on the first three questions.

Finally, six RCTs [6, 11, 17, 33, 35, 43] were considered to be of high quality and clinically relevant. Five RCTs [6, 11, 17, 33, 35] evaluated injections and 1 RCT [43] medication.

Evidence of effectiveness

Even in subgroups according to the intervention the included RCTs were not considered clinically comparable concerning study population (e.g. underlying cause of LRS and acute, subacute and chronic patients), control treatments, duration of follow-up, and outcome measures. Because of this heterogeneity we refrained from statistical pooling and performed a qualitative analysis.

Injections

Table 1 shows the characteristics of fourteen studies that compared injection to placebo (9 RCTs), to no treatment (2 RCTs) and to other injections (4 RCTs).

Versus placebo

Nine studies [5, 6, 8, 11, 14, 17, 18, 29, 33] compared epidural or extradural corticosteroid injection to placebo injection. Six studies were considered high quality [6, 8, 11, 17, 29, 33] of which one study [29] did not provide any data.

In three high quality studies [6, 11, 33] and one low quality study [14], we found no difference in pain between injection and placebo at short-term. However, in another one high quality [17] and one low quality study [5] we found an effect in pain at short-term, in favour of injection.

In three high quality studies [6, 8, 33] and one low quality study [18], we found no difference in overall improvement between injection and placebo at short-term. However, in another low quality study [14] we found an effect in improvement, in favour of injection.

Long-term effects for pain and overall improvement were not found in two high quality studies [17] and one low quality study [5]. Also, no short or long-term effects were found for disability and return to work in three high quality studies [6, 11, 17].

In conclusion, when comparing corticosteroid injections to placebo for patients with LRS we found conflicting

Table 1 Characteristics of 14 included studies evaluating injections

Study	Participants	Interventions	Outcomes	Results and side effects	Notes
Borms [2] MQ 2 (1,8)[a] CR 2 (1,2)[b]	40 patients with acute, subacute or chronic complaints. 12 women, mean age in years: I 36.7, C 41.6	I Intramuscular injection, *N* = 20. Tiaprofenic 200 mg C Intramuscular injection, *N* = 20. Ketoprofen 100 mg	At 1–4 days follow-up evaluated were: (1) Pain (VAS 0–100) (2) Straight leg raising test (3) Finger to floor distance (cm) (4) Schöber (5) Spinal stiffness (0–4)	Pain: D1: ES 0.1 (–0.6; 0.7)[c] D2: ES 0.3 (–0.3; 0.9) D3: ES 0.6 (0.0; 1.3) D4: ES 0.6 (0.0; 1.3) Side effects: stomach pain: 5 times reported skin reaction: 3 times reported	Dropouts: not described. Other treatments were allowed
Buchner et al. [3] MQ 5 (1,3,4,8,9) CR 2 (1,3)	36 patients with acute, subacute or chronic complaints. 13 women, age range: 20–50 years	I Epidural injection, *N* = 17 Methylprednisolone 100 mg/10 ml bupivacaine (0.25%) C No injection, *N* = 19	At 2 and 6 weeks and 6 months follow-up evaluated were: (1) Pain (VAS 0–100) (2) Disability (HFAQ 0–100) (3) Straight leg raising test (4) Return to work (5) Surgery	Pain: W2: (I) 30.8 vs. (C) 37.1 W6: (I) 32.9 vs. (C) 38.1 M6: (I) 32.9 vs. (C) 39.2 Disability: W2: (I) 63.7 vs. (C) 57.5 W6: (I) 61.5 vs. (C) 78.8 M6: (I) 80.9 vs. (C) 73.4 Return to work: M6: RR 0.5 (0.1; 2.0) Surgery: M6: RR 0.6 (0.1; 2.7) Side effects: 0	Dropouts: 0
Bush and Hillier [5] MQ 4 (1,4,5,7) CR 4 (1,2,3,4)	23 patients with acute, subacute or chronic complaints. 8 women, mean age in years: 37.7	I Epidural injection *N* = 12. Triamcinolone acetonide 80 mg/25 ml C Placebo injection, *N* = 11. Normal saline 25 ml	At 4 weeks and 1-year follow-up evaluated were: (1) Pain (VAS 0-100) (2) Patients' lifestyle (Grogono and Woodgate 6–18) (3) Straight leg raising test	Pain: W4: ES 1.2 (0.2; 2.0) Y1: ES 0.4 (–0.4; 1.3) Side effects: none	Dropouts: I 4, C 1 Bed rest, analgesics, corsets and manipulation were allowed
Carette et al. [6] MQ 9 (1,2,3,4,5,6,7,8,9) CR 3 (1,2,3)	158 patients with acute, subacute or chronic complaint. 55 women. Mean age in years: I 39.0, C 40.6	I Epidural injection. *N* = 78. Methylprednisolone acetate 2 ml mixed by 8 ml of isotonic saline. C Placebo injection *N* = 80. Isotonic saline 1 ml	At 3 weeks and 3 months follow-up evaluated were: (1) Disability (OLBPQ 0–100 and SIP) (2) Improvement (7 item scale) (3) Pain in leg (VAS 0–100) (4) Pain (MGPQ) (5) Physical examinations	Disability (OLBPQ): W3: TE: -2.5 (–7.1; 2.2) M3: TE: -1.9 (–9.3; 5.4) Improvement: W3: TE: 3.4 (–11.4; 18.2) M3: TE: -0.4 (–16.5; 15.7) Pain in leg: W3: TE: –8.6 (–17.5; 0.3) M3: TE: –4.0 (–15.2; 7.2) Side effects: dura punctured: 2 times reported headache: 37 times reported	Dropouts: I 4, C 1

