

Effects of neural mobilization augmented by traditional physical therapy on pain, functional disability and H-reflex in patients after lumbar laminectomy: a randomized controlled trial

March 19, 2019

Objective: The purpose of the study was to determine whether the addition of neural mobilization to a standard postoperative physical therapy program could improve the outcome of patients after lumbar laminectomy.

Design: Randomized controlled trial with blinded evaluators.

Setting: The study was conducted in outpatient physical therapy clinic.

There are fewer studies examining physical therapy programs for post-operative rehabilitation after lumbar surgery. The aim of the current study was to establish whether the addition of neural mobilization to a standard postoperative physical therapy program is valuable for patients who had undergone lumbar decompressive laminectomy.

Methods

Participants

Sixty patients of both sexes, aged from 35-50 years who underwent lumbar laminectomy of one or two levels shared in the study. They were recruited from the orthopedic surgery and neurosurgery departments, Cairo University hospitals. The purpose and procedures were explained to each patient before participation. A signed informed consent was taken from all patients who accept participation in the study. Approval of the Research Ethical Committee of the Faculty of Physical Therapy, Cairo University was obtained (P.T.REC/012/002241). This study followed the principles of Helsinki Declaration.

Exclusion criteria

- Patients who had arthritis in the joints of the lower limbs (which would limit walking).
- Patients who had tumors, fractures or infections of the spine.
- Patients who had diabetes mellitus.
- Patients who had polyneuropathy
- Patients who had evidence of spinal cord compression.
- Patients who had previous spinal surgery, spinal stability problems (e.g. spondilo-listhesis, spondilolysis).
- Patients who had sensory loss.

Participants were randomly assigned through computer-generated random numbers into two groups. The study group consisted of 30 patients (15 females and 15 males). Patients in this group received neural mobilization in addition to a selected physical therapy program. The control group consisted of 30 patients (12 females and 18 males) and treated with the same selected physical

therapy program only. The treatment started after four weeks postoperative.²¹ All patients received their treatment three sessions/week for six successive weeks.

Outcome measures

All measurements were conducted by examiners who were blinded to the patient's group. All patients were evaluated for; 1) Leg pain intensity: It was evaluated through visual analogue scale (VAS). VAS is a 10-cm line with a "0" at the left end for "no pain" and 10 at the right end for "worst possible pain", each patient was asked to indicate on the line where his pain is in relation to the two extremes by circling the number. 2) Functional ability: It was evaluated by Oswestery disability index (ODI). The ODI is a valid and reliable tool for assessment of functional ability.

3) Nerve root compression: It was assessed through assessment of latency of H-reflex of S₁. The participant was in prone-lying position. The active recording electrode was located on the soleus between the two heads of the gastrocnemius, while reference recording electrode was located on the Achilles tendon. The stimulation was applied at the midline in the popliteal fossa on the tibial nerve. The active stimulating electrode was closer to the spine. Stimulation was performed manually every 2 seconds (sec) with a stimulus duration of 0.5 or 1.0 msec. The intensity of stimulation was increased gradually and H-reflex & M-wave were watched. The latency is measured automatically by the device from the beginning of stimulation to the beginning of the initial deflection of the H-reflex. Assessment was conducted after surgery by four weeks before starting the study (initial evaluation) and repeated after treatment (post-treatment evaluation).

