Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Study Design	Country Setting	Inclusion Criteria	Exclusion Criteria
Brown, 2012	RCT	USA Single center Pain clinic	Degenerative lumbar spinal stenosis with painful lower limb neurogenic claudication and hypertrophic ligamentum flavum; with MRI or CT correlation; >18 years of age; failed conservative therapy; ODI >20; able to walk >10 feet unaided; duration not specified	Prior surgery at the intended treatment level, previous epidural steroids, recent spinal fractures, disabling back or leg pain from causes other than lumbar spinal stenosis, fixed spondylolisthesis > grade 1, disk protrusion or osteophyte formation, excessive facet hypertrophy, bleeding disorders, current use of anticoagulants, ASA or NSAID within 5 days, pregnant or breastfeeding, unable to lie prone, on Workman's Compensation or considering litigation
Cuckler, 1985	RCT	USA >1 center Type of clinics not reported	Acute unilateral sciatica; well defined, discrete neurological findings or neurogenic claudication; failure to improved with at least two weeks of noninvasive therapy; duration of symptoms not specified; imaging findings not required	Lumbar surgery for similar symptoms or any lumbar surgery within 6 months

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Number of Treatment and Control Subjects (number approached, number eligible, number enrolled)	Type of Intervention (experimental & control groups, dose, duration of treatment)	Subject Characteristics
Brown, 2012	Approached: 50 Eligible: 46 Randomized: 38 (17 vs. 21) Analyzed: 38 at 6 weeks	A: Interlaminar epidural steroid injection with 80 mg triamcinolone acetate (40 mg in diabetic patients) plus NS (6 ml), with fluoroscopic guidance (n=17) B: Minimally invasive lumbar decompression (mild) procedure using device to access the interlaminar space and remove portions of the lamina and ligamentum flavum, with fluoroscopic guidance (n=21)	Age (mean): 74 vs. 79 years Male: 62% vs. 47% Duration of medical management >6 months: 76% vs. 62% Baseline pain: Not reported Baseline function: Not reported
Cuckler, 1985	Approached: Not reported Eligible: Not reported Randomized: 37 (23 vs. 14) Analyzed: 37 at 20-22 months	A: Interlaminar epidural injection with 80 mg methylprednisolone (2 ml) and 1% procaine (5 ml) (n=23) B: Interlaminar epidural injection with saline (2 ml) and 1% procaine (5 ml) (n=14)	Age (years): 49 vs. 50 Male: 48% vs. 55% Duration of symptoms (months): 17.3 vs. 13.8 Baseline pain: Not reported Baseline function: Not reported

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Other Patient Characteristics (expectations of treatment benefit, confidence in clinician, worker's compensation status, ongoing litigation, smoking status, other treatments received)	Number and Frequency of Injections Number of Levels Provider Experience	Imaging Guidance	Type of Comparison
Brown, 2012	Treatments prior to intervention: Not specified Treatments following intervention: Not specified Other patient characteristics: Not reported	Number and frequency of treatments: One treatment up to 6 weeks, then patient unblinded and given option of additional treatments, including nonallocated treatment Number of levels: 7/17 epidural steroid vs. 7/21 had one level treated Provider experience: Not reported	Fluoroscopy with contrast verification in epidural space	Noninjection intervention
Cuckler, 1985	Treatments prior to intervention: Not specified Treatments following intervention: Not specified Previous surgery: 2% (1/42) vs 7% (2/31), RR 0.38 (95% CI 0.04 to 4.05) Herniated disc: 52% vs 45% Spinal stenosis: 48% vs. 55%"	Number of injections: 43% (18/42) vs. 58% (18/31), RR 0.82 (95% CI 0.48 to 1.39) received second injection with corticosteroid and local anesthetic after 24 h due to no relief after initial injection Number of levels: Single level Provider experience: Not reported	Interlaminar epidural injection with corticosteroid and local anesthetic	Interlaminar or transforaminal epidural injection with local anesthetic

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Results
Brown, 2012	A vs. B <u>Pain</u> >=2 point improvement in VAS pain (0-10): 35% (6/17) vs. 76% (16/21) at 2 weeks, RR 0.46 (95% CI 0.23 to 0.92) Pain (mean, 0-10 VAS): 6.4 vs. 6.4 at baseline, 6.3 vs. 3.8 at 6 weeks <u>Function</u> Oswestry Disability Index: 40 vs. 39 at baseline, 35 vs. 27 at 6 weeks <u>Other Outcomes</u> Zurich Claudication Questionnaire patient satisfaction (mean, 1-6): 2.8 vs. 2.2 at 6 weeks, patient satisfaction <=2.5: 41% (7/17) vs. 59% (12/21) at 6 weeks, RR 0.72 (95% CI 0.36 to 1.74)
Cuckler, 1985	A vs B (spinal stenosis subgroup) <u>Pain</u> Pain improved >=75%: 22% (5/23) vs. 14% (2/14) at mean 20 months, RR 1.52 (95% CI 0.34 to 6.81) <u>Other Outcomes</u> Surgery: 26% (6/23) vs. 29% (4/14) at mean 20 months, RR 0.91 (95% CI 0.31 to 2.68)

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Duration of Followup	Loss to Followup	Compliance to Treatment	Adverse Events and Withdrawal due to Adverse Events	Sponsor	Quality Rating	Comments
Brown, 2012	6 weeks	None reported	No crossover prior to 6 weeks	Mortality: None "No major procedure-related or device-related complications reported in either treatment group"	Vertos Medical	Fair	
Cuckler, 1985	13 to 30 months (mean 20 .2 vs. 21.5 months)	None reported	Appears complete	Not reported	Not reported	Fair	

