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>
<thead>
<tr>
<th>Trial</th>
<th>Number</th>
<th>Interventions</th>
<th>Outcomes / follow-up</th>
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</table>
| 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] | 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 | 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=0.0008); 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,
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<td>32d</td>
<td>1. PRI bupivacaine (15)</td>
<td>2. PRI bupivacaine + steroid (17)</td>
<td>Mental health (P&lt;0.01), role physical (P=0.03), walking distance, leg numbness, improvement, satisfaction (P&lt;0.01)</td>
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<td>Podichetty et al. [45]</td>
<td>55</td>
<td>1. Nasal calcitonin (36)</td>
<td>2. Placebo (19)</td>
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<td>Porter &amp; Miller [47]</td>
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<td>1. Injected calcitonin (20)</td>
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<td>Sahin et al. [50]</td>
<td>45</td>
<td>1. Nasal calcitonin(^c) (23)</td>
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<td>83</td>
<td>1. Decompression surgery (45)</td>
<td>2. NSAID, back school, some individualised physical therapy (38)</td>
<td>Oswestry, NRS, treadmill test at mean 6 years NS difference; SD over time</td>
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<td>Tafazal et al. [56]</td>
<td>40</td>
<td>1. Nasal calcitonin (20)</td>
<td>2. Placebo (20)</td>
<td>VAS back / leg pain, Oswestry, LBOS, walking distance at 4, 10, 16 weeks: NS differences</td>
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<tr>
<td>Tafazal et al. [57]</td>
<td>48(^d)</td>
<td>1. PRI bupivacaine (25)</td>
<td>2. PRI bupivacaine + steroid (23)</td>
<td>VAS back / leg pain, Oswestry, LBOS at 6, 12 weeks 1 year: Oswestry at 3 months (P=0.04)</td>
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<td>Uratsuji et al. [66]</td>
<td>84</td>
<td>1. Opalman (30 mgd)(^h) (29)</td>
<td>2. Opalman (15 mgd)(^h) (32)</td>
<td>Self-reported improvement, functional tasks at 6 weeks. NS differences</td>
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3. Opalman (6 mgd)h (23)

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<td>Waikakul &amp; Waikakul [67] 152</td>
<td>1. Methylcobalam (70) 2. Control (82)</td>
<td>Both groups – education, strengthening exercises, physical therapy, NSAID.</td>
<td>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&lt;0.05)</td>
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<td>Weinstein et al. [69] 304e</td>
<td>1. Decompressive surgery (159) 2. Usual care′ (145)</td>
<td>SF 36, Oswestry at 6 weeks, 3, 6, 12, 24 months: NS differences</td>
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<tr>
<td>Weinstein et al. [70] 289e</td>
<td>1. Decompressive surgery (138) 2. Usual care′ (151)</td>
<td>SF 36, Oswestry at 6 weeks, 3, 6, 12, 24 months: 1 v 2 SF 36 bodily pain at 2 years (P not stated)</td>
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<tr>
<td>Weinstein et al. [71] 304e</td>
<td>1. Decompressive surgery (159) 2. Usual care′ (145)</td>
<td>SF 36, Oswestry at 3, 4 years: NS differences</td>
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<td>Whitman et al. [72] 58</td>
<td>1. MT, BWST, flexion exercises (29) 2. Flexion exercises, walking, US (29)</td>
<td>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</td>
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<td>Yaksi et al. [74] 55</td>
<td>1. Flexion / strengthening exercises traction, corset, NSAID (27) 2. As 1 + gabapentin (28)</td>
<td>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)</td>
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<tr>
<td>Zucherman et al. [76] 191</td>
<td>1. Decompression surgery (100) 2. ESI (NSAID, physical therapy) (91)</td>
<td>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)</td>
<td></td>
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<tr>
<td>Zucherman et al. [77] 191</td>
<td>1. Decompression surgery (100)</td>
<td>ZCQ at 2 years:</td>
<td></td>
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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
i = 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.