Is surgery more effective than non-surgical treatment for spinal stenosis and which non-surgical treatment is more effective? a systematic review

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Table 2. Summary of included trials

Trial[j]	Number	Interventions	Outcomes / follow-up[a]
Amundsen et al. [1]	31	1. Decompression surgery (13) 2. Orthosis, back school (18) Both groups general physical training	Clinician determined good or bad result at 6 months 1, 4 and 10 years. Good results: 1: 92%, 69%, 92%, 91%.2: 39%, 33%, 47%, 71%
Comer et al. [7][j]	40	1. Walking stick if not using one (20) 2. No walking stick (20)	ZCQ at 2 weeks: NS differences
Cuckler et al. [9]	37[d]	1. ESI + procaine (20) 2. Saline + procaine (17) Both groups ESI if < 50% better	Success = 75% self-reported improvement at 24 hours and mean 20 months: NS differences
Eskola et al. [13]	40	1. Calcitonin then placebo 2. Placebo then calcitonin	VAS rest pain and jumping, walking distance 1, 3, 4, 6, 12 months. **Active stage V placebo: VAS rest (P=0.01); jump pain (P=0.001 / 0.019; walking distance (P=0.007 / 0.14) up to 3 months** No long term difference.
Fukusaki et al. [16]	53	1. Saline epidural injection 2. Mepivacaine epidural injection 3. ESI + mepivacaine	Walking distance improvement: 100m (excellent), 20-100m (good), <20m (poor) at 1 week, 1, 3 months **2 + 3 V 1 at 1 week (P<0.01);** NS at 1 and 3 months
Goren et al. [21]	50	1. US + exercise (17) 2. Sham US + exercise (17) 3. Control (16)	VAS leg / back, Oswestry, treadmill test, medication after 3 weeks of treatment **1 + 2 V 3: Leg pain (P<0.007); Oswestry (P<0.014); 1 V 3: medication (P=0.016)** 1 V 2 = NS differences

Koc et al. [31]	29	1. In-patient physical therapy (10) 2. ESI (10) 3. Controls (9)	VAS, flexion, treadmill test, sit-to-stand, Roland-Morris (RMD), NHP at 2 weeks, 1, 3, and 6 months **2 v 3 at 2 weeks: VAS (P=0.008); RMD (P=0.007); NHP (P=0.004). SD in all groups.** NS 1 V 2.
Kurihara et al. [32]	146	1. Opalman (15 mgd)[h] (69) 2. Opalman (3 mgd)[h] (77)	Improvement in sensation, walking distance, leg pain standing pain at 6 months **1 V 2: improvement (P=0.005); improvement in sensation (P=0008); walking distance (P=0.019).**
Lee et al. [33]	99	1. Interlaminar ESI (42) 2. Bilateral transforaminal ESI (57)	NRS, Patient Satisfaction Index (PSI), 5-point pain score at 2 weeks, 2 and 4 months **2 V 1 at 2w, 2 and 4m NPRS / pain score (P<0.05)**
Malmivaara et al. [35]	94	1. Decompression surgery (50) 2. NSAID, back school, some individualised physical therapy (44)	Oswestry, NRS, treadmill test at 6, 12, 24 months **1 V 2 entire follow-up period: Oswestry (P=0.01), leg pain walking (P=0.02), LBP walking (P=0.0003)**
Manchikanti et al. [36]	40	1. Caudal ESI + anaesthetic (20) 2. Caudal epidural anaesthetic (20)	NRS, Oswestry at 3, 6, 12 months NS differences; SD over time
Manchikanti et al. [37]	50	1. Caudal ESI + anaesthetic (25) 2. Percutaneous adhesiolysis (25)	NRS, Oswestry at 3, 6, 12 months **2 V 1 entire follow-up period NRS and Oswestry (P<0.0001)**
Mariconda et al. [38]	44	1 Decompression surgery (22) 2. Bed rest, orthosis, physical therapy (22)	Beaujon Scoring System[g] at 1, 2 years, and mean 47 months: **1 V 2 at 2 years / long-term (P≤0.05 / ≤0.01)**
Matsudaira et al. [39]	79	1. Prostaglandin (39) 2. Etodolac (NSAID) (40)	SF 36, rating scale for back and leg pain and walking distance, improvement, satisfaction at 8 weeks **1 V 2 SF 36 physical functioning, bodily pain,**

