Supplementary article data

Evidence and practice in spine registries

A systematic review, and recommendations for future design of registries

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APPENDIX 1: Search strategies

MEDLINE - Pubmed

("Lumbar vertebrae"[MH] OR
"Spine"[mesh] OR
"intervertebral disk"[mesh] OR
"intervertebral disc"[tiab] OR
spine[tiab] OR
spinal[tiab] OR
vertebra*[tiab] OR
disc[tiab] OR
discs[tiab] OR
disk[tiab] OR
disks[tiab])

AND

("low back pain"[tiab] OR
"back pain"[mesh] OR
"back pain"[tiab] OR
"intermittent neurogenic claudication"[tiab] OR
"intermittent claudication"[mesh] OR
"intermittent claudication"[tiab] OR
"neurogenic claudication"[tiab] OR
dorsalgia[tiab] OR
backache[tiab] OR
lumbago[tiab] OR
(lumbar[tiab] AND ("pain"[mesh] OR "pain"[all fields])) OR
"sciatica"[mesh] OR
"sciatica"[all fields] OR
sciatica[tiab] OR
"Spondylolisthesis"[mesh] OR
"spondylolisthesis"[tiab] OR
"isthmic"[tiab] OR
"lytic"[tiab] OR
"low-grade"[tiab] OR
"lumbar stenosis"[tiab] OR
"spinal stenosis"[mesh] OR
"spinal stenosis"[TIAB] OR
"stenosis" [TIAB] OR
"scoliosis"[TIAB] OR
"deformity"[ti] OR
"Scoliosis"[Mesh] OR
"degenerative disc disease"[tiab] OR
"spinal diseases"[mesh] OR
"intervertebral disk displacement"[mesh] OR
"intervertebral disk displacement"[tiab] OR
"discitis"[mesh] OR
"discitis"[all fields] OR
"spondylosis"[tiab] OR
((disc[tiab] OR discs[tiab] OR disk[tiab] OR disks[tiab]) AND degeneration[tiab]) OR
herniated[tiab] OR
hernia[tiab] OR
"Failed back surgery syndrome" [TIAB] OR
"FBSS" [TIAB] OR
"myelomeningocele"[TIAB] OR
"Ankylosing spondylitis" [TIAB] OR
"tumours" [TIAB] OR
"metastases" [TIAB] OR
"Trauma" [TIAB] OR
"Fracture" [TIAB])

AND

("Clinical Audit"[Mesh] OR
"audit"[TIAB] OR
"Quality Assurance, Health Care"[Mesh]
"Outcome and Process Assessment (Health Care)"[Mesh]
"Quality Improvement"[Mesh]
"Benchmarking"[Mesh] OR
"Benchmarking"[TIAB] OR
"Register"[TIAB] OR
"Registry"[TIAB] OR
"Registries"[Mesh])

Within Reference manager on all fields (indexed and non-indexed)

("Outcome and Process Assessment (Health Care)"[Mesh] OR
"Quality of Life"[Mesh] OR
"Functional status"[TIAB] OR
"disability"[tiab] OR
"Patient reported outcome" [tiab] OR
"PROMS"[tiab])

APPENDIX 2:

NEWCASTLE - OTTAWA QUALITY ASSESSMENT SCALE for COHORT STUDIES

Note: A study can be awarded a maximum of one star (*) for each numbered item within the Selection and Outcome categories. A maximum of two stars can be given for Comparability.

