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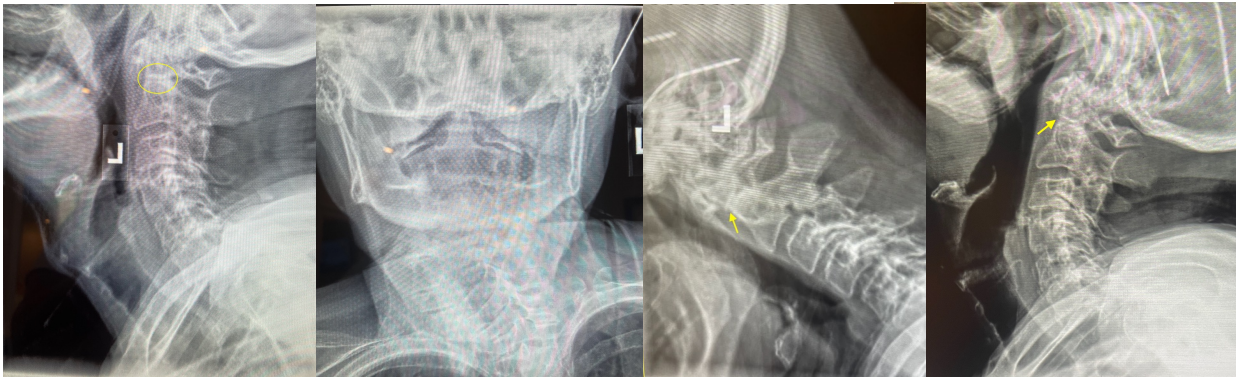
Grand Rounds
Pre-Game Warm-Up

James Demetrious, DC, DABCO
Diplomate, American Board of Chiropractic Orthopedists


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Instructive Case



The image displays four X-ray views of the cervical spine. From left to right: 1) A lateral view with a yellow circle highlighting a vertebral body fracture and a white arrow pointing to a fracture line. 2) An anterior-posterior view with a white arrow pointing to a fracture. 3) A lateral view with a white arrow pointing to a fracture and a yellow arrow pointing to a fracture. 4) A lateral view with a yellow arrow pointing to a fracture.

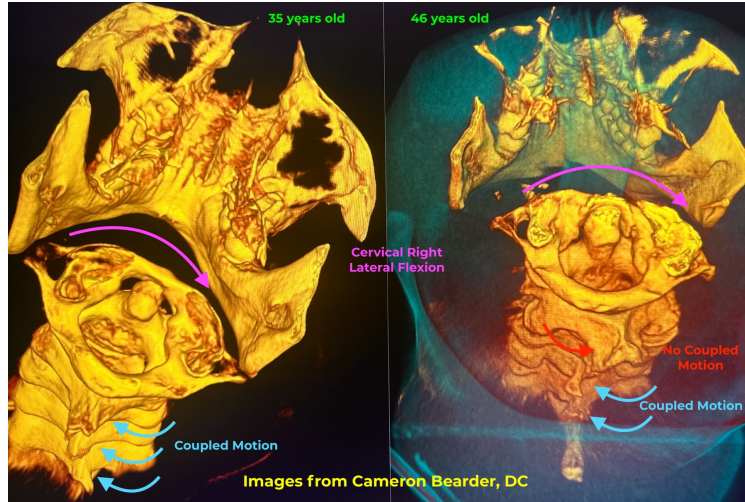
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Instructive Case

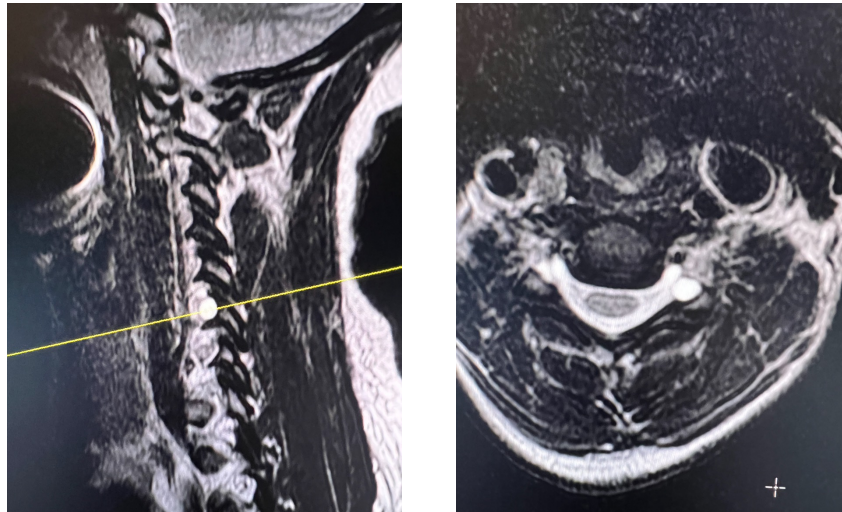


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Instructive Case



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Instructive Case

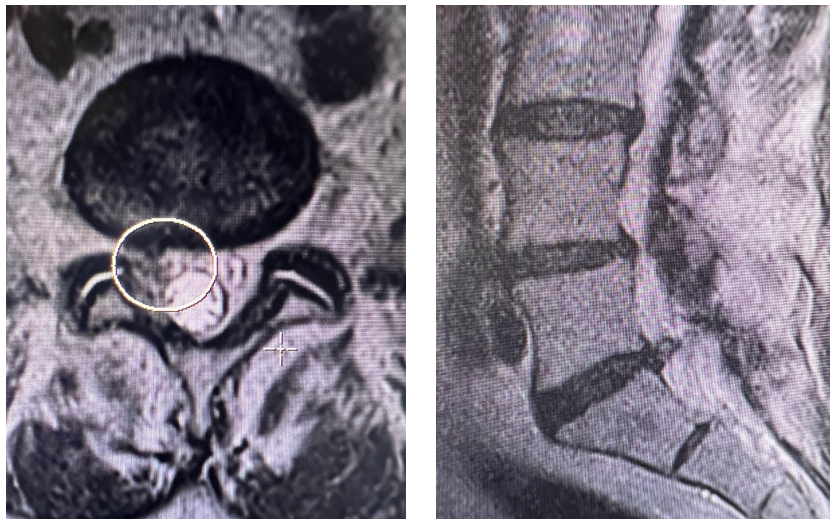


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Instructive Case

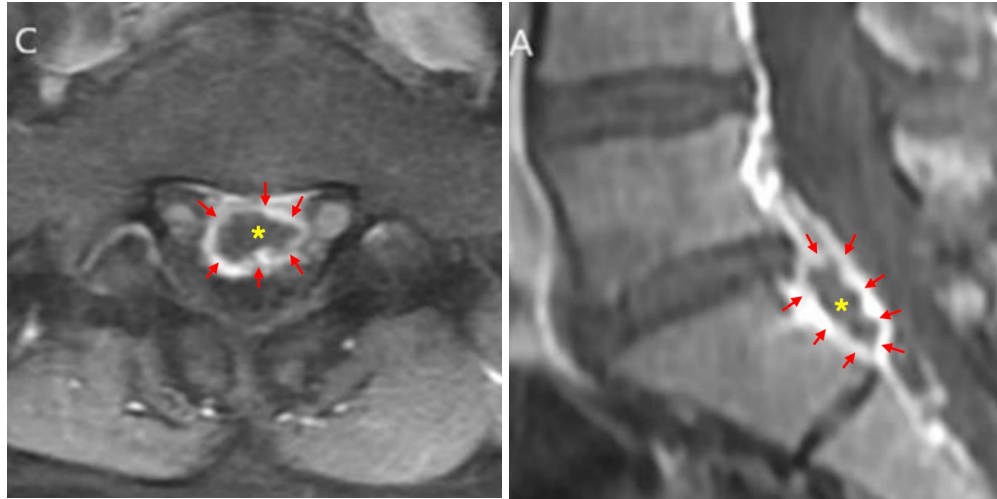


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Instructive Case



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IVD Resorption

Clinical Case Report **Medicine**
OPEN

Non-surgical treatment of giant tumor-like lumbar disc herniation based on enhanced MRI

A case series
Xiaojiang Shen, PhD¹, Shun Lin, PhD², Hong Jiang, PhD³, Jintao Liu, PhD⁴, Pingli Yu, PhD⁵

Abstract
Background: In recent clinical follow-up, it has been verified that resorption in lumbar disc herniation (LDH) could be of great curative effect in non-surgical treatment for LDH. However, reports of resorption in giant tumor-like LDH are rarely mentioned due to its risk of irreversible neurological damage which could be covered by long-term non-surgical treatment. In our clinical observations, we have found that enhanced MRI helps to distinguish LDH from intradiscal tumours and to predict the probability of resorption in LDH. We analysed 6 patients with giant tumor-like LDH who underwent non-surgical treatment, and these patients had resorption during follow-up. All patients were examined with enhanced MRI before treatment, and the types of 'bull's eye' sign classification was determined by images. The MRI progression volume (VP), resorption rate (RR) and JCSA scores of patients at the first visit and the last follow-up were recorded.

