Surgery versus conservative care for neck pain: a systematic review

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Abstract

Objective General practitioners refer patients with continued neck pain that do not respond well to conservative care frequently to secondary care for further assessment. Are surgical interventions to the cervical spine effective when compared to conservative care for patients with neck pain?

Design Systematic review.

Method The search strategy outlined by the Cochrane Back Review Group (CBRG) was followed. The primary search was conducted in MEDLINE, EMBASE, CINAHL, CENTRAL, and PEDro up to June 2011. Randomised controlled trials (RCTs) and controlled clinical trials (CCTs) of adults with neck pain, which evaluated at least one clinically relevant primary outcome measure (e.g. pain, functional status, recovery), were included. In addition, treatments had to include surgery and conservative care. Two authors independently assessed risk of bias using the

criteria recommended by the CBRG and extracted the data. The quality of the evidence was rated using the GRADE method.

Results Patients included had neck pain with or without radiculopathy or myelopathy. In total, three RCTs and six CCTs were identified comparing different surgical interventions with conservative care, of which one had a low risk of bias. Overall there is very low quality of evidence available on the effectiveness of surgery compared to conservative care in neck pain patients showing overall no differences.

Conclusion Most studies on surgical techniques comparing these to conservative care showed a high risk of bias. The benefit of surgery over conservative care is not clearly demonstrated.

Keywords Systematic review · Randomised controlled trials · Surgery · Conservative care

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Introduction

Cervical disorders are common and are frequently disabling and costly [1–4]. Cervical disorders can be classified into specific and non-specific disorders, such as cervical radiculopathy, discopathy and spondylosis. Typically, patients who are first managed in primary care end receive conservative therapy, which may consist of physiotherapy or manual therapy [5]. Conservative treatment is primarily aimed at reduction of pain and improvement of function. When patients do not respond to conservative treatment, they are often referred for further evaluation, including a surgical consultation. Consensus is lacking whether surgery is useful or not in the absence of serious neurologic deficits or for persistent neck pain. The rationale for

performing any form of surgery should be balanced against the likely natural history and the results of conservative care.

Recently, a Cochrane review on surgery versus conservative care has been updated, still including the same two small randomized clinical trials, one with radiculopathy patients and one with myelopathy patients [6, 7]. This review includes only randomized clinical trials and concludes that there is insufficient data to provide a reliable conclusion on the effectiveness of cervical spine surgery for radiculomyelopathy.

Due to reluctance of patients being randomised between surgery and non-surgical care, various controlled clinical trials are conducted. In combining randomized as well as non-randomised controlled studies, we might be able to provide a more accurate answer to our study question. In addition, since the publication of the Cochrane review, at least one new trial has been published.

Therefore, we aim to present the current evidence from (randomized and controlled) clinical trials on surgical interventions compared to conservative care in patients with neck pain in the presence of radiculopathy and/or myelopathy in the absence of serious pathology.

Methods

Study selection

Only randomized controlled trials (RCT) and controlled clinical trials (CCTs) were considered (see Table 1). All surgical interventions, including single or double-level anterior discectomies, discectomy with different interbody fusion methods, foraminotomy, corpectomy, spondylodesis and laminotomy are included. Only studies presenting the following self-reported measures were included: neck and/or arm pain, neck-pain specific functional status, self-perceived recovery (e.g. subjective overall improvement, proportion of patients recovered), lost days at work (e.g. return to work status, number of days off work or with sick-leave) and complications. Studies were combined into the following main clusters: (1) surgery compared to conservative

care in patients with neck pain with or without radiculopathy; (2) surgery compared to conservative care in myelopathy patients.

Search strategy

The search strategy outlined by the Cochrane Back Review Group (CBRG) was followed. The search was conducted in MEDLINE, EMBASE, CINAHL, CENTRAL (the Cochrane Central Register of Controlled Trials), and PEDro up to June 2011.

References from the included studies were also screened and experts approached in order to identify additional primary studies not previously identified. The language was limited to English, Dutch, and German. The search strategy was developed by an experienced librarian using free text words and MeSH headings. The complete search strategy is available upon request from the primary author(s).

Two review authors (SMR, MvM) independently first selected citations based on titles and abstracts. Full articles were obtained for those citations thought to fulfil the inclusion criteria. Eligibility was assessed by two review authors independently (SMR, MvM). A third review author (APV) was consulted if necessary.