Selection

1) Representativeness of the exposed cohort (dependent on the diagnostic group)
a) truly representative of the average case in the community *****
b) somewhat representative of the average case in the community *****
c) selected group of users eg nurses, volunteers
d) no description of the derivation of the cohort

2) Selection of the non-exposed cohort
a) drawn from the same community as the exposed cohort *****
b) drawn from a different source
c) no description of the derivation of the non-exposed cohort

3) Ascertainment of exposure
a) secure record (eg surgical records) *****
b) structured interview *****
c) written self-report
d) no description

4) Demonstration that outcome of interest was not present at start of study
a) yes *****
b) no

Comparability

5) Comparability of cohorts on the basis of the design or analysis
a) study controls for the most relevant case mix variables (1. Diagnosis and 2. Baseline outcome score) *****
b) study controls for any additional factor *****

Outcome

6) Assessment of outcome
a) independent blind assessment *****
b) record linkage *****
c) self-report
d) no description

7) Was follow-up long enough for outcomes to occur
a) yes (select an adequate follow up period for outcome of interest) *****
b) no

8) Adequacy of follow up of cohorts
a) complete follow up - all subjects accounted for *****
b) subjects lost to follow up unlikely to introduce bias - small number lost → 20%; 80% response *****
c) follow up rate < 80% (select an adequate %) and no description of those lost
d) no statement

Total score (n stars)	

APPENDIX 3: Table 1. Study characteristics

Author, year reference	**Name Registry**	**Study purpose**	**Indication**	**Outcomes** [1]	**Covariate adjustment**	**Statistics**
Nerland et al., 2014	NORspine Norwegian Registry for Spine Surgery Norway	To study the equivalence of changes in functional outcomes	Lumbar spinal stenosis	PROM: ODI v.2.0 Secondary PROMs: EQ5D Clinical: perioperative complications duration of surgical procedures length of hospital stay	Adjustment for: Numbers of levels operated (one or two) Age BMI Baseline ODI value	Descriptive statistics Mixed linear models Methods Missing data: Complete cases analysis
Solberg et al., 2013	NORspine Norwegian Registry for Spine Surgery Norway	To estimate cut off values for success	Lumbar disc herniation	PROMs: ODI v.1 NPRS (0-10) Back pain intensity NPRS (0-10) Leg pain intensity EQ5D Secondary PROM: Global perceived effect (7-point Likert scale)	Adjustment for baseline scores: ODI v.1 NPRS Back pain intensity NPRS Leg pain intensity EQ5D	Descriptive statistics Treatment effect: Paired Students *t*-tests Subgroup comparison: one-way ANOVA Relationship Global Perceived change and change scores: Spearman rank correlation coefficient Cut off values for success: ROC analyses and AUC

Corcoll et al., 2006	NRT en el SNS Registry within Spanish National Health Service Spain - Balearic Islands	To describe the implementation of Neuroreflexotherapy and the audit results	Non-specific subacute and chronic neck, back, and low back pain.	Rates of referral and appropriate referral Patient satisfaction Physician satisfaction Secondary PROMs: VAS pain intensity of local and referred pain RMDQ	Not reported	Descriptive statistics
Kovacs et al., 2012	NRT en el SNS Registry within Spanish National Health Service Spain	To explore the feasibility of implementing a registry in routine practice. To develop predictive models to quantify the likelihood that a given patient experiences a clinical relevant improvement	Acute and chronic Low Back Pain with or without leg pain Seeking care	PROMs: RMDQ VAS (10cm) Back pain intensity VAS (10cm) Leg pain intensity	Independent variables in model: Gender Age Duration of current pain episode (acute, subacute, chronic) Employment status Education Recruitment setting Previous back surgery Current episode because of Failed Back Surgery Syndrome Diagnostic procedures/tests current episode Concomitant treatments	Descriptive statistics Improvement based on Minimal Clinical Important Change Multivariate logistic regression models using backward strategy Methods Missing data: Multiple imputation analysis (n= 5 imputed datasets)
Kovacs et al., 2007	NRT en el SNS Registry within Spanish National Health Service Spain - Balearic Islands	To identify prognostic factors for clinical outcome.	Non-specific subacute and chronic neck, back, and low back pain.	PROMs: RMDQ VAS (10cm) local pain intensity VAS (10cm) referred pain intensity	Independent variables in model: Reason for referral (neck, back) Gender Age Baseline PROMs Number of days with implanted surgical staples Duration of current pain episode (classified) Duration since first diagnosis (classified) Failed previous surgery for current	Descriptive statistics Multivariate logistic regression models using backward strategy