Patients/evidence: 6 patients of low ethnicity were admitted to the department of orthopedics complaining of low back pain for weeks to 12 months. They were diagnosed with giant tumor-like LDH by enhanced MRI.

Diagnosis: These patients were diagnosed with giant tumor-like LDH.

Interventions: We adopted a non-surgical treatment plan for the patients, including taking oral non-steroidal anti-inflammatory agents and performing rehabilitation exercises. In consideration of the risk of irreversible neurological damage, patients were closely observed during treatment and follow-up. Once the following conditions occur, surgical treatment is required immediately. The symptoms are not significantly relieved after 3 to 6 months of non-surgical treatment; The symptoms are aggravated by non-surgical treatment; The clinical manifestations of cauda equina syndrome.

Outcomes: After treated with oral non-steroidal anti-inflammatory agents and rehabilitation exercises, the resorption was associated with clinical symptom relief. No neurological damage occurred in all patients, and the clinical symptoms did not recur in the subsequent follow-up.

Lessons: Clinicians should fully consider the possibility of resorption prior to surgical treatment in patients with giant LDH. We can predict the probability of resorption in patients with giant LDH based on enhanced MRI. For patients with a high probability of resorption, we can choose non-surgical treatment in the absence of progressive neurological impairment and cauda equina syndrome.

Abbreviations: AFH = herniated area as percentage of corresponding vertebral canal area, JCSA = Japanese orthopaedic association, LDH = lumbar disc herniation, MRI = magnetic resonance imaging, FPH = resorption rate, VP = volume of protrusion.

Keywords: enhanced MRI, lumbar disc herniation, resorption, tumour-like.

1. Introduction
Since Guo et al.^[1] first identified the phenomenon of "disk regression" in herniated intervertebral disc through computer tomography follow-up, in 1994, scholars have conducted in-depth research on resorption of lumbar disc herniation (LDH) in the last 20 years, and the understanding of this phenomenon has made great progress. Without surgical

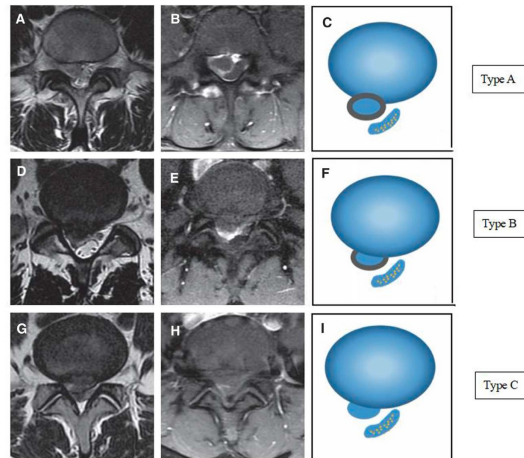


Figure 4. Classification of "bull's eye" sign on enhanced MRI. (A, D, G) Maximum level of the plain MRI T2WI horizontal view; (B, E, H) Maximum level of the enhanced MRI T1WI horizontal view; (C, F, I) Schematic diagram of the protrusion ring enhancement area: type A, showing a complete "bull's eye" sign, the annular enhanced area surrounds the whole protruding nucleus pulposus; type B, showing an annular enhanced area partially surrounded the protruding nucleus pulposus; type C, there is no obvious annular enhancement around the protrusion. MRI = magnetic resonance imaging.

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IVD Resorption

REVIEW ARTICLE
SPINE SURGERY AND RELATED RESEARCH

Prediction and Mechanisms of Spontaneous Resorption in Lumbar Disc Herniation: Narrative Review

Zili Zeng¹, Jun Qin¹, Liang Guo¹, Takashi Hirai², Zhiheng Gui², Tao Liu², Chen Su², Daiyang Yu² and Mengmeng Yan²

1) Department of Orthopedics, University-Town Hospital of Chongqing Medical University, Chongqing, China
2) Department of Orthopaedic and Spine Surgery, Tokyo Medical and Dental University, Tokyo, Japan

Abstract:

The major symptoms of lumbar disc herniation (LDH) are low back pain, radiative lower extremity pain, and lower limb movement disorder. Patients with LDH suffer from great distress in their daily life accompanied by severe economic hardship and difficulty in self-care, with an increasing tendency in the aging population. PubMed and the Cochrane Central Register of Controlled Trials were searched for relevant studies of spontaneous resorption or regression in LDH after conservative treatment and for other potential studies, which included those from inception to June 30, 2023. The objective of this narrative review is to summarize previous literatures about spontaneous resorption in LDH and to discuss the mechanisms and influencing factors in order to assess the probability of spontaneous resorption by conservative treatment. **Spontaneous resorption without surgical treatment is influenced by the types and sizes of the LDH, inflammatory responses, and therapeutic factors. If the lumbar disc herniated tissue comprises a higher percentage of cartilage or modic changes have been shown on magnetic resonance imaging (MRI), resorption in LDH is prevented. The bull's eye sign on enhanced MRI, which is a ring enhancement around a protruding disc, is a vital indicator for easy resorption. In addition, the type of extrusion and sequestration in LDH could forecast the higher feasibility of natural resorption. Moreover, the higher the proportion of protrusion on the intervertebral disc tissue within the spinal canal, the greater the likelihood of resorption. Therefore, which illustrates the feasibility of conservative treatments for LDH. Nonsurgical management of LDH with clinical symptoms is recommended by the authors.**

Keywords:
Spontaneous resorption, Lumbar disc herniation (LDH), Mechanisms of resorption, Conservative treatment

Spine Surg Relat Res 2024; 8(3): 235-242
dx.doi.org/10.22603/ssrr.2023-0152

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IVD Resorption

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Relationship between the Time of Spontaneous Resorption of Herniated Material and the Types of LDH

- Many studies have shown that enormous ruptured tissue in LDH is resorbed more easily, whereas small ruptured tissues took longer³⁶).
- Recently, researchers reported that the spontaneous regression rate of sequestration, extrusion, protrusion, and bulging was 96%, 70%, 41%, and 13%, respectively.
- As time passed, the rate of complete resorption in LDH was 43% for sequestration and 15% for extrusion²¹).
- The majority of massive LDHs resolved at variable points between 3 and 21 months⁴⁶).
- The average time for spontaneous resorption was 9 months, which occurred the earliest in giant disc herniation than in other types of herniation ²⁶⁶).

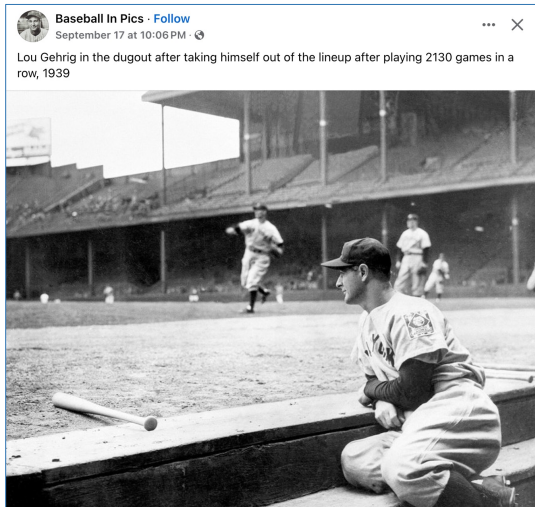
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Reflecting



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Grand Rounds: The Post-Surgical IVD

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Clinician

- Active Practice >38 years
- Diplomate, American Board of Chiropractic Orthopedists
- Diplomate, International Academy of Neuromusculoskeletal Medicine



Publications

- Over 31 Peer-Reviewed chiropractic journal articles.
- Many Contributions to NCMIC Examiner and Podcast



Educator

- Post-Grad. > 24 years
- NCMIC Speakers' Bureau for >10 years
- Northeast College of Health Sciences
- **PostGradDC**



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- Editorial Reviewer for journals *Spine*, *Annals of Internal Medicine*, and *Clinical Anatomy*
- Former Managing Editor of *Journal of Chiropractic Orthopedists*



Honors

- Academy of Chiropractic Orthopedists Distinguished Service and Fellow Awards
- American College of Chiropractic Orthopedists Outstanding Achievement Award



Community

- Lower Cape Fear Hospice, Board Member
- Founder, Past-President Wilmington Autism Society
- Optimists Club – Safety Officer



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Purpose...Initial Chiropractic Care Saves Lives

REVIEW ARTICLE SPINE SURGERY AND RELATED RESEARCH

Prediction and Mechanisms of Spontaneous Resorption in Lumbar Disc Herniation: Narrative Review

Zili Zeng¹, Jun Qin¹, Liang Guo¹, Takashi Hirai², Zhibeng Gai¹, Tao Liu¹, Chen Su¹, Duiyang Yu¹ and Mengmeng Yan¹

1) Department of Orthopedics, University-Town Hospital of Chongqing Medical University, Chongqing, China
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Keywords:

Spontaneous resorption, Lumbar disc herniation (LDH), Mechanisms of resorption, Conservative treatment

Spine Surg Relat Res 2024; 8(3): 235-242
dx.doi.org/10.22603/ssr.2023-0152

- Conservative treatment and radiological follow-up may be the most appropriate initial treatment option for patients without progressive neurological dysfunction, rectal bladder impairment, or refractory pain.
- This helps to improve patient prognosis, decrease the financial burden on patients, and ultimately reduce national healthcare costs.