Table 1 continued

Study	Participants	Interventions	Outcomes	Results and side effects	Notes
Cuckler et al. [8] MQ 8 (1,3,4,5,6,7,8,9) CR 2 (1,2)	73 patients with subacute or chronic complaints in hospital. 36 women. Mean age in years: I 48.5, C 49.5	I Epidural injection, *N* = 42. Two ml of sterile water containing 80 mg of methylprednisolone acetate and 5 ml of 1% procaine C Placebo injection. *N* = 31. Two ml of saline with 5 ml 1% procaine	(1) Success (no. of patients) (2) Surgery (no. of patients)	Success: H24: RR: 1.0 (0.7; 1.3) M13-M30: RR: 0.9 (0.7; 1.1) Surgery: M13-M30: RR: 0.8 (0.6; 1.1)	Dropouts: 0. No side effects reported in article
Dilke et al. [11] MQ 5 (1,3,4,5,7) CR 5 (1,2,3,4,5)	100 patients with acute, subacute or chronic complaints. 44 women, age range in years: 18–75	I Extradural injection. *N* = 51. Methylprednisolone 80 mg/10 ml normal saline C Placebo injection. *N* = 48.	At 3 months follow-up were evaluated: (1) Pain (no. of patients) (2) Return to work (3) Surgery (no. of patients) (4) Analgesic consumption	No pain: M3: RR: 0.8 (0.7; 1.0) Return to work: M3: RR: 0.2 (0.1; 0.7) Surgery: M3: RR: 0.7 (0.3; 1.6) Side effects: none	Dropouts: not described
Helliwell et al. [14] MQ 4 (1,4,5,7) CR 4 (1,2,4,5)	39 patients with subacute or chronic complaints. 30 women, mean age in years: I 44.6, C 47.4.	I Extradural injection, *N* = 20. Methylprednisolone 80 mg/10 ml normal saline C Placebo injection, *N* = 19	At 3 months follow-up evaluated were: (1) Pain (no pain) (2) Improvement (no. of patients) (3) Straight leg raising (4) Lumbar movement	No pain: M3: RR: 2.1 (0.8; 5.3) Improvement: M3: RR: 2.7 (1.2; 6.0) Side effects: 0	Dropouts: not described
Karpinnen et al. [17] MQ 8 (1,2,3,4,5,6,7,8) CR 3 (1,2,3)	160 patients with acute, subacute or chronic complaint. 38 women, mean age in years: I 43.8, C 43.7.	I Epidural injection. *N* = 80. Methylprednisolone 40 mg/ml—bupivacaine 5 mg/ml injection. C Placebo injection, *N* = 80 Isotomic (0.9%) sodium chloride solution injection	At 2 and 4 weeks, at 3, 6, and 12 months follow-up evaluated were: (1) Pain in leg (VAS 0-100) (2) Disability (OLBPQ 0-100) (3) Sick leave (days per month) (4) Lumbar flexion (Schöber) (5) Quality of life (NHP) (6) Straight leg raising	Pain in leg: W2: TE 12.5 (1.6; 23.4) W4: TE 2.3 (–8.7; 13.4) M3: TE –0.5 (–12.0; 11.0) M6: TE –16.2 (–26.8; –5.6) M12: TE –5.3 (–15.7; 5.0) Disability OLBPQ: W2: TE 5.1 (-0.3; 10.4) W4: TE 1.5 (-4.4; 7.3) M3: TE -1.3 (-8.6; 6.1) M6: TE -5.9 (-12.4; 0.7) M12: TE -0.4 (-7.0; 6.2) Sick leave: W4: TE -0.5 (-4.9; 3.9) M3: TE 0.2 (-3.9; 4.4) M6: TE -1.7 (–5.1; 1.7) M12: TE 0.6 (–1.2; 2.4) Side effects: retroperitoneal hematoma: 1 time	Dropouts: I 2, C 0

Table 1 continued

Study	Participants	Interventions	Outcomes	Results and side effects	Notes
Klenerman et al. [18] MQ 2 (1,4) CR 2 (1,2)	74 patients with acute, subacute or chronic complaints	I1 Epidural injection, *N* = 16. Depo-medrone 80 mg/20 ml normal saline I2 Epidural injection, *N* = 19 Bupivacaine solution 20 ml 0.25% C1 Placebo injection, *N* = 16. Normal saline 20 ml C2 No injection, *N* = 12	At 2 weeks and 2 months follow-up evaluated were: (1) Pain (VAS 100 mm) (2) Clinician opinion of patient (3) Lumbar flexion (Schöber) (3) Straight leg raising (4) Failed or not failed	Clinician opinion patient failed: I1 vs. C1: RR 0.7 (0.2; 2.6) I2 vs. C1: RR 1.0 (0.4; 2.8) I1 vs. C2: RR 1.3 (0.3; 5.9) I2 vs. C2: RR 1.9 (0.4; 8.1) Side effects: 0	Dropouts: 11
Mathews et al. [25] MQ 3 (1,3,4) CR 1 (2)	57 patients with acute or subacute complaints. 14 women, age range in years: 22–59	I Epidural injection, *N* = 23 Bupivacaine 20 ml (0.125%) and 2 ml methylprednisolone acetate C Control injection, *N* = 34. Lignocaine 2 ml over the sacral hiatus	At 1, 3, 6, and 12 months follow-up evaluated were: (1) Improvement (2) Range of movement (3) Straight leg raising (4) Neurological examination	Improvement (pain score 5 or 6 on 6-point VAS): M1: RR 1.2 (0.7; 1.8) M12: RR 1.0 (0.5; 1.8)	Dropouts: I 5, C 14. No data reported at 3 and 6 months follow-up. No side effects reported in article
Ridley et al. [29] MQ 5 (1,3,4,5,8) CR 3 (1,2,4)	39 patients with acute, subacute or chronic complaints 20 women, mean age in years: I 40, C 39	I Epidural injection, *N* = 19. Methylprednisolone 2 ml with 10 ml saline C Placebo injection, *N* = 16 Saline 2 ml	At 1 and 2 weeks follow-up evaluated were: (1) Rest pain (VAS) (2) Walking pain (VAS) (3) Straight leg raising test	Side effects: Headache: 2 times reported	Dropouts: 4. Data not clear presented and at 4, 12, and 24 weeks only I was measured In C 14 received a steroid injection (crossover)
Rogers et al. [31] MQ 4 (1,3,5,7) CR 3 (1,2,3)	30 patients with acute, subacute or chronic complaints 16 women, mean age in years: I 42, C 41	I Epidural injection, *N* = 15 Methylprednisolone 80 mg/2 ml, 14 ml lignocaine 2% and saline 4 ml C Epidural injection, *N* = 15 Lignocaine 14 ml 2% with saline 6 ml	At 1 month follow-up evaluated were: (1) Pain (5-point scale) (2) Work status (3-point scale) (3) Straight leg raising test (4) Drug intake	No pain: M1: RR 3.0 (0.3; 25.7) Full work status: M1: RR 1.6 (0.7; 3.8)	Dropouts: 0. No side effects reported in article
Snoek et al. [33] MQ 5 (1,3,4,5,7) CR 3 (1,2,3)	51 patients with acute, subacute or chronic complaints. 25 women, age range in years: 26–67	I Extradural injection, N = 27 Methylprednisolone 80 mg/2 ml C Placebo injection, *N* = 24 Saline 2 ml	After treatment and at 14 months follow-up evaluated were: (1) Improvement by patient (2) Improvement by physical therapist (3) Radiating pain (3) Mobility of the lumbar spine (4) Straight leg raising test (5) Analgesic consumption	Improvement by patient: AF: RR 1.6 (0.9; 2.8) Improvement by physical therapist: AF: RR 1.7 (1.0; 2.9) Relief of radiating pain: AF: RR 2.1 (0.6; 7.1) Side effects: 0	Dropouts: not described

