Development and Efficacy of a Preoperative Neuroscience Education Program for Lumbar Radiculopathy

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Why develop a Preoperative Neuroscience Education Program for Lumbar Radiculopathy?

Current Landscape of Lumbar Surgery in the US:

- Lumbar Surgery in the US is ever-increasing

- At least one in three patients following Lumbar Surgery have persistent Pain and Disability
Why develop a Preoperative Neuroscience Education Program for Lumbar Radiculopathy?

Current Landscape of Lumbar Surgery in the US:

- Postoperative Rehabilitation has shown little efficacy in decreasing postoperative Pain and Disability

- Surgeons do not readily refer patient to therapy post-Lumbar Surgery
  - UK Study:
  - US Study:
What about Preoperative Education helping Lumbar Surgery Patients?

Preoperative Education To Date:

- Procedural information
- Informed consent
- No postoperative benefit

- Pain and Education issues related to Preoperative Lumbar Surgery Education
  - Patients require more preoperative information regarding the surgical procedure, the potential risks, and the limitations and benefits of surgery
  - More information on their pain and how surgery will impact pain.
  - Patients require more preoperative information
  - Patients in general satisfied with the care given to them preoperatively
    - Not with the content of the information regarding the impending spinal surgery.
  - Patients have unrealistic expectations regarding surgery and correlates to poor outcomes
But Surgeons Do Provide Preoperative Education for Lumbar Radiculopathy


- **Background:** Determine current utilization, importance, content and delivery methods of preoperative education by spine surgeons in the US for patients with lumbar radiculopathy
- **Design and Setting:** Online cross-sectional survey
- **Participants:** Random sample of spine surgeons in the US
- **Interventions:** A Spinal Surgery Education Questionnaire (SSEQ) was developed based on previous related surveys and assessed for face and content validity by an expert panel. The SSEQ captured information on demographics, content, delivery methods, utilization and importance of preoperative education as rated by surgeons.
- **Main Outcome Measure(s):** Descriptive statistics were used to describe the current utilization, importance, content and delivery methods of preoperative education by spine surgeons in the US for patients with lumbar radiculopathy.
- **Results:** 89/200 (45% response rate) surgeons responded to the online survey. The majority (64.2%) provide preoperative education informally during the course of clinical consultation versus formal preoperative education session. Mean time from the decision to undergo surgery to date of surgery was 33.65 days. Highest rated topics to educate: surgical procedure (96.3%), complications (96.3%), outcomes/expectations (93.8%), anatomy (92.6%), and amount of postoperative pain expected (90.1%) and hospital stay (90.1%). Surgeons estimated spending approximately 20% of the preoperative education time specifically addressing pain. 75% of the surgeons personally provide the education and nearly all surgeons (96.3%) use verbal communication with the use of a spine model.

- **Conclusion(s):** Spine surgeons believe preoperative education is important and utilize a predominantly biomedical approach in preparing patients for surgery. Larger studies are needed to validate these findings.

**Biomedical Education**

- Biomedical education is very commonly used in orthopedic based professions focusing on anatomy and pathoanatomy
- Not only have these models shown limited efficacy in decreasing pain and disability, but they may increase fear in patients, which in turn, may increase their pain.
Education is Therapy

Is there an Educational Approach that helps Pain and Disability for Non-Operative Low Back and Leg Pain Patients?

**Therapeutic Neuroscience Education**


- **OBJECTIVE**: To evaluate the evidence for the effectiveness of neuroscience education (NE) for pain, disability, anxiety, and stress in chronic musculoskeletal (MSK) pain.
- **DATA SOURCES**: Systematic searches were conducted on Biomed Central, BMJ.com, CINAHL, the Cochrane Library, NLM Central Gateway, OVID, ProQuest (Digital Dissertations), PsycInfo, PubMed/Medline, ScienceDirect, and Web of Science. Secondary searching (PEARLing) was undertaken, whereby reference lists of the selected articles were reviewed for additional references not identified in the primary search.
- **STUDY SELECTION**: All experimental studies including randomized controlled trials (RCTs), nonrandomized clinical trials, and case series evaluating the effect of NE on pain, disability, anxiety, and stress for chronic MSK pain were considered for inclusion. Additional limitations: studies published in English, published within the last 10 years, and patients older than 18 years. No limitations were set on specific outcome measures of pain, disability, anxiety, and stress.
- **DATA EXTRACTION**: Data were extracted using the participants, interventions, comparison, and outcomes (PICO) approach.
- **DATA SYNTHESIS**: Methodological quality was assessed by 2 reviewers using the Critical Review Form-Quantitative Studies. This review includes 8 studies comprising 6 high-quality RCTs, 1 pseudo-RCT, and 1 comparative study involving 401 subjects. Most articles were of good quality, with no studies rated as poor or fair. Heterogeneity across the studies with respect to participants, interventions evaluated, and outcome measures used prevented meta-analyses. Narrative synthesis of results, based on effect size, established compelling evidence that NE may be effective in reducing pain ratings, increasing function, addressing catastrophization, and improving movement in chronic MSK pain.
- **CONCLUSIONS**: For chronic MSK pain disorders, there is compelling evidence that an educational strategy addressing neurophysiology and neurobiology of pain can have a positive effect on pain, disability, catastrophization, and physical performance.