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Class Outline

- Instructive Cases
- Epidemiology of IVD Surgery
- Complications of Surgery
 - Cervical Spine
 - Hardware Failure
 - Lumbar Spine
 - Failed Back Surgery Syndrome
- Chiropractic Studies
- Cases

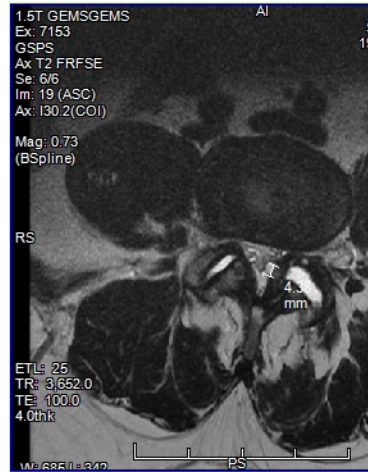
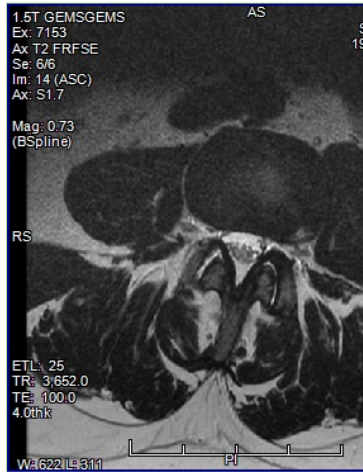


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Instructive Case: 50-year old Fireman...

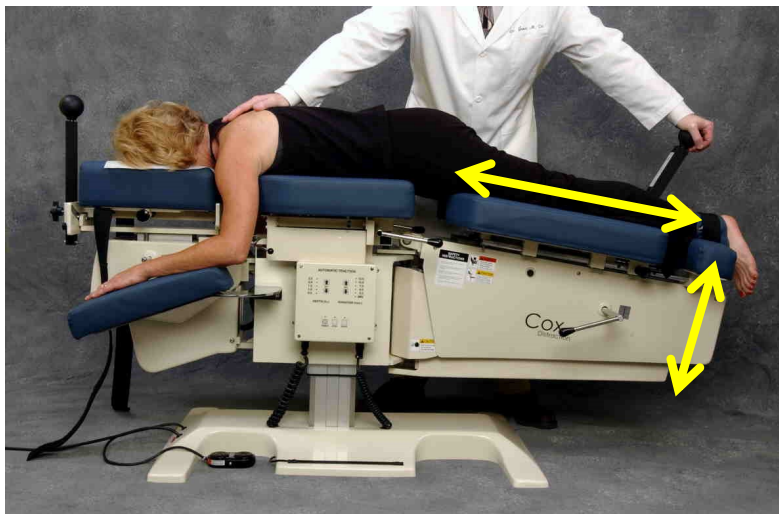


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Cox Technic

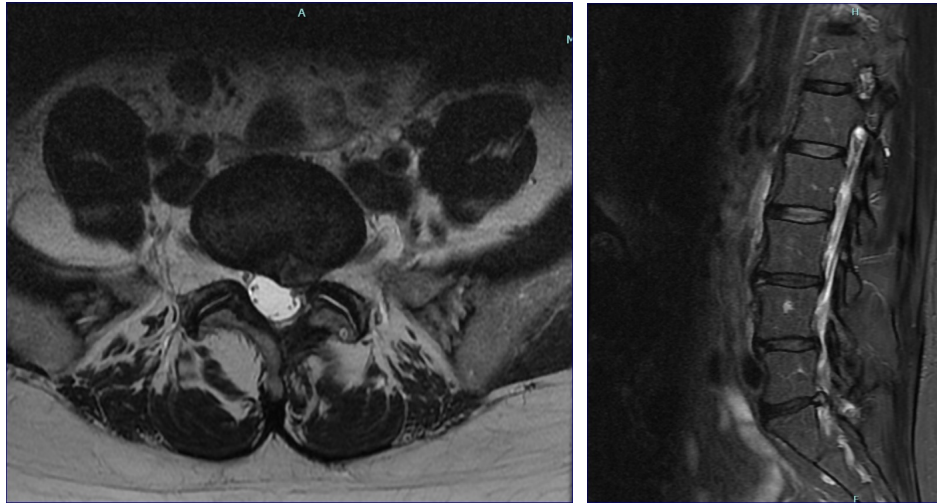


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Instructive Case: 51-year-old Executive



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Intermittent Decompression - Chattanooga Triton DTS



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Intermittent Decompression - Chattanooga Triton DTS



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Intermittent Traction

Effects of segmental traction therapy on lumbar disc herniation in patients with acute low back pain measured by magnetic resonance imaging: A single arm clinical trial Cite

Article type: Research Article

Authors: Karimi, Nouredin^a | Akbarov, Parvin^{b,*} | Rahnama, Leila^a

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Correspondence: [*] Corresponding author: Parvin Akbarov, Department of Physiotherapy, University of Social Welfare and Rehabilitation Sciences, Koudakyar Ave, Daneshjo Blvd, Evin, Tehran, Iran. Tel.: +99 4552222005; E-mail:akbar0122@gmail.com

Abstract: BACKGROUND: Low Back Pain (LBP) is considered as one of the most frequent disorders, which about 80% of adults experience in their lives. Lumbar disc herniation (LDH) is a cause for acute LBP. Among conservative treatments, traction is frequently used by clinicians to manage LBP resulting from LDH. However, there is still a lack of consensus about its efficacy. OBJECTIVE: The purpose of this study was to evaluate the effects of segmental traction therapy on lumbar discs herniation, pain, lumbar range of motion (ROM), and back extensor muscles endurance in patients with acute LBP induced by LDH. METHODS: Fifteen patients with acute LBP diagnosed by LDH participated in the present study. Participants undertook 15 sessions of segmental traction therapy along with conventional physiotherapy, 5 times a week for 3 weeks. Lumbar herniated mass size was measured before and after the treatment protocol using magnetic resonance imaging. Furthermore, pain, lumbar ROM and back muscle endurance were evaluated before and after the procedure using clinical outcome measures. RESULTS: Following the treatment protocol, herniated mass size and patients' pain were reduced significantly. In addition, lumbar flexion ROM showed a significant improvement. However, no significant change was observed for back extensor muscle endurance after the treatment procedure. CONCLUSION: The result of the present study showed segmental traction therapy might play an important role in the treatment of acute LBP stimulated by LDH. ➔

Keywords: Low back pain, physical therapy modalities, traction, inter-vertebral disc herniation, magnetic resonance imaging

DOI: 10.3233/BMR-160741

Journal: *Journal of Back and Musculoskeletal Rehabilitation*, vol. 30, no. 2, pp. 247-253, 2017

Published: 2 March 2017

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Intermittent Traction

Non-surgical Spinal Decompression: Patient Reported Outcomes Across Multiple Clinics

Shannon Schuere, Gina Anza Medina, Nathan D. Schilsky

INTRODUCTION

Non-surgical spinal decompression (NSSD) is a therapeutic modality utilized in treatment of intervertebral disc (IVD) disc hernia as a non-invasive alternative to surgical interventions. Little information is available on clinical outcomes and utilization associated with NSSD, leaving a significant gap in understanding its efficacy, safety profile, patient satisfaction rates, and long-term effects on diverse populations.

OBJECTIVE: Assess utilization and patient reported outcomes of NSSD across multiple clinics. This will provide valuable insights into real-world practices and impact of NSSD on patient care and satisfaction.

METHODS

CONTACT

REVISION

STATISTICAL ANALYSIS

RESULTS

230 patient chart notes were obtained across 4 private chiropractic clinics.

Characteristic	Value
SEX	43.3% FEMALE, 56.7% MALE
CHRONIA	MEAN (SD)
Age	33.4 (16.4)
Height (cm)	172.1 (10.0)
Weight (kg)	84 (22.2)

Table 1: Demographics. Mean height, weight, and age are reported alongside ratio of female to male patients.

Length of Pain	Population %
0-3 months (acute)	38.2
3-6 months (sub-acute)	11.1
6-12 months (chronic)	12.0
1-3 years (chronic)	18.8
3+ years (chronic)	19.9

Table 2: Length of Current Pain. Percentage of study population presenting with acute, sub-acute, or chronic pain pre-NSSD.