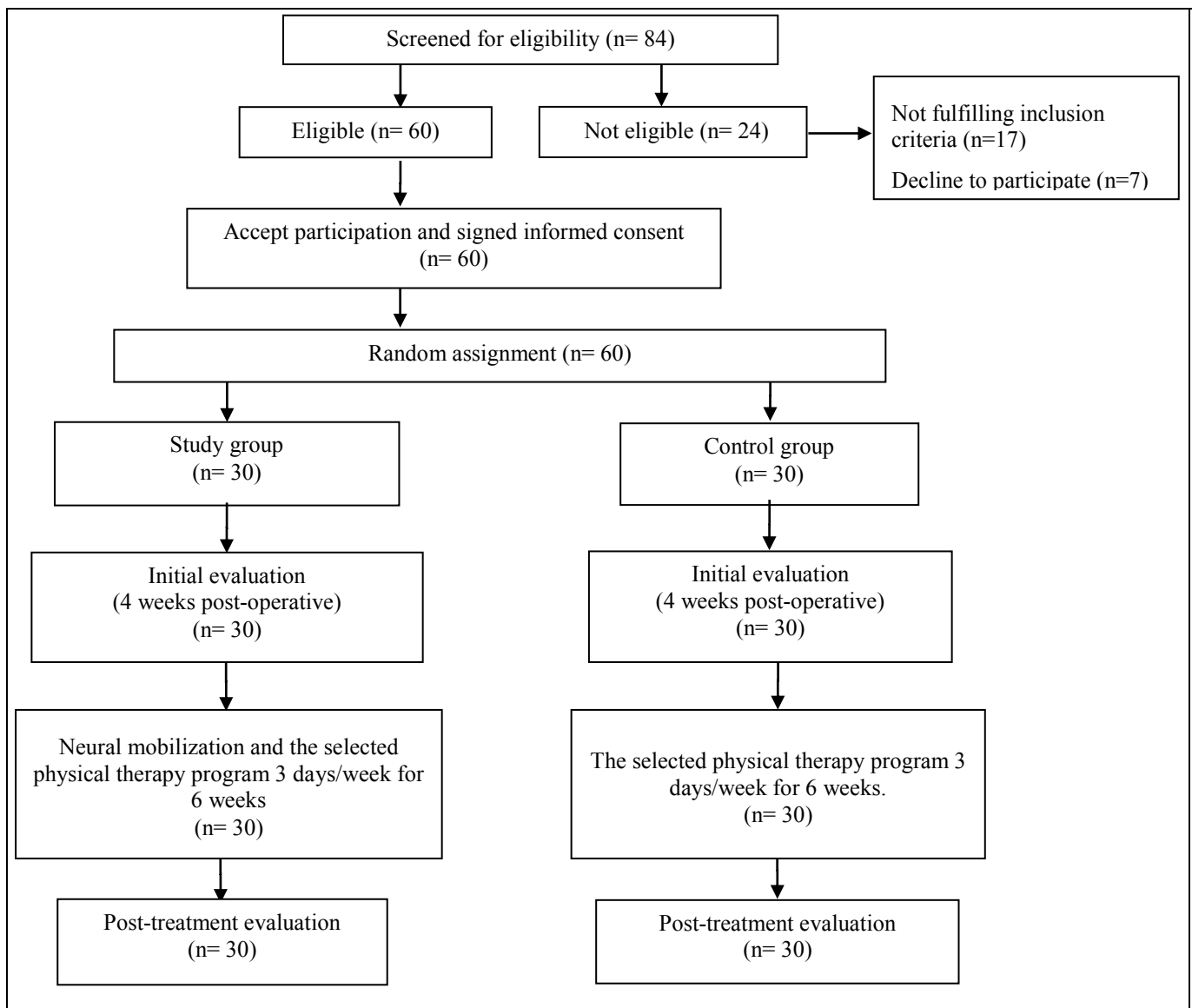


Figure 1: Flow chart of participants

Physical therapy intervention

Patients in the study group received neural mobilization in the form of straight leg raising (SLR) and dorsiflexion with two-ended slider that were designed to mobilize the neural tissues. Both groups received a selected physical therapy treatment which included TENS and dynamic back and abdominal exercises.

The neural mobilization was carried out in the steps described by Butler (1991) and Shacklock (2005). The patient was in supine lying position with symmetrical alignment of his body parts and no pillow under the head. The therapist was in stride-standing beside the patient's involved side with one hand under the patient's ankle, while the other hand placed above the patient's knee joint. The therapist began to elevate the affected lower limb in a standard straight leg raising (SLR) with full knee extension until there is back pain or pain referred to the leg. Then the

therapist lowered the patient's limb few degrees. Then the therapist grasped the patient's foot and gently made dorsiflexion oscillations. Oscillations were repeated 5 to 10 times and can be repeated for 5 sets with one to two minutes rest in between sets. The amplitude of the technique can be increased gradually according to the patient tolerance and response. This technique was repeated with increasing the tension on the sciatic nerve gradually through making variations of the lower limb position as: hip adduction and hip medial rotation. These procedures were performed 3 days/week for 6 successive weeks. The total time for applying this technique was about 10 to 15 minutes according to tolerability of the patient.

