

Rehabilitation Treatment Protocol in Spinal Conditions

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Abstract

Introduction: The processes that determine low back pain have notable effects on health spending and occupational medicine. This is due to the fact that lumbar pain pathology is the main cause of disability in the working population under 45 years of age, and the third cause of physical deterioration in those over 45 years of age. The physiotherapeutic approach has proven to be a non-surgical intervention method, which provides great benefits for the prevention of patients diagnosed with lumbar disc herniation, spondylolysis and spondylolisthesis.

Objective: To establish the guide for the pre and post-operative rehabilitation treatment that will be applied to patients with spinal conditions: lumbar disc herniation, spondylolysis and spondylolisthesis.

Methods: An electronic and library search of national and foreign medical journals indexed in Scielo, Imbiomed, Pubmed, Web of Science, and Evidence-Based Physiotherapy (PEDro) that had been published for less than 5 years was carried out. The search strategy was developed in the period of July and September 2021.

Conclusion: The application of a rehabilitation protocol for patients in the pre and post-operative period of spinal disorders contributes to the improvement of the prognosis and quality of life of these patients. It is imperative to be able to find more effective and less expensive ways to include the person in their activities of daily life with the least functional limitation possible, to achieve greater success after surgery and reduce both hospital costs and rehabilitation time.

Keywords: Spinal Disorders; Physiotherapy; Lumbar Disc Herniation; Spondylolysis and Spondylolisthesis; Rehabilitation Treatment

Introduction

Since the beginning of written history, human beings have suffered from low back pain, which in the past was considered a curse. At present it is an international epidemic disease [1].

The processes that determine low back pain have notable effects on health spending and occupational medicine. This is due to the fact that lumbar pain pathology is the main cause of disability in the working population under 45 years of age, and the third cause of physical deterioration in those over 45 years of age [2].

Worldwide there is a large economic health expenditure for the treatment of people with low back pain, occupying an important place in the Gross Domestic Product (GDP).

Physiotherapy has proven to be useful in many pathologies, it can help reduce public health costs and can