Pain was reduced by 4.4 (confidence interval of 95%: 4.0, -4.7) (Fig. 2). (p<0.001)

Activity of Daily Living (% affected)	Odds Ratio	95% Confidence (Lower, Upper)	Chi-Square	p-value
Walking (48.3%)	5.2	1.9, 14.2	95.9	<0.001
Household Chores (28.7%)	15.3	5.0, 46.4	49	<0.001
Sex (15.6%)	68.5	8.1, 566.8	21.2	<0.001
Bathing (14.6%)	33.9	7.0, 164.4	24.5	<0.001
Dressing (18.1%)	22.9	4.8, 105.9	36.4	<0.001
Sitting/Standing (81.4%)	11.5	3.5, 38.1	113.3	<0.001
Eating (13.7%)	-	-	4	0.045
Using the Bathroom (87.7%)	-	-	18	<0.001

Table 3: Odds Ratio (Improvement in ADLs). This table provides an overview of odds ratios for improvement in ADLs among patients who underwent NSSD. Dark (grey) highlights indicate the most frequently reported ADL affected pre-NSSD, and red highlights indicate statistical significance change from pre- to post-NSSD.

Neuro Root	% affected	p-value	Myeloma	% affected	p-value	Dermatome	% affected	p-value	Reflex	% affected	p-value
T12	0.4	0.9247	0	-	-	-	-	-	-	-	-
L1	2.8	-	0.7	0.001	-	-	-	-	-	-	-
L2	5.2	-	1.5	-	-	-	-	-	-	-	-
L3	4.9	0.7518	3.0	<0.001	-	-	-	-	-	-	-
L4	16.9	<0.001	15.0	<0.001	23.2	<0.001	-	-	-	-	-
L5	32.2	<0.001	21.0	<0.001	17.1	<0.001	-	-	-	-	-
B1	10.5	<0.001	12.0	0.001	24.7	<0.001	-	-	-	-	-

Table 4: Probability of Improvement to peripheral neurological symptoms following NSSD. If likelihood of improvement to various neurological signs indicate most frequently affected neurological sign. Red represents statistically significant change from pre- to post-treatment.

Table 5: Pain was most frequently reported as contralateral (83.4%) or radiating (53.3%) compared to ipsilateral (25.2%), and more commonly reported on the left if ipsilateral or radiating (44.3%).

NSSD decreases low back pain (-4.4) and improves functional outcomes, including activities of daily living.



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Epidemiology

Cunha et al. *Arthritis Research & Therapy* (2018) 20:251
https://doi.org/10.1186/s13075-018-1743-4

Arthritis Research & Therapy

REVIEW

Open Access

CrossMark

The inflammatory response in the regression of lumbar disc herniation

Carla Cunha^{1,2*}, Ana J. Silva^{1,2}, Paulo Pereira^{3,4,5}, Rui Vaz^{3,4,5}, Raquel M. Gonçalves^{1,2,6} and Mário A. Barbosa^{1,2,6}

Abstract

Lumbar disc herniation (LDH) is highly associated with inflammation in the context of low back pain. **Currently, inflammation is associated with adverse symptoms related to the stimulation of nerve fibers that may lead to pain.** However, **inflammation has also been indicated as the main factor responsible for LDH regression.** This apparent controversy places inflammation as a good prognostic indicator of spontaneous regression of LDH. This review addresses the molecular and cellular mechanisms involved in LDH regression, including matrix remodeling and neovascularization, in the scope of the clinical decision on conservative versus surgical intervention. Based on the evidence, a special focus on the inflammatory response in the LDH context is given, particularly in the monocyte/macrophage role. The phenomenon of spontaneous regression of LDH, extensively reported in the literature, is therefore analyzed here under the perspective of the modulatory role of inflammation.

Keywords: Low back pain, Spine, Intervertebral disc, Immunomodulation, Macrophages

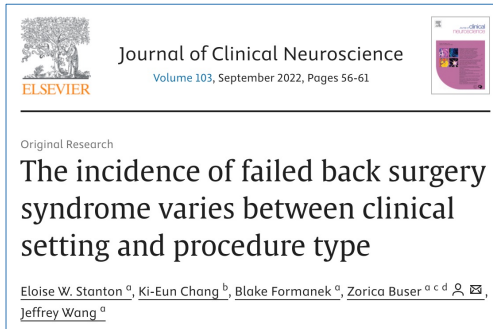
- Lumbar disc herniation (LDH) is a major contributor to low back pain and affects around 9% of all people worldwide, with a high associated economic burden and a tendency to increase as the population ages [1].



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Epidemiology



- The overall rates of lumbar spine surgery that result in worsened or new pathologies are estimated to be between 10 and 40% [7].

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Epidemiology



- From 2010 to 2017, 102,047 patients underwent lumbar fusion or decompression surgery (54% decompression procedures, 36% posterior fusions, and 8.9% anterior fusions).
- 5.4% of patients were diagnosed with FBSS within six months of the index procedure, and 8.4% were diagnosed with FBSS within twelve months.

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Complications of Cervical IVD Surgery

Failure in Cervical Spinal Fusion and Current Management Modalities

Terence Verla, MD, MPH¹ David S. Xu, MD¹ Matthew J. Davis, BS²
 Edward M. Reece, MD, MBA, FACS, FAAP^{1,2} Michelle Kelly, PA-C² Mervin Nunez, PA-C²
 Sebastian J. Winocour, MD, MSc, FACS² Alexander E. Ropper, MD¹

¹Department of Neurosurgery, Baylor College of Medicine, Houston, Texas
²Division of Plastic Surgery, Michael E. DeBakey Department of Surgery, Baylor College of Medicine, Houston, Texas
 Address for correspondence: Alexander E. Ropper, MD, Department of Neurosurgery, Baylor College of Medicine, 7200 Cambridge Street, Suite 9A, Houston, TX 77030 (e-mail: alexander.opper@bcm.edu).
 Semin Plast Surg 2021;35:10-13.

- Failed fusion in the cervical spine is a multifactorial problem stemming from a combination of patient and surgical factors.
- Surgical risks for failed fusion include the number of segments fused, anterior versus posterior approach for fusion, the type of bone graft, and the instrumentation utilized.
- Many symptomatic cases of failed fusion (pseudarthrosis) result in pain, neurological deficits, or loosened hardware necessitating a revision surgery consisting of extending the prior construct and utilizing additional allografts or autografts to augment the fusion.
- Given the relatively mobile nature of the cervical spine, pseudoarthrosis (either known or anticipated) must be recognized by the spine surgeon, and steps should be considered to optimize the likelihood of future fusion.
- This consists of both performing a rigid fixation and using appropriate bone graft to enhance the environment for arthrodesis.



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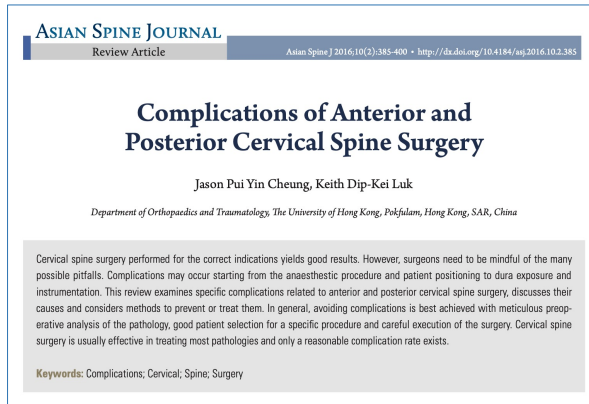
Complications of Cervical IVD Surgery

Dysphagia	▼	Infection	▼	Neck pain	▼
Cerebrospinal fluid leak	▼	Nerve injury	▼	Esophageal Perforation	▼
Muscle weakness or spasms	▼	Paralysis	▼	Adjacent segment disease	▼
Failed fusion	▼	Vascular injury	▼	Changes in spinal curve	▼
Difficulty in walking	▼	Infrequently reported complications	▼	Pain going down your arms	▼
Reaction to anesthesia	▼	Bleeding, major blood vessel injury	▼	Chronic pain	▼
Failure to heal	▼	Fever	▼	Fusion failure, also known as pseud...	▼
General surgery risks	▼	Headache	▼	Horner syndrome	▼



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Complications of Cervical IVD Surgery

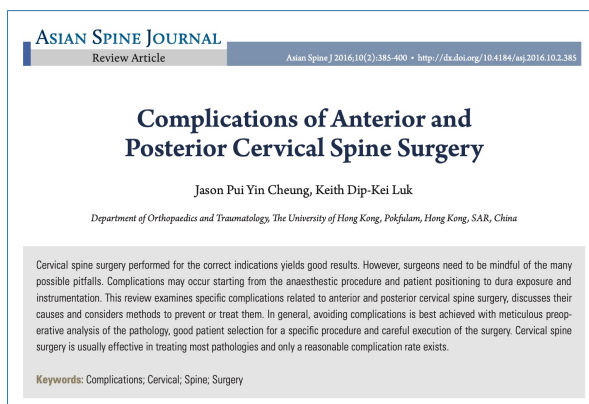


● General complications:

- Anesthesia and positioning
- Bone grafting,
- Wound infection in discitis,
- Cervical pin traction,
- Dural, tear and CSF leak.

