

Supplementary table S1 Characteristics of studies included in the review

Study	Yr	Ctr	Design	Population / fracture type	N	Treatment / exposure	Outcomes assessed	FU	Main findings relevant to QoL
Abudou M et al., ⁷⁵	2013	CN UK	SR	Thoracolumbar burst fractures without neurological deficit	2 RCTs (n=87)	Surgical vs non-surgical treatment	Pain, function (RMDQ, ODI), return to work, complications, radiographic outcomes	2-4 years	Insufficient evidence to conclude superiority of surgical or non-surgical treatment No significant differences in pain or functional outcomes Surgical group had better radiographic kyphosis but also higher complication rates and costs Identified different patterns of collapse based on spinal region Fractures at the thoracolumbar junction (T11-L1) showed greater progression of kyphosis compared to midlumbar fractures (L2-L3), which could potentially impact long-term pain and QoL LSPF provided better maintenance of kyphosis correction However, there were no significant differences in functional outcomes (pain, work status) between the short- and long-segment fixation groups at final follow-up A significant deterioration in function (Hannover spine score decreased by 15%) was observed 52% of physical laborers returned to their original job Radiological deformity (SPK) did not correlate with clinical scores, suggesting QoL is multifactorial Satisfactory reduction and maintenance of fractured vertebrae were achieved regardless of Load Sharing Score Kyphotic change occurred due to disc height loss, especially after implant removal Back pain aggravation correlated with this correction loss
Al-Khalifa FK et al., ⁵⁶	2005	CA	RS	Stable thoracolumbar burst fractures (T8-L3) without neurological deficit	60	Conservative treatment (brace therapy)	Radiological kyphosis	Mean 78 months	
Altay M et al., ³⁶	2007	TR	RS	Unstable thoracolumbar junction burst fractures (Magerl type A) with Load Sharing Score ≥ 6	63	Short-segment vs long-segment posterior fixation	Neurological status, pain (VAS), functional outcome (Denis scales), radiological correction	Mean 487 months	
Andress HJ et al., ⁴²	2002	DE	RS	Thoraco-lumbar burst fractures (type A3) without neurological deficit	50	Exclusive dorsal stabilization with AO internal fixator (with/without transpedicular bone grafting)	Hannover spine score, activity score, pain, return to work, radiological correction	Mean 68 months	
Aono H et al., ⁷³	2016	JP	RS	Single thoracolumbar burst fractures	27	Temporary short-segment posterior instrumentation without fusion (implant removal at ~1 year)	Neurological status (ASIA), pain (Denis scale), radiological angles (VBA, SIEA), complications	Minimum 2 years	

Axelsson P & Strömqvist B ¹⁴⁵	2016	SE	RS	Thoracolumbar segment fractures treated with posterior instrumentation without bone grafting	7	Implant removal	Intervertebral mobility (RSA), radiological deformity, patient-reported clinical outcome	3 months post-removal	Implant removal restored some mobility to the fractured segment in all patients Clinical outcome was rated as good by 5 of 7 patients, suggesting that restoring motion can be beneficial for patient-perceived outcome No significant difference was found in the primary outcome (RMDQ at 3 months) or any secondary outcomes between the two groups Suggests that for stable burst fractures, a brace may not be necessary for a good functional outcome Treatment without an orthosis was equivalent to treatment with a TLSO for the primary outcome (RMDQ at 3 months) and all secondary outcomes (pain, function, QoL) up to 2 years Combined approach yielded better maintenance of kyphosis correction However, neurological outcome and long-term pain scores were not different between groups 83% of all patients were completely free of pain 73% of aviators with TL fractures returned to flight duty Burst fractures were associated with a lower return-to-flight rate This highlights the significant impact of fracture type on occupational QoL DREZ lesioning was effective for treating neuropathic pain of the lower extremities (nerve root origin), with an overall VAS improvement of 811% Pain relief was excellent or good in 833% of patients, significantly improving QoL
Bailey CS et al., ¹⁴¹	2009	CA	MRCT	Thoracolumbar burst fractures without neurologic injury	72	Thoracolumbosacral orthosis (TLSO) vs no orthosis	RMDQ, SF-36, VAS for pain, satisfaction, kyphosis	3 months (primary) up to 2 years	
Bailey CS et al., ¹⁴³	2014	CA	RCT	Thoracolumbar burst fractures without neurologic injury	96	Orthosis (TLSO) vs no orthosis	RMDQ, SF-36, VAS for pain, satisfaction, kyphosis	2 years	
Been HD & Bouma GJ ⁴¹	1999	NL	RCS	Thoraco-lumbar burst fractures	46	Combined anterior-posterior stabilization vs posterior instrumentation only	Neurological outcome (Frankel), radiological kyphosis, pain, complications	Mean 7 years (Group 1), 45 years (Group 2)	
Belmont PJ Jr et al., ²	2001	US	RS	Thoracolumbar fractures among US Army aviators	62	Descriptive epidemiology and occupational outcomes	Return to flight duty, functional limitations, pain	NS	
Bing N et al., ³⁰	2019	CN	RS	Neuropathic pain due to thoracolumbar spine fracture (complete paraplegia)	42	Dorsal Root Entry Zone (DREZ) lesion	Pain (VAS), pain relief rate, complications	Mean 401 months	

Bransford RJ & Dekutoski M ¹¹⁰	2012	US DE	Rev	Thoracolumbar fracture care	NA	Minimally invasive surgery (MIS) vs open surgery	Blood loss, infection rates, functional outcome	Var	MIS techniques are associated with less blood loss and potentially lower infection rates However, there is a lack of long-term data demonstrating superior functional or QoL outcomes compared to conventional open surgery
Briem D et al., ⁵³	2004	DE	RMPA	Unstable burst fractures (A3) of the thoracolumbar transition	20	Combined dorsoventral vs purely dorsal stabilization	SF-36, radiological correction (Cobb angle, sagittal index)	Mean 297 months (combined) vs 475 months (dorsal)	Both surgical procedures led to a reduced quality of life (SF-36), particularly in physical health domains, compared to a healthy population There was no significant difference in QoL between the two surgical techniques Surgical treatment was effective, with 96% of patients having good or fair pain outcomes 80% of patients were able to walk without support All patients with incomplete neurological deficits showed improvement
Butt MF et al., ⁴³	2007	PK	PS	Unstable thoracolumbar spinal injuries	50	Posterior short segment spinal fixation	Neurological recovery (Frankel), pain (Denis scale), ambulation status, complications	Mean 18 months	Both procedures negatively impacted QoL and sexual function However, the short-segment group had significantly better postoperative EQ-5D and IIEF-5 scores compared to the long-segment group Partners' sexual function was also better in the short-segment group PPSIS maintained segmental kyphosis correction better over 1 year compared to PPSK, which showed significant correction loss PPSK showed a greater initial reduction Suggests intermediate screws provide better long-term stability
Cankaya D et al., ¹⁵²	2016	TR	PS	Thoracolumbar junction burst fractures in men	24	Short-segment vs long-segment posterior fixation	Life quality (EQ-5D), sexual function (IIEF-5 for men, FSFI for partners)	1 year	
Caruso G et al., ⁵⁰	2018	IT	RCS	Thoracolumbar fractures (AO A1-A3)	49	Percutaneous pedicle screw with intermediate screw (PPSIS) vs with kyphoplasty (PPSK)	Segmental kyphosis (SK), vertebral kyphosis (VK) angles	1 year	

Cecchinato R et al., ⁶⁰	2014	IT	Rev	Post-traumatic thoracolumbar deformity	NA	Spinal osteotomies (SPO, PSO, VCR)	Pain, function, neurological status, radiological correction	NA	Corrective osteotomies are effective for treating symptomatic post-traumatic deformity, improving pain and function The choice of technique depends on deformity characteristics Emphasizes restoring sagittal balance to improve QoL Loss of upper intervertebral angle correction was the major contributor to overall kyphosis recurrence Age, preoperative anterior/posterior height ratio, and anterior vertebral height <50% were independent risk factors for kyphosis recurrence
Chen JX et al., ⁹	2016	CN	RS	Thoracolumbar burst fractures treated with posterior short-segment fixation	122	Analysis of risk factors for kyphosis recurrence after implant removal	Radiological correction loss, clinical data (VAS, ASIA)	Mean 25 months	Evidence was insufficient to inform the selection of different pedicle screw fixation methods or the use of fusion No differences were found in function, QoL, or pain across comparisons Fusion was associated with donor site pain
Cheng LM et al., ¹⁰⁹	2013	CN AU	SR	Traumatic fractures of the thoracic and lumbar spine	8 trials (448)	Different methods of pedicle screw fixation (short vs long, with/without fusion, etc)	Function, QoL, neurological status, pain	Var	While vertebroplasty provided significant pain relief, it did not prevent progressive kyphosis, which was significantly correlated with worse ODI scores at the final follow-up This suggests that spinal alignment is an important factor for long-term functional QoL Fixation without fusion yielded similar long-term radiographic and functional outcomes (pain, SF-36) as fixation with fusion The non-fusion group had less operative time, blood loss, and avoided donor-site morbidity
Chou KN et al., ⁵⁹	2014	TW	RS	Osteoporotic vertebral compression fracture	100	Vertebroplasty	Pain (VAS), ODI, radiological kyphosis	Mean 306 months	
Dai LY et al., ¹⁰³	2009	CN	RCT	Single-level thoracolumbar burst fractures (LSC ≤6)	73	Posterior short-segment fixation with fusion vs without fusion	Pain (VAS), SF-36, neurological status (Frankel, ASIA), radiological kyphosis, complications	Minimum 5 years	