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Study Design	Country Setting	Inclusion Criteria	Exclusion Criteria
Friedly, 2014	RCT	USA Multicenter	≥50 years of age; central lumbar spinal stenosis on MRI or CT; average pain rating >4 on 0 to 10 scale; pain in lower back, buttock, or on standing, walking, or spinal extension in the past week; worse pain in the buttock, leg or both than in the back; score ≥7 on RDQ; duration not specified	Spondylolisthesis requiring surgery, history of lumbar surgery or epidural injections within past 6 months

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Number of Treatment and Control Subjects (number approached, number eligible, number enrolled)	Type of Intervention (experimental & control groups, dose, duration of treatment)	Subject Characteristics
Friedly, 2014	Approached: 2224 Eligible: 422 Randomized: 400 (200 vs. 200) Analyzed: 386 (193 vs. 193) at 6 weeks	A: Interlaminar (n=143) or transforaminal (n=57) injection with 1 to 3 ml triamcinolone (60 to 120 mg), betamethasone (6 to 12 mg), dexamethasone (8 to 10 mg), or methylprednisolone (60 to 120 mg) plus 0.25% to 1% lidocaine (3 ml), with fluoroscopic guidance (n=200) B: Interlaminar (n=139) or transforaminal (n=61) injection with 0.25% to 1% lidocaine, with fluoroscopic guidance (2 to 6 ml) (n=200)	Age (mean): 68 vs. 68 years Male: 42% vs. 48% Nonwhite: 32% vs. 30% Duration of symptoms: <3 months 12% to 20%; 3 to < 12 months 25% to 28%; 1 to 5 years 29.5 to 31.2% ; >5 years 21.1 to 33.5% Baseline leg pain (0-10 NS): 7.2 vs. 7.2 Baseline RDQ (0-24): 16 vs. 16

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Other Patient Characteristics (expectations of treatment benefit, confidence in clinician, worker's compensation status, ongoing litigation, smoking status, other treatments received)	Number and Frequency of Injections Number of Levels Provider Experience	Imaging Guidance	Type of Comparison
Friedly, 2014	Treatments prior to intervention: Not specified Treatments following intervention: Not specified Employed full-time or part-time: 28% vs. 36% Smoker: 12% vs. 16% Diabetes on insulin: 8.0% vs. 7.5% Expectation of pain relief (0-10): 7.7 vs. 7.8	Number of injections: Up to two injections in 1st six weeks Number of levels: Multilevel and bilateral injections allowed (numbers not reported) Provider experience: Board-certified anesthesiologists, physiatrist, and radiologists with expertise in epidural injections, trained to administer injections in standardized manner	Fluoroscopy	Interlaminar or transforaminal epidural injection with local anesthetic

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Results
Friedly, 2014	A vs. B <u>Pain</u> Leg pain improved >=30%: 49.2% (96/193) vs. 49.7% at 6 weeks (96/193), RR 1.0 (95% CI 0.82 to 1.22 Leg pain improved >=50%: 38.3% (74/193) vs. 38.3% (74/193) at 6 weeks, RR 1.0 (95% CI 0.78 to 1.29) Leg pain (0-10): 7.2 vs. 7.2 at baseline; 4.4 vs. 5.0 at 3 weeks, difference -0.6 (95% CI -1.2 to -0.10; 4.4 vs. 4.6 at 6 weeks, 95% CI -0.2 (95% CI -0.8 to 0.4) BPI, SSSQ symptoms and physical function, EQ-5D, GAD-7: No differences <u>Function</u> RDQ (0-24): 16 vs. 16 at baseline; 12 vs. 13 at 3 weeks, difference -1.8 (95% CI -2.8 to -0.9); 12 vs. 12 at 6 weeks, difference -1.0 (95% CI -2.1 to 0.1) RDQ improved >=30%: 37.3% (72/193) vs. 31.6% (61/193) at 6 weeks, RR 1.18 (95% CI 0.90 to 1.56) RDQ improved >=50%: 23.8% (46/193) vs. 20.2% (39/193) at 6 weeks RR 1.14 (95% CI 0.78 to 1.69) <u>Other Outcomes</u> PHQ-8: More improvement in group A (p=0.007) SSQ satisfaction "very" or "somewhat" satisfied: 67% (129/193) vs. 54% (104/191), RR 1.23 (95% CI 1.04 to 1.45) Interlaminar <u>Pain</u> Leg pain (0-10): 7.3 vs. 7.4 at baseline; 4.1 vs. 5.0 at 3 weeks, difference -0.9 (95% CI -1.5 to -0.3); 4.2 vs. 4.5 at 6 weeks, difference -0.3 (95% CI -1.0 to 0.4) <u>Function</u> RDQ (0-24): 17 vs. 16 at baseline; 11 vs. 13 at 3 weeks, difference -2.5 (95% CI -3.7 to -1.3); 12 vs. 13 at 6 weeks, difference -1.4 (95% CI -2.8 to -0.1) Transforaminal <u>Pain</u> Leg pain (0-10): 7.0 vs. 7.0 at baseline; 5.0 vs. 5.1 at 3 weeks, difference 0.0 (95% CI -0.9 to 0.9); 4.9 vs. 4.9 at 6 weeks, difference 0.1 (95% CI -0.9 to 1.0)