Two-ended slider was used before mobilizations and repeated after the mobilization. The two-ended slider was performed from side lying position on the non-painful side with his hips and knees flexed to about 45°. The neck is moved by the therapist into flexion and extension and the patient is asked to make bilateral active knee flexion during neck flexion and make bilateral active knee extension during neck extension. The two-ended slider was performed by the same procedure from sitting position (if this is more convenient for the patient). The two-ended slider was performed five sets of five repetitions with 20 to 30 seconds rest between sets (the total time for performing the two-ended slider was about 10 minutes).

The selected physiotherapy treatment consisted of transcutaneous electrical nerve stimulation (TENSs), pelvic tilt exercises, abdominal exercises, back exercises. For TENSs application, one electrode was located over the origin of the sacral plexus and the other was located distally over the nerve trunk. The following settings for TENS was used: pulse width 260 msec, pulse frequency 150 Hz, Amplitude (or intensity) always set for the patient's comfort level. TENSs was applied for 30 minutes.

The selected exercise program included:

1) Drawing-in exercises from crook lying position: the patient was asked to contract transversus abdominus muscle and maintain contraction for 5 seconds (sec) and 5 sec rest. This exercise was repeat 5 times.

2) Raising the head from crook lying position with hold this position for 5 sec and 5 sec rest. This exercise was repeat 5 times.

3) Bridging exercises from crook lying position: the patient was asked to raise his pelvis off the plinth with hold this position for 5 sec and 5 sec rest. This exercise was repeat 5 times.

4) Raising the head and chest from prone-lying position: the patient was asked to raise his head with hold this position for 5 sec and 5 sec rest. This exercise was repeat 5 times.

5) Abdominal draw-in with double knee to chest from crook lying position: this exercise was started in the 6th week post-surgery. The patient was asked to bring his knees to his chest with maintain abdominal draw in throughout the entire exercise with maintaining this position for 5 sec. This exercise was repeat 5 times with 5 sec rest in between.

6) Alternately raising one limb from quadruped position: this started at the 7th week post-surgery. From quadruped position with maintaining the head and back straight, the patient was instructed to raise one upper limb till horizontal level and hold this position for 5 seconds then return it. Then he was asked to repeat this with the other upper limb after 5 seconds of rest then return. After that, the patient was asked to repeat this with one lower limb, then with the other lower limb after 5 seconds of rest. This exercise was repeat 2 times.

7) Alternately raising two opposite limbs from quadruped position at the same time: this exercise was started at the 9th week post-surgery. From quadruped position with maintaining the head and back straight, the patient was instructed to raise both one upper limb with the opposite lower limb simultaneously till horizontal level and hold this position for 5 seconds then return them. Then, the patient was asked to repeat this with the other two limbs. This exercise was repeat 2 times.

Each the previous sets of exercises was done 5 sets with 30 seconds rest in between sets. During exercises, patients were instructed to keep normal respiration and avoid holding of breathing. The selected exercises was done for a total of 30 to 45 minutes according to the types of exercises given to the patient.

Effects of neural mobilization augmented by traditional physical therapy on pain, functional disability and H-reflex in patients after lumbar laminectomy: a randomized controlled trial

Statistical Analysis

March 19, 2019

Sample size

The sample size was calculated prior to the study. Calculation was performed using G*POWER statistical software [F tests- MANOVA: Repeated measures, within-between interaction, $\alpha=0.05$, $\beta=0.2$, effect size = 0.37] and revealed that the required sample was N=60.

Statistical analysis

All statistical analysis was out using the Statistical Package for Social Studies (SPSS) version 25 for windows (IBM SPSS, Chicago, IL, USA).

Descriptive statistics and t-test were conducted for comparison of subject characteristics between both groups.

Chi- squared test was used for comparison of sex distribution. Shapiro–Wilk test was used to explore the normality of data. Levene’s test was used to check the homogeneity between groups.

Mixed MANOVA was conducted to compare within and between groups effects on visual analogue scale (VAS), Oswestry Disability Index (ODI) and H-reflex latency. Post-hoc tests using the Bonferroni correction were performed for subsequent multiple comparison. The level of significance for all statistical tests was set at $p < 0.05$.