					episode	
Royuela et al., 2013	NRT en el SNS Registry within Spanish National Health Service Spain	To assess the feasibility of using a registry in routine practice. To develop models predicting the probability of improvement	Non-specific subacute and chronic neck, back, and low back pain.	PROMs: RMDQ for LBP / NDI for neck pain VAS (10cm) local pain intensity VAS (10cm) referred pain intensity	Independent vars in model: Reason for referral (neck, back LBP) Gender Age Baseline PROMs Number of days with implanted surgical staples Duration of current pain episode (classified) Duration since first diagnosis (classified) Employment status Type of pain Diagnosis of fybromyalgia Other comorbidities Involvement in employment claims Involvement in litigation Diagnostic tests before Neuroreflexotherapy (NRT) Imaging findings History of spine surgery Treatments before NRT	Descriptive statistics Improvement based on Minimal Clinical Important Change Multivariate logistic regression models Nomograms to illustrate results of models Methods Missing data: Multiple imputation analysis (n= 10 imputed datasets)
Fritzell et al., 2014	SweSpine Swedish National Spine Register Sweden	To compare PROMs between primary LDH and recurrent LDH. To determine risk factors for worse outcomes.	Lumbar disc herniation	PROMs: VAS (10cm) leg pain intensity VAS (10cm) back pain intensity ODI EQ5D Satisfaction and Global assessment of change in leg pain	Adjustments for: Age Gender Smoking Baseline value of analysed PROM	Descriptive statistics Comparison baseline characteristics between groups: independent Students' *t*-test continuous variables, Chi-square test ordinal data. In outcome calculation ANCOVA was used. Multivariate logistic regression analysis
Forsth et al., 2013	SweSpine Swedish National	To compare satisfaction after decompression	Lumbar spinal stenosis in one or	PROMs: VAS (10cm) leg pain	Adjustments for: Age (continuous)	Descriptive statistics Adjusted means were

	Spine Register Sweden	alone and following decompression and fusion.	two levels, with and without pre-operative spondylolisthesis Age: ≥ 50 years	intensity VAS (10cm) back pain intensity ODI EQ5D Satisfaction and Global assessment of change in leg pain	Gender Smoking Duration of symptoms Previous spinal surgery Baseline analgesic use Baseline value of analysed PROM A frailty component was included to handle within-hospitals dependencies in patient selection and surgical technique	estimated using Students' *t*-tests. Multivariate logistic regression analyses
Jansson et al., 2005	SweSpine Swedish National Spine Register Sweden	To report the health-related quality of life outcome in Lumbar Disc herniation. To compare the results with the Swedish population.	Lumbar disc herniation	PROM: EQ5D	Covariates: Age Gender Smoking status Type of surgery Duration of back and leg pain PROM: baseline VAS leg pain Pre-operative walking distance PROM: baseline EQ5D	Descriptive statistics MANOVA, adjusted for covariates.
Jansson et al., 2009	SweSpine Swedish National Spine Register Sweden	To report HRQoL outcome in an Lumbar Spinal Stenosis cohort To compare the findings with the Swedish population.	Lumbar spinal stenosis	PROM EQ5D score and EQ-VAS	Covariates: Age Gender Smoking status Type of surgery Duration of back and leg pain Pre-operative walking distance PROM: baseline EQ5D	Descriptive statistics MANOVA, adjusted for covariates.
Knutsson et al., 2013	SweSpine Swedish National Spine Register Sweden	To determine the association between BMI and outcome of lumbar spine surgery.	Lumbar spinal stenosis	PROMs: VAS (10cm) leg pain intensity VAS (10cm) back pain intensity ODI EQ5D	Adjustment for: Age Gender Smoking Use of analgesics Previous back surgery Duration od symptoms	Descriptive statistics General linear models (GLM). Restricted cubic-spline logistic regression analysis