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Duration of Followup	Loss to Followup	Compliance to Treatment	Adverse Events and Withdrawal due to Adverse Events	Sponsor	Quality Rating	Comments
Friedly, 2014	6 weeks	3.5% (7/200) vs. 3.% (7/200) at 6 weeks	Appears complete	A vs. B At least 1 adverse event: 22% (43/200 vs. 16% (31/200), RR 1.39 (95% CI 0.91 to 2.11) Adverse event rate, interlaminar approach: 0.22 (32/143) vs. 0.10 (14/139), RR 2.22 (95% CI 1.24 to 3.98) Adverse event rate, transforaminal approach: 0.46 (26/57) vs. 0.33 (20/61), RR 1.39 (95% CI 0.88 to 2.20) Excessive pain: 2.5% (5/200) vs. 3.5% (7/200), RR 0.71 (95% CI 0.23 to 2.21) Headache: 4% (8/200) vs. 1.5% (3/200), RR 2.67 (95% CI 0.72 to 9.91) Fever and/or infection: 5% (10/200) vs. 1.0% (2/200), RR 5.0 (95% CI 1.11 to 22.53) Dizziness/lightheadedness: 2% (4/200) vs. 2% (4/200), RR 1.0 (95% CI 0.25 to 3.94) Dural puncture: 0.5% (1/200) vs. 0.5% (1/200), RR 10. (95% CI 0.6 to 15.88) Serious adverse event: 2.5% (5/200) vs. 2.0% (4/200), RR 1.25 (95% CI 0.34 to 4.59)	Agency for Healthcare Research and Quality	Good	

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Study Design	Country Setting	Inclusion Criteria	Exclusion Criteria
Fukusaki, 1998	RCT	Japan Single center Pain clinic	Pseudoclaudication and diagnosed by an orthopedist as having lumbar degenerative spinal canal stenosis with imaging correlation; duration not specified	Not reported
Huda, 2010	RCT	India Single center Orthopedics clinic	Clinical signs and symptoms of lumbar canal stenosis, refractory pain after full dose NSAIDs or physical therapy for >2 weeks; imaging findings not specified	Prior back surgery, back or leg pain due to other causes, pregnant, breast feeding, serious medical comorbidities

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Number of Treatment and Control Subjects (number approached, number eligible, number enrolled)	Type of Intervention (experimental & control groups, dose, duration of treatment)	Subject Characteristics
Fukusaki, 1998	Approached: Not reported Eligible: Not reported Randomized: 53 (19 vs. 18 vs. 16) Analyzed: 53 at 3 months	A: Interlaminar epidural injection with 40 mg methylprednisolone and 1% mepivacaine (8 ml) B: Interlaminar epidural injection with 1% mepivacaine (8 ml) C: Interlaminar epidural injection with normal saline (8 ml)	Mean age (years): 72 vs. 69 vs. 70 Male: 68% vs. 72% vs. 75% Duration of symptoms: Not reported Baseline pain: Not reported Baseline function: Not reported Walking distance (m): 9 vs. 11 vs. 10
Huda, 2010	Approached: Not reported Eligible: Not reported Randomized: 70 (35 vs. 35) Analyzed: 70	A: Caudal epidural injection with 80 mg methylprednisolone (2 ml) plus 0.125% bupivacaine (5 ml) and normal saline (13 ml) (n=35) B: Caudal epidural injection with 80 mg triamcinolone acetate (80 mg) plus 0.125% bupivacaine (5 ml) and normal saline (13 ml) (n=35)	Age (mean): 45 vs. 42 years Male: 54% vs. 66% Duration of symptoms (months): 18 vs. 17 Baseline pain (0-10 VAS): 6.4 vs. 6.3 Baseline function: Not reported

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Other Patient Characteristics (expectations of treatment benefit, confidence in clinician, worker's compensation status, ongoing litigation, smoking status, other treatments received)	Number and Frequency of Injections Number of Levels Provider Experience	Imaging Guidance	Type of Comparison
Fukusaki, 1998	Treatments prior to intervention: Not specified Treatments following intervention: Not specified Other patient characteristics: Not reported	Number and frequency of injections: 2 injections in first week Number of levels: Not specified (L3/4 or L4/5 interspace) Provider experience: "Experienced anesthesiologist"	No use of imaging guidance reported	Epidural local anesthetic Epidural saline
Huda, 2010	Treatments prior to intervention: Not specified Treatments following intervention: Not specified Baseline claudication distance (m) 170 vs. 163	Number and frequency of injections: 2 injections with 2nd injection after 2 weeks Number of levels: Caudal Provider experience: Not reported	Not reported	Head-to-head comparison of different corticosteroids