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Complications of Cervical IVD Surgery

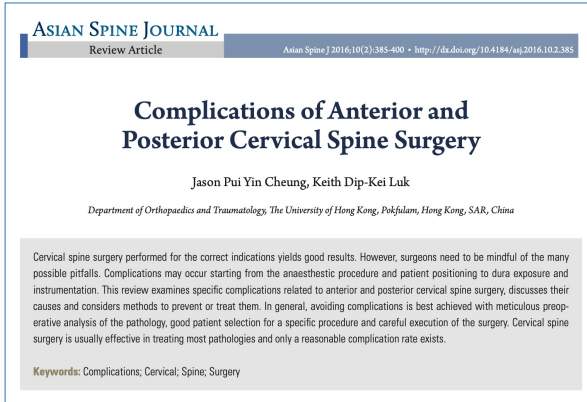


● Anterior surgical exposure:

- Recurrent laryngeal, superior laryngeal, and hypoglossal nerve injuries,
- Esophageal injury,
- Vertebral and carotid artery injuries,
- Tracheal injury.

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Complications of Cervical IVD Surgery



• Posterior surgery:

- Injury to spinal cord and nerve roots,
- Screw fixation,
- Posterior occiptocervical instrumentation
- C-5 palsy,
- Spring break closure – Hinge fracture,
- Post-laminectomy kyphosis,
- Minimally invasive surgery.



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Complications of Cervical IVD Surgery

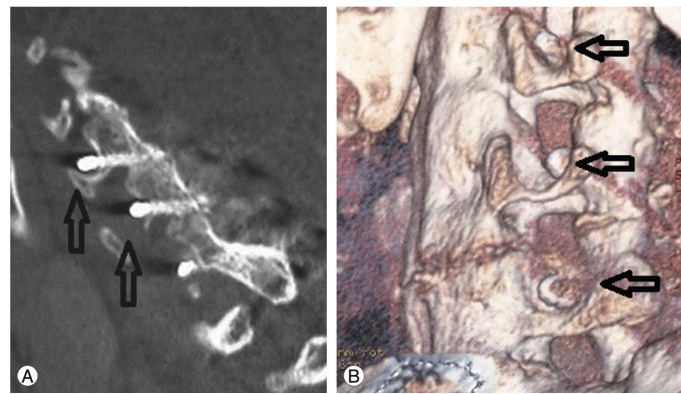
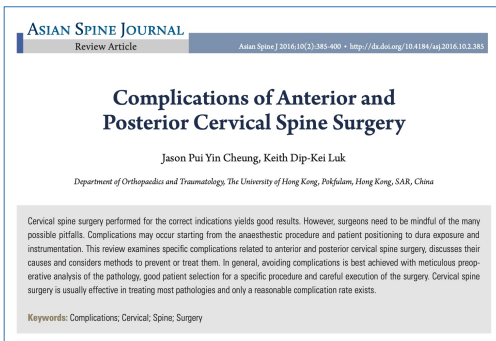


Fig. 3. Postoperative (A) lateral computed tomography (CT) scans and (B) three-dimensional CT reconstruction showing penetration of the lateral mass screw into the exiting nerve root foramen (arrows). As the patient was asymptomatic, these screws were left *in-situ*.

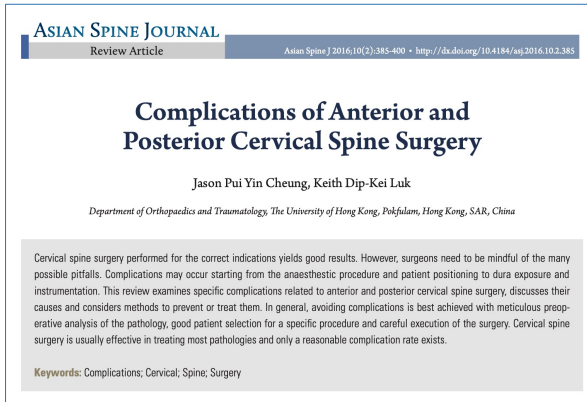


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Complications of Cervical IVD Surgery



• Anterior surgery:

- Injury to spinal cord and nerve roots,
- Corpectomy,
- OPLL
- Adjacent segment degeneration,
- Pseudoarthrosis,
- Cervical disc arthroplasty.

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Complications of Cervical IVD Surgery

RSNA Education Exhibits

 Free Access

Complications of Spinal Instrumentation

Phillip M. Young, Thomas H. Berquist, Laura W. Bancroft, Jeffrey J. Peterson

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- ¹From the Department of Radiology, Mayo Clinic, 2400 San Pablo Rd, Jacksonville, FL 32224. Recipient of a Certificate of Merit award for an education exhibit at the 2005 RSNA Annual Meeting. Received April 5, 2006; revision requested August 9; revision received September 29 and accepted October 10. All authors have no financial relationships to disclose.
- **Address correspondence to** P.M.Y. (e-mail: young.phillip@mayo.edu).

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Complications of Cervical IVD Surgery

- Radiography has long been the standard method for evaluation of the fusion construct (Figs 6, 7).
- The assessment of fusion may be difficult, but, typically, signs of bridging bone should occur by 6–9 months after surgery.
- Ray (8) defined six criteria for assessing the solidity of fusion at radiography (Table).
- These criteria have not been externally validated, but they have gained clinical acceptance and are useful for interpreting postoperative radiographs.

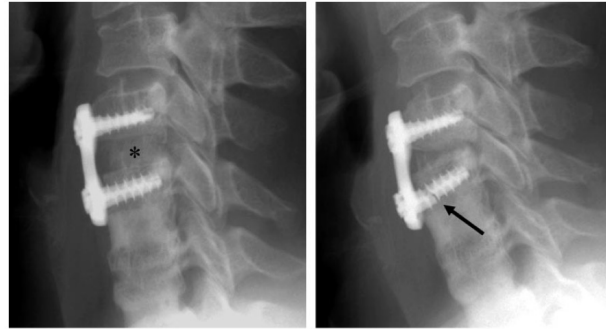
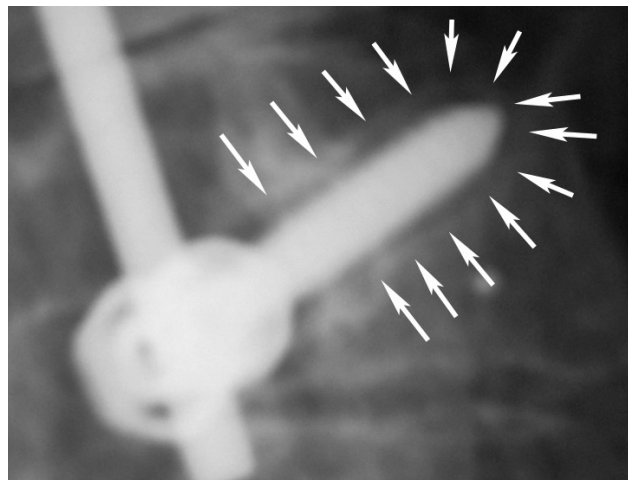


Figure 7. Resorption of nonunited graft material and hardware fracture. (a) Initial postoperative lateral radiograph demonstrates anterior plate and screw fixation of C4 to C5 with an intervertebral lateral bone graft (*). Note the excellent graft incorporation at the levels of previous anterior fusion (C5 to C6 and C6 to C7); hardware was removed from those levels during surgical fusion of C4 to C5. (b) Extension radiograph obtained at 13-month follow-up demonstrates resorption of the graft material and fracture of the inferior screw (arrow).

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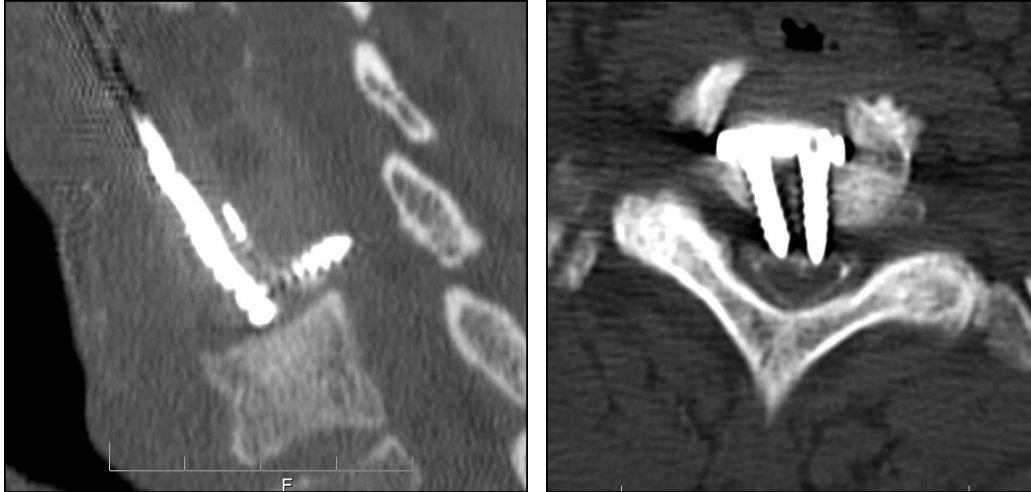
Complications of Cervical IVD Surgery

- In addition to postoperative radiography, **multidetector CT with multiplanar reformatting of image data can be extremely useful for presurgical planning; it has the capability to provide exquisitely detailed depiction of hardware and graft materials** (Fig 8).