De Gendt EEA et al., ¹¹⁷	2020	NL	PCS	Traumatic burst fractures (AO A3/A4) without neurological deficits	17	Pedicle screw fixation with balloon-assisted endplate reduction and cement injection	Pain (NRS), EQ-5D, ODI, DWS, radiological angles	Mean 138 years	Clinical, patient-reported, and radiological outcomes remained stable and satisfactory between 6 and 13 years of follow-up Most patients (71%) returned to previous employment and reported minimal disability (median ODI 8%) TSR (manual reduction + minimally invasive fixation) resulted in less blood loss and significantly better ODI scores at all time points compared to traditional open surgery Early VAS scores were also better, suggesting improved early recovery and QoL 66% of patients had no or minimal pain 72% returned to some form of work SF-36 scores were lower than reference values A significant loss of proximal disc height was correlated with poorer functional outcomes Preoperative Cobb angle, surgically corrected angle, intervertebral disc injury, and interpedicular distance (IPD) were significant predictors of adverse events Disc status was the most important predictor, highlighting its role in long-term stability and outcomes Both MIS techniques yielded similar and satisfactory improvements in pain (VAS) and function (ODI) The percutaneous group had less blood loss and shorter operation time Vertebroplasty resulted in significantly better outcomes regarding pain relief, disability reduction (ODI), kyphosis correction, and earlier return to work compared to conservative treatment
Decheng W et al., ¹³⁷	2019	CN	RCT	Thoracolumbar burst fracture	60	Three-step Reduction Therapy (TSR) vs Posterior Open (PO) surgery	Pain (VAS), ODI, radiological correction, blood loss	6 months	
Defino HLA & Canto FRT, ⁵⁴	2007	BR	PS	Low thoracic and lumbar burst fractures	18	Posterior arthrodesis and fixation with transpedicular cancellous bone grafting	Pain (Denis scale), work status (Denis scale), SF-36, radiological correction	2 years	
Dong S et al., ⁷²	2022	CN	RS	Single-segment thoracolumbar burst fractures (AO A3/A4)	150	Percutaneous pedicle screw fixation (PPSF)	Radiological outcomes (Cobb angle, VBCR), adverse events (implant failure, kyphosis >20°)	Minimum 1 year	
Dong SH et al., ¹¹²	2013	CN	RCS	Thoracolumbar mono-segmental vertebral fractures without neurological compromise	65	Minimally invasive percutaneous vs trans-spacium intermuscular short-segment pedicle instrumentation	Pain (VAS), ODI, radiological correction, operation time, blood loss	Mean 182 months	
D'Oria S et al., ⁵²	2022	IT	PCS	Magerl's A1 and A2 traumatic compression fractures at thoraco-lumbar junction	102	Vertebroplasty vs conservative management (bed rest, brace)	Pain (VAS), Oswestry Disability Index (ODI), regional kyphosis angle (RKA), return to work (DWS)	1 year	

Du JP et al., ¹³⁵	2018	CN	PCS	Multi-segment thoracolumbar mild osteoporotic fractures (MSTMOVCF)	470	Surgical (PVP/PKP) vs conservative treatment	Pain (VAS), ODI, SF-36, radiological outcomes	1 year	The surgical group had significantly better short- and long-term outcomes for pain (VAS), disability (ODI), and quality of life (SF-36) compared to the conservative group, which had high rates of treatment failure and complications. PSO resulted in significantly better clinical outcomes (lower VAS, lower ODI), higher satisfaction, and higher return to work rate compared to ACP. PSO also provided better and more stable kyphosis correction.
El-Sharkawi MM et al., ⁵⁸	2011	EG	MCS	Post-traumatic kyphosis	80	Pedicle subtraction osteotomy (PSO) vs anterior corpectomy and plating (ACP)	Pain (VAS), ODI, return to work, radiological correction	Mean 293 mo (PSO) vs 401 mo (ACP)	The procedure was safe and effective, resulting in significant and sustained pain relief (VAS from 82 to 18) and functional improvement (ODI from 78.2% to 20.9%), with a low cement leakage rate (5.1%). HRQoL was significantly impaired in women with vertebral fractures. The impairment increased with the number and severity of fractures, particularly affecting pain, physical function, and social function domains. Mean ODI score was low (6.4), indicating minimal disability. There was no difference in ODI between treatment groups. However, a significant correlation was found between final vertebral kyphosis and the total ODI score, especially the pain domain. Open kyphoplasty significantly improved pain (mean VAS from 85 to 18) and function (mean ODI from 75% to 22.4%), demonstrating its effectiveness in improving QoL for severe osteoporotic fractures.
Fan J et al., ¹²⁷	2016	CN	RS	Osteoporotic vertebral compression fracture	218 (236 vertebrae)	Jack vertebral dilator kyphoplasty	Pain (VAS), ODI, vertebral height, Cobb angle	Mean 142 months	
Fechtenbaum J et al., ¹⁵³	2005	FR	CSS	Osteoporotic postmenopausal women with vertebral fractures	290	Analysis of fracture severity on HRQoL	Health-Related Quality of Life (QUALEFFO-41), number and severity of vertebral fractures	NA	
Freslon M et al., ³²	2008	FR	MRS	Thoracolumbar junction fractures (T11-L2)	136	Orthopedic vs surgical treatment	Oswestry Disability Index (ODI), radiological kyphosis	Mean 7 years	
Fuentes S et al., ¹³³	2009	FR	CS	Severe osteoporotic spinal fractures	10	Open kyphoplasty	Pain (VAS), ODI, radiological correction	Mean 24 months	

Fuentes S et al., ¹¹⁸	2007	FR	RS	Thoracolumbar burst fractures (Magerl A3) without neurological deficit	4	Percutaneous pedicle screw fixation and kyphoplasty	Pain (VAS), hospital stay, radiological correction	Mean 12 months	The combined minimally invasive technique led to rapid pain reduction (mean VAS from 7 to 2 at discharge), early mobilization (day 1), and a short hospital stay (mean 45 days), suggesting improved early QoL. No evidence for the effectiveness of bracing was found. There were no significant differences in functional outcome, pain, or radiological results between patients treated with or without a brace. Kyphoplasty provided good clinical results with significant pain relief (mean VAS from 83 to 24). However, it did not prevent long-term loss of vertebral body height, which could potentially impact long-term QoL. No significant differences were found in pain, function, or return to work. Operative treatment improved kyphosis but had a higher complication rate and cost. No clear QoL benefit for surgery was established. Postero-inferior corner translation ≥ 4 mm, retropulsed fragment comminution, and complete lamina fracture were significantly associated with a lack of neurological recovery. These features had higher odds ratios than the initial AIS grade, suggesting their importance for functional prognosis. Both groups showed good reduction and clinical results. The percutaneous group had less blood loss, shorter operating time, and better early functional results, suggesting MIS can improve early QoL.
Giele BM et al., ¹⁴⁰	2009	NL	SR	Thoracolumbar fractures	NA (11 studies)	Bracing vs no bracing in conservatively treated patients	Functional outcome, pain, radiological outcome	Var	
Gioia G et al., ¹²³	2012	IT	RS	Amyelic somatic fractures (thoracolumbar)	26	Kyphoplasty with calcium phosphate cement	Pain (VAS), radiological correction	Mean 18 months	
Gnanenthiran SR et al., ⁸⁰	2012	AU	MA	Thoracolumbar burst fractures without neurologic deficit	NA (4 trials)	Nonoperative vs operative treatment	Pain (VAS), function (RMDQ), return to work, kyphosis, complications	Var	
Goulet J et al., ¹⁷	2020	CA	RetCoh	Thoracolumbar burst fractures (AO A3/A4) with severe TSCI (AIS A, B, C)	25	Analysis of morphological fracture features	Neurological recovery (AIS grade improvement)	Minimum 12 months	
Grass R et al., ¹¹⁴	2006	DE	PCS	Fractures of the thoracolumbar border	46	Percutaneous dorsal vs open instrumentation	Pain (VAS), functional score (Frankel), radiological correction, complications	NS	