**Considering the evidence for NE, the development of a preoperative NE for lumbar radiculopathy was undertaken, comprising several sub-studies:**
Does Preoperative Education Decrease Pain and Disability in Preoperative Orthopedic Surgery: A Systematic Review of the Literature


- **Objective:** To evaluate the content and educational delivery methods of preoperative education in orthopedics addressing postoperative pain.

- **Data Sources:** Systematic searches were conducted on Biomed Central, BMJ.com, CINAHL, the Cochrane Library, NLM Central Gateway, OVID, ProQuest (Digital Dissertations), PsycInfo, PubMed/Medline, ScienceDirect and Web of Science. Secondary searching (PEARLing) was undertaken, whereby reference lists of the selected articles were reviewed for additional references not identified in the primary search.

- **Study Selection:** All randomized controlled trials (RCTs) evaluating the effect of preoperative education on postoperative pain in orthopedic surgery were considered for inclusion. Additional limitations: Studies published in English; published within the last 20 years and patients over the age of 18. No limitations were set on specific outcome measures of pain.

- **Data Extraction:** Data was extracted utilizing the PICO approach.

- **Data Synthesis:** This review includes 13 RCTs involving 1017 subjects. Educational delivery methods comprised verbal one-on-one or group education sessions; delivered within 4 weeks of surgery lasting an average of 30 minutes; and accompanied by booklets. The educational content centered on descriptions of preoperative preparation; hospital stay; surgical procedure; immediate/ intermediate experiences; expectations following surgery; rehabilitation; encouragement/ reassurance; and answering common question associated with the surgical experience. Only one study, utilizing pain education was able to reduce postoperative pain.

- **Conclusions:** Preoperative education centered on a biomedical model of anatomy and pathoanatomy as well as procedural information has limited effect in reducing postoperative pain in orthopedics. Preoperative educational sessions that aim to increase patient knowledge of pain may be more effective in managing postoperative pain.
How does the General Population in the US view Lumbar Surgery?


- **Purpose/Hypothesis:** Studies have shown that poor lumbar surgery outcomes may be influenced by a person’s preconceived perceptions of low back surgery (LBS). However, the perceptions of the general population about issues related to lumbar surgery are not known. Therefore, the purpose of this study was to investigate the general population’s perceptions regarding LBS.

- **Number of Subjects:** This study included 262 participants (Average age: 46.1, SD=16.9; 125 Males, 137 Females) who completed the questionnaire from the general population in the Las Vegas area.

- **Materials/Methods:** Questionnaire development involved expert panel feedback from three physical therapists, three spine surgeons, two surgeon assistants/nurses, two researchers specializing in questionnaire design and two pain scientists. After revision and establishment of test-retest reliability, it was distributed at 12 grocery stores which were randomly selected from the Las Vegas area. The questionnaire consisted of demographic information, personal and family medical history, and 11 questions pertaining to perceptions of lumbar surgery.

- **Results:** Of the surveyed population, approximately a third believed that lumbar surgery is successful to the point that they would be able to return to their previous level of activity. Over half of the respondents agreed that they would be afraid to undergo back surgery. In addition, more than half belief that side effects are common and recovery from low back surgery is long. 76% of the respondents agreed that they would try all other means of treatment before opting for lower back surgery, yet 39% said they would undergo back surgery if they had severe low back pain.

- **Conclusions:** Our results show that the general population has a somewhat negative bias towards back surgery with the general view that LBS will result in a poor outcome, side effects, and protracted recovery. In addition, our results show that most people trust alternate means of treatment before surgery. Most of the participants are afraid to have surgery and are not confident in returning to work or participating in previous physical activities. They are also not sure whether or not lower back surgery is successful. A large majority would first attempt recovery through alternate means like physical therapy, medication, etc.
Enhancing the Brain: Can Beliefs Surrounding Surgery be Harnessed to Aid in the Recovery Process?


- **Background**: Sham or placebo surgery is quite rare. This systematic review was performed to evaluate the evidence for the effectiveness of sham surgery in orthopedics.