				Satisfaction 3-point Likert scale Clinical outcome: Height & weight (BMI)	PROMs: Baseline values	
Robinson et al., 2013	SweSpine Swedish National Spine Register Sweden	To compare the 2-year results of 3 methods of lumbar fusion (UIF, IPF, and TLIF/PLIF).	Degenerative disc disease	PROMs: VAS (10cm) leg pain intensity VAS (10cm) back pain intensity ODI EQ5D	Adjustment for: Age Gender Smoking Use of analgesics Previous back surgery Duration od symptoms PROMs: Baseline value understudy Year of surgery: as 2 of the methods were unevenly distributed over study period. In many hospitals 1 surgical method predominated.	Descriptive statistics PROC MIXED and Kenward-Roger method, adjusted means Modified Poisson regression approach
Sanden et al., 2011	SweSpine Swedish National Spine Register Sweden	To determine the relation between smoking status and disability after surgical treatment.	Lumbar spinal stenosis	PROMs: VAS (10cm) leg pain intensity VAS (10cm) back pain intensity ODI Walking distance (categorized) SF36 EQ5D	Adjustment for: Age Gender Smoking Use of analgesics PROMs: Baseline value under study	Descriptive statistics General Linear Models (GLM), adjusted means Multivariate logistic regression
Sigmundsson et al., 2012	SweSpine Swedish National Spine Register Sweden	To determine predictive factors of surgical outcome.	Lumbar spinal stenosis	PROMs: VAS (10cm) leg pain intensity VAS (10cm) back pain intensity ODI Walking distance (categorized) EQ5D	Controlled for: Age Duration of back and leg pain MRI: Multilevel stenosis and spondylolisthesis MRI: Central dural sac area ? PROMs: baseline values Walking distance, Back and Leg pain	Descriptive statistics Paired Students' *t*-test; Mann Whitney *U*, Kruskall Wallis) Multivariate regression analysis MANOVA for variation in PROMs.

Sigmundsson et al., 2013	SweSpine Swedish National Spine Register Sweden	To determine how different constellations of back and leg pain influence preoperative health related quality of life.	Lumbar spinal stenosis	PROMs: VAS (10cm) leg pain intensity VAS (10cm) back pain intensity ODI Walking distance (categorized) SF36 EQ5D	Not reported	Descriptive statistics Parametric tests: Satterthwait *t*-tes Non-parametric tests: Mann-Whitney test, test for trend (Chi-square)
Sigmundsson et al., 2014	SweSpine Swedish National Spine Register Sweden	To evaluate outcome of surgery and to explore the role of spinal fusion in predominant back pain and predominant leg pain.	Lumbar spinal stenosis	PROMs: VAS (10cm) leg pain intensity VAS (10cm) back pain intensity ODI Walking distance (categorized) SF36 EQ5D Satisfaction with operation (categorized)	Adjustments for: Age Gender Duration of Leg and Back Pain Comorbidity Smoking Baseline PROM score	Descriptive statistics Linear regression analysis. Cox proportional hazard model (Robust) Outcomes compared with unadjusted nonparametric tests, test for trend (Chi square), Mann Whitney U test.
Stromqvist et al., 2012	SweSpine Swedish National Spine Register Sweden	To elucidate the incidence of dural lesions in decompressive surgery, to identify risk factors and effect on postoperative outcome.	Lumbar spinal stenosis	Clinical: Dural lesion PROMs: VAS (10cm) leg pain intensity VAS (10cm) back pain intensity ODI SF36 EQ5D Satisfaction with operation (categorized)	Risk factors: Age Gender Smoking Work Consumption of analgesics Walking distance Clinical risk factors: Dural lesion Number of levels decompressed	Descriptive statistics Logistic regression analysis