Grelat M et al., ⁵¹	2018	FR	RS	Thoracolumbar traumatic vertebral compression fractures (Magerl A)	77	Kyphoplasty	Pain (VAS), ODI, EIFFEL score, radiological kyphosis	Mean 37 years	Kyphoplasty provided significant and stable pain relief (VAS from 84 to 25) and good functional outcomes (mean ODI 155%) A minor but statistically significant loss of kyphosis correction was observed but did not correlate with clinical outcomes
Grobost P et al., ¹³⁸	2020	FR	RS	Thoracic and lumbar spine trauma	44	Early vs delayed corpectomy with VBR	ODI, SF-12, VAS, return to work/sport, radiological correction	Mean 51 years	Early anterior reconstruction (Group A) provided significantly better long-term clinical results (lower ODI, higher SF-12 scores, less pain, higher return to work/sport rates) compared to delayed reconstruction for nonunion (Group B) Fixation including a screw at the fracture level provided better
Guyen O et al., ⁹⁹	2009	TR	RCT	Unstable thoracolumbar burst fractures	72	Four posterior fixation techniques, including with/without screw at fracture level	Kyphosis correction, implant failure	Mean 50 months	intraoperative correction and maintenance Clinical outcomes (pain, function) were not reported, but better radiological stability could imply better long-term QoL
Hallberg I et al., ¹⁰	2009	SE	PFS	Postmenopausal women with vertebral or hip fractures	67 (vertebral n=42, hip n=25)	Comparison of vertebral vs hip fracture outcomes and vs reference group	Health-related quality of life (SF-36), physical performance, pain (GRS), BMD, vertebral fracture assessment	Mean 7 years	Vertebral fractures had a severe long-term impact on HRQoL (SF-36), with scores remaining significantly below the reference group in most domains, particularly bodily pain This was not seen in the hip fracture group
Hao D et al., ²¹	2014	CN	RS	Thoracolumbar fracture-dislocation	27	Surgical treatment (posterior, anterior, or combined)	Neurological function (ASIA), complications	Minimum 2 years	Surgical treatment was effective for spinal reconstruction 889% of patients with incomplete SCI showed neurological improvement of at least one ASIA grade Significant improvement in neurological function directly translates to improved QoL

Hartmann F et al., ¹²⁶	2015	DE	PS	Traumatic incomplete burst fractures (A31)	18	Vertebral body stenting (VBS)	Pain (VAS), ODI, SF-36, radiological correction	Mean 274 months	VBS was safe and effective, resulting in significant pain relief (mean VAS from 8 to 2) and moderate disability (mean ODI 289%) QoL (SF-36) was moderately limited The stent provided durable reconstruction with reduced loss of correction The technique was effective, with 917% of patients reporting no or occasional pain 875% of patients returned to their previous job, indicating a high level of functional and occupational QoL recovery
Hasankhani EG & Omid-Kashani F ¹⁵¹	2014	IR	RS	Thoracolumbar flexion-distraction injuries	24	Posterior tension band wiring and instrumentation	Pain (VAS), neurological status (Frankel), return to work, radiological correction	Mean 25 years	The PIF-PKP group had significantly better pain relief (VAS), functional outcomes (ODI), and kyphosis correction compared to the simple PKP group, with fewer refractures Nonoperative management was successful in 50/68 patients Patients requiring early surgery had more severe initial injuries At follow-up, there was no significant difference in ODI or VAS scores between the operative and nonoperative groups
He D et al., ¹²⁰	2013	CN	RCT	Thoracolumbar burst fractures in elderly patients	43	Internal fixation with percutaneous kyphoplasty (PIF-PKP) vs simple percutaneous kyphoplasty (PKP)	Pain (VAS), ODI, radiological correction (Cobb angle)	Minimum 2 years	Minimally invasive anterior spondylodesis (MIAS) led to good to excellent long-term clinical outcomes (minimal disability on ODI) with no deterioration between 6 and 12 years Sagittal alignment did not correlate with clinical outcome scores
Hitchon PW et al., ³⁴	2016	US	RS	Neurologically intact thoracolumbar burst fractures	68	Nonoperative management (bracing, mobilization)	ODI, pain (VAS), radiological kyphosis, return to work	Mean 15-21 months	
Hoffmann C et al., ⁶⁵	2020	DE	PCS	Unstable incomplete burst fractures (AO type A3) of the thoracolumbar junction	15	Thoracoscopic anterior spondylodesis with or without posterior stabilization	ODI, SF-36, VAS spine score, radiological alignment, adjacent segment degeneration (ASD)	Mean 129 years	

Hu X & Lieberman IH¹³⁹ Hu X et al.,³ Hu ZC et al.,¹⁰¹ Iwata A et al.,⁶⁸ Jacobs C et al.,⁸¹ James KS et al.,⁹⁵	2015	US	CR	Proximal instrumented vertebral body chance fracture after pedicle screw instrumentation in osteoporotic kyphosis patient	1	Revision posterior C5-T3 instrumentation and fusion	Neurological status, pain, radiological alignment	12 months	The revision surgery successfully corrected the deformity and restored sagittal balance At 12 months, the patient was doing exceptionally well with near-complete relief of back pain, highlighting the importance of correcting alignment for QoL
	2020	CN	RS	Unstable thoracolumbar osteoporotic burst fracture (AO A3/A4)	43	Posterior short segment fixation including the fractured vertebra (PSFFV) combined with kyphoplasty	Pain (VAS), ODI, radiological correction	Mean 192 months	The combined procedure was reliable and safe, with significant improvement in pain (VAS) and disability (ODI) scores Radiological correction was well-maintained with minimal loss at final follow-up
	2019	CN	RCT prot	Thoracolumbar burst fractures (AO A3/A4)	70 (planned)	Modified pedicle screw placement at fracture level (distraction-screw vs screw-distraction)	Percentage loss of vertebral body height, Cobb angle, VAS, ODI, JOA score	24 months	This protocol aims to determine the optimal order of screw placement and distraction to maximize reduction and minimize trauma to the fractured vertebra, which could improve long-term stability and QoL Spinopelvic malalignment was a significant risk factor for non-union A large DSVA (>5 cm) and a large PI-LL mismatch (>30°) were associated with failure of fracture healing, which can lead to chronic pain and poor QoL
	2017	JP	PS	Thoracolumbar osteoporotic vertebral compression fracture	48	Non-operative treatment (brace, pharmaceuticals)	Radiographic union, spinopelvic alignment parameters (SVA, PI-LL)	6 months	3D thoracoscopic VBR was safe and effective, leading to resolution of initial back pain (mean VAS 2/10) with no significant restrictions in daily routine Improved 3D optics increased surgeon's comfort and perceived safety
	2018	DE	RCS	Symptomatic nonunion or loss of reduction after complex thoracolumbar junction fractures	12	3D thoracoscopic vertebral body replacement (VBR) after initial posterior stabilization	Pain (VAS), complications, surgical time, blood loss, return to daily routine	Mean 26 months	Pedicle screw systems provided greater stiffness and stability compared to Harrington distraction rods, suggesting better potential for maintaining alignment and facilitating recovery, which indirectly affects QoL
	1994	US	BMS	Thoracolumbar burst fractures	15 (cadaveric spines)	Biomechanical testing of different fixation methods (Harrington rods, pedicle screws)	Stiffness, stability	NA	

Jin YJ et al., ¹²⁴	2011	KR	RS	Osteoporotic vertebral compression fractures	224 (280 vertebrae)	Vertebroplasty	Pain (VAS), ODI, radiological correction, cement volume	Mean 123 months	A greater volume of injected cement was significantly associated with better pain relief (VAS) and functional improvement (ODI) However, it was also associated with a higher risk of cement leakage The procedure was effective for deformity correction and resulted in significant clinical improvement, with mean VAS for back pain decreasing from 66 to 2 and ODI from 554% to 226%
Jo DJ et al., ⁶¹	2015	KR	RS	Posttraumatic thoracolumbar kyphosis	13	Modified posterior closing wedge osteotomy	Pain (VAS), ODI, radiological correction, neurological status (AIS)	Mean 22 months	The 6-screw construct significantly improved postoperative pain (VAS), radiological outcomes (Cobb angle), and reduced implant failure, at the cost of slightly longer operation time and more blood loss No significant difference in ODI was found
Kapoen C et al., ³⁸	2020	NL	SR	Thoracolumbar fractures	1890	Conventional short segment (4-screw) vs short segment with intermediate screws (6-screw)	Pain (VAS), ODI, Cobb angle, AVBH, implant failure, operation time, blood loss	Var	Greater canal compromise was associated with neurological deficit Disruption of posterior elements indicated a more severe initial injury but also a higher probability of neurological recovery, which directly impacts long-term function and QoL
Kim NH et al., ¹⁴	1999	NS	RS	Thoracolumbar burst fractures	148	Morphological/radiological predictors (posterior element disruption, canal compromise)	Neurological deficit (Frankel grade), neurological recovery	NS	The technique prevented recurrent kyphosis after implant removal TCP cement showed good osseointegration
Kitzen J et al., ⁴⁸	2017	NL	RCS	Thoracic or lumbar burst fractures (AO A3 or B1)	14	Balloon Assisted Endplate Reduction (BAER) with TCP cement and short-segment instrumentation	Histological evaluation, radiological parameters (kyphosis), pain (VAS), SF-36, RMDQ	Mean 29 months	Functional outcomes at final follow-up were good (mean VAS 28, mean RMDQ 53), demonstrating a durable result