- **Methods**: Systematic searches were conducted on Biomed Central, BMJ.com, CINAHL, the Cochrane Library, NLM Central Gateway, OVID, ProQuest (Digital Dissertations), PsycInfo, PubMed/Medline, ScienceDirect and Web of Science. Secondary searching (Pearling) was undertaken, whereby reference lists of the selected articles were reviewed for additional references not identified in the primary search. Methodological quality was assessed by 2 reviewers using the Critical Review Form – Quantitative studies.

- **Results**: This review includes three RCT’s involving 163 subjects. All 3 papers were rated as very good. Heterogeneity across the studies, with respect to participants, interventions evaluated and outcome measures used, prevented meta-analyses. Narrative synthesis of results, based on effect size, demonstrated that sham surgery in orthopedics was as effective as actual surgery in reducing pain and improving disability.

- **Conclusions**: Although care should be taken to generalize findings from the small number of reported orthopedic surgery studies, which is limited in surgery-types, sham surgery has been shown to be just as effective as actual surgery in reducing pain and disability.
The Image of Pain: Can Viewing Images of Lumbar Surgery Increase a Stress Response in Patients scheduled for Lumbar Surgery?


- Preliminary date indicates negative effect of viewing currently produced operative images for Lumbar Surgery for both Internet and preoperative booklets in regards to:
  - Pain (NRS)
  - Catastrophization (PCS)
  - Fear Avoidance (FABQ)
  - Physical Movement (Trunk flexion and Straight Leg Raise)
  - Pressure Pain Thresholds
  - Attitudes and Beliefs regarding impending Lumbar Surgery
Development of a Preoperative Neuroscience Educational Program

Louw A, Diener I, Butler DS, Puentedura EJ. Development of a Preoperative Neuroscience Educational Program for Patients with Lumbar Radiculopathy - Accepted for Publication. American Journal of Physical Medicine & Rehabilitation July 2012

- **Objective:** Postoperative rehabilitation for lumbar radiculopathy has shown little effect in reducing pain and disability. Current preoperative education programs with a focus on a biomedical approach feature procedural and anatomical information, and these too have shown little effect on postoperative outcomes. The purpose of this study is to report on the development of a preoperative neuroscience education program for patients with lumbar radiculopathy.

- **Design:** This study aimed to utilize a recent systematic review of neuroscience education for musculoskeletal pain to develop an evidence-based educational program and booklet for patients undergoing lumbar surgery for radiculopathy. The systematic review produced evidence for neuroscience education as well as best-evidence synthesis of the content and delivery methods for neuroscience education for musculoskeletal pain. Evidence statements were extracted and developed into patient-centered messages and booklet. The draft of the booklet, content and images was evaluated by peer and patient review.

- **Results:** A neuroscience educational booklet and preoperative program was built around key messages from the systematic review aimed at reducing fear and anxiety prior to surgery and assist in developing realistic expectations regarding pain after surgery. Key topics include the decision to undergo surgery, pain processing, peripheral nerve sensitization, effect of anxiety and stress on pain, surgery and the nervous system and decreasing nerve sensitization.

- **Conclusions:** Feedback from the evaluations was favorable from all review groups, suggesting that this evidence-based neuroscience educational program may be ready for clinical application.
Does it Work?
Immediate Post-Education Effect of Preoperative Neuroscience Education for Lumbar Radiculopathy


- **Background:** A preoperative neuroscience educational tool (PNET) has been developed for patients with lumbar radiculopathy; however, any immediate effects on cognitions regarding pain, psychometric measures, beliefs regarding lumbar surgery and physical movements remain unknown.

- **Purpose:** To describe changes immediately following a preoperative therapeutic neuroscience education (TNE) session in patients scheduled for lumbar surgery for radiculopathy, as well as subsequent 1 and 3 month follow-up measurements after lumbar surgery.

- **Design:** Case series.

- **Patient Sample:** Ten patients (7 female; 47.7 years of age) scheduled for non-instrumented lumbar decompressive surgery for lumbar radiculopathy. The average duration of the patients’ leg pain was 7.2 months (range 2-23 months), average perceived leg pain intensity was 4.1 out of ten on a numeric rating scale (NRS), average Oswestry Disability Index (ODI) scores was 40.8% and average time to surgery was 9.5 days.

- **Outcome Measures:** Pre-education assessment consisted of self-report measures including pain ratings, pain catastrophization, fear avoidance, perceptions of the upcoming surgery (Likert Scale) and knowledge of pain. Physical measurements included active lumbar forward flexion, passive straight leg raise (SLR) on the involved leg and pressure pain thresholds in the low back, leg and upper extremity.

- **Methods:** All outcome measures were repeated after the 30 minute preoperative TNE session. All psychometric measurements and questions regarding surgery were repeated at 1 and 3 months after surgery.