Risk of bias assessment

The risk of bias assessment (RoB) for RCTs and CCTs was conducted using the 12 criteria recommended by the Cochrane Back Review Group and evaluated independently by two review authors (SMR, MvM). The criteria were scored as “yes” (low risk of bias), “no” (high risk of bias) or “unclear”. One of the original 12 items (selective outcome reporting) was scored ‘unclear’, because we were unable to retrieve protocols or design publications. Any disagreements between the review authors were resolved by discussion, including input from a third review author (APV). A study with a low risk of bias was defined as fulfilling six or more of the items are met and the studies had no serious flaws, which is supported by empirical evidence [10].

Table 1 Selection criteria

Patients	Adults (≥ 18 years of age) with neck pain with or without radiculopathy or myelopathy
Interventions	Surgery
Control interventions	Conservative care
Outcome	Primary outcomes: neck and/or arm pain and neck-pain specific functional status Secondary outcomes: self-perceived recovery (e.g. subjective overall improvement, proportion of patients recovered), lost days at work (e.g. return to work status, number of days off work or with sick-leave) and complications

Data collection and analysis

Data extraction and management

A standardized form was used to extract data from the included papers. The following was extracted: study characteristics (e.g. country of origin, RoB), patient characteristics (e.g. age, gender of participants, nature and duration of the complaint, inclusion/exclusion criteria), description of the experimental and control interventions, co-interventions (if used), duration of follow-up, types of outcomes assessed, and the authors results and conclusions. Data were extracted independently by two review authors (SMR, MvM). Any disagreements were discussed and a third review author (APV) was consulted if necessary.

Data relating to the primary outcomes were assessed and final value scores (mean and standard deviations) were to be extracted. The follow-up time intervals were defined as: short-term mean 3 months and long-term mean 24 months. In case of multiple follow-up measurements or only follow-up measurements greater than 3 months and less than 24 months, we choose the one closest to one of these intervals. When the last follow-up measurement is 12 months, it is regarded as long-term outcome.

Measures of treatment effect

A mean difference (MD) was calculated for pain and functional status. All VAS (visual analogue scale) or NRS (numerical rating scale) scores were converted to scales ranging from 0 to 100, where necessary. For recovery, a risk ratio (RR) was calculated and the event defined as the number of subjects recovered. Review Manager 5.0 was used for the calculation of the treatment effects, including 95 % confidence intervals.

Strength of the evidence

The overall quality of the evidence and strength of recommendations were evaluated using GRADE [11]. The quality of the evidence for a specific outcome was based upon five domains and downgraded by one level for each of the factors that was encountered: (1) limitations in design (>25 % of the participants from studies with a high RoB), (2) inconsistency of results (significant statistical heterogeneity ($I^2 > 40\%$) or inconsistent findings among studies ($\leq 75\%$ of the participants report findings in the same direction)), (3) indirectness (i.e. generalizability of the findings), (4) imprecision (total number of participants <300 for each outcome) and (5) other (e.g. publication bias, flawed design). The judgment of these factors was determined by two review authors (SMR, MvM). Single randomized studies ($n < 300$ for dichotomous outcomes and

<400 for continuous outcomes) were considered inconsistent and imprecise and provide “low quality evidence”, which could be further downgraded to “very low quality evidence” if there were also limitations in design (i.e. high RoB), indirectness or other considerations. The following levels of the quality of the evidence were applied:

1. *High quality*: Further research is very unlikely to change the level of evidence. There are sufficient data with narrow confidence intervals. There are no known or suspected reporting biases; all domains were fulfilled.
2. *Moderate quality*: Further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate; one of the domains was not fulfilled.
3. *Low quality*: Further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change it; two of the domains were not fulfilled.
4. *Very low quality*: Great uncertainty about the estimate; three of the domains were not fulfilled.
5. *No evidence*: No evidence from any RCTs.

The GRADE method is not applied for comparisons in which there were contrasting effects of outcome and results were therefore inconsistent.

Results

Description of the studies

In total, three RCTs and six CCTs were identified comparing different surgical interventions with conventional treatment (Fig. 1). Six studies, four of which were CCTs, were identified which examined surgery versus non-surgical interventions in patients with radiculopathy [12–17]. Three studies, of which two CCTs, compared surgery versus non-surgical interventions in myelopathy patients [18, 19, 20]. The RCT also reported the 10-year follow-up data [21].