Knop C et al., ⁹¹	2009	DE	PS	Thoracolumbar injuries	29	Combined posterior-anterior stabilization with a vertebral body replacing implant (Synex™)	Pain (VAS), VAS-Spine Score, ODI, SF-36, return to work/activities	Mean 31 months	Patients had a significant decrease in QoL post-injury (VAS Spine Score from 893 pre-injury to 696 at follow-up) 66% returned to their former occupation Highlights the long-term functional impact despite advanced surgical reconstruction 833% of patients had good to excellent clinical outcomes (SWS) Mean ODI was very low (478), indicating minimal disability Radiological correction was maintained Functional outcomes did not correlate with final radiographic alignment
Ko SB & Lee SW ¹⁰⁶	2014	KR	RS	Unstable thoracolumbar and lumbar burst fracture	60	Posterior instrumentation without fusion, with implant removal at ~10 months	ODI, VAS, Smiley-Webster Scale (SWS), radiological correction	Mean 47 months	Patients had significant impairment in QoL (SF-36, RMDQ) Higher segmental kyphosis at follow-up correlated with decreased VAS-spine-scores and SF-36 PCS Sagittal imbalance correlated with increased disability (RMDQ)
Koller H et al., ⁶⁷	2008	DE AT	RLTFU	Nonsurgically treated thoracolumbar and lumbar burst fractures	21	Nonsurgical treatment (closed reduction and casting)	RMDQ, LBOS, SF-36, VAS-Spine-Score, pain (VAS), Denis scales	Mean 113 years	Highlights that osteoporotic fractures are a source of significant pain and diminished QoL Minimally invasive techniques (VP/KP) offer rapid pain relief, improved mobility, and better QoL compared to conservative care in selected patients The author comments on Liao et al [108] and presents his own data showing that a hybrid technique (kyphoplasty + fixation) significantly improved pain (VAS) and QoL (SF-36 physical and pain domains), with good deformity correction
Komadina R et al., ⁴	2024	SI NL DE CH US	Rev	Fractures of the thoracolumbar spine in osteoporosis	NA	Review of classification and treatment	Conservative vs operative treatment (vertebroplasty, kyphoplasty, instrumentation)	NA	
Korovessis P ¹⁰²	2011	GR	Letter	Acute lumbar fractures	18	Kyphoplasty with calcium phosphate + segmental short instrumentation with fusion	Pain (VAS), SF-36, radiological correction	Mean 22 months	

Krishnakumar R & Lenke LG ²⁹	2015	US	CR	"Sternum-Into-Abdomen" Deformity after osteoporotic vertebral compression fractures	1	2-level vertebral column resection (VCR) and reconstruction	Respiratory function, nutritional status, pain, posture	5 years	The corrective surgery resolved the abdominal compression, allowing the patient to tolerate food and gain weight Pulmonary function improved dramatically, demonstrating a profound QoL improvement from restoring spinal alignment The novel technique was effective, providing excellent/good/satisfactory results in all patients
Kwon WK et al ⁹⁴	2018	KR	RS	Unstable thoracolumbar burst fractures	18	Decompression with lateral pediculectomy and circumferential reconstruction	Clinical outcome (Odom criteria), radiological outcomes (RA, LA, DR)	6 months	Radiological outcomes (restoration angle, decompression rate) were significantly better than a posterior-only surgery cohort Both techniques yielded similar radiological results in height restoration and kyphosis correction Both groups had excellent clinical results, with 95% of patients returning to previous activities
La Maida GA et al ⁸⁷	2016	IT	RS	Thoracolumbar spine fractures (Type A, B, C)	48	Monosegmental vs bisegmental pedicle fixation	Vertebral body height, kyphotic deformity, clinical results (pain, return to work)	Minimum 1 year	Monosegmental fixation is a viable option for selected cases The surgical group had significantly less pain, faster return to work and daily activities, better functional scores (ODI, Roland), and higher patient satisfaction compared to the conservative group
Landi A et al., ⁷⁶	2014	IT	RCS	A3 burst fractures of thoraco-lumbar junction and lumbar spine	50	Percutaneous short fixation vs conservative treatment (brace)	Pain (VAS), ODI, Roland Disability Scale, return to work, patient satisfaction	1 year	Patients reported moderate disability (mean ODI 282%) and lower QoL (SF-36) compared to a healthy population Loss of radiological correction did not significantly correlate with patient-reported outcomes
Lang S et al., ⁴⁰	2021	DE	PS	Traumatic thoraco-lumbar spinal fractures	96 (radiological), 51 (PROM)	Dorso-ventral stabilization using an expandable vertebral body replacement (VBR)	SF-36, ODI, EQ-5D, radiological kyphosis (BKA), complications	Mean 1064 months (PROM)	VAS spine score improved from 563 at 12 months to 647 at 20 months 86% of patients returned to work, although many to less physical jobs, indicating a good functional recovery but with some limitations
Lange U et al., ⁹⁰	2006	DE	PCS	Various spinal pathologies requiring vertebral body replacement	50	Anterior vertebral body replacement with an adjustable titanium implant	Pain (VAS), back function (VAS spine score), return to work, radiological correction	Mean 195 months	

Lange U et al., ⁸⁸	2007	DE	PCS	Thoracic and lumbar spine injuries (fractures, tumors, etc)	50	Anterior vertebral body replacement with an adjustable titanium implant (Synex™)	Pain (VAS), back function (VAS-Spine Score), return to work/activities, radiological correction	Mean 195 months	The procedure was effective for stabilizing the spine VAS spine score improved significantly from 563 at 12 months to 647 at 20 months 86% of previously working patients returned to work, though many changed to lighter jobs
Lazennec JY et al., ⁶⁶	2006	FR	RS	Post-traumatic kyphosis at thoracolumbar and lumbar levels	20	Wedge osteotomy	Pain, functional outcome, neurological status, radiological correction	Mean 5 years	Corrective osteotomy provided significant pain relief (mean VAS from 67 to 31) and improvement in function, with 75% of patients satisfied with the outcome Highlights the importance of sagittal balance for QoL
Ledlie JT & Renfro M ⁷¹	2003	US	RS	Painful VCFs (osteoporosis, myeloma, etc)	96 (133 VCFs)	Balloon kyphoplasty	Pain (VAS), ambulatory status, vertebral body height restoration	1 year	Kyphoplasty was safe and effective, providing sustained significant pain reduction (mean VAS from 86 to 14) and improvement in ambulatory status (from 25 non-ambulatory patients to 0 at 1 year), directly improving QoL
Lee JK et al., ¹⁰⁴	2013	KR	CS	Thoracolumbar burst fractures	60	Percutaneous short-segment fixation without fusion vs open short-segment fixation with fusion	Pain (VAS), ODI, radiological correction, blood loss, operation time	Mean 13 months	The percutaneous group had less blood loss, shorter operative time, and shorter hospital stay Both groups showed similar and significant improvements in pain (VAS) and disability (ODI) scores, with comparable radiological outcomes
Leferink VJ et al., ¹⁴⁹	2003	NL	RS	Thoracolumbar burst fractures without neurological deficit	19	Dorsal instrumentation and transpedicular cancellous bone grafting	RMDQ, VAS Spine Score, SF-36, physical tests, return to work	3-8 years	Functional outcome was comparable to healthy people according to SF-36 Patients were only mildly restricted in activities (RMDQ, VAS) 87% returned to work Leg muscle performance was a more important factor for impairment than overall condition
Li K et al., ³⁹	2016	CN	MA	Thoracolumbar fractures	568	Pedicle screw fixation combined with intermediate screw at fracture level vs conventional pedicle screw fixation	Postoperative Cobb angle, AVH, VAS, complications	Var	The combined screw technique was associated with better radiological reduction, less correction loss, and lower implant failure rate There was no significant difference in postoperative VAS scores