			mental health (P<0.01), role physical (P=0.03), walking distance, leg numbness, improvement, satisfaction (P<0.01)
Ng et al. [40]	32[d]	1. PRI bupivacaine (15) 2. PRI bupivacaine + steroid (17)	VAS back / leg pain, walking distance at 2, 4, 6, 12 weeks: NS difference in walking distance (only outcome separate data for spinal stenosis)
Podichetty et al. [45]	55	1. Nasal calcitonin (36) 2. Placebo (19)	VAS, Oswestry, walking distance, SF 36 at 6 weeks: NS differences
Porter & Miller [47]	42	1. Injected calcitonin (20) 2. Injected saline (placebo) (22)	Walking distance, pain, sleep, mobility, analgesics at 4, 8 weeks: NS differences
Pua et al. [48]	68	1. BWST[b] (33) 2. Cycling[b] (35)	Oswestry, Roland-Morris, VAS, patient-rated change at 3, 6 weeks: NS differences, SD over time
Sahin et al. [50]	45	1. Nasal calcitonin[c] (23) 2. Paracetamol[c] (22)	VAS, ROM, Roland-Morris, walking distance at 8 weeks: NS differences, SD over time
Slatis et al. [53]	83	1. Decompression surgery (45) 2. NSAID, back school, some individualised physical therapy (38)	Oswestry, NRS, treadmill test at mean 6 years NS difference; SD over time
Tafazal et al. [56]	40	1. Nasal calcitonin (20) 2. Placebo (20)	VAS back / leg pain, Oswestry, LBOS, walking distance at 4, 10, 16 weeks: NS differences
Tafazal et al. [57]	48[d]	1. PRI bupivacaine (25) 2. PRI bupivacaine + steroid (23)	VAS back / leg pain, Oswestry, LBOS at 6, 12 weeks 1 year: **Oswestry at 3 months (P=0.04)**
Uratsuji et al. [66]	84	1. Opalman (30 mgd)[h] (29) 2. Opalman (15 mgd)[h] (32)	Self-reported improvement, functional tasks at 6 weeks. NS differences

		3. Opalman (6 mgd)[h] (23)	
Waikakul & Waikakul [67]	152	1. Methylcobalamin (70) 2. Control (82) Both groups – education, strengthening exercises, physical therapy, NSAID.	Pain on movement, ROM, SLR, Neurology, walking distance, medication at 6, 12, 18, 24 months: **1 v 2 at 6, 12, 18 months: walking distance (P<0.05)**
Weinstein et al. [69]	304[e]	1. Decompressive surgery (159) 2. Usual care[f] (145)	SF 36, Oswestry at 6 weeks, 3, 6, 12, 24 months: NS differences
Weinstein et al. [70]	289[e]	1. Decompressive surgery (138) 2. Usual care[f] (151)	SF 36, Oswestry at 6 weeks, 3, 6, 12, 24 months: **1 V 2 SF 36 bodily pain at 2 years (P not stated)**
Weinstein et al. [71]	304[e]	1. Decompressive surgery (159) 2. Usual care[f] (145)	SF 36, Oswestry at 3, 4 years: NS differences
Whitman et al. [72]	58	1. MT, BWST, flexion exercises (29) 2. Flexion exercises, walking, US (29)	Global rating of change (GRC), Oswestry, NPRS, SSS at 6 weeks, 1 year: **1 V 2 GRC at 6 weeks (P=0.0015).** Other outcomes NS differences
Yaksi et al. [74]	55	1. Flexion / strengthening exercises traction, corset, NSAID (27) 2. As 1 + gabapentin (28)	Walking distance, VAS with movement, neurological deficit at 1, 2, 3, 4 months: **2 V 1 walking distance at 2, 3, 4 months (P=0.03, 0.04, 0.001); VAS at 3, 4 months (P=0.039, 0.006); improvement sensory loss at 4 months (P=0.04)**
Zucherman et al. [76]	191	1. Decompression surgery (100) 2. ESI (NSAID, physical therapy) (91)	SF 36, ZCQ, ZCS at 6 weeks, 6, 12 months: **1 V 2 at all time points ZCQ (P not stated), and SF 36 (P not stated)**
Zucherman et al. [77]	191	1. Decompression surgery (100)	ZCQ at 2 years:

2. ESI (NSAID, physical therapy) (91) **1 V 2 all domains of ZCQ (P<0.001)**

[a] = significant differences in bold (with more effective treatment given first)
[b] = in addition both groups received warm-up (heat, traction) and home flexion exercise programme
[c] = in addition both groups did exercise programme (heat, flexion and stabilisation exercises)
[d] = spinal stenosis patients only, trial also included patients with disc herniations
[e] = in randomised controlled trial, more patients in an observational study
[f] = physical therapy, ESI, education, home exercises, NSAID
[g] = combination: walking distance, leg pain rest / exertion, back pain, neurological deficit, medication, quality of life
[h] = mgd = micrograms per day; Japanese trademark name for prostaglandin E
[j] = high quality (≥ 6 on PEDro scale) in bold

BWST = body-weight supported treadmill; ESI = epidural steroid injection; LBOS = Low Back Outcome Score; LBP = low back pain; MT = manual therapy; NPRS = Numeric Pain Rating Scale; NRS = Numeric (pain) Rating Scale; NS = not significant; NSAID = non-steroidal anti-inflammatory drugs; PRI = periradicular infiltration; ROM = range of movement; SD = significant difference; SSS = Spinal Stenosis Scale; US = ultrasound; VAS = visual analogue scale; ZCQ = Zurich Claudication Questionnaire; ZCS = Zurich Claudication Score.