Participants In total, 787 participants are included in the review, of which 608 patients were in the subgroup of radiculopathy, and 179 were in the myelopathy subgroup. Four studies included patients with cervical disc protrusion, one with cervicobrachial pain, one with degenerative cervical disc disease, one with cervical spinal disorders and three studies patients with cord compression and/or myelopathy. Mean duration of complaints was unknown in three studies and varied between 1 and 7 years in the other six studies. Mean sample size in the smallest study arm was 31.6 and varied between 20 [17] and 58 [16].

Interventions In most studies, the surgical procedures were clearly described. Three studies performed nucleoplasty

Fig. 1 Flow chart

procedure [12, 16, 17] which seem largely comparable. In five studies, an ACDF procedure (anterior cervical discectomy with fusion) was described and in one study the surgical procedure was an occipitocervical fusion [20].

Two studies provided no information on the conservative intervention [13, 20], one study mentioned a rehabilitation programme (tertiary care) [14] and all others mentioned a physiotherapy programme.

Outcome measures All studies reported measures of pain, recovery or return to work. Other outcome measures frequently measured were function, depression or quality of life.

Conflict of interest Two studies made no mention of funding or conflict of interest, two studies clearly mentioned the funding agency and all others stated there was no conflict of interest.

Risk of bias

All six CCTs were identified with a high risk of bias (Table 2) [12, 13, 14, 17, 19, 20]. Two out of three RCTs also had a high risk of bias. The most common item that was scored positively included the timing of the outcome assessment. One study [16] scored positive on the item ‘allocation concealment’, but none on ‘patient blinding’,

‘blinding care provider’, blinding outcome assessor’ or ‘were co-interventions avoided or similar’.

Effect of interventions

Data were not pooled due to poor reporting of data and few clinical homogenous studies included per comparison. In most cases, where continuous data were reported, either the measure of variation (e.g. SD, SE, range, IQR), the time of measurement, or the type of data (e.g. mean, median) were missing; therefore, results are qualitatively described. The summary of effects is reported in Tables 3, 4, 5 and 6.

Surgery compared to conservative care in neck pain patients with or without radiculopathy

Plasma decompression/nucleoplasty

One RCT ($n = 120$) in patients with neck/arm pain with low risk of bias was found [16]. Using repeated measurement analysis they found significant improvements in favour of surgery in pain but not in function at 3 months, and in pain and function at 12 months.

Two CCTs, both with a high risk of bias, were identified which examined the effects of percutaneous decompression/nucleoplasty to standard medical care or physiotherapy in

Table 2 Overview risk of bias for studies on the effect of surgery compared to conservative care for neck pain

Author	Items												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Birnbaum [12]	–	–	–	–	–	?	?	?	?	?	+	?	1
Cesaroni and Nardi (RCT) [16]	+	+	–	?	–	+	+	+	?	+	+	?	7
Lofgren [13]	–	–	–	–	–	?	+	+	?	?	+	?	3
Mayer [14]	–	–	–	–	–	+	?	–	?	?	+	?	2
Persson [15] (RCT)	+	?	–	–	–	+	?	–	?	?	+	?	3
Heffez [19]	–	–	–	–	–	?	+	+	?	?	+	?	3
Kadanka [18,21] (RCT)	+	?	–	–	–	?	–	+	?	+	+	?	4
Matsunaga [20]	–	–	–	–	–	?	+	?	?	?	?	?	1
Nardi et al. [17]	?	?	–	–	–	+	?	?	?	?	?	?	1

+ yes (low risk of bias), – no (high risk of bias), ? unclear

Criteria items: 1, Was the method of randomization adequate?; 2, Was the treatment allocation concealed?; 3, Was the patient blinded to the intervention?; 4, Was the care provider blinded to the intervention?; 5, Was the outcome assessor blinded to the intervention?; 6, Was the drop-out rate described and acceptable?; 7, Were all randomized participants analyzed in the group to which they were allocated?; 8, Were the groups similar at baseline regarding the most important prognostic indicators?; 9, Were co-interventions avoided or similar?; 10, Was the compliance acceptable in all groups?; 11, Was the timing of the outcome assessment similar in all groups?; 12, Selective outcome reporting?

patients with radicular arm pain [12, 17]. Throughout the 2-year follow-up period, the nucleoplasty group demonstrated a clinically relevant effect on pain relief (i.e. three- to four-point difference on an 11-point VAS) compared to the conservative care group in one study [12] and after 60 days a 60 % higher recovery rate in another CCT [17]. This latter study presented a mean follow-up of 3 months, which might indicate that the study was not really a prospective one.