Liang C et al., ⁹⁶	2020	CN	RS	Thoracolumbar fractures (AO A3, B, C)	58	Posterior limited long-segment (LLSPI: 2 above, 1 below) vs short-segment (SSPI) instrumentation	ODI, neurological status (ASIA), radiological correction loss	Mean 191 months	LLSPI resulted in significantly less loss of kyphosis correction and vertebral height compared to SSPI Final functional outcomes (ODI) and neurological improvement were similar between the two groups Clinical results were satisfactory with a mean pain score of 18 (minimal pain) and 60% of patients returning to previous work Suggests calcium sulphate is an effective graft substitute, avoiding donor-site morbidity The combination of two additional pedicle screws and vertebroplasty at the fracture level provided the stiffest construct with the lowest stress on pedicle screws, suggesting the highest biomechanical stability and potentially better long-term outcomes Both groups showed good clinical results The cement group had shorter operative time and less blood loss, avoiding donor-site morbidity Functional outcomes (pain, work) were similar, suggesting cement is an effective alternative for improving QoL The technique was effective for the aging population, providing significant pain control (VAS from 88 to 19), functional improvement (ODI from 832% to 330%), and neurological recovery in 18/20 patients The PLR approach with postoperative mobilization for reduction led to fewer surgical complications and a shorter hospital stay Final clinical outcomes (ODI, VAS, etc) were comparable and satisfactory in both groups
Liao JC et al., ¹⁰⁷	2009	TW	PS	Thoracolumbar burst fracture	20	Posterior instrumentation with transpedicular calcium sulphate graft	Pain (Denis scale), work status (Denis scale), neurological status (ASIA), radiological correction	Mean 285 months	
Liao JC et al., ⁹⁷	2017	TW	FEA	Thoracolumbar burst fractures	NA (FE model)	Comparison of 4 short-segment fixation methods (with/without intermediate screws, with/without cement)	Range of motion (ROM), von Mises stress on screws	NA	
Liao JC et al., ¹⁰⁸	2010	TW	RCS	Acute thoracolumbar burst fracture	51	Transpedicular grafting: calcium sulfate cement vs autogenous iliac bone graft	Pain (Denis scale), work status (Denis scale), neurological status (ASIA), radiological correction	Mean 527 mo (bone) vs 286 mo (cement)	
Lin CL et al., ¹²	2018	TW	RS	Thoracolumbar osteoporotic fractures with neurological deficits	20	Short-segment decompression and fixation	Pain (VAS), ODI, Frankel grade, radiological correction	Mean 406 months	
Lindtner RA et al., ¹¹⁵	2017	AT	RS	Hyperextension injuries of the thoracolumbar spine in patients with ankylosing spinal disorders	20	Open rigid (OR) vs percutaneous less rigid (PLR) posterior instrumentation	Complications, radiological course, clinical outcome (VAS Spine Score, ODI, RMDQ, etc)	Mean 292 months	

Loibl M et al., ⁴⁶	2015	DE	PS	Traumatic thoraco-lumbar spinal fractures	20	Minimal-invasive reduction and stabilization with transpedicular Schanz Screw system	Pain (VAS), ODI, SF-36, radiological correction	1 year	The MIS procedure was effective, with significant improvement in pain and function ODI improved from 72% to 15% SF-36 scores improved but remained below population norms, especially the physical component All radiological parameters showed some loss of correction over the first year, which then stabilized The study focused on radiological outcomes, with the implication that maintaining alignment is important for long-term clinical results, although clinical data were not reported
Lorente A et al., ⁴⁷	2017	ES	RMCS	Unstable thoraco-lumbar fractures without neurological deficit	100	Posterolateral fusion with short or long screw fixation	Radiological parameters (fracture angle, kyphotic deformity, sagittal index, etc)	Mean 72 years	All radiological parameters lost some correction over 24 months, particularly the degree of displacement and sagittal index Clinical outcomes were not reported, but the high re-intervention rate (162%) suggests potential for late pain/disability Percutaneous techniques resulted in less blood loss and lower postoperative pain (VAS) at 3 months compared to open surgery There were no significant differences in final radiological outcomes or correction loss among the three groups
Lorente R et al., ⁴⁹	2018	ES	RMCS	Unstable thoraco-lumbar fractures (Type A) without neurological deficit	37	Percutaneous surgery without arthrodesis	Radiological parameters (fracture angle, kyphotic deformity, etc), complications	Mean 22 years	The procedure was safe and effective, providing significant and progressive pain relief (VAS) and functional improvement (ODI) over the 12-month follow-up period Emergency surgery resulted in slow but steady improvement in neurological function At follow-up, the patient was walking without assistance and had no bowel/bladder issues, demonstrating a dramatic QoL recovery
Lyu J et al., ¹¹¹	2016	CN	RCT	Type A thoracolumbar fractures without neurological deficit	90	Three-level percutaneous fixation vs two-level percutaneous fixation vs three-level open fixation	Pain (VAS), Cobb angle, anterior height ratio, operation time, blood loss	Mean 177 months	
Masala S et al., ¹²⁵	2014	IT	RS	Thoraco-lumbar traumatic vertebral fractures	25	Vertebral augmentation with strontium-hydroxyapatite bone substitute	Pain (VAS), ODI, radiological evaluation	12 months	
Mayle RE et al ²³	2012	US	CR	Thoracolumbar fracture dislocation during childbirth in a patient with ankylosing spondylitis	1	Posterior T11-L2 segmental instrumentation and reduction	Neurological function, pain, functional recovery	NS (recent)	

Mazel C & Ajavon L, ⁶⁴	2018	FR	Rev	Malunion of post-traumatic thoracolumbar fractures	NA	Evaluation and treatment strategies for malunion	Pain, function, sagittal balance, neurological signs	NA	Malunion can be asymptomatic for a long time but often becomes painful due to sagittal imbalance and adjacent degenerative changes Corrective surgery aims to alleviate pain and improve function by restoring spinal balance, highlighting its importance for QoL Percutaneous stabilization produced better outcomes at 6 months, including better pain relief (VAS), lower disability (Oswestry), and faster return to work (DWS) compared to brace treatment Most patients without lower extremity fractures ambulated independently after one or two PT sessions A longer LOS and more therapy were required for patients with concomitant lower extremity fractures, highlighting impact on acute functional recovery Back extensor strength was the most significant contributor to spinal mobility As spinal mobility is a strong predictor of QoL, this suggests back strengthening exercises may improve QoL in these patients QoL was impaired by all types of postural deformities, especially whole kyphosis Spinal mobility was strongly correlated with QoL; multiple regression analysis showed spinal ROM was the most important predictor of total QoL score
Medici A et al., ²²	2014	IT	PS	Magerl's A1 or A2 thoracolumbar spine fractures in adults	39	Non-operative (3-point brace) vs percutaneous posterior stabilization	Pain (VAS), Regional Kyphosis Angle (RKA), Oswestry Disability Questionnaire (OLBPSQ), Denis Work Scale (DWS)	6 months	
Melchiorre PJ, ¹⁵⁰	1999	US	RCR	Neurologically intact thoracolumbar vertebral fractures	27	Conservative management with TLSO and physical therapy	Functional status, length of hospital stay (LOS), physical/occupational therapy received	Acute hospitalization	
Miyakoshi N et al., ²⁸	2005	JP	CSS	Postmenopausal women with osteoporosis	128	Analysis of factors related to spinal mobility	Spinal ROM, number of fractures, kyphosis angles, paravertebral muscle thickness, back extensor strength	NA	
Miyakoshi N et al., ²⁷	2003	JP	CSS	Postmenopausal women with osteoporosis and postural deformities	157	Analysis of postural deformities and spinal mobility on QoL	Japanese Osteoporosis QOL Questionnaire (JOQOL), radiological angles, spinal ROM	NA	