Table 1 continued

Study	Participants	Interventions	Outcomes	Results and side effects	Notes
Thomas et al [35]	31 patients with acute or subacute complaints. 18 women, mean age in years: 50.5	I Transforaminal epiduraal corticosteroid injection with radioscopic control, $N = 15$	At 6, 30 days and 6 months follow-up evaluated were:	Pain:	Dropouts: 0
MQ 7 (1,2,3,4,5,7,8)			(1) Pain (VAS)	D6: ES 0.5 (–0.3; 1.2)	
CR 5 (1,2,3,4,5)		C Interspinous epidural corticosteroid injection with no epidurographic control, $N = 16$	(2) Disability (RDQ)	D30: ES 0.5 (–0.2; 1.3)	
			(3) Schöber's index (cm)	M6: ES 0.9 (0.2; 1.7)	
			(4) Finger floor distance (cm)	Disability:	
			(5) Straight leg raising test	D6: ES 0.97 (0.3; 1.8)	
				D30: ES 0.3 (–0.4; 1.0)	
				M6: ES 0.7 (0.1; 1.5)	
				Side effects: 0	

C control group, *RR* relative risk, *ES* effect size, *TE* treatment effect (the difference between the change in the intervention group and the change in the control group; negative values indicate a positive treatment effect), *H* hour, *D* day, *W* week, *M* month, *AF* after treatment, *HFAQ* Hannover functional ability questionnaire, *MGPQ* McGill pain questionnaire, *OLBPQ* Oswestry low back disability questionnaire, *NHP* Nottingham health profile

[a] Total score of the MQ (items that scored 'Yes')

[b] Total score of the CR (questions that scored 'Yes')

[c] 95% Confidence Interval I: Intervention group

evidence regarding pain and overall improvement at short-term follow-up and no difference (2 HQ, 1 LQ trials: strong evidence) at long-term follow-up. For disability and return to work we found no difference (3 HQ trials: strong evidence) at short and long-term follow-up.

Versus no treatment

Two studies [3, 18] compared epidural corticosteroid injection to no injection. In both studies, one of high quality [3] and one of low quality [18], we found no difference in overall improvement and return to work between groups. Therefore, when comparing corticosteroid injections to no treatment for patients with LRS we found no difference (1 LQ trial: limited evidence) regarding overall improvement at short-term follow-up and no difference (1 HQ trial: moderate evidence) regarding return to work at intermediate follow-up.

Versus other injections

Four studies [2, 25, 31, 35] compared epidural or intramuscular corticosteroid injection to an injection of a NSAID or an anaesthetic. In one high quality [35] and two low quality studies [25, 31] we found no difference in pain and return to work at short-term. However, in another low quality study [2] we found a difference in pain at short-term, in favour of corticosteroid injection. In one high quality study [35] we found a difference in pain at intermediate follow-up, in favour of injection with radioscopic control. In one low quality study [25] we found no difference in pain at long-term.

In one high quality study [35] we found a difference in disability at short-term and intermediate follow-up, in favour of injection with radioscopic control.

Therefore, we conclude that there is conflicting evidence for the benefit of corticosteroid injection over an injection with a NSAID or anaesthetic regarding pain at short-term follow-up. There is moderate evidence that an injection with radioscopic control is more effective than injection without radioscopic control regarding pain at intermediate follow-up and regarding disability at short-term and intermediate follow-up for patients with LRS. No difference (2 LQ trials: moderate evidence) between injections was found regarding return to work at short-term follow-up and regarding pain at long-term follow-up.

Traction

Table 2 shows the characteristics of nine studies that compared traction to inactive/sham traction (4 RCTs) and to another conservative treatment (5 RCTs).