Therefore, there is low quality evidence (limitations in design, inconsistency and imprecision) that plasma decompression (nucleoplasty) is more effective compared to conservative care concerning pain and function.

Anterior cervical decompression with fusion (ACDF)

Three studies [13–15] were identified, all of which with a high RoB, and only one study was an RCT [15].

Pain One RCT [15] ($n = 81$) found significantly less pain at the short-term in the surgical group compared to the collar group, but not to the physiotherapy group. No significant differences were observed for long-term pain relief between any of the three groups. One CCT ($n = 82$) found

that the surgical group demonstrated less pain at the short and intermediate follow-up [13]. Another CCT ($n = 202$) which examined patients who were totally or partially disabled at baseline found no differences in self-reported pain between the groups at any follow-up measurement [14].

Therefore, there is very low quality evidence (limitations in design, inconsistency and imprecision) for the effectiveness of surgery for short-term pain relief compared to a collar, but not to physiotherapy and very low quality evidence (limitations in design, inconsistency and imprecision) was found that there is no difference in effectiveness between both interventions at long-term follow-up.

Function. The RCT found no differences between the three groups at short- or long-term function (data not shown in original publication) [15]. Furthermore, no differences at 12 months were reported in function from a CCT ($n = 202$) that investigated the effect of a rehabilitation programme following ACDF to the rehabilitation programme alone [14]. One CCT ($n = 82$) found a slightly better functional status at the short- and long-term follow-up in the surgery group; however, this was not a significant difference [13].

There is very low quality of evidence (limitations in design, inconsistency and imprecision) for no difference between surgery and conservative care at short- and long-term follow-up.

Recovery was examined in one study [15]; return to work in one study [14] and complications in two studies [13, 15]. There is very low quality evidence for no difference in effectiveness on recovery at the long-term (although one RCT found a 25 % clinically relevant difference in favour of the collar group) and surgery did not improve return-to-work when added to a rehabilitation programme. Persson [15] reported that 8 (29 %) patients who had undergone surgery required additional surgery during the long-term follow-up period.

Surgery versus conservative care in myelopathy patients

Four studies were identified which examined the effects of surgery versus non-surgical procedures, including one RCT [18] and two CCTs [19, 20], all with high risk of bias.

Anterior cervical decompression with fusion (ACDF)

One RCT ($n = 68$) compared anterior decompression combined with osseous graft, corpectomy, laminoplasty or fixation using a Caspar plate with conservative treatment consisting of soft collar, NSAIDs, bed rest and advice [17]. A significant difference between the groups was found on

Table 3 Surgery versus conservative care in patients with neck pain with or without radiculopathy

Author	Outcome	Follow-up (months)	Surgery		Conservative treatment		MD or RR
			Mean (SD)	N	Mean (SD)	N	
Pain							
Short-term							
Persson [15]	Current pain (VAS)	4	27 (23.0)	26	PT: 41 (28.6)	27	MD: 14 (−0.2; 28.2)
			27 (23.0)	26	Collar 48 (23.2)	26	MD: 21 (8.4; 33.6)
Cesaroni [16]	Pain (% achieving MICD)	3	85 %	62	66 %	57	19 %, RR = 1.3 (1.05; 1.6)
Lofgren [13] (CCT) ^a	Maximal neck pain (VAS)	3	70	43	90	39	
	Maximal arm pain (VAS)	3	70	43	80	39	
Birnbaum [12] (CCT)	Pain (VAS)	3	20	26	58	30	
Long-term							
Cesaroni [16]	Pain (% achieving MICD)	12	95 %	62	69 %	58	26 %; RR = 1.37 (1.2; 1.7)
Mayer [14] (CCT)	Pain (VAS)	12	49 (20)	52	60 (82)	150	MD: 11 (−11.7; 33.7)
Persson [15]	Current pain (VAS)	16	30 (28.1)	26	PT: 39 (25.8)	27	MD: 9 (−6.5; 24.6)
					Collar 35 (23.2)	26	MD: 5 (−10.4; 20.4)
Lofgren [13] (CCT) ^a	Maximal neck pain (VAS)	24	70	43	80	39	
	Maximal arm pain (VAS)	24	80	43	70	39	
Birnbaum [12] (CCT)	Pain (VAS)	24	23	26	51	30	
Function							
Short-term							
Cesaroni and Nardi [16]	NDI (% achieving MICD)	3	85 %	62	84 %	58	1 %; RR = 1.03 (0.9; 1.2)
Lofgren [13] (CCT) ^a	SIP	3	9.2 (6.5)	43	7.0 (6.0)	39	MD: −2.2 (−5.0; 0.6)
Long-term							
Cesaroni [16]	NDI (% achieving MICD)	12	98 %	62	81 %	58	17 %; RR = 1.2 (1.04; 1.4)
Lofgren [13] (CCT) ^a	SIP	24	10.0 (8.1)	43	7.7 (8.3)	39	MD: −2.3 (−5.9; 1.3)
Overall outcome							
Short-term							
Nardi [17]	Recovery	3	40 (80 %)	50	4 (20 %)	20	60 %; RR = 4 (1.6; 9.7)
Long-term							
Persson [15]	Subjective improvement of disability	12	7 (27 %)	26	PT: 14 (52 %)	27	−25 %; RR = 0.5 (0.3; 1.1)
					Collar: 11 (42 %)	26	−15 %; RR = 0.6 (0.3; 1.4)
Mayer [14] (CCT)	Return to work	12	42 (82 %)	52	136 (91 %)	150	−9 %; RR = 0.9 (0.8; 1.02)