Moller A et al., ⁷⁴	2007	SE	RLTFU	Nonoperatively treated burst fractures of the thoracic and lumbar spine	27	Nonoperative treatment (mobilization with/without brace, or bedrest)	Oswestry Disability Index (ODI), work capacity	Mean 27 years (23-41)	Long-term outcome was predominantly favorable, with 78% of patients reporting no or minimal pain and disability (mean ODI 8%) No correlation was found between the degree of kyphosis and the subjective outcome Kyphoplasty was effective in relieving referred distal lumbosacral pain in patients with OTVF, with significant and sustained improvement in VAS and ODI scores, demonstrating its utility for unusual pain presentations impacting QoL
Niu J et al., ¹³⁴	2018	CN	RS	Osteoporotic thoracolumbar vertebral fracture with distal lumbosacral pain	32	Percutaneous kyphoplasty	Pain (VAS), ODI, radiological correction	Mean 276 months	The DISH group had a significantly lower rate of bony union at 6 months (69% vs 100%) compared to controls This suggests that the presence of DISH can negatively impact fracture healing, potentially leading to prolonged pain and worse QoL
Okano I et al., ¹¹	2019	JP	MCC	Stable low-energy thoracolumbar vertebral fractures in nonfused segments among elderly patients with DISH	14 (DISH) vs 28 (control)	Conservative treatment	Bony union rates, neurological complications, malunion	Mean 71 months	
Oner FC et al., ¹⁹	2010	US NL CA	Rev	Thoracolumbar spine trauma	NA	Review of therapeutic decision making	Patient-reported outcomes, neurological status, sagittal alignment	NA	Emphasizes that treatment decisions must consider patient factors, injury morphology, and neurological status Highlights the lack of consensus and notes that QoL is an increasingly important outcome measure
Ortin-Barcelo A et al., ¹³¹	2018	ES	CS	Type A3 unstable vertebral fractures in elderly patients	4	Adjacent single-level combined fixation (kyphoplasty + percutaneous pedicle screws)	Radiological correction (kyphotic angle, vertebral height)	1 month	The combined minimally invasive procedure allowed for early mobilization and discharge with good deformity correction and restoration of vertebral body height, suggesting benefits for early QoL in elderly patients

Özbek Z et al., ¹⁰⁰	2017	TR	PS	Unstable Thoracolumbar Fractures (AO A3/A4)	74	Short-segment fixation including fracture level (SSIFL) vs Long-segment (LS) fixation	Bone healing (SPECT), ODI, VAS, radiological parameters	2 years	SSIFL group showed significantly faster bone healing at 12 months Patients with confirmed fusion had significantly better VAS and ODI scores Clinical improvement was more rapid in the SSIFL group, though final outcomes were similar The paraspinal approach was associated with less blood loss and trauma All patients had improved Frankel grades, and pain VAS scores decreased from a mean of 82 pre-op to 17 post-op, suggesting good functional and pain outcomes with this muscle-sparing technique Operative treatment provided significantly better long-term radiographic outcomes (less kyphosis, less vertebral collapse) However, no significant differences were found in any clinical or functional outcomes (ODI, JOA, SF-36, VAS, return to work) Mono-segment fixation was effective, with significant improvements in pain (VAS from 83 to 17) and disability (ODI from 714% to 234%) 80% of patients returned to their previous employment The cementless technique was effective, with significant and sustained improvements in pain (VAS) and disability (ODI) Radiological correction was maintained after implant removal, demonstrating a durable restoration of anatomy and function
Pang W et al., ⁸³	2009	CN	RS	Thoracolumbar fracture	20	Surgical treatment through a paraspinal muscle approach	Pain (VAS), Frankel grade, radiological correction	Mean 18 months	
Pehlivanoglu T et al., ⁷⁸	2020	TR	RCS	Stable thoracolumbar burst fractures in neurologically intact patients	45	Conservative (TLSO brace) vs operative (short-segment posterior fixation)	ODI, JOA score, SF-36, VAS, radiological outcomes, return to work	Mean 65 months	
Perera A et al., ⁸⁶	2015	UK	RS	Thoracolumbar burst fractures	20	Mono-segment posterior fixation	Pain (VAS), ODI, radiological correction, return to work	Mean 24 months	
Piazzolla A et al., ¹²⁹	2018	IT	RS	Type A post-traumatic vertebral fractures (non-osteoporotic)	105	Pedicle instrumentation and percutaneous elevation (PiPe) - a cementless hybrid technique	Pain (VAS), ODI, radiological correction	24 months	

Post RB et al., ¹⁴⁸	2006	NL	RS	Type A thoracolumbar spinal fractures without neurological deficit	33	Non-operative treatment (brace vs no brace)	RMDQ, VAS Spine Score, SF-36, physical tests (lifting, ergometry), return to work	Mean 53 years	Functional outcome was reasonably good SF-36 scores were comparable to a healthy population Patients were mildly restricted in activities (RMDQ, VAS) No difference was found between braced and unbraced patients in any outcome measure
Rajasekaran S et al., ⁵	2017	IN DE US	Rev/PS	Osteoporotic Thoracolumbar Fractures	NA	Classification and treatment algorithm development	Pain, function, mortality, complications	NA	Emphasizes that osteoporotic fractures lead to significant pain, deformity, and impaired mobility, impacting QoL Proposes a treatment algorithm based on fracture type to optimize outcomes and minimize morbidity in elderly patients
Ramieri A et al., ⁹²	2009	IT	PS	Thoracolumbar seat-belt type injuries in young population	19	Posterior tension band fixation	Pain rating scale, neurological status (ASIA), fusion	Mean 456 months	Surgical treatment provided good outcomes, with 84% of patients reporting good pain results at final follow-up Neurologically intact patients remained so, and solid fusion was achieved in all cases, indicating good functional recovery The combined MIS approach was feasible Loss of correction during follow-up was 6° VAS and ODI were not reported, but neurological improvement was seen in 6/31 patients Focus was on technique and radiological outcome rather than QoL
Ringel F et al., ⁴⁵	2008	DE	PS	Acute traumatic thoracic and lumbar fractures	68	Combined minimally invasive posterior and anterior approach (endoscopy-assisted)	Neurological status (Frankel), radiological correction, complications, fusion rate	Mean 23 months	

Rong Z et al., ¹³⁰	2018	CN	RS	Osteoporotic thoracolumbar vertebral compression fracture (AO Type A)	28	Cement-injectable cannulated pedicle screw (CICPS) fixation	Pain (VAS), ODI, radiological correction, stability of fixation	Mean 24 months	CICPS was effective and safe, resulting in significant symptomatic improvement (VAS from 49 to 05; ODI from 57% to 68%) Good fracture reduction and kyphosis correction were achieved and maintained, with no screw loosening observed The prevalence of vertebral fractures was high (46%) QoL was significantly impaired in patients with vertebral fractures, and worsened with increasing number and severity of fractures, especially in physical function, social function, and general health domains
Rostom S et al., ¹⁵⁴	2012	MA	CSS	Postmenopausal women	347	Assessment of vertebral fracture prevalence and HRQoL	Health-Related Quality of Life (QUALEFFO), number and severity of vertebral fractures	NA	PVP provided immediate pain relief, but there was no significant difference in pain, physical, or mental outcomes between groups at 3 and 12 months Suggests long-term QoL benefit over conservative care is not established High-viscosity cement vertebroplasty was effective in fully correcting the kyphotic angle to its anatomic state and resisted fatigue damage, suggesting a potential for better deformity correction and subsequent QoL improvement in vivo
Rousing R et al., ¹³²	2010	DK	RCT	Acute/semiacute osteoporotic vertebral fractures	49	Percutaneous vertebroplasty (PVP) vs conservative treatment	Pain (VAS), SF-36, DPQ, EQ-5D	12 months	All four techniques provided good correction and stability No significant differences were found in final functional outcomes (VAS, ODI) among the groups Short-segment fixation with screw at fracture level had shorter operation time and less blood loss
Rüger M & Schmoelz W, ¹²²	2009	AT DE	IV-BMS	Wedge compression fractures	6 (cadaveric spines)	Vertebroplasty with high-viscosity PMMA cement	Kyphosis correction, stiffness, stability	NA	
Saglam N et al., ¹	2019	TR	RS	Thoracolumbar junction (T11-L2) fractures (TLICS ≥4)	63	Four different posterior screw fixation techniques (varying segment lengths with screw augmentation at the fracture level)	Local kyphosis angle (LKA), pain (VAS), Oswestry Disability Index (ODI), operation time, blood loss	Mean 427 months	