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Post-Surgical Sequelae



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Post-Surgical Sequelae

 **Raed Abusuwwa** · 2nd
Neurosurgery Division Lead, Advocate Good ...
18h · 🌐

ACDF is a king 👑 or a queen 👑!
A patient with symptomatic severe cervical spinal stenosis as a result of partially calcified her ...more



(14:59)
Caption KEY to cervical report

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Failed Back Surgery Syndrome

AI Overview

Lumbar disc surgery can have a number of adverse effects, including:

- Nerve injury: This can include new numbness or weakness in one or both legs, or even paralysis.
- Bleeding: This can include bleeding inside the spinal column, or epidural bleeding.
- Blood clots: These can form in the veins of the legs, which is called Deep Venous Thrombosis (DVT).
- Infection: This can occur at the incision site.
- Spinal fluid leak: This can occur during surgery.
- Reaction to anesthetic agents: This can occur during surgery.
- Migration of a fusion cage or bone graft: This can happen soon after surgery, before the cage or graft is firmly attached by bone growth.
- Recurrent disc herniation: This can occur after surgery.

Other issues that can occur after lumbar disc surgery include back pain, stiffness, and soreness. It can take 4 to 6 weeks to regain mobility and function, and 6 months to a year for the back to fully improve.



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Complications of Lumbar IVD Surgery

Review Article

Complications associated with lumbar discectomy surgical techniques: a systematic review

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Background: Open discectomy (OD) and microdiscectomy (MD) are routine procedures for the treatment of lumbar disc herniation. Minimally invasive surgery (MIS), such as micro-endoscopic discectomy (MED) and full endoscopic discectomy (FED), offers potential advantages (less pain, less bleeding, shorter hospitalisation and earlier return to work), but their complications have not yet been fully evaluated. The aim of this paper was to identify the frequency of these complications with a focus on MIS in comparison to OD/MED.

Methods: The authors conducted a Medline database search for randomised controlled and prospective studies reporting complications associated with MIS and MED/OD from 1997 to February 2020. Included studies were assessed for bias using the Newcastle-Ottawa Quality assessment form. Mean complication rates for each technique were calculated by dividing the total number of each complication by the total number of patients included in the studies which reported the specific complication.

Results: Of the 1,091 articles retrieved from Medline, 54 met the inclusion criteria. OD, MD, MED and FED were associated with recurrent lumbar disc hernia in 4.1%, 5.1%, 5.9% and 3.9%, respectively; re-operation in 2.2%, 2.7%, 4.9% and 4% respectively; overall complications in 5.7%, 5.9%, 1.2% and 2% respectively; dactylitis in 6.4%, 2.1%, 4.4% and 1.1% respectively; neurological complications in 1.8%, 2.8%, 4.7% and 4.9% respectively. Nerve root injury was reported in 3.1% for MD, 0.8% for MED and 1.2% for FED.

Discussion: This up-to-date systematic review of complications after various techniques of lumbar discectomy (including a large pool of patients who had MED) confirms previous findings of low and comparable rates. However notable levels of bias were reported amongst included studies, which reported complications with varying levels of clinical detail.

Keywords: Lumbar microdiscectomy, endoscopic discectomy, percutaneous discectomy, complications, systematic review

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* ORCID: 0000-0002-5480-8275.

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Bombieri et al. Complications after lumbar discectomy: a systematic review

Table 3 Classification of complications of lumbar discectomy by category

Complication	Criteria
Durotomy	Any intraoperative injury to the dura plus postoperative CSF leak and meningocele
Nerve root injury	Any intraoperative nerve root injury or displacement
Neurological complications	Worsening of pre-existing motor or sensory symptoms and new postoperative symptoms (including symptomatic nerve root injury)
Wound complications	Superficial wound infections (including cellulitis) and deep wound infections (including spondylodiscitis), wound haematoma, poor wound healing and dehiscence.
Recurrent discopathy	Relapsing disc herniation
Re-operation	Any re-operation regardless of indication during the postoperative period
Other	Surgical errors* and medical complications**

*, surgical errors: exploration of wrong vertebral level, surgical equipment failure and iatrogenic vessel injury; **, medical complications: thrombotic events, bleeding requiring blood transfusion, urinary tract infections and urinary retention. CSF; cerebrospinal fluid.



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Complications of Lumbar IVD Surgery

CUREUS

Open Access Original Article

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Postoperative Evaluation of Pain and Disability in Patients Undergoing Spinal Discectomy

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Abstract

Background: A spinal discectomy surgery (SDS) is a common surgical procedure performed to treat lumbosacral radiculopathy.

Aim: To evaluate postoperative patterns of pain and disability in patients undergoing spinal discectomy.

Methods and materials: This investigation was a retrospective longitudinal review of prospective information gathered from 545 enrolled patients for lumbar radiculopathy. The study participants were divided into two categories: Category 1 (SDS) comprising patients of lumbar radiculopathy managed with SDS (n=270) and Category 2 (non-SDS) comprising patients of lumbar radiculopathy managed with therapy other than SDS (n=275). It included study participants taking medication for pain control including opioids and non-opioids and physiotherapy for strengthening lower back muscles. At baseline, three months, 12 months, and 24 months after surgery, patient-reported information was gathered. Leg pain magnitude, back pain magnitude, and pain-related impairment were the key outcome metrics of interest.

Results: The mean postoperative visual analog scale (VAS) score for leg pain at three-month follow-up was 4.3±1.2 in study participants in SDS and 6.1±1.2 in the non-SDS category. The VAS score was lower in the SDS category showing greater reduction in postoperative pain with statistically meaningful results (p<0.0001). The mean postoperative VAS score at 12-month follow-up was 2.8±1.1 in study participants in SDS and 7.9±1.5 in the non-SDS category. The VAS score was lower in the SDS category showing greater reduction in postoperative pain with statistically meaningful results (p<0.0001). The mean postoperative VAS score at 24-month follow-up was 1.7±1.2 in study participants in SDS and 1.1±1.1 in the non-SDS category. The VAS score was lower in the SDS category showing greater reduction in postoperative pain with statistically meaningful results (p<0.0001).

Conclusion: It was observed that after discectomy, patients suffering from lumbar radiculopathy have significant pain and disability recovery. According to these results, only a small percentage of individuals exhibit negative results at the level of impairment.

- It was observed that after discectomy, patients suffering from lumbar radiculopathy have significant pain and disability recovery.
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Failed Back Surgery Syndrome



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Failed Back Surgery Syndrome

Wwaire J. Orhurhu; Robert Chu; Jatinder Gill.

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Last Update: May 1, 2023.

Enhancing Healthcare Team Outcomes ?

interprofessional pain clinics are the gold standard in the setting of treatment for patients with complex chronic pain syndromes such as failed back surgery syndrome. The interprofessional care team in these clinics consists of pain physicians, nurses, psychologists, psychiatrists, physical therapists, pharmacists, and occupational therapists. The integration of different members of the healthcare team results in close communication between experts in distinct methodologies of treating chronic pain and promotes a biopsychosocial approach to the patient's pain.[2]



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Failed Back Surgery Syndrome

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Failed Back Surgery Syndrome
 Vwaire J. Orhurhu; Robert Chu; Jatinder Gill.

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² Johns Hopkins University
³ Beth Israel, Harvard Medical School

Last Update: May 1, 2023.