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Results
Fukusaki, 1998	A vs. B vs. C <u>Function</u> Walking distance: 87 vs. 92 vs. 23 at 1 week, 26 vs. 28 vs. 18 at 1 month, 10 vs. 13 vs. 11 at 3 months ($p<0.05$ for A and B vs. C at week 1 only) Good or excellent results (walk >20 meters): 63% (12/19) vs. 56% (10/18) vs. 12% (2/16) at 1 week: A vs. B, RR 1.14 (95% CI 0.66 to 1.94); A vs C, RR 5.05 (95% CI 1.32 to 19.31); B vs. C, RR 4.44 (95% CI 1.14 to 17.33); 16% (3/19) vs. 17% (3/18) vs. 6.3% (1/16) at 1 month: A vs. B, RR 0.94 (95% CI 0.22 to 4.10); A vs. C, RR 2.53 (95% CI 0.29 to 21.98); B vs. C RR 2.67 (95% CI 0.30 to 23.14); 5.3% (1/19) vs. 5.6% (1/18) vs. 6.3% (1/16) at 3 months: A vs. B, RR 0.95 (95% CI 0.06 to 14.03); A vs. C RR 0.84 (95% CI 0.06 to 12.41); B vs. C, RR 0.89 (95% CI 0.06 to 13.07)
Huda, 2010	A vs. B <u>Pain</u> Pain (0-10 VAS): 6.3 vs. 6.4 at baseline; 5.6 vs. 5.4 at 1 month; 4.9 vs. 4.7 at 3 months; 3.6 vs. 4.8 at 6 months (p values not reported and SD's not provided) Pain score improved >2 points on 0-10 VAS: 94% (33/35) vs. 86% (30/35) at 1 month, RR 1.10 (95% CI 0.94 to 1.30); 30/35 (86%) vs. 26/35 (74%) at 3 months, RR 1.15 (95 % CI 0.91 to 1.46); 28/35 (80%) vs. 21/35 (60%) at 6 months, RR 1.33 (95% CI 0.97 to 1.83) <u>Function</u> Claudication distance (m): 163 vs. 170 at baseline; 467 vs. 280 at 1 month; 587 vs. 312 at 3 months; 637 vs. 350 at 6 months (p-values not reported)

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Duration of Followup	Loss to Followup	Compliance to Treatment	Adverse Events and Withdrawal due to Adverse Events	Sponsor	Quality Rating	Comments
Fukusaki, 1998	3 months	Unclear	Appears complete	"No incidence of dural puncture, hypotension, or subarachnoid injection in any group."	Not reported	Poor	
Huda, 2010	6 months	Not reported	Appears complete	"No serious complications like epidural abscess, infection, or hematoma…during the study period of 12 months"	Not reported	Fair	

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Study Design	Country Setting	Inclusion Criteria	Exclusion Criteria
Koc, 2009	RCT	Turkey Single center Clinic setting unclear	Lumbar spinal stenosis based on medical history; physical and neurologic exam and MRI; duration not specified	Coronary artery or peripheral artery disease; spinal surgery; recent vertebral fracture; progression neurologic deficit; cauda equina syndrome
Manchikanti, 2009	RCT	USA Single center Pain clinic	≥ 50 yrs of age; evidence of lumbar spinal stenosis with radicular pain; chronic (≥ 6 months) function-limiting low back and lower extremity pain; failed fluoroscopically directed epidural injections; failed to improve substantially with conservative management; imaging findings not specified	Previous lumbar surgery; central spinal stenosis without radicular pain; uncontrollable or unstable opioid use; uncontrolled psychiatric disorder or acute/chronic medical illness; pregnant or lactating; history or potential for adverse reaction to study medications

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Number of Treatment and Control Subjects (number approached, number eligible, number enrolled)	Type of Intervention (experimental & control groups, dose, duration of treatment)	Subject Characteristics
Koc, 2009	Approached: Unclear Eligible: Unclear Randomized: 33 (10 vs. 13 vs. 10) Analyzed: 29 (10 vs. 10 vs. 9) at 6 months	A: Interlaminar epidural injection with 60 mg triamcinolone acetonide (1.5 ml), 15 mg 0.5% bupivacaine (3 ml), and 0.9% NS (5.5 ml), with fluoroscopic guidance B: Physical therapy 5 days/week for 2 weeks, including ultrasound for 10 minutes, hot pack for 20 minutes, and TENS for 20 minutes C: No injection or physical therapy	Age (mean): 61 vs. 63 vs. 53 years Male: 80% vs. 50% vs. 89% Duration of pain (years): 5.0 vs. 5.7 vs. 5.7 Baseline pain (0-100 VAS): 56 vs. 54 vs. 59 Baseline Roland Morris Disability Index (estimated from graph): 18 vs. 19 vs. 15
Manchikanti, 2009	Approached: 116 Eligible: 106 Randomized: 82 (not reported by group) Analyzed: 50 (25 vs. 25) at 12 months, including 8 patients (8 vs. 0) missing data (preliminary analysis)	A: Caudal epidural injection with 6 mg betamethasone, normal saline (6 mL), and 2% lidocaine (5 ml), with fluoroscopic guidance B: Epidural adhesiolysis with fluoroscopic guidance, followed by injection of 6 mg betamethasone, 10% sodium chloride (6 ml), and 2% lidocaine (5 ml), with fluoroscopic and lumbar epidurogram guidance	Age (mean): 62 vs. 61 years Male: 44% vs. 40% Duration of pain (months): 114 vs. 164 Baseline pain (0-10 NRS): 8.0 vs. 7.8 Functional status: Not reported

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Other Patient Characteristics (expectations of treatment benefit, confidence in clinician, worker's compensation status, ongoing litigation, smoking status, other treatments received)	Number and Frequency of Injections Number of Levels Provider Experience	Imaging Guidance	Type of Comparison
Koc, 2009	Treatments prior to intervention: Training to perform home-based therapeutic exercise program and oral diclofenac sodium 75 mg bid x 2 weeks Treatments following intervention: Not specified Other patient characteristics: Not reported	Number and frequency of injections: Single injection Number of levels: Single level Provider experience: Not reported	Fluoroscopy with contrast verification in epidural space	Physical therapy without injection No injection or physical therapy
Manchikanti, 2009	Treatments prior to intervention: Epidural injection with fluoroscopic guidance Treatments following intervention: Not specified Other patient characteristics: Not reported	Number of injections: 1.8 vs. 3.5 per year, frequency not reported Number of levels: Caudal approach Provider experience: Not reported	Fluoroscopy with lumbar epidurogram	Epidural adhesiolysis with corticosteroid and local anesthetic