Continuous data are presented as a mean (SD), while dichotomous data are presented as a percentage, except where otherwise noted. All pain scales were standardized to a 100-point scale

NDI Neck Disability Index, SIP Sickness impact profile, MD mean difference, RR relative risk, MICD minimal important clinical difference (VAS >25 points improvement; NDI >3.4 point improvement)

Bold values indicate the significant findings

^a Data derived from graphs

the modified JOA and ‘self perceived recovery’ at 6-month follow-up only, in favour of the surgery group. No significant differences were found during the 24–36 month follow-up period between both groups on the modified JOA

score and recovery. For the 10-year follow-up in 47 patients also no difference in recovery was found.

A CCT [19] ($n = 71$) examined the effects of decompression of the cervical spine or foramen magnum by

Table 4 Surgery versus conservative care in myelopathy patients

Author	Outcome	Follow-up	Surgery		Conservative care		MD or RR
			Mean (SD)	<i>N</i>	Mean (SD)	<i>N</i>	
Function							
Short-term							
Kadanka [18]	Modified JOA	6 months	13.4 (1.7)	33	14.5 (2)	35	MD: 1.1 (0.19; 2.0)
Long-term							
Heffez [19] (CCT)	SF-36 Physical functioning	12 months	36.1 (12.7)	40	28.5 (9.6)	31	MD: 7.6 (2.1; 13.1)
Kadanka [18]	Modified JOA	24 months	13.7 (2)	33	14.5 (1.8)	35	MD: 0.8 (−0.1; 1.7)
Kadanka [21]	Modified JOA	10 years	14.0 (2.3)	22	15.0 (2.8)	25	MD: 1 (−0.5; 2.5)
Overall outcome							
Short-term							
Kadanka [18]	Self-perceived recovery	6 months	20 (61 %) ^a	33	7 (20 %)	35	41 %; RR = 3.03 (1.5; 6.2)
Long-term							
Kadanka [18]	Self-perceived recovery	24 months	8 (24 %)	33	4 (11 %)	35	13 %; RR = 2.1 (0.7; 6.4)
Kadanka [21]	Self-perceived recovery	10 years	12 (36 %)	33	11 (31 %)	35	5 %; RR = 1.2 (0.6; 2.3)
Matsunaga [20] (CCT)	One-level improvement (Ranawat Classification)	?	9 (47 %)		0 (0 %)		−9 %

Continuous data are presented as a mean (SD), while dichotomous data are presented as a percentage, except where otherwise noted. All pain scales were standardized to a 100-point scale

MD mean difference, RR relative risk, ? no information

Bold values indicate the significant findings

^a A significant mean subjective deterioration was found in the surgical group between 6 and 36 months

Table 5 Summary effect of surgical interventions for radiculopathy patients

Comparison	Outcome	Follow-up	Number of Studies	Best evidence synthesis
Decompression	Pain	Short-term	1	Low quality of evidence for the effectiveness of decompression compared to conservative care
	Function	Short-term	1	Low quality of evidence for no difference in effectiveness
	Pain	Long-term	2	Low quality of evidence for the effectiveness of decompression compared to conservative care
	Function	Long-term	1	Low quality of evidence for the effectiveness of decompression compared to conservative care
	Recovery	Long-term	1	Very low quality of evidence for the effectiveness of surgery compared to conservative care
ACDF	Pain	Short-term	2	Very low quality of evidence for the effectiveness of surgery compared to collar, no difference compared to physiotherapy
	Function	Short-term	1	Low quality of evidence for no difference in effectiveness
	Pain	Long-term	3	Very low quality of evidence for no difference in effectiveness
	Function	Long-term	1	Low quality of evidence for no difference in effectiveness
	Recovery	Long-term	2	Very low quality of evidence for no difference in effectiveness