Treatment / Management

Therapies for the treatment of failed back surgery syndrome broadly split into conservative (physical therapy or medication) and aggressive (interventional or surgical) management. Conservative management should always be the first option before invasive techniques in patients without indications for emergency surgery.[5]

Studies of conservative treatment specifically for failed back surgery syndrome are rare, and the studies that do exist are often contradictory.[18] Common



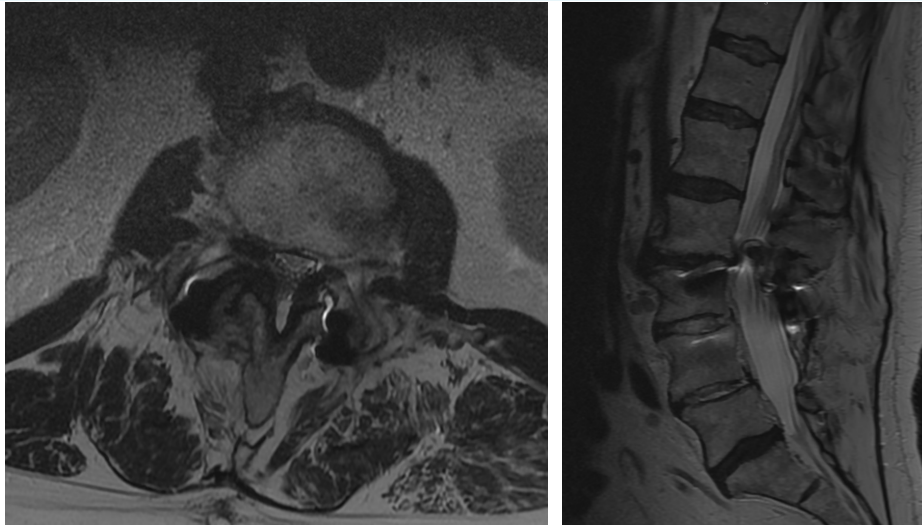
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Post-Surgical Sequelae



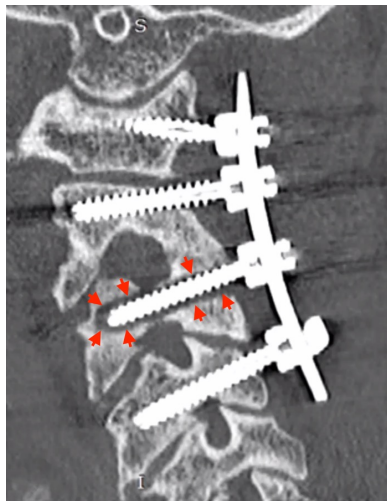
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Post-Surgical Sequelae



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Post-Surgical Sequelae



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Chiropractic Studies

Trager et al. *Chiropractic & Manual Therapies* (2023) 21:10
https://doi.org/10.1186/s12924-023-00461-2

Chiropractic & Manual Therapies

SYSTEMATIC REVIEW

Open Access

Clinician approaches to spinal manipulation for persistent spinal pain after lumbar surgery: systematic review and meta-analysis of individual patient data

Robert J. Trager^{1,2*}, Clinton J. Daniels³, Kevin W. Meyer⁴, Amber C. Stout⁵ and Jeffrey A. Dusek^{1,6}

Abstract
Background This review aimed to identify variables influencing clinicians' application of spinal manipulative therapy (SMT) for persistent spine pain after lumbar surgery (PPS-2). We hypothesized markers of reduced clinical/surgical complexity would be associated with greater odds of applying SMT to the lumbar region, use of manual thrust, lumbar SMT, and SMT within 1 year post-surgery as primary outcomes, and chiropractors would have increased odds of using lumbar manual-thrust SMT compared to other practitioners.
Methods For our published protocol, observational studies describing adults receiving SMT for PPS-2 were included. PubMed, Web of Science, Scopus, OVID, PsycInfo, and Index to Chiropractic Literature were searched from inception to January 6, 2022. Individual patient data (IPD) were requested from contact authors when needed for selection criteria. Data extraction and a customized risk-of-bias rubric were completed in duplicate. Odds ratios (ORs) for primary outcomes were calculated using binary logistic regressions, with covariates including age, sex, symptom distribution, provider, motion segments, spinal implant, and surgery to SMT interval.
Results 71 articles were included describing 113 patients (mean age 52.8 ± 15.5 years old). The most common surgeries were laminectomy (46%), fusion (34%), and discectomy (29%). Lumbar SMT was used in 85% of patients, and of these patients was non-manual thrust in 59%, manual thrust in 13%, and unclear in 18%. Clinicians were most often chiropractors (66%). SMT was used 1 year post-surgery in 66% of cases. While no primary outcomes reached significance, non-reduced motion segments approached significance for predicting use of lumbar manual-thrust SMT (OR 0.07 [95% CI 0.01–0.46], *P* = 0.025). Chiropractors were significantly more likely to use lumbar manual-thrust SMT (OR 12.26 [3.17–32.78], *P* = 0.003). A sensitivity analysis omitting high-risk-of-bias cases (missing 2, 20% IPD) revealed similar results.
Conclusions Clinicians using SMT for PPS-2 most often apply non-manual thrust SMT to the lumbar spine, which chiropractors are more likely to use. Lumbar manual-thrust SMT relative to other providers. As non-manual thrust SMT may be gentler, this practice suggests providers are cautious when applying SMT after lumbar surgery. Environmental variables such as patient or clinician preference, or limited sample size may have influenced our findings. Large observational studies and/or international surveys are needed for an improved understanding of SMT use for PPS-2.

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Chiropractic Studies

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Approval of Paper: Eric Chan-Pu Chu¹, Robert J. Trager²

Final Approval: Eric Chan-Pu Chu¹, Robert J. Trager²

DATABASE ANALYSIS

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Effectiveness of Multimodal Chiropractic Care Featuring Spinal Manipulation for Persistent Spinal Pain Syndrome Following Lumbar Spine Surgery: Retrospective Chart Review of 31 Adults in Hong Kong

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Corresponding Author: Robert J. Trager, e-mail: robert.trager@postgrad.com
Research support: Robert J. Trager indicates that he received royalties as the author of 2 books on the topic of statistics.
Conflicts of interest: None declared.

Background: The term "persistent spinal pain syndrome type 2" (PPS-2) has been proposed by the International Association for the Study of Pain to replace the term "failed back surgery syndrome". This retrospective study aimed to evaluate effectiveness of multimodal care featuring chiropractic spinal manipulation (CSMT) in 31 adults in Hong Kong with PPS-2.

Material/Methods: We identified new adult patients with PPS-2 receiving CSMT from 2016 to 2018. Demographic and clinical data and baseline/follow-up numeric pain rating scale (NPRS) and Oswestry Disability Index (ODI) scores were extracted. Multiple linear regression was used to estimate posttreatment NPRS and ODI reduction, with clinical variables as covariates.

Results: Of 6389 patients with low back pain, 31 met criteria (mean age 52.2 ± 13.7 years). Surgeries included laminectomy (87%), discectomy (13%), and fusion (0%). Mean baseline NPRS was 8.6 ± 1.8, ODI was 43.8 ± 15.1%. Patients received CSMT (100%), drop technique (87%), passive modalities (87%), soft tissue manipulation (17%), flexion-distraction (13%), and mechanical traction (13%). Mean posttreatment NPRS was 5.6 ± 1.0, ODI was 24.6 ± 3.7%. All patients had a minimum clinically important difference for NPRS (2.0/10) and ODI (20%). One year after treatment, 40% maintained improvement, 45% experienced recurrence, in 10%, follow-up was unavailable. Regression analysis identified younger age, shorter symptom duration, and greater baseline NPRS as predictors of NPRS reduction, and greater baseline ODI as a predictor of ODI reduction (all *P* < 0.05).

Conclusions: Patients with PPS-2 improved with multimodal care featuring CSMT, which was more effective in patients with younger age, shorter symptom duration, and higher baseline pain or disability levels.

Keywords: Chiropractic • Failed Back Surgery Syndrome • Low Back Pain • Manipulation, Spinal • Multimodal • Manipulations.

Full-text PDF: <https://www.medonmonitor.com/abstract/index/MSH1937640>

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Journal of Chiropractic Medicine (2013) 12, 168–175

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Case studies

Chiropractic management of postoperative spine pain: a report of 3 cases

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Key indexing terms:
 Manipulation;
 Chiropractic;
 Postoperative period;
 Adverse effect.