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Results
Koc, 2009	A vs. B vs. C <u>Pain</u> Pain intensity (mean VAS, 0 to 100; estimated from graph): 53 vs. 55 vs. 58 at baseline; 20 vs. 31 vs. 47 at 2 weeks; 21 vs. 32 vs. 56 at 1 month; 23 vs. 24 vs. 38 at 3 months; 26 vs. 22 vs. 33 at 6 months <u>Function</u> Roland Morris Disability Index (mean, 0-24; estimated from graph): 18 vs. 19 vs. 15 at baseline; 8 vs. 12 vs. 12 at 2 weeks; 13 vs. 14 vs. 11 at 1 month; 11 vs. 11 vs. 10 at 3 months; 13 vs. 12 vs. 9 at 6 months Nottingham Health Profile (NHP), pain (median, 0-100): 56 vs. 54 vs. 59 at baseline; 7.3 vs. 19 vs. 33 at 2 weeks; 36 vs. 31 vs. 20 at 1 month, 20 vs. 18 vs. 28 at 3 months; 23 vs. 23 vs. 20 at 6 months NHP, physical mobility (median, 0-100): 42 vs. 42 vs. 42 at baseline; 22 vs. 31 vs. 31 at 2 weeks; 32 vs. 37 vs. 20 at 1 month; 31 vs. 32 vs. 31 at 3 months; 31 vs. 37 vs. 20 at 6 months NHP, energy (median, 0 to 100): 100 vs. 88 vs. 63 at baseline; 61 vs. 30 vs. 63 at 2 weeks; 100 vs. 24 vs. 61 at 1 month; 62 vs. 30 vs. 100 at 3 months; 82 vs. 49 vs. 63 at 6 months, (p>0.05 at all time points) NHP, sleep (median, 0 to 100): 58 vs. 56 vs. 56 at baseline; 26 vs. 32 vs. 12 at 2 weeks; 45 vs. 12 vs. 12 at 1 month; 14 vs. 12 vs. 29 at 3 months; 26 vs. 12 vs. 29 at 6 months, (p>0.05 at all time points) NHP, social isolation (median, 0 to 100): 42 vs. 29 vs. 0 at baseline; 22 vs. 18 vs. 0 at 2 weeks; 22 vs. 19 vs. 0 at 1 months; 32 vs. 11 vs. 0 at 3 months; 32 vs. 0 vs. 0 at 6 months, (p>0.05 at all time points)
Manchikanti, 2009	A vs. B <u>Pain</u> Pain (mean NRS, 0 to 10): 8.0 vs. 7.8 at baseline (p=0.47); 5.4 vs. 3.6 at 3 months, (p<0.0005); 6.0 vs. 3.8 at 6 months, (p<0.0005); 6.2 vs. 3.9 at 12 months Pain relief >=50% from baseline: 28% (7/25) vs. 80% (20/25) at 3 months, RR 0.35 (95% CI 0.18 to 0.67); 12% (3/25) vs. 80% (20/25) at 6 months, RR 0.15 (95% CI 0.50 to 0.44); 4% (1/25) vs. 76% (19/25) at 12 months RR 0.05 (95% CI 0.00 to 0.36) <u>Function</u> ODI (0 to 50): 30 vs. 31 at baseline (p=0.80), 23 vs. 16 at 3 months, (p<0.0005), 25 vs. 16 at 6 months, (p<0.0005), 25 vs. 16 at 12 months, (p<0.0005) ODI improved >=40% from baseline: 24% (6/25) vs. 80% (20/25) at 3 months, RR 0.30 (95% CI 0.14 to 0.62); 8% (2/25) vs. 76% (19/25) at 6 months RR 0.11 (95% CI 0.03 to 0.41); 0% (0/25) vs. 80% (20/25) at 12 months RR 0.02 (95% CI 0.00 to 0.38)

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Duration of Followup	Loss to Followup	Compliance to Treatment	Adverse Events and Withdrawal due to Adverse Events	Sponsor	Quality Rating	Comments
Koc, 2009	6 months	0% (0/10) vs. 23% (3/13) vs. 10% (1/10) at 6 months, RR 0.18 (95% CI 0.01 to 3.16)	Appears complete	2 withdrawals due to adverse events, group not described	None	Fair	
Manchikanti, 2009	12 months	32% (8/25) vs. 0% (0/25) at 12 months	Unclear; 18/25 patients in caudal epidural injection group unblinded early and received additional interventions	Subarachnoid placement of catheter: 0% (0/25) vs. 4% (1/25), RR 0.33 (5% CI 0.01 to 7.81)	None reported	Poor	All of the patients failed the control treatment prior to enrollment, preliminary analysis