Table 2 Characteristics of 9 included studies evaluating traction

Study	Participants	Interventions	Outcomes	Results and side effects	Notes
Coxhead et al. [7] MQ 2 (1,4)[a] CR 1 (3)[b]	334 patients with acute, subacute or chronic complaints.149 women, mean age in years: 41.9	Factorial design. I1 Traction, *n* = 143 C1 No traction, *n* = 149 I2 Manipulation, *n* = 155 C2 No manipulation, *n* = 137 I3 Exercises, *n* = 150 C3 No exercises, *n* = 142 I4 Corset, *n* = 124 C4 No corset, *n* = 168	(1) Improvement (no. of patients) (2) Pain (score range –100 to +100) (3) Return to work (no. of patients)	Improvement: W4: I1 vs. C1, RR: 0.7 (0.5; 1.1)[c] W4: I2 vs. C2, RR: 0.7 (0.4; 1.0) W4: I3 vs. C3, RR: 0.8 (0.5; 1.3) W4: I4 vs. C4, RR: 0.8 (0.5; 1.2) M4: I1 vs. C1, RR: 1.0 (0.7; 1.5) M4: I2 vs. C2, RR: 0.8 (0.6; 1.3) M4: I3 vs. C3, RR: 1.3 (0.9; 2.0) M4: I4 vs. C4, RR: 1.1 (0.7; 1.7) Pain: W4: I1 vs. C1, ES: 0.1 (–0.1, 0.4) W4: I2 vs. C2, ES: 0.3 (0.0; 0.5) W4: I3 vs. C3, ES: 0.1 (–0.2, 0.3) W4: I4 vs. C4, ES: 0.1 (–0.1, 0.3) Return to work: W4: I1 vs. C1, RR: 0.9 (0.7; 1.2) W4: I2 vs. C2, RR: 0.9 (0.7; 1.2) W4: I3 vs. C3, RR: 1.0 (0.8; 1.3) W4: I4 vs. C4, RR: 1.0 (0.7; 1.3)	Dropouts: 66. No data presented at 16 months follow-up. No side effects reported in article
Larsson et al. [20] MQ 3 (1,3,4) CR 3 (1,2,4)	82 patients with acute or subacute complaints. 31 women, mean age in years: 37	I Auto traction, *N* = 41 Traction force performed by patient, C *N* = 41. Corset and rest	At 1 and 3 weeks, at 3 months follow-up evaluated were: (1) Pain in leg (no pain) (2) Free of symptoms (no. of patients) (3) Surgery (no. of patients) (4) Straight leg raising	No pain in leg: W1: RR 8.0 (1.1; 61.1) W3: RR 2.3 (0.8; 6.7) Free of symptoms: M3: RR 1.1 (0.7; 1.8) Surgery: M3: RR 0.7 (0.2; 2.2)	Dropouts: 3 No side effects reported in article
Lidström and Zachrisson [21] MQ 3 (1,4,5) CR 3 (1,2,4)	62 patients with acute, subacute or chronic complaints. 33 women, age range in years: 21–61	I1 Physical therapy, *N* = 2. Hot packs, massage, mobilising and strengthening exercises for the spine I2 Traction, *N* = 2. Tru-Trac traction C Control, *N* = 21. Hot packs and rest	After treatment evaluated were: (1) Improvement by patient (2) Improvement by clinician	Improvement by patient: I1 vs. C: RR 0.7 (0.4; 1.2) I2 vs. C: RR 1.4 (1.0; 1.9) Improvement by clinician: I1 vs. C: RR 0.8 (0.4; 1.4) I2 vs. C: RR 1.4 (1.0; 2.3)	Dropouts: not described. No side effects reported in article
Ljunggren et al. [23] MQ 2 (1,4) CR 2 (1,2)	49 patients subacute or chronic complaints. 17 women, mean age in years: 39	I Traction, *N* = 2. Traction is performed by patient C Traction, *N* = 2. Traction is performed by physical therapist	After treatment and at 2 weeks follow-up evaluated were: (1) Pain (VAS) (2) Effect by clinician (2) Physical examination	Good effect by clinician: AF: RR 0.7 (0.2; 2.7) W2: RR 1.2 (0.3; 4.7)	Dropouts: not described. No data reported at 3 months, and at 1 to 2 years follow-up. No side effects reported in article

Table 2 continued

Study	Participants	Interventions	Outcomes	Results and side effects	Notes
Ljunggren et al. [22] MQ 4 (1,4,5,9) CR 2 (1,2)	50 patients with subacute or chronic complaints. 23 women, age range in years: 19–62	I Traction, *N* = 2. Traction is performed by physical therapist C Exercises, *N* = 2. Isometric exercises for the abdominal, back, hip and thigh muscles	After treatment evaluated were: (1) Pain (VAS) (2) Improvement (by clinician) (2) Disability (RDQ) (3) Mobility lumbar spine (4) Straight leg raising test	Improved by clinician or free of pain: AF: RR 1.1 (0.6; 2.1)	Dropouts: not described. No side effects reported in article
Mathews and Hickling [24] MQ 2 (1,4) CR 1 (2)	27 patients with acute, subacute or chronic complaints. 9 women, mean age in years: 44	I Traction, *N* = 1. Force between 36 and 61 kg C Inactive traction, *N* = 1. Traction force did not exceed 9 kg	At 3, 6 weeks and 3 months follow-up evaluated were: (1) Pain (2) Finger floor distance (3) Straight leg raising test	–	Dropouts: not described. No data reported. No side effects reported in article
Reust et al. [28] MQ 6 (1,3,4,5,8,9) CR 2 (1,2)	60 patients. 25 women. Mean age in years: I1 51.6, I2 45.7, C 55.3	I1 Light traction, *N* = 2. First day 5 kg, second day 10 kg, other days 15 kg traction force I2 Normal traction, *N* = 1. First day 5 kg, second day 10 kg, other days increasing with 5 kg till max of 50 kg traction force C Inactive traction, *N* = 2. Traction force of 5 kg a day	After treatment evaluated were: (1) Pain (VAS 0–100) (2) Straight leg raising test (3) Finger floor distance	Pain: AF: I1 vs C: ES 0.02 (-0.6; 0.6) AF: I2 vs C: ES 0.13 (-0.5; 0.8)	Dropouts: 0. No side effects reported in article
Weber [41] MQ 2 (1,4) CR 2 (1,2)	86 patients with acute, subacute or chronic complaints. 30 women, age range in years: 30–60	I Tru-Trac traction, *N* = 3. Force 1/3 of patient's body weight C Inactive traction, *N* = 3. Same as in I, but force up to 7 kp	After treatment evaluated were: (1) Pain (no. of patients) (2) Mobility of the lumbar spine (3) Neurological signs	Pain improved: AF: RR 1.1 (0.7; 1.8) Side effects: 0	Dropouts: I 6, C 8
Weber et al. [44] MQ 3 (1,4,9) CR 2 (1,2)	215 patients with subacute or chronic complaints. 91 women	I1 Tru-Trac traction, *N* = 37 I2 Spina-Trac, *N* = 21 Patient performed traction force I3 Auto-traction, *N* = 2. Patient performed traction force I4 Manual traction, *N* = 24 Traction force performed by physical therapist. C1 Simulated Tru-Trac, *N* = 35 C2 Simulated Spina-trac, *N* = 23 C3 Manual traction, *N* = 23 C4 Isometrec exercises, *N* = 26	After treatment, 2 weeks and 3 months follow-up evaluated were: 1) Improvement 2) Pain 3) Mobility of lumbar spine 4) Straight leg raising test 5) Motor and sensory function 6) Need for analgesics	Improvement: I1 vs C1: RR 1.1 (0.7; 1.8) I2 vs C2: RR 1.1 (0.4; 3.3) I3 vs C3: RR 0.6 (0.2; 1.5) I4 vs C4: RR 1.1 (0.6; 2.1)	Dropouts: 28 No side effects reported in article

C control group, *RR* relative risk, *ES* effect size, *W* week, *M* month, *AF* after treatment

[a] Total score of the MQ (items that scored 'Yes')

[b] Total score of the CR (questions that scored 'Yes')

[c] 95% Confidence Interval I: Intervention group

Versus inactive/sham traction

Four studies [24, 28, 41, 44] compared traction to inactive/sham traction. One low quality study [24] did not report any data.