means of anterior discectomy and instrumented fusion, posterior cervical laminectomy with or without instrumented fusion or suboccipital decompression and duraplasty compared to a non-surgical treatment, which consisted of neck immobilization using a soft collar and physiotherapy. A statistical significant difference in

improvement was found on the SF36 physical functioning score after 12 months follow-up, in favour of the surgical group.

Another CCT examined the effects of occipitocervical fusion, associated with C1 laminectomy compared to conservative treatment in patients with rheumatoid arthritis

Table 6 Summary effect of surgical interventions for myelopathy patients

Comparison	Outcome	Follow-up	Number of Studies	Best evidence synthesis
ACDF	Functional status	Short-term	1	Very low quality of evidence for the effectiveness of surgery compared to collar
	Functional status	Long-term	2	Insufficient evidence
	Recovery	Short-term	2	Very low quality of evidence for the effectiveness of surgery compared to conservative care
	Recovery	Long-term	2	Very low quality of evidence for no difference in effectiveness

and related myelopathy [20]. The recovery ratio is not reported for both interventions.

No overall conclusion can be drawn on the effectiveness of surgical interventions compared to conservative care, because of the heterogeneity between the studies in patients with myelopathy.

Discussion

In this review, 3 RCTs and 6 CCTs were included that evaluated the effectiveness of surgical interventions compared to conservative care in patients with neck pain with or without radiculopathy or myelopathy. In short, low quality evidence was found in favour of plasma decompression compared to conservative care for pain and function.

All other studies were of high risk of bias and provided very low quality of evidence for the effectiveness of surgery compared to collar use on short-term pain only in patients with cervical radiculopathy. Controversially, very low quality of evidence was also found for the effectiveness of physiotherapy compared to surgery on the long-term recovery.

It is striking that there are only two randomised trials in patients with neck pain, of which one with low risk of bias that compared surgery to conservative care. Overall, no firm conclusion can be drawn on the effectiveness of surgical treatment compared to conservative care.

Three studies, including two CCTs, compared surgery to conservative care in patients with myelopathy symptoms. All compared different surgical treatments with different conventional treatments. Therefore, it was not possible to apply the best evidence synthesis. However, the results of these studies indicate that there are no large differences between both types of interventions.

Methodological considerations

The methodological quality of most studies was poor. Many methodological criteria regarding the internal

validity of the studies were not fulfilled. All but one study had a high risk of bias. Only one study performed a concealed randomisation and just three (one RCT) performed an intention to treat analysis. These design elements can be easily performed without changing the design. Blinding however is impossible in these kinds of studies, but there is no reporting about evaluating the magnitude of bias, or minimising the bias associated with lack of blinding.

It was apparent that some studies reported a mean follow-up time instead of assessing all participants at the same time interval. Drop-out ratios were relatively high and the long-term analyses are therefore likely confounded. The reporting of the data was poor in most of the studies, including the reporting of mean and standard deviations of the primary outcome measures. Therefore, there is much room for improvement of the reporting and conduct of the studies. The CONSORT statement should be followed in the future.

Other methodological problems make the interpretation of the results difficult. For example, in the study by Lofgren et al. [13], the conservative treated patients had better functional status and less severe disease based upon MRI findings at baseline; therefore, comparisons between the groups may be confounded.

Strengths and limitations

This review included all available studies comparing any type of surgery and conservative care in all neck pain patients. We might have missed relevant unpublished trials, which are more likely to be small studies with non-significant results, leading to publication bias. Screening references of identified trials and systematic reviews may result in an over representation of positive studies in this review, because trials with a positive result are more likely to be referred to in other publications, leading to reference bias. Studies not published in English, Dutch or German were not included in this review. It is not clear whether a language restriction is associated with bias and it is debatable what these studies would have added to this discussion [23].

Conclusions

There is insufficient literature available to draw a firm conclusion on the effectiveness of surgery compared to conservative care in neck pain patients. Nevertheless, evaluating plasma decompression compared to conservative care showed low quality evidence in favour of plasma decompression.

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Conflict of interest None.

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