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Study Design	Country Setting	Inclusion Criteria	Exclusion Criteria
Manchikanti, 2012	RCT	USA Single center Pain clinic	>30 years of age, chronic function-limiting low back pain and lower extremity pain of at least 6 on a scale of 0-10 for >6 months; diagnosis of central spinal stenosis with radicular pain; failure to improve with conservative management; imaging findings not specified	Spinal stenosis without radicular pain; foraminal stenosis without central stenosis; uncontrolled psychiatric disorders; a history of lumbar surgery; uncontrollable or unstable opioid use; pregnant or lactating women; uncontrolled medical illness (either acute or chronic); patients with a history or potential for adverse reaction(s) to local anesthetics or steroids
Manchikanti 2012 Manchikanti 2012 Manchikanti 2008	RCT	USA Single center Pain clinic	Spinal stenosis with radicular pain, ≥30 years of age; history of function-limiting low back pain and lower extremity pain >6 on a scale of 0-10 for >6 months; failed to improve with conservative management; imaging findings not specified	History of lumbar surgery, spinal stenosis without radicular pain; uncontrollable or unstable opioid use; uncontrolled psychiatric disorders; uncontrolled medical illness, pregnant or lactating; patients with a history or potential for adverse reaction to study medications

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Number of Treatment and Control Subjects (number approached, number eligible, number enrolled)	Type of Intervention (experimental & control groups, dose, duration of treatment)	Subject Characteristics
Manchikanti, 2012	Approached: 164 Eligible: 138 Randomized: 120 Analyzed: 60 (30 vs. 30) at 12 months, including 6 (3 vs. 30) with missing data (preliminary analysis)	A: Interlaminar epidural injection with betamethasone (1 ml, dose not specified) plus 0.5% lidocaine (5 ml), with fluoroscopic guidance B: Interlaminar epidural injection with 0.5% lidocaine (6 ml), with fluoroscopic guidance	Age (mean): 50 vs. 54 years Male: 63% vs. 40% Duration of pain (months): 121 vs. 138 Baseline pain (0 to 10 NRS): 8.1 vs. 8.1 Baseline ODI (0 to 50): 29 vs. 31
Manchikanti 2012 Manchikanti 2012 Manchikanti 2008	Approached: 140 Eligible: 112 Randomized: 100 (50 vs. 50) Analyzed: 100 (50 vs. 50) at 24 months including 29 (14 vs.15) with missing data	A: Caudal epidural injection with betamethasone 6 mg (1 ml) plus lidocaine 0.5% (9 ml) with fluoroscopic guidance B: Caudal epidural injection with lidocaine 0.5% (10 ml) with fluoroscopic guidance	Age (mean): 56 vs. 57 years Male: 50% vs. 32% Race: Not reported Duration of pain (months): 105 vs. 94 Baseline pain (NRS 0 to 10): 7.6 vs. 7.9 Baseline ODI (0 to 50): 28 vs. 40

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Other Patient Characteristics (expectations of treatment benefit, confidence in clinician, worker's compensation status, ongoing litigation, smoking status, other treatments received)	Number and Frequency of Injections Number of Levels Provider Experience	Imaging Guidance	Type of Comparison
Manchikanti, 2012	Treatments prior to intervention: Not specified Treatment following intervention: Not specified Other patient characteristics: Not reported	Number of injections: Mean 3.5 vs. 3.6 per year, Frequency not specified Number of levels: Appears to be single Provider experience: Not reported	Fluoroscopy with contrast verification in epidural space	Interlaminar epidural injection with local anesthetic
Manchikanti 2012 Manchikanti 2012 Manchikanti 2008	Treatments prior to intervention: Not specified Treatment following intervention: Not specified Other patient characteristics: Not reported	Number of injections: Mean 3.8 vs. 4.2 over 2 years, Frequency not specified Number of levels: Caudal Provider experience: Not reported	Fluoroscopy with contrast verification in epidural space	Caudal epidural local anesthetic