Berg et al., 2010	SweSpine Swedish National Spine Register Sweden	To determine whether a registry can provide the same information as an RCT.	CLBP - Degenerative disc disease	Global rating scale for improvement of back and leg pain Secondary PROMs: VAS (10cm) leg pain intensity VAS (10cm) back pain intensity ODI Walking distance (categorized) SF36 EQ5D Satisfaction with operation (categorized) Complications Reoperations Work status Medication	Not reported	Descriptive statistics Two-tailed Mann-Whitney U; Wilcoxon rank sum tests Students' t test; Spearman r, Fisher exact; Chi-square tests
Grob and Mannion, 2009	SSE Spine Tango Surgery Registry Switzerland	To investigate the occurrence of post-surgical complications form the patient's perspective.	Spine surgery for different pathologies of the cervical and lumbar spine	PROM: COMI Occurrence / nature of postop complications Secondary PROMs: Satisfaction intervention (5-point Likert scale) Global perceived effect (5-point Likert scale) Patient-rated complications (dichotomous)	Not reported	Descriptive statistics To evaluate group differences: Chi-square tests for proportion differences

Porchet et al. 2009	SSE Spine Tango Surgery Registry Switzerland	To compare outcome after lumbar disc excision with and without the use of the microscope.	Lumbar / lumbosacral degenerative disorders	PROM: COMI, incl. - NPRS (0-10) Back pain intensity - NPRS (0-10) Leg pain intensity Secondary PROMs: Satisfaction intervention (5-point Likert scale) Global perceived effect (5-point Likert scale) Patient-rated complications (dichotomous)	Gender Age categories (<60; >60) Health insurance (Private; Basic obligatory) Comorbidity (ASA score) Baseline PROM score (COMI, NPRS back and leg)	Descriptive statistics Unpaired Students t tests Contingency analyses (Chi-square tests)
Aghayev et al. 2012	SSE Spine Tango Surgery Registry SWISSspine SWISSspine Registry Switzerland	To compare back and leg pain alleviation after total disc arthroplasty and ALIF stratified by implant and surgeon from the SWISS-spine and Spine Tango registries.	CLBP - Degenerative disc disease	PROM: NASS, used - VAS (10 cm) Back pain intensity - VAS (10 cm) Leg pain intensity EQ5D	Covariates: Implant Surgeon Depression Age Gender Follow-up interval Length of stay (LoS) Baseline PROM score	Descriptive statistics First step: univariate logistic regression Second step: generalized linear model (GLM), adjusted
Aghayev et al. 2010	SWISSspine SWISSspine Registry Switzerland	To evaluate the outcomes of all single-level Dynardi TDAs compared with all other prostheses in the SWISSspine data pool.	CLBP - Degenerative disc disease	PROM: NASS, used - VAS (10 cm) Back pain intensity - VAS (10 cm) Leg pain intensity EQ5D	Covariates: Device used Gender Age (categorized) Surgical volume of center of intervention Pharmacologically treated depression	Descriptive statistics Wilcoxon rank-sum test Chi-square tests Multiple logistic regression models; backward elimination