Sanderson PL et al., ¹⁰⁵	1999	AU	RS	Thoracolumbar burst fractures	24	Short-segment fixation of thoracolumbar burst fractures without fusion	Pain, return to work, radiological correction, implant failure	Mean 31 years	86% of patients had no or minimal pain and 79% returned to work Implant failure occurred in 14%, but there was no correlation between radiographic and functional results Suggests routine fusion is unnecessary
Sandquist L et al., ¹⁶	2015	US	CR	Complete traumatic spondyloptosis at the thoracolumbar junction (T12-L1)	1	Single-stage posterior L1 vertebrectomy, reduction, and T8-L4 instrumented fusion	Neurological status, radiographic fusion, functional recovery	2 years	Single-stage posterior vertebrectomy allowed for safe reduction and stable fixation, enabling the patient to regain personal independence, attend college, and drive a modified vehicle despite complete initial SCI Modified PSO allowed for significant correction of deformity (32°), nearly restoring physiological sagittal alignment
Schnake KJ & Kandziora F, ⁵⁷	2010	DE	CR/TN	Posttraumatic kyphosis of the thoracolumbar spine	1	Modified pedicle subtraction osteotomy (PSO)	Radiological correction, functional recovery	NS	Postoperative physiotherapy was crucial for regaining full hip movement and normalizing gait, emphasizing rehabilitation's role in QoL
Schnake KJ et al., ⁶	2017	DE	Review/Classification proposal	Thoracolumbar spinal fractures in the elderly	NA	Proposes OF-Classification and OF-Score for treatment decision	Pain, mobilization, neurological deficits, comorbidities	NA	Emphasizes that osteoporotic fractures cause pain, deformity, and immobility, leading to frailty and increased mortality The proposed scoring system aims to individualize treatment to improve QoL by considering patient-specific factors
Schnake KJ et al., ⁹³	2014	DE	PS	Thoracolumbar fractures	52	Combined anteroposterior stabilization	Pain (VAS), SF-36, ODI, RMDQ, radiological correction	5 years	Combined stabilization resulted in excellent and stable radiological correction However, clinical results showed significant and persistent impairment in QoL (SF-36) and function (ODI, RMDQ) compared to pre-injury status

Schouten R et al., ¹⁴⁷	2015	CA	SR/EO	Common thoracolumbar injuries (burst fractures, flexion-distraction)	38 publications + 31 experts	Synthesis of literature and expert opinion on functional prognosis	Pain, range of motion (ROM), recreational activities, return to work, length of stay	Var	Provides expected functional outcomes for common injuries For non-op burst fracture, 61% chance of being pain-free at 1 year For surgically treated burst fractures, 62% chance of being pain-free Establishes a baseline for patient expectations, which can influence QoL A significant correlation was found between kyphotic deformity (K-Angle) and functional outcomes (ODI, Hannover Score) Poorer functional scores were observed in patients with kyphosis >12°, indicating that sagittal alignment impacts long-term QoL No significant differences were found in radiological or clinical outcomes (pain, disability, HRQoL) between the TLSO and no-brace groups The no-brace group had a significantly shorter hospital stay Operative treatment provided better initial and final kyphosis correction, but there were no significant differences in functional outcome (pain, Low Back Outcome Score) or return to work between the two groups Vertebroplasty provided significant pain relief (mean VAS from 82 to 24) and functional improvement (Karnofsky scale from 54 to 81), suggesting it is an effective option for improving QoL in this specific patient group Health-related QoL (EQ-5D, SF-36) did not return to population norms but was comparable to patients with less severe fractures treated only with posterior instrumentation The procedure was safe with a high fusion rate
Schulz R et al., ³¹	2014	DE BR	RS	Fractures at the thoracolumbar junction (T12-L2)	94	360° instrumented fusion (combined anterior-posterior)	Hannover VAS-Spine Score, Oswestry Disability Index (ODI), pain (VAS), radiological kyphosis (K-Angle)	Mean 716 months	
Shamji MF et al., ¹⁴²	2014	CA	RCT	Stable thoracolumbar burst fractures without neurological deficit	23	Custom-fitted TLSO vs no-brace	Pain (VAS), ODI, SF-36, radiological kyphosis	6 months	
Shen WJ et al., ⁶⁹	2001	TW	RCT	Thoracolumbar junction burst fractures without neurologic deficit	68	Nonoperative treatment (brace) vs posterior fixation	Low Back Outcome Score, pain (VAS), work status, complications, radiological correction	Mean 418 months	
Shin JJ et al., ¹²¹	2009	KR	RS	Osteoporotic burst fractures	26	Percutaneous vertebroplasty	Pain (VAS), functional outcome (Karnofsky Performance Status Scale), radiological correction	Mean 139 months	
Smits AJ et al., ⁸²	2018	NL	RS	Thoracic and thoracolumbar fractures without spinal cord injury	46	Thoracoscopic anterior stabilization with a distractible cage	EQ-5D, SF-36, radiological kyphosis, complications	Median 49 months	

Smits AJ et al., ¹⁴⁶	2017	NL	RCS	Thoracolumbar spine fractures	102	Posterior implant removal	Patient satisfaction, QoL (SF-36, EQ-5D), RMDQ, complications	Mean 68 years post-removal	Implant removal was safe with high patient satisfaction 62% of symptomatic patients experienced decreased symptoms Even 74% of asymptomatic patients reported some benefit QoL scores remained below population norms, especially for severely injured patients The majority of patients maintained acceptable pain and functional scores Posttraumatic kyphosis magnitude did not correlate with chronic pain or disability (ODI) However, older age was significantly correlated with higher disability (ODI)
Soultanis K et al., ⁸	2021	GR	RS	Stable vertebral compressive fractures of the thoracolumbar junction (T12-L2)	75	Non-operative treatment	Pain (VAS), Oswestry Disability Index (ODI), regional kyphosis (Cobb angle)	Mean 35 years	The technique provided good deformity correction Clinical results were good, with a mean Oswestry score of 2975% Patients who also had anterior grafting had a significantly better Oswestry score (2071 vs 374)
Steib JP et al., ⁴⁴	2006	FR	RS	Thoracolumbar fractures	70	Posterior osteosynthesis by "in situ contouring"	Pain, functional outcome (Oswestry), radiological correction	Mean 307 months	The severity of fracture deformation was the most significant factor predicting the severity and longevity of symptoms (pain, disability, QoL) Crush fractures had the worst prognosis for all outcome measures
Suzuki N et al., ³³	2009	SE	PS	Acute osteoporotic vertebral body fracture	107	Analysis of fracture level, type, and grade on prognosis	Pain (von Korff), disability (von Korff), Hannover ADL score, EQ-5D	12 months	The presence of previous vertebral fractures added a negative effect to a subsequent acute fracture, resulting in worse outcomes for disability, QoL (EQ-5D), and ADL, but not pain, compared to patients without previous fractures
Suzuki N et al., ²⁵	2010	SE	PS	Acute osteoporotic vertebral compression fractures	107	Comparison between patients with and without previous vertebral fractures	Pain (von Korff), disability (von Korff), Hannover ADL score, EQ-5D	12 months	

Tanasansomboon T et al., ²⁴	2022	TH US	Rev	Thoracolumbar burst fractures without neurological deficit	NA	Review of controversies and evidence	Conservative vs operative treatment, surgical approaches, fixation constructs, fusion, implant removal	NA	Disability and pain outcomes do not significantly differ between conservative and surgical management For surgery, short segment posterior-only fixation with an intermediate screw is recommended MIS techniques provide equivalent outcomes to open surgery Surgical treatment was effective, with 94% of patients having no or mild pain at final follow-up 88% of patients returned to their previous work Demonstrates good functional recovery and pain relief after surgery for complex injuries No high-quality evidence (Level I or II) was found Low-quality evidence did not demonstrate superiority of one treatment over another regarding pain, function, or return to work Operative treatment had a higher complication rate A strong and significant association was found between clinical parameters (pressure/percussion pain, painful muscle tension, FFD) and multiple HRQoL instruments, demonstrating that objective clinical findings directly correlate with patient-reported QoL The MIS procedure led to adequate fracture reduction with a low rate of screw misplacement (63%) and complications Neurological status improved or remained stable Focuses on technical feasibility, implying QoL benefits of MIS
Tezer M et al., ¹⁸	2005	TR	RS	Thoracolumbar burst fractures with flexion-distraction injury of posterior elements	32	Posterior instrumentation and fusion	Pain (VAS), functional outcome (Denis scales), radiological kyphosis	Mean 27 months	
Thomas KC et al., ⁵⁵	2006	CA	SR	Thoracolumbar burst fractures without neurological deficit	NA	Operative vs nonoperative treatment	Pain, function, return to work, complications, radiographic outcomes	Var	
Thormann U et al., ²⁶	2013	DE	RS	Operatively treated thoracolumbar fractures	66	Association of clinical parameters with QoL	SF-36, VAS spine score, BDI, IES-R, and other QoL instruments; clinical parameters (pain on palpation, muscle tension, FFD)	Mean 42 years	
Tinelli M et al., ¹¹⁶	2018	DE	RS	One-level traumatic thoraco-lumbar and lumbar spine fractures (Magerl A3)	127	Minimally invasive reduction and percutaneous posterior fixation	Radiological correction (kyphosis), operation time, complications	NS (postoperative)	