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Results
Manchikanti, 2012	A vs. B <u>Pain</u> Pain (mean NRS, 0 to 10): 8.1 vs. 8.1 at baseline, (p=0.90); 4.1 vs. 3.7 at 3 months, (p=0.37); 4.2 vs. 3.8 at 6 months, (p=0.38); 4.2 vs. 4.0 at 12 months, (p=0.67) Pain relief >=50% from baseline: 77% (23/30) vs. 77% (23/30) at 3 months, RR 1.0 (95% CI 0.76 to 1.32); 73% (22/30) vs. 73% (22/30) at 6 months, RR 1.0 (95% CI 0.74 to 1.36); 63% (19/30) vs. 70% (21/30) at 12 months, RR 0.90 (95% CI 0.63 to 1.30) <u>Function</u> ODI (0 to 50): 29 vs. 31 at baseline, (p=0.18); 16 vs.15 at 3 months, (p=0.73); 15 vs.16 at 6 months, (p=0.92); 16 vs.16 at 12 months, (p=0.84) ODI improved >=50% from baseline: 63% (19/30) vs. 80% (24/30) at 3 months, RR 0.79 (95% CI 0.57 to 1.10); 67% (20/30) vs. 67% (20/30) at 6 months, RR 1.0 (95% CI 0.70 to 1.43); 60% (18/30) vs. 70% (21/30) at 12 months, RR 0.86 (95% CI 0.59 to 1.25)
Manchikanti 2012 Manchikanti 2012 Manchikanti 2008	**A vs. B** <u>Pain</u> Pain (mean NRS, 0 to 10): 7.6 vs. 7.9 at baseline; 4.1 vs. 4.1 at 3 months; 4.2 vs. 4.1 at 6 months; 4.3 vs. 4.4 at 12 months; 4.7 vs. 4.6 at 24 months, (p=0.80 for group difference) Pain relief >=50% from baseline: 62% (31/50) vs. 66% (33/50) at 3 months RR 0.94 (95% CI 0.70 to 1.26); 56% (28/50) vs. 58% (29/50) at 6 months, RR 0.97 (95% CI 0.63 to 145); 46% (23/50) vs. 48% (24/50) at 12 months, RR 0.97 (95% CI 0.63 to 145); 44% (22/50) vs. 42% (21/50) at 24 months, RR 1.05 (95% CI 0.67 to 1.65) <u>Function</u> ODI (0 to 50): 28 vs. 30 at baseline; 17 vs. 17 at 3 months; 7 vs.17 at 6 months; 17 vs.18 at 12 months; 17 vs.18 at 24 months, (p=0.60 for group difference) ODI improved >=50% from baseline: 49% (24/50) vs. 58% (29/50) at 3 months, RR 0.83 (95% CI 0.57 to 1.20); 50% (25/50) vs. 54% (27/50) at 6 months RR 0.93 (95% CI 0.64 to 1.35); 50% (25/50) vs. 50% (25/50) at 12 months RR 1.0 (95 % CI 0.68 to 1.48); 46% (23/50) vs. 42% (21/50) at 24 months RR 1.10 (95 % CI 0.70 to 1.71) <u>Global Assessment</u> Success (pain improved >=50% and ODI improved >=50%): 48% (24/50) vs. 58% (29/50) at 3 months; 50% (25/50) vs. 54% 927/50) at 6 months; 46% (23/50) vs. 44% (22/50) at 12 months; 44% (22/50) vs. 38% (19/50) at 24 months <u>Other Outcomes</u> Opioid use (mg MED/day): 49 vs. 46 at baseline; 33 vs. 33 at 3 months; 34 vs. 34 at 6 months; 33 vs. 36 at 12 months; 32 vs. 36 at 24 months, (p>0.05 at all time points)

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Duration of Followup	Loss to Followup	Compliance to Treatment	Adverse Events and Withdrawal due to Adverse Events	Sponsor	Quality Rating	Comments
Manchikanti, 2012	12 months	10% (3/30) vs. 10% (3/30) at 12 months, RR 1.0 (95% CI 0.22 to 4.56)	Appears complete	3 subarachnoid punctures (not reported by group)	None reported	Fair	Preliminary analysis
Manchikanti 2012 Manchikanti 2012 Manchikanti 2008	24 months	28% (14/50) vs. 30% (15/50) at 24 months, RR 0.93 (95% CI 0.51 to 1.72)	Appears complete	"No major adverse events"	None reported	Fair	

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Study Design	Country Setting	Inclusion Criteria	Exclusion Criteria
Nam, 2011	RCT	South Korea Single center Physical medicine and rehabilitation clinic	≥50 years of age; pain increased with lumbar extension and decreased with lumbar flexion; pain radiating below knee; thoracolumbar scoliosis greater than 10 degrees, visible on x-rays; spinal stenosis on CT or MRI; duration not specified	Systemic inflammatory disease or diabetes; on anticoagulants; prior side effects from lidocaine or contrast dye; suspected infectious disease; steroid injection within 3 months; degenerative spondylolisthesis, osteoporosis, or compression fracture; surgical treatment of thoracolumbar region or cancer metastasis to thoracolumbar site or with spinal deformity caused by metabolic disease
Ohtori, 2012	RCT	Japan Single center Orthopedic surgery clinic	Low back and leg pain >1 month, lumbar spinal stenosis (central stenosis, lateral recess, or foraminal stenosis) on x-ray and MRI and physical examination	Monoradiculopathy, cauda equina syndrome, polyradiculopathy
el Zahaar, 1991	RCT	Egypt Single center Surgery clinic	Acute unilateral sciatica with neurological findings or neurogenic claudication without specific neurologic deficits; failure to improve with at least 2 weeks of conservative therapy; findings on MRI or CT consistent with clinical presentation	Surgery for similar symptoms or within 6 months

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Number of Treatment and Control Subjects (number approached, number eligible, number enrolled)	Type of Intervention (experimental & control groups, dose, duration of treatment)	Subject Characteristics
Nam, 2011	Approached: Not reported Eligible: Not reported Randomized: 48 Analyzed: 36 (17 vs. 19) at 12 weeks	A: Transforaminal epidural injection with 20 mg triamcinolone (0.5 ml) plus 0.5% lidocaine (1.5 ml), with fluoroscopic guidance (n=17) B: Transforaminal epidural injection with 0.5% lidocaine (2 ml), with fluoroscopic guidance (n=19)	Age (mean): 75 vs. 71 years Male: 24% vs. 26% Duration of symptoms (months): 7.7 vs. 6.7 Baseline pain (0-10 VAS): 7.3 vs. 7.4 Baseline ODI (0-100): 63 vs. 63
Ohtori, 2012	Approached: Not reported Eligible: Not reported Randomized: 80 (40 vs. 40) Analyzed: Not reported	A: Transforaminal epidural injection with 3.3 mg dexamethasone plus 1% lidocaine (2 ml), with fluoroscopic guidance (n=40) B: Transforaminal epidural injection with 10 mg etanercept plus 1% lidocaine (2 ml), with fluoroscopic guidance (n=40)	Age (mean): 67 vs. 65 years Male: 45% vs. 55% Race: Not reported Duration of symptoms (months): 2.3 vs. 2.5 Baseline pain (0-10 VAS): 7.5 vs. 7.9 Baseline ODI (0-100): 40 vs. 38
el Zahaar, 1991	Approached: Not reported Eligible: Not reported Randomized: 30 (18 vs. 12) Analyzed: 30	A: Caudal epidural injection with hydrocortisone (5 ml), 4% Carbocaine (4 ml), and saline (21 ml) (n=18) B: Caudal epidural injection with 4% Carbocaine (4 ml) plus saline (26 cc) (n=12)	Age (mean): 46 vs. 49 years Male: 54% vs. 65% Duration of symptoms (months): 17 vs. 14 Herniated disc: 51% vs. 54% Spinal stenosis: 49% vs. 46% Baseline pain: Not reported Baseline function: Not reported