					Preoperative PROM scores (pain and EQ5D; categorized)	
Schluessmann et al. 2009	SWISSspine SWISSspine Registry	To report the methodology and implementation of the SWISSspine registry and early results of the cases with TDA.	Not reported Lumbar Total Disc Arthroplasty (TDA)	PROM: NASS, used - VAS (10 cm) Back pain intensity - VAS (10 cm) Leg pain intensity EQ5D	Covariates: Prosthesis used Gender Age Surgical volume of center of intervention (categorized) Pharmacologically treated depression Preoperative PROM scores (pain and EQ5D)	Descriptive statistics Wilcoxon rank-sum test Chi-square test Multiple logistic regression models, backward elimination
Zweig et al. 2011	SWISSspine SWISSspine Registry Switzerland	To prove that preoperative nucleus pulposis status and presence or absence of radiculopathy has an influence on clinical outcomes in patients with mono-segmental lumbar total disc replacement.	Not reported mono-segmental TDR surgery for Degenerative disc disease Hernia nucleus pulposis - no radiculopathy, Stenosis, Hernia nucleus pulposis - radiculopathy	PROM: NASS, used - VAS (10 cm) Back pain intensity - VAS (10 cm) Leg pain intensity EQ5D	Adjustement for covariates: Gender Age Preoperative pain medication Intervertebral level of intervention Pharmacologically treated depression Type of work Working activity level	Descriptive statistics Univariate logistic regression or ANOVA General linear modelling (GLM). Bonferroni-Holm adjustments for multiple testing .
McGirt et al. 2013	N^2QOD National Neurosurgery Quality and Outcomes Database USA	To provide an overview of the aims, registry design and methods of the N2QOD pilot year lumbar module.	Lumbar spinal disorders: - symptomatic lumbar disc herniation - symptomatic recurrent lumbar disc herniation - lumbar stenosis - lumbar adjacent segment disease	Perioperative measures: Blood loss Length of Stay Need for inpatient rehabilitation or skilled nursing 90-day morbidity readmission reoperation Occupational outcome (return to work, capacity)	Patient characteristics and demographic factors for risk-adjustment	Descriptive statistics Risk-adjusted models Complete cases analyses

				PROMs: Patient satisfaction NPRS (1-10) back and leg pain ODI EQ5D		
Deer et al. 2004	National Outcomes Registry for LBP USA	To obtain data on patient demographics, clinical practices, and long-term outcomes for patients with CLBP treated with implantable drug-delivery systems.	CLBP - intrathecal Drug Delivery (IDD)	PROMs: NPRS (0-10) back and leg pain ODI v1.0 Secondary Return to work Satisfaction (with IDD, recommend IDD to others, and quality of life) Adverse events	Patient characteristics: age, gender, underlying cause of pain, type of pain, previous pain treatments, use of systemic opioids, work status, trialling site, trial duration, type of medical insurer, previous psychological evaluations, implant location, type of system.	Descriptive statistics. Chi-square tests and Paired t-tests treatment effect. Repeated measures ANOVA outcomes over time .
Taylor et al. 2000	Community outcomes management study USA; community-based	To examine factors associated with favourable self-reported outcomes 1 year after elective surgery.	Lumbar spinal disorders: - degenerative changes - herniated disc - instability (incl. Spondylolisthesis) - spinal stenosis	Patient-reported questions: - back surgery changed quality of life - functioning better/worse than before surgery - rate of overall treatment of back problem - bothersomeness back pain - bothersomeness leg pain - interference of physical health in activities	Age Gender Smoking habits Duration of symptoms Clinical signs Diagnosis Surgical procedure Previous surgery Work status Workers' compensation Seeing attorney Baseline scores on patient-reported questions	Descriptive statistics Chi-square test, Fisher exact test differences characteristics Unconditional logistic regression techniques used Multivariate logistic regression models