In one high quality [28] and one low quality studies [41] we found no difference in pain between traction and inactive/sham traction at short-term. Also, in one low quality study [44] we found no difference in improvement between groups at short-term.

Therefore, when comparing traction and inactive/sham traction for patients with LRS we found no difference (1 HQ, 2 LQ trials: moderate evidence) regarding pain and disability at short-term follow-up.

Versus other conservative care

Five studies [7, 20–23] compared traction to another conservative treatment. All five studies were considered of low quality. In one study [21] we found a difference between traction and other conservative care in overall improvement, in favour of traction. However, in three studies [7, 22, 23,] we found no difference in overall improvement between groups. In one study [7] we found no difference in pain between traction and other treatments, but in another study [20] we found a difference in pain, in favour of traction. In one study [7] we found no difference in return to work between groups.

Therefore, when comparing traction to other conservative treatments for patients with LRS we found conflicting evidence regarding improvement and pain at short-term follow-up. We found no difference (1 LQ trial: limited evidence) regarding return to work at short-term follow-up.

Physical therapy

Table 3 shows the characteristics of four studies that compared physical therapy to inactive treatment (1 RCT), to other conservative care (2 RCTs) and to surgery (1 RCT).

Versus inactive treatment

In one high quality study [16] we found no difference in pain and disability at short and intermediate follow-up between the groups.

Therefore, when comparing physical therapy to inactive treatment for patients with acute LRS we found no difference (1 HQ trial: moderate evidence) regarding pain and disability at short and intermediate follow-up.

Versus other conservative care

Two low quality studies [7, 21] compared physical therapy to other conservative treatments. In these studies we found no difference in overall improvement, pain and return to work between groups.

Therefore, when comparing physical therapy to other conservative care for patients with LRS we found no difference (2 LQ trials: moderate evidence) regarding overall improvement, pain and return to work at short-term.

Versus surgery

In one low quality study [42] we found a difference in improvement at 1-year follow-up, in favour of surgery. In the same study we found no difference in improvement at 4 and 10-year follow-up between the two groups.

Therefore, we conclude there is limited evidence that surgery is more effective for patients with LRS regarding overall improvement than physical therapy at 1-year follow-up. At 4 and 10-year follow-up we found no difference (1 LQ trial: limited evidence) regarding overall improvement between surgery and physical therapy.

Bed rest

Table 4 shows the characteristics of two studies that compared bed rest to no treatment.

In one low quality study [39] we found no differences in overall improvement, pain, and disability at short-term follow-up between the groups. In one high quality study [16] we found no differences in pain, disability, at short and intermediate follow-up between the groups.

Therefore, when comparing bedrest to no treatment for patients with acute LRS we found no difference (1 HQ, 1 LQ trial: moderate evidence) regarding overall improvement at short-term follow-up and no difference (1 HQ trial: moderate evidence) regarding pain and disability at short and intermediate follow-up.

Manipulation

Table 5 shows the characteristics of two studies that compared manipulation to other conservative care (1 RCT) and to surgery (1 RCT).

Versus other conservative care

In one low quality study [7] we found no difference in overall improvement, pain and return to work between the groups. Therefore, when comparing manipulation to other

conservative care for patients with LRS we found no difference (1 LQ trial: limited evidence) regarding overall improvement, pain and return to work at short-term follow-up.

Versus chemonucleolysis

In one low quality study [4] we found no differences in pain and disability between the groups. Therefore, when comparing manipulation to chemonucleolysis for patients with LRS we found no difference (1 LQ trial: limited evidence) regarding pain and disability at short and long-term follow-up.

Medication

Table 6 shows the characteristics of two studies that compared medication to placebo.

In one high quality study [43] we found no difference in sick leave between the groups. In one low quality study [1] we found no difference in overall improvement between the groups. Therefore, when comparing piroxicam or tizanidine to placebo for patients with acute LRS we found no difference (1 HQ, 1 LQ trial: moderate evidence) regarding overall improvement and sick leave at short-term follow-up.

Acupuncture

Table 7 shows the characteristics of a high quality study [12] that compared acupuncture to placebo.

No data were presented in this article. Therefore, we conclude that there is no evidence of the effectiveness of acupuncture for patients with LRS.

Discussion

This systematic review included 30 RCTs with a total of 2,780 patients with LRS that evaluated various conservative treatments. Twelve of the 30 included studies were of high methodological quality and 10 studies were considered clinically relevant. Based on the results of this systematic review regarding the conservative treatment of patients with LRS we conclude that:

1. At long-term there is no evidence in favour of corticosteroid injections when compared to placebo, no treatment or NSAID or anaesthetic injection, apart from conflicting evidence for short-term pain relief.
2. At short term there is no evidence in favour of traction when compared to sham traction or other conservative treatments.
3. At short term there is no evidence in favour of physical therapy compared to inactive treatment, other conservative treatments or surgery.
4. At short term there is no evidence in favour of bed rest compared to no treatment.
5. At short term there is no evidence in favour of manipulation compared to other conservative treatments or chemonucleolysis.
6. At short term there is no evidence in favour of medication compared to placebo.
7. No evidence was found regarding acupuncture.