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Other Patient Characteristics (expectations of treatment benefit, confidence in clinician, worker's compensation status, ongoing litigation, smoking status, other treatments received)	Number and Frequency of Injections Number of Levels Provider Experience	Imaging Guidance	Type of Comparison
Nam, 2011	Treatments prior to intervention: Not specified Treatments following intervention: Physical therapy not allowed Other patient characteristics: Not reported	Number and frequency of injections: 2nd injection after 3 weeks for partial improvement (53% vs. 47% received 2 injections) Number of levels: Single level (L5-S1 35% vs. 42%; L4-L5 41% vs. 37%) Provider experience: Not reported	Fluoroscopic guidance with contrast verification	Transforaminal epidural injection with local anesthetic
Ohtori, 2012	Treatment prior to intervention: Not specified (85% vs. 88% used meloxicam) Treatments following intervention: Not reported Spondylosis on x-ray: 60% vs. 65% Spondylolisthesis on x-ray: 40% vs. 35% Central stenosis on MRI: 70% vs. 78% Foraminal stenosis on MRI: 15% vs. 10% L4: 18% vs. 12% L5: 60% vs. 60^ S1: 22% vs. 28%	Number of injections: Single injection Number of levels: Single level Provider experience: Not reported	Fluoroscopic guidance with contrast verification of nerve	Transforaminal epidural injection with etancercept
el Zahaar, 1991	Treatment prior to intervention: Not specified Treatment following intervention: Advised to take aspirin, no physical therapy or exercise program Other patient characteristics: Not reported	Number and frequency of injections: Single injection Number of levels: Single level Provider experience: Not reported	Not reported	Caudal epidural injection with local anesthetic

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Results
Nam, 2011	A vs. B <u>Pain</u> Pain (mean, 0-10 VAS): 7.3 vs. 7.4 at baseline; 3.4 vs. 4.0 at 2 weeks; 3.5 vs. 4.4 at 1 month; 3.8 vs. 4.7 at 3 months (p<0.05 a 2 weeks, 1 month, and 3 months) <u>Function</u> ODI (mean, 0-100): 63 vs. 63 at baseline; 42 vs. 44 at 2 weeks; 39 vs. 46 at 1 month; 37 vs. 49 at 3 months (p<0.05 at 2 weeks; 1 month; and 3 months) <u>Global Assessment</u> Success (pain improved >40%, ODI improved >20%, patient satisfaction good or excellent): 76% (13/17) vs. 42% (8/19), RR 1.82 (95% CI 1.0 to 3.27) In multiple regression, sex, age, BMI, duration, and radiographic findings not associated with likelihood of success
Ohtori, 2012	A vs. B <u>Pain</u> Leg pain (0-10 VAS): 7.5 vs. 7.9 at baseline, 5.2 vs. 3.5 at 1 m (p=0.026) Leg numbness (0-10 VAS): 6.0 vs. 6.9 at baseline, 4.9 vs. 4.8 at 1 m (p>0.05) <u>Function</u> ODI (0-100): 40 vs. 38 at baseline, 30 vs. 28 at 1 m (p>0.05)
el Zahaar, 1991	A vs B (spinal stenosis subgroup) <u>Global Assessment</u> Treatment success (>75% improvement in pre-injection symptoms and no spinal surgery): 38% (7/18) vs. 33% (4/12) at 13-36 months; RR 1.17 (95% CI 0.43 to 3.13) <u>Other Outcomes</u> Subsequent surgery: 44% (8/18) vs. 58% (7/12) at 13-36 months, RR 0.68 (95% CI 0.33 to 1.40)

Appendix E2. Epidural Steroid Injections for Spinal Stenosis

Author, Year Title	Duration of Followup	Loss to Followup	Compliance to Treatment	Adverse Events and Withdrawal due to Adverse Events	Sponsor	Quality Rating	Comments
Nam, 2011	3 months	12 patients excluded from analysis for various reasons; 13 others excluded after "enrollment" (unclear if randomized)	Appears complete	Not reported	Inje University	Poor	
Ohtori, 2012	1 month	Not reported	Appears complete	No cases of infection, hematoma, spinal nerve injury, or other complications reported	No funding received	Fair	
el Zahaar, 1991	Mean 20 to 21 months	Unclear	Appears complete	Not reported	Not reported	Poor	

ASA = aspirin; CI = confidence interval; CT = CT=computed tomography; MRI = magnetic resonance imaging; NSAID = nonsteroidal antiinflammatory drug, ODI = Oswestry Disability Index; RCT = randomized controlled trial; RDQ = Roland Disability Questionnaire; RR = relative risk; VAS = visual analogue scale

Please see Appendix C. Included Studies for full study references.