Abstract
Objective: The purpose of this case series is to describe chiropractic care including spinal manipulation for 3 patients with postoperative spine pain.
Clinical features: Three patients with postoperative spine pain (1 cervical fusion, 1 lumbar discectomy, and 1 lumbar laminectomy) presented for chiropractic treatment at a major US medical center. Treatment included spinal manipulation and/or flexion-distraction mobilization based on patient response to joint loading strategies.
Intervention and outcome: Two patients were treated with high-velocity, low-amplitude spinal manipulation, and 1 patient was treated with flexion-distraction mobilization. Treatment frequency and duration were 4 treatments over 4 weeks for case 1, 17 treatments over 7 years for case 2, and 5 treatments over 5 weeks for case 3. Subjective improvement was noted using numeric pain scores and functional changes, and upon completion, the patients reported being "satisfied" with their overall outcome. One episode of transient height increases was noted by 1 patient. No additional adverse events or effects were noted.
Conclusion: In these 3 cases, patients with postoperative spine pain responded positively to chiropractic care. Spinal manipulation/mobilization was tolerated without significant adverse effects.
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Introduction
 Chronic pain after surgery is common.^{1,2} It has been reported that about 1 in 5 patients who have undergone various surgical procedures experience severe postoperative pain or only poor to fair pain relief despite

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Chiropractic Studies

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BMC Musculoskeletal Disorders

RESEARCH Open Access

Association between spinal manipulative therapy and lumbar spine reoperation after discectomy: a retrospective cohort study

Robert J Trager^{1,2}, Jordan A. Glead³, Colin M. Labak⁴, Clinton J. Daniels^{1,2} and Jeffrey A. Dusek^{1,2}

Abstract
Background: Patients who undergo lumbar discectomy may experience ongoing lumbosacral radiculopathy (LSR) and seek spinal manipulative therapy (SMT) to manage these symptoms. We hypothesized that adults receiving SMT for LSR at least one year following lumbar discectomy would be less likely to undergo lumbar spine reoperation compared to matched controls not receiving SMT over two years' follow-up.
Methods: We searched a United States network of health records (TRIM, Inc.) for adults aged ≥ 18 years with LSR and lumbar discectomy ≥ 1 year previous, without lumbar fusion or reoperation from 2003 to 2012. We divided patients into two cohorts: (1) chiropractic SMT and (2) usual care without chiropractic SMT. We used propensity matching to adjust for confounding variables associated with lumbar spine reoperation (e.g., age, body mass index, income, depression, calculated risk ratios (RR), with 95% confidence intervals (CIs), and explored cumulative incidence of reoperation and the number of SMT follow-up visits.
Results: Following propensity matching there were 378 patients per cohort (mean age 61 years). Lumbar spine reoperation was less frequent in the SMT cohort compared to the usual care cohort (SMT: 7% usual care: 13%), yielding an RR (95% CI) of 0.55 (0.35–0.85, P = 0.0062). In the SMT cohort, 72% of patients had ≥ 1 follow-up SMT visit (median 4).
Conclusions: This study found that adults experiencing LSR at least one year after lumbar discectomy who received SMT were less likely to undergo lumbar spine reoperation compared to matched controls not receiving SMT. While these findings hold promise for clinical application, they should be corroborated by a prospective study including measures of pain, disability, and safety to confirm their relevance. We cannot exclude the possibility that our results stem from a generalizable effect of engaging with a non-surgical clinician, a factor that may extend to related contexts such as physical therapy or acupuncture.
Registration: Open Science Framework: <https://osf.io/vyqzd/>.
Keywords: Chiropractic, Spinal manipulation, Lumbosacral region, Lumbar vertebrae, Surgical decompression, Interventional date.

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Comparative Study > J Manipulative Physiol Ther. 2011 Jul-Aug;34(6):408-12.
doi: 10.1016/j.jmpt.2011.05.011.

Chiropractic management of postsurgical lumbar spine pain: a retrospective study of 32 cases

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Affiliations + expand
PMID: 21807265 DOI: 10.1016/j.jmpt.2011.05.011

Abstract

Objective: Although chiropractic manipulation is commonly used for low back pain, applying this procedure to the patient with postlumbar spine surgery has not been adequately studied. The purpose of this retrospective chart review is to report on the results of chiropractic management (including Cox flexion distraction technique) of patients with postsurgical lumbar spine pain to determine the change in reported pain based on surgical type.

Methods: Ten years of patient files from one chiropractic practice were electronically screened for lumbar spine surgery occurring before presenting for chiropractic care. Of the 58 patients with a postsurgical diagnosis, 32 files contained all pertinent components for this study including treatment with Cox flexion distraction manipulation (in addition to adjunct procedures) for at least 2 weeks and pretreatment and posttreatment pain measures using the Numeric Pain Scale (NPS) that ranged from 0 (no pain) to 10 (worst pain imaginable).

Results: A change was observed in the mean pretreatment and posttreatment NPS pain scores of 6.4 to 2.3, a reduction of 4.1 of 10. The mean number of treatments was 14, with a range of 6 to 31. When stratified by surgical type, the mean change in pain was most remarkable in patients who underwent a surgery that combined lumbar discectomy, fusion, and/or laminectomy, with an average NPS pain reduction of 5.7 of 10. No adverse events were reported for any of these postsurgical patients.

Conclusions: The results of this study showed improvement for patients with low back pain subsequent to lumbar spine surgery who were managed with chiropractic care.



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Opioid Use Reduction in Failed Back Surgery Syndrome Patients at Three Months Utilizing Manual Spinal Decompression Manipulation

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- Chiropractic interventions and spinal manipulation have demonstrated beneficial outcomes for patients with spinal pain following spinal surgery.^{26,27}
- Additionally, patients with spinal pain who saw a chiropractor had half the incidence of filling an opioid prescription.^{28,29} Cox Technic Flexion Distraction Decompression (CTFDD) is a form of spinal manipulation that has been shown to benefit post-surgical spine pain cases.^{30,31}
- **Conclusion:**
 - The results of this prospective study revealed a patient-reported reduction or discontinuation of opioid use during their initial three-month course of care.



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Effectiveness of postsurgical rehabilitation following lumbar disc herniation surgery: A systematic review^a

Hainan Yu^{a,b,c}, Carol Cancelliere^{a,b}, Silvano Mior^{a,b,d,e}, Paulo Pereira^{c,f}, Margareta Nordin^g, Ginny Brunton^{a,b}, Jessica J. Wong^{a,b,h,i}, Heather M. Shearer^{a,b,i}, Gaelan Connell^{a,b}, Lauren Ead^{a,b,h,i}, Leslie Verville^{a,b,h}, Mana Rezaei^{a,b}, Danny Myrtois^j, Dan Wang^{a,b}, Andr e-Anne Marchand^k, Andrew Romaneli^l, Darrin Germann^l, Daphne To^l, James J. Young^{l,m}, Danielle Southerst^{n,o}, Henry Candelariaⁿ, Sheila Hogg-Johnson^{b,d,o,p}, Pierre C te^{a,b,o,p}

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Discussion and conclusion:

- Evidence on effective and safe post-surgical rehabilitation interventions is sparse.



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Open access Protocol

BMJ Open Clinical decision-making for spinal manipulation for persistent spinal pain following lumbar surgery: a protocol for a systematic review and meta-analysis of individual patient data

Robert James Trager¹, Clinton J Daniels², Kevin W Meyer³, Amber C Stout⁴, Jeffrey A Dusek⁵

Abstract There are limited available research and evidence regarding the use of spinal manipulative therapy (SMT) in patients with low back related symptoms (LBRSS) following spine surgery. A systematic review and meta-analysis of individual patient data (IPD) is required to identify and synthesize individual patient data (IPD) to examine associations between patient clinical and/or post-operative and SMT outcomes in adults with PPS2.

Methods and analysis: PubMed, OVID, Web of Science, Scopus, EMBASE, Embase, Cochrane, Litvise and Scopus will be searched from inception to 1 January 2022 without language restriction. Case reports, case series, observational studies and data from grey literature of adult receiving SMT for PPS2 will be included. Two investigators will independently screen citations, abstracts and full articles. A risk-of-bias assessment will be performed on articles to be included according to research and/or clinical significance and data completeness. Data extracted will be performed in duplicate and reported.

IPD will be requested from corresponding authors. Multiple binary logistic regression will be used to identify independent predictors of the use of lumbar-SMT (Lumbar-SMT) and SMT-related outcomes (low back pain, disability, surgery, clinical and/or patient variables) with univariate and multivariate analyses. The results of this review will be disseminated as conference and/or published in a peer-reviewed journal.

PROSPERO registration number: CRD43201506093.

Introduction Persistent spinal pain syndrome (PPSS) describes chronic or recurrent pain of spinal origin, including axial and/or radicular symptoms. This syndrome is divided into PPS1 type 1, in which there is no prior relevant surgery, and persistent spinal pain syndrome type 2 (PPS2), in which patients have a history of spinal surgery. The latter category includes cases in which surgery directly or indirectly caused symptoms, was unsuccessful, was successful but symptoms recurred, and there is no relationship between surgery and symptoms, or this association is unclear.¹ The term PPS2 was recently proposed by an international group to replace 'failed back surgery syndrome' (FBSS) and provide a clearer inclusive of other terms such as postlaminectomy syndrome, adjacent-segment degeneration, chronic spinal pain after surgery, and postoperative spinal syndrome.²

Description of the condition A systematic review found that PPS2 occurs in 45-50% of patients following lumbar surgery and has various aetiologies, the most



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Questions?

- How do you manage post-IVD surgery patients?
- When do you initiate chiropractic care for those patients?
- Preferential chiropractic techniques?
- Precautions?
- Thoughts?



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Thank you!



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Upcoming Grand Rounds Schedule



The First Tuesday of the Month at 8PM EST

Upcoming Rounds

- **January 7, 2025 – MRI of Facet Syndrome**
- **Additional live qualifying CAD classes will be available at the end of the year.**