- **Results:** Immediately following TNE, average pain catastrophization decreased by 6.5 points; SLR increased by 8.2 degrees and active forward flexion increased 4.5 cm. All beliefs regarding surgery shifted positively to reflect a more realistic expectation of surgery and outcomes. At one month post-operatively, all measures of back pain, leg pain, fear avoidance, pain catastrophization, pain knowledge and disability were significantly reduced and stayed intact 3 months postoperatively.

- **Conclusions:** This case series describes the immediate changes to cognitions regarding pain and surgery, as well as physical movement and nerve sensitivity. Although case series have significant limitation, including the fact that no cause-and-effect claims can be made, the physical changes observed after TNE in these patients could suggest an improvement in cognitive appraisal of the threat of the impending lumbar surgery. Further research is needed to determine if the immediate preoperative improvements associated with the PNET translate to superior postoperative outcomes following lumbar surgery for radiculopathy.
Does it Work?  

fMRI Changes After Preoperative Neuroscience Education for Lumbar Radiculopathy


- **Study Design:** Case report

- **Background:** Therapeutic neuroscience education (TNE) has been shown to be an effective intervention in the management of musculoskeletal pain conditions. It is postulated that TNE allows for a reconceptualization of a patient’s pain experience from one of pain signaling tissue injury/damage to pain signifying heightened sensitivity of the nervous system. The purpose of this case is to describe the observed changes in brain activation, as measured during functional MRI scanning, before and after the application of a pre-operative TNE session.

- **Case Description:** A 30-year-old female professional dancer with a 4-year history of chronic recurrent low back pain (LBP) and diagnosed L5/S1 disc herniation and L5 radiculopathy participated in a pre-operative neuroscience education session. She completed pre-education measures including: visual analog scale (VAS) for LBP and leg pain; Oswestry Disability Index (ODI); Fear Avoidance Beliefs Questionnaire (FABQ); Pain Catastrophizing Scale (PCS) and a series of Likert-scale questions on her beliefs and attitudes to lumbar surgery. Pre-education fMRI scans established baseline brain activation during a painful task (isometric trunk extension) and then, following a 30-minute TNE session, post-education measures and fMRI scanning was repeated.

- **Outcomes:** The patient’s ODI decreased by 10%, PCS decreased by 10 points and her beliefs and attitudes regarding impending lumbar surgery changed. Pain scores increased slightly but FABQ was unchanged. Physical tests improved with straight leg raise increasing by 7° and forward flexion in standing increasing by 8 cm. Brain activity following the TNE revealed 3 marked differences compared to pre-education scan including: deactivation of the periaqueductal gray area and cerebellum, and increased activation of the motor cortex.

- **Discussion:** This case report describes the observed effects of TNE on brain activation during a painful task in a patient scheduled for lumbar surgery for radiculopathy. Taken together with the observed changes in pre-education measures and physical tests, they may imply the importance of education in leading to immediate changes in cognitions, movement and beliefs regarding a patient’s perception of injury, treatment and potential recovery.

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Education is Therapy

Does it Work?
Multicenter Randomized Controlled Trial

Does it Work?
Multicenter Randomized Controlled Trial

- Louw A, Diener I, Butler DS, Puente
dura EJ, Landers MA. A Multicenter Randomized Controlled Trial of Preoperative Neuroscience Education for Lumbar Radiculopathy. In Preparation.

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Does it Work?
Multicenter Randomized Controlled Trial

Does it Work?
Multicenter Randomized Controlled Trial


In all categories measured, patients having received a preoperative neuroscience education program in conjunction with the surgeon’s preoperative education resulted in superior outcomes:

- Low Back Pain after surgery
- Leg Pain after surgery
- Function
- Fear of Work
- Fear of Physical Activities
- Pain Catastrophization
- Healthcare Utilization after surgery
- Self-reported return to regular activity
- Perceptions of the surgical experience, including:
  - Glad to have undergone Lumbar Surgery
  - Felt fully prepared for the surgery
  - Thinking preoperative education was beneficial and prepared them for surgery
  - Willingness to again undergo Lumbar Surgery
  - Surgery meeting their expectations

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How is this different than other approaches? Comparison of Biomedical Surgery Booklet and Neuroscience Education Booklet


- Content of YOUR BACK OPERATION compared to YOUR NERVES ARE HAVING BACK SURGERY by an international panel of pain scientists and health literacy specialists (n = 17) to highlight use of provocative words/language.

- Booklet A (Your Back Operation) resulted in nearly three times more provocative terms than Booklet B (Your Nerves Are Having Back Surgery). Booklet A (Your Back Operation) resulted an average of 67.23 terms per expert review, while booklet B (Your Nerves Are Having Back Surgery) resulted in an average of 22.64 provocative terms per expert review.