In this review, like every review, there are risks of publication and language bias. There are indications that studies with negative results are not easily published as positive studies [9, 32]. Furthermore, relevant studies, which are registered in unknown databases may not be included. Because of our extensive search strategy this risk was considered small. Although efforts were made to find all published RCTs in restricted languages (i.e. English, Dutch, French and German), some relevant studies published in other languages might have been missed. Also, the number of non-English journals indexed in searched electronic databases is limited.

There was an overall clinical heterogeneity of the included studies. There appeared to be many differences in study populations i.e. underlying cause of LRS and acute, subacute and chronic patients), interventions, duration of follow-up and outcome measures.

It was considered clinically inappropriate to pool the results of the RCTs in the different types of conservative treatments. Therefore a qualitative analysis was performed, using the five levels of evidence [36]. Although the levels of evidence used may be considered arbitrary, it seems unlikely that a different rating system would have resulted in different conclusions. But, in this review we included studies that almost all reported no differences in outcomes between intervention and control group. When finding no differences between groups we cannot conclude ‘there is evidence that the intervention is not effective or not different from the control treatment’ [15]. As recommended by the Cochrane Collaboration than to conclude that there is ‘no evidence for an effect’. The analyses according the five levels of evidence are useful when significant differences are reported between treatment groups. But, when no differences between groups are reported in the majority of the included studies we found it problematic to use the levels, because we cannot conclude for example: ‘there is strong evidence for no evidence of an effect’. Therefore, we have chosen to conclude with statements such as: ‘we found

Table 3 Characteristics of 4 included studies evaluating physical therapy

Study	Participants	Interventions	Outcomes	Results and side effects	Notes
Coxhead et al. [7]MQ 2 (1,4)[a] CR 1 (3)[b]	334 patients with acute, subacute or chronic complaints.149 women, mean age in years: 41.9	Factorial design I1 Traction, *n* = 143 C1 No traction, *n* = 149 I2 Manipulation, *n* = 155 C2 No manipulation, *n* = 137 I3 Exercises, *n* = 150 C3 No exercises, *n* = 142 I4 Corset, *n* = 124 C4 No corset, *n* = 168	(1) Improvement (no. of patients) (2) Pain (score range –100 to +100) (3) Return to work (no. of patients)	Improvement: W4: I1 vs. C1, RR: 0.7 (0.5; 1.1)[c] W4: I2 vs. C2, RR: 0.7 (0.4; 1.0) W4: I3 vs. C3, RR: 0.8 (0.5; 1.3) W4: I4 vs. C4, RR: 0.8 (0.5; 1.2) M4: I1 vs. C1, RR: 1.0 (0.7; 1.5) M4: I2 vs. C2, RR: 0.8 (0.6; 1.3) M4: I3 vs. C3, RR: 1.3 (0.9; 2.0) M4: I4 vs. C4, RR: 1.1 (0.7; 1.7) Pain: W4: I1 vs. C1, ES: 0.1 (–0.1; 0.4) W4: I2 vs. C2, ES: 0.3 (0.0; 0.5) W4: I3 vs. C3, ES: 0.1 (–0.2; 0.3) W4: I4 vs. C4, ES: 0.1 (–0.1; 0.3) Return to work: W4: I1 vs. C1, RR: 0.9 (0.7; 1.2) W4: I2 vs. C2, RR: 0.9 (0.7; 1.2) W4: I3 vs. C3, RR: 1.0 (0.8; 1.3) W4: I4 vs. C4, RR: 1.0 (0.7; 1.3)	Dropouts: 66 No data presented at 16 months follow-up No side effects reported in article
Hofstee et al. [16] MQ 5 (1,3,4,8,9) CR 2 (1,3)	250 patients with acute complaints. 100 women. Mean age in years: 39.0	I1 Bed rest, *N* = 84; 43 at home and 41 in hospital. Stay in bed for 7 days. Only out of bed for bathroom and shower I2 Physical therapy, *N* = 83 Instructions and advice, segmental mobilisation, disc unloading and loading exercises depending on patient's condition and hydrotherapy. Twice a week for at least 4, at most, 8 weeks C Continuation of ADL, *N* = 83	At 1, 2 and 6 months follow-up evaluated were: (1) Pain in leg (VAS 0–100) (2) Disability (QDS 0–100) (3) Surgery (no. of patients)	Pain: M1: I1 vs. C, MD: 2.5 (–6.4; 11.4) M1: I2 vs. C, MD: 0.8 (–8.2; 9.8) M2: I1 vs. C, MD: 0.9 (–8.7; 10.4) M2: I2 vs. C, MD: –0.3 (–9.4; 10.0) M6: I1 vs. C, MD: 0.5 (–8.4; 9.3) M6: I2 vs. C, MD: –1.0 (–10.0; 8.0) Disability: M1: I1 vs. C, MD: –4.8 (–10.6; 0.9) M1: I2 vs. C, MD: –0.5 (–6.3; 5.3) M2: I1 vs. C, MD: –2.7 (–9.9; 4.4) M2: I2 vs. C, MD: 0.0 (–7.2; 7.3) M6: I1 vs. C, MD: –2.7 (–10.2; 4.8) M6: I2 vs. C, MD: –0.7 (–8.4; 6.9) Surgery: M6: I1 vs. C, RR: 1.4 (0.7; 2.9) M6: I2 vs. C, RR: 1.2 (0.6; 2.5) Side effects: cauda equina syndrome: 1 time pulmonary embolism: 1 time	Dropouts: I1 6, I2 11, C 8