Tsai PJ et al., ¹²⁸	2017	TW	RCT	Acute thoracolumbar burst fracture	61	Balloon kyphoplasty vs vertebroplasty (both with pedicle-screw instrumentation)	AVH, kyphotic angle, VAS, ODI, complications (cement leakage)	Minimum 24 months	Additional balloon kyphoplasty led to significantly better restoration of vertebral height and kyphosis correction, which was maintained at 24 months It also had a significantly lower cement leakage rate Clinical outcomes (VAS, ODI) were similar The procedure was effective for
Uchida K et al., ⁸⁹	2006	JP	RS	Osteoporotic thoracolumbar vertebral collapse with neurological deficits	28	Anterior expandable strut cage replacement	Neurological outcome (JOA score), pain (VAS), radiological correction	Mean 49 years	decompression and stabilization, leading to significant neurological improvement (JOA score from 67 to 111) and pain relief (VAS from 78 to 36), thus improving functional QoL Both techniques provided good deformity correction and clinical results The
Vanek P et al., ¹¹³	2014	CZ	PCS	Thoracolumbar trauma	70	Short-segment percutaneous vs open transpedicular screw instrumentation	Pain (VAS), ODI, radiological correction, complications	Minimum 2 years	percutaneous group had less blood loss, shorter hospital stay, and better early pain scores, suggesting an advantage for early QoL Final VAS and ODI scores were similar
Verlaan JJ et al., ¹⁵	2004	NS	SR	Thoracolumbar burst fractures	5748	Surgical treatment (anterior vs posterior vs combined approaches)	Neurological status, radiological correction, complications, outcome	Var	No single surgical approach showed universal superiority in outcomes Treatment choice largely reflected injury severity, and surgical strategy influenced radiological outcomes more consistently than QoL
Vorlat P et al., ¹³	2018	BE	PCS	AO-Type A thoracolumbar spine fractures without neurological deficit	48	Conservative treatment (Jewett brace)	Pain (VAS), ODI, Greenough & Fraser low back outcome scale (GF score), satisfaction	12 months	Income insurance and smoking were significant negative predictors for recovery (higher disability, less satisfaction) Pre-existent back pain was associated with less satisfaction Highlights psychosocial and lifestyle factors' impact on QoL

Wang J et al., ⁷⁷	2024	CN	RCS	Type A1 traumatic thoracolumbar fractures	220	Conservative treatment vs PPSF vs percutaneous balloon kyphoplasty with CSP	Pain (VAS), ODI, AVBHR, Cobb angle	Mean 7 years	All three methods showed satisfactory long-term clinical efficacy Both surgical options were superior to conservative treatment radiologically Kyphoplasty was less invasive than PPSF Interim functional outcomes were similar across all groups Preoperative intravenous TXA (with or without topical application) significantly reduced TBL and HBL compared to topical use alone, potentially improving postoperative recovery and reducing anemia-related QoL impairments LSPF was associated with longer operative time All construct failures (18%) occurred in the SSPF group Loss of correction at 6 months was significant only in the SSPF group, suggesting a trend toward poorer radiological and clinical outcomes with SSPF Patients with PD had a higher rate of perioperative complications and inferior walking ability post-surgery However, other outcomes like kyphosis correction, mechanical failure rates, pain relief (VAS), and JOA scores were similar to non-PD patients Both techniques achieved satisfactory deformity correction and good clinical outcomes Monosegmental fixation had less blood loss and shorter operative time, but a slightly higher rate of instrument failure, without affecting the final clinical effect
Wang X et al., ¹³⁶	2019	CN	RCT	Thoracolumbar fracture	181	Intravenous, topical, and combined application of tranexamic acid (TXA) during percutaneous screw fixation	Intraoperative blood loss (IBL), total blood loss (TBL), hidden blood loss (HBL), complications	1 week	
Waqar M et al., ³⁵	2017	UK	RR	Traumatic, single-level thoracolumbar junction (T11-L2) fractures	28	Short-segment (SSPF) vs long-segment (LSPF) posterior fixation	Neurological outcome (Frankel grade), radiological kyphosis (Cobb angle), operation time, length of stay, construct failure	Median 14 months	
Watanabe K et al., ⁷	2019	JP	MRS	Osteoporotic thoracolumbar vertebral fractures in patients with Parkinson's disease (PD)	26 (PD) vs 296 (non-PD)	Spinal fusion (various techniques)	Surgical invasion, sagittal alignment, mechanical failure, clinical outcomes (JOA, VAS, walking ability)	Minimum 2 years	
Wei FX et al., ⁸⁵	2010	CN	RS	Thoracolumbar burst fractures	48	Transpedicular fixation: monosegmental vs short-segment	Cobb angle, vertebral height, complications	Mean 203 months	

Wood KB et al., ⁷⁹	2015	US	RCT	Thoracolumbar burst fracture without neurological deficit	37 (19 op, 18 non-op)	Operative vs nonoperative treatment	Pain (VAS), RMDQ, ODI, SF-36, work status, radiological kyphosis	16-22 years	At long-term follow-up, the nonoperatively treated group had significantly less pain, better function (ODI, RMDQ), and better scores on 7 of 8 SF-36 domains compared to the surgical group, despite slightly worse kyphosis. The muscle-sparing paraspinal approach was effective for indirect decompression and stabilization, resulting in significant neurological improvement (839% recovered to normal) and pain relief (VAS from 69 to <15).
Wu H et al., ⁸⁴	2016	CN	RS	Denis type B thoracolumbar burst fracture with neurological deficiency	62	Paraspinal approach reduction and fixation (PARF) without laminectomy/fusion	Neurological status (Frankel), pain (VAS), radiological correction	Mean 28 months	There was no statistically significant difference in clinical recovery (neurological status) or radiological outcomes at one year between patients who had bone fragments removed and those who did not.
Yaldiz C et al., ⁷⁰	2015	TR	RS	Thoracolumbar burst fractures requiring instrumented fusion	40	Comparison of removing vs not removing reduced bone fragments	Neurological recovery (Benzel-Larson, ASIA), radiological parameters	1 year	Anterior fusion provided good functional outcomes with a mean ODI of 186% and mean VAS of 21.94% of patients returned to work or their previous level of activity, indicating a high level of functional QoL restoration.
Zahra B et al., ²⁰	2012	CA	RS	Thoracolumbar burst fractures	22	Anterior fusion and cage	ODI, pain (VAS), return to work, radiological correction	Mean 27 years	The minimally invasive combined procedure resulted in significant and lasting pain relief (mean VAS from 82 to 2) and functional improvement (mean ODI from 712% to 225%), demonstrating excellent QoL outcomes.
Zairi F et al., ¹¹⁹	2012	FR	RS	Thoraco-lumbar fractures	29	Combined percutaneous fixation and balloon kyphoplasty	Pain (VAS), ODI, radiological correction	Mean 32 months	AFV was associated with significantly better postoperative pain relief (VAS), superior radiological outcomes (AVH, Cobb angle), less correction loss, and lower implant failure rate compared to CFV.
Zhang C & Liu Y, ⁹⁸	2018	CN	MA	Thoracolumbar fractures	1280 (18 RCTs)	Pedicle screw fixation at the fracture vertebrae (AFV) vs conventional method (CFV)	Pain (VAS), AVH, Cobb angle, complications, operation time, blood loss	Var	

Zhang H et al., ⁶³	2016	CN	RS	Kyphosis in ankylosing spondylitis with pathological fracture	13	Osteotomy through the gap of a pathological fracture	Pain (VAS), radiological correction (GK, LL, SVA)	Mean 25 months	The novel procedure provided satisfactory kyphosis correction and significant improvement in back pain (VAS from 72 to 19), demonstrating a safe and effective approach to improve QoL and function in this complex patient group Postoperative bracing was not effective No significant differences were found in VAS, VCR, collapse rate, or refracture rate
Zhang J et al., ¹⁴⁴	2019	CN	MRS	Thoracolumbar osteoporotic vertebral compression fractures	276 (138 per group)	Bracing vs no bracing after percutaneous vertebroplasty (PVP)	Pain (VAS), ODI, vertebral body compression ratio (VCR), collapse/refracture rate	6 months	The braced group had significantly worse ODI scores at 1 month, suggesting a negative impact on early functional QoL
Zhang X et al., ⁶²	2016	CN	RS	Kümmell disease with neurological deficits	16	Modified transpedicular subtraction and disc osteotomy with long-segment fixation	Neurological function (ASIA), pain (VAS), Cobb angle	Mean 33 months	The modified osteotomy was effective for kyphosis correction and decompression, resulting in significant pain relief (VAS from 71 to 11) and neurological improvement in 9 patients
Zhao QM et al., ³⁷	2015	CN	RS	Single-level A31 and A32 thoracolumbar fractures without neurological involvement	67	Posterior fixation including the fractured vertebra (PFFV) vs traditional short-segment fixation (TSSF)	Cobb's angle, vertebral body height, pain (Denis pain scale), operation time, blood loss	1 year	PFFV provided better maintenance of kyphosis correction and vertebral height compared to TSSF However, there was no significant difference in pain scores between the two groups at 12 months