				- most strenuous level of physical activity		
Bridwell et al. 2007	Adult Deformity Outcomes Database USA	To prospectively analyse the responsiveness of the SRS-22 to change 1 and 2-years following primary surgery.	Adult deformity	PROMs: SRS-22 ODI SF12	Age (categorized) Curve type (major curve location)	Descriptive statistics
Glassman et al. 2009	Adult Deformity Outcomes Database USA	To examine outcomes after adult deformity surgery. Do 1-year outcomes predict 2-year outcomes?	Adult deformity	PROMs: SRS-22 ODI NPRS (0-10) for back and leg pain SF12 (physical and mental component scores)	Subgroup analyses based on: Diagnosis Curve type	Descriptive statistics Matched-pairs sample t-test statistics and post-hoc ANOVA for treatment effect and differences in subgroups
Glassman et al. 2007	Adult Deformity Outcomes Database USA	To determine whether perioperative complications alter clinical outcomes.	Adult deformity	Clinical: Complications PROMs: SRS-22 ODI NPRS (0-10) for back and leg pain SF12 (physical and mental component scores)	Three defined complication cohorts were matched: Age (categorized) Diagnosis Baseline PROM SRS-22 total score Distal fusion level Sagittal balance at 1-year post-operation	Descriptive statistics Propensity modelling. Analysis: 1-way and repeated measures ANOVA.
Kasliwal et al. 2012	Adult Deformity Outcomes Database USA	To assess differences in surgical parameters (e.g. Surgical time, blood loss), complication rates, and outcomes in adults undergoing spinal deformity correction who either did or did not have a history of a short-segment spinal	Adult deformity	PROMs: SRS-22 ODI v1 NPRS (0-10) for back and leg pain SF12 (physical and mental component scores) Clinical:	Patients with/without prior surgery were matched: Age (categorized) Baseline PROM ODI score Cobb angle Sagittal Vertical Axis (SVA)	Descriptive statistics Propensity modelling Wilcoxon signed-rank or Fisher exact tests used to compare outcomes.

		procedure.		Complications		
Schwab et al. 2008	Adult Deformity Outcomes Database USA	To determine if models for predicting outcome and complications can be constructed.	Adult deformity	PROMs: SRS-22 ODI v1 NPRS (0-10) for back and leg pain SF12 (physical and mental component scores) Clinical: Complications	Diagnosis Classification type (type and modifiers) Surgical procedure Age Gender BMI Previous surgery (revision state) Baseline PROM scores	Descriptive statistics Two approaches were used to determine factors predicting successful surgical outcome: 1. Binary logistic regression models were built to examine how factors combine and interact. 2. Multiple linear regression analyses using backward and stepwise techniques were used to eliminate redundant predictive factors. Subsequently, binary logistic regression to predict a reported complication.
Adogwa et al. 2013	Multicenter registry for lumbar spine surgery USA & Canada	To assess the effect of incidental durotomies on the immediate postoperative complications. To investigate the patient-reported outcomes at longer-term follow up following lumbar fusion.	Lumbar spinal disorders: - Degenerative disc disease - Grade spondylolisthesis with central of foraminal stenosis	PROMs: VAS Back pain VAS Leg pain ODI Clinical: Postoperative complications	Patients with durotomy and controls were matched using propensity modelling (1:2) `based on: Age Gender Comorbidities Other relevant surgical factors	Descriptive statistics Student *t*-test, Mann-Whitney *U* test and Chi-square tests. Propensity modelling to stratify risk.

Seng et al. 2013	Singapore General Hospital Spine Outcomes Registry Singapore	To compare midterm clinical and radiological outcomes of minimal invasive surgery (MIS) versus open transforaminal lumbar interbody fusion (TLIF).	Lumbar spinal disorders	PROMs: ODI Neurogenic Symptom Score (NSS) SF36 VAS Back pain VAS Leg pain Clinical: Bridwell classification	Not reported	Pearson Chi-square, Students' *t*-test to compare differences in characteristics. ANOVA to evaluate differences in PROMs. Independent Students' *t*-test to compare differences between groups.

[1] *PROM* Patient-reported outcome measure; *ODI* Oswestry Disability Index; RMDQ Roland and Morris Disability Questionnaire; *NPRS* Numeric Pain Rating Scale; *VAS* Visual Analogue Scale; *NASS* North American Spine Society lumbar spine outcome scale; *COMI* Core Outcome Measures Index; *SF36, SF 12* Short Form 36 or 12 questions; *EQ5D* EuroQol 5 Dimensions (including EQ VAS); *SRS-22* Scoliosis Research Society 22 questions