Table 3 continued

Study	Participants	Interventions	Outcomes	Results and side effects	Notes
Lidström and Zachrisson [21]	62 patients with acute, subacute or chronic complaints. 33 women. Age range in years: 21–61	I1 Physical therapy, $N = 21$. Hot packs, massage, mobilising and strengthening exercises for the spine	After treatment evaluated were: (1) Improvement by patient (2) Improvement by clinician	Improvement by patient: I1 vs. C: RR 0.7 (0.4; 1.2) I2 vs. C: RR 1.4 (1.0; 1.9) Improvement by clinician: I1 vs. C: RR 0.8 (0.4; 1.4) I2 vs. C: RR 1.4 (1.0; 2.3)	Dropouts: not described. No side effects reported in article
MQ 3 (1,4,5)		I2 Traction, $N = 20$. Tru-Trac traction			
CR 3 (1,2,4)		C Control, $N = 21$. Hot packs and rest			
Weber [42]	126 patients with acute, subacute or chronic complaints. 58 women. Mean age in years: I 40.0, C 41.7	I Surgery, $N = 60$	At 3, 6, 9 months and at 1, 4, and 10 years follow-up evaluated were: (1) Pain (2) Improvement by patient (3) Neurological deficits (4) Mobility of the lumbar spine	Improvement by patient: Y1: RR 1.8 (1.2; 2.6) Y4: RR 1.3 (1.0; 1.7) Y10: RR 1.0 (0.8; 1.4)	Dropouts: 5. No data presented at 3, 6 and 9 months follow-up No side effects reported in article
MQ 2 (1,4)		C Conservative treatment, $N = 66$. Continued physical therapy in other hospital for six weeks			
CR 3 (1,2,4)					

C control group, *RR*: relative risk, *ES* effect size, *MD* mean differences, *W* week, *M* month, *QDS* Quebec disability scale

[a] Total score of the MQ (items that scored 'Yes')

[b] Total score of the CR (questions that scored 'Yes')

[c] 95% Confidence Interval I: Intervention group

no differences between groups'. The question remains; how many trials are needed or how strong must the evidence be, to conclude that a treatment is not effective.

The methodological quality of the majority of the included studies, although improving over the past several years, was not high. Only 12 of the 30 included studies were regarded of high methodological quality. There is, however, a difficulty in blinding the patients and care provider during most conservative treatments that cannot be compared with placebo (i.e. bed rest, physical therapy, manipulation and traction).

There were studies with small sample sizes available for inclusion in this review. The number of patients in the groups was often too small to reach an adequate statistical power; only 12 studies had groups, that each consisted of over 30 patients, included.

The methodological quality might have been misclassified. Relying on the information in reported RCTs may create bias due to under reporting. But the risk of misclassification is considered small because a valid and reliable criteria list was used [37].

The conclusions of this review that included 30 trials are not all in accordance with the conclusions of the review of Vroomen et al. [39] that included 19 trials. We included more trials that evaluated corticosteroid injections and found no evidence of effect at short or at long-term follow-up. Also regarding traction we found more trials with no evidence of effect at short-term follow-up. Therefore, we do not recommend these two treatment options for patients with LRS. For the other conservative treatment options (physical therapy, bed rest, manipulation and medication) no evidence of effect was found at short-term follow-up, and long-term effects are unknown. At present there is no evidence that one type of treatment is clearly superior to others for patients with a lumbosacral radicular syndrome.

Conclusions

Implications for practice

Based on the results of this systematic review it is not recommended to use corticosteroid injections and traction because several trials indicated no evidence of an effect. Whether clinicians should prescribe physical therapy, bed rest, manipulation or medication could not be concluded from this review. For acupuncture no evidence was found.

Implications for research

There is no knowledge whether corticosteroid injection could play a role in short-term pain relief. Also unknown

Table 4 Characteristics of 2 included studies evaluating bed rest

Study	Participants	Interventions	Outcomes	Results and side effects	Notes
Hofstee et al. [16] MQ 5 (1,3,4,8,9)[a] CR 2 (1,3)[b]	250 patients with acute complaints. 100 women, mean age in years: 39.0	I1 Bed rest, *N* = 84; 43 at home and 41 in hospital. Stay in bed for 7 days. Only out of bed for bathroom and shower I2 Physical therapy, *N* = 83. Instructions and advice, segmental mobilisation, disc unloading and loading exercises depending on patient's condition and hydrotherapy. Twice a week for at least 4, at most, 8 weeks C Continuation of ADL, *N* = 83	At 1, 2 and 6 months follow-up evaluated were: (1) Pain in leg (VAS 0–100) (2) Disability (QDS 0–100) (3) Surgery (no. of patients)	Pain: M1: I1 vs. C, MD: 2.5 (–6.4; 11.4)[c] M1: I2 vs. C, MD: 0.8 (–8.2; 9.8) M2: I1 vs. C, MD: 0.9 (–8.7; 10.4) M2: I2 vs. C, MD: –0.3 (–9.4; 10.0) M6: I1 vs. C, MD: 0.5 (–8.4; 9.3) M6: I2 vs. C, MD: –1.0 (–10.0; 8.0) Disability: M1: I1 vs. C, MD: –4.8 (–10.6; 0.9) M1: I2 vs. C, MD: –0.5 (–6.3; 5.3) M2: I1 vs. C, MD: –2.7 (–9.9; 4.4) M2: I2 vs. C, MD: 0.0 (–7.2; 7.3) M6: I1 vs. C, MD: –2.7 (–10.2; 4.8) M6: I2 vs. C, MD: –0.7 (–8.4; 6.9) Surgery: M6: I1 vs. C, RR: 1.4 (0.7; 2.9) M6: I2 vs C, RR: 1.2 (0.6; 2.5) Side effects: cauda equina syndrome: 1 time pulmonary embolism: 1 time	Dropouts: I1 6, I2 11, C 8
Vroomen et al. [40] MQ 4 (1,3,4,8) CR 3 (1,2,3)	183 patients with acute complaints. 80 women, mean age in years: I 44, C 48	I Bed rest, *N* = 92. Only out of bed to use toilet and to bathe C Watchful-waiting, *N* = 91	At 2, 3 and 12 weeks follow-up evaluated were: (1) Improvement by patients (2) Improvement by investigator (3) Pain in leg (VAS 0–100) (4) Disability (RDQ) (5) Satisfaction (11-point) (6) Days off work	Improvement by patients: W2: adj OR: 1.1 (0.6; 2.0) W12: adj OR: 1.0 (0.4; 2.9) Improvement by investigator: W2: adj OR: 0.7 (0.3; 2.0) W12: adj OR: 0.6 (0.2; 1.7) Pain in leg: W3: ES 0.3 (0.0; 0.6) W12: ES 0.1 (–0.2; 0.4) Disability: W3: ES 0.2 (–0.1; 0.5) W12: ES 0.1 (–0.2; 0.4) Days off work: W12: median I 46, C 47	Dropouts: I 7, C 7. No side effects reported in article

I intervention group, *C* control group, *RR* relative risk, *ES* effect size, *MD* mean differences, *W* week, *M* month, *adj OR* adjusted odds ratio

[a] Total score of the MQ (items that scored 'Yes')

[b] Total score of the CR (questions that scored 'Yes')

[c] 95% Confidence Interval

Table 5 Characteristics of 2 included studies evaluating manipulation

Study	Participants	Interventions	Outcomes	Results and side effects	Notes
Burton et al. [4] MQ 4 (1,3,4,8)[a] CR 3 (1,2,3)[b]	40 patients with acute, subacute or chronic complaints. 21 women, mean age in years: 41.9	I Manipulation, $N = 20$ C Chemonucleolysis, $N = 20$	At 2 and 6 weeks and 12 months follow-up evaluated were: (1) Pain in leg (7-point rating scale) (2) Disability (RDQ) (3) Pain in back	Pain: W2: ES 0.0 (–0.6; 0.7)[c] W6: ES 0.0 (–0.6; 0.6) M12: ES 0.1 (–0.6; 0.7) Disability: W2: ES 0.7 (0.1; 1.3) W6: ES 0.5 (–0.1; 1.1) M12: ES 0.2 (–0.4; 0.8) Side effects: 0	Dropouts: I 5, C 5
Coxhead et al. [7] MQ 2 (1,4) CR 1 (3)	334 patients with acute, subacute or chronic complaints.149 women, mean age in years: 41.9	Factorial design. I1 Traction, $n = 143$ C1 No traction, $n = 149$ I2 Manipulation, $n = 155$ C2 No manipulation, $n = 137$ I3 Exercises, $n = 150$ C3 No exercises, $n = 142$ I4 Corset, $n = 124$ C4 No corset, $n = 168$	(1) Improvement (no. of patients) (2) Pain (score range -100 to +100) (3) Return to work (no. of patients)	Improvement: W4: I1 vs. C1, RR: 0.7 (0.5; 1.1) W4: I2 vs. C2, RR: 0.7 (0.4; 1.0) W4: I3 vs. C3, RR: 0.8 (0.5; 1.3) W4: I4 vs. C4, RR: 0.8 (0.5; 1.2) M4: I1 vs. C1, RR: 1.0 (0.7; 1.5) M4: I2 vs. C2, RR: 0.8 (0.6; 1.3) M4: I3 vs. C3, RR: 1.3 (0.9; 2.0) M4: I4 vs. C4, RR: 1.1 (0.7; 1.7) Pain: W4: I1 vs. C1, ES: 0.1 (-0.1; 0.4) W4: I2 vs. C2, ES: 0.3 (0.0; 0.5) W4: I3 vs. C3, ES: 0.1 (-0.2; 0.3) W4: I4 vs. C4, ES: 0.1 (-0.1; 0.3) Return to work: W4: I1 vs. C1, RR: 0.9 (0.7; 1.2) W4: I2 vs. C2, RR: 0.9 (0.7; 1.2) W4: I3 vs. C3, RR: 1.0 (0.8; 1.3) W4: I4 vs. C4, RR: 1.0 (0.7; 1.3)	Dropouts: 66 No data presented at 16 months follow-up No side effects reported in article

C control group, *RR* relative risk, *ES* effect size, *W* week, *M* month

[a] Total score of the MQ (items that scored 'Yes')

[b] Total score of the CR (questions that scored 'Yes')

[c] 95% Confidence Interval I: Intervention group

Table 6 Characteristics of 2 included studies evaluating medication

Study	Participants	Interventions	Outcomes	Results and side effects	Notes
Berry and Hutchinson [1] MQ 4 (1,3,4,8)[a] CR 1 (2)[b]	59 patients with acute complaints, age range: 18–70 years	I Tizanidine (muscle relaxant), $N = 28$. Tablets 4 mg, 3 times daily C Placebo tablets, $N = 31$	At 3 and 7 days follow-up evaluated were: (1) Improvement (2) Pain on movement, at rest, at night (VAS 0–100) (3) Restriction of movement (4) Consumption of aspirin tablets	Improvement: D3: RR 0.9 (0.3; 3.0)[c] D7: RR 0.8 (0.5; 1.2)	Dropouts: not described. The 59 patients were a subgroup from 112 patients with acute low back pain No side effects reported in article
Weber et al. [43] MQ 5 (1,4,5,6,7) CR 3 (1,2,3)	214 patients with acute complaints, mean age in years: 48	I Piroxicam (NSAID), $N = 120$ C Placebo medication, $N = 94$	At 1, 2, 3, 4 weeks and 3 and 12 months follow-up evaluated were: (1) Pain in leg (VAS 0–100) (2) Disability (RDQ) (3) Sick leave	Sick leave: W4: RR 1.0 (0.8; 1.3)	Dropouts: 36 Data not clear presented No side effects reported in article

I intervention group, *C* control group, *RR* relative risk, *D* day, *W* week

[a] Total score of the MQ (items that scored 'Yes')

[b] Total score of the CR (questions that scored 'Yes')

[c] 95% Confidence Interval

Table 7 Characteristics of included study evaluating acupuncture

Study	Participants	Interventions	Outcomes	Results and side effects	Notes
Duplan et al. [12] MQ 5 (1,3,4,5,7)[a] CR 0 (-)[b]	30 patients with acute complaints. 9 women. Mean age in years: 40	I Acupuncture on electrically detected points, $N = 15$ C Acupuncture on placebo points, $N = 15$	After 5 sessions evaluated were: (1) Duration of improvement (2) Improvement in decubitis (3) Improvement after 10 min standing (4) Use of analgesics	–	Dropouts: not described No data presented No side effects reported in article

I intervention group, *C* control group

[a] Total score of the MQ (items that scored 'Yes')

[b] Total score of the CR (questions that scored 'Yes')

are the long-term effects of traction, physical therapy, bed rest, manipulation or medication. We recommend high quality RCTs of sufficient sample size with long-term follow-up concerning physical therapy, manipulation or medication for patients with LRS. The outcome measures should include overall improvement, patients' satisfaction, severity of pain in the leg, functional health status, quality of health status, return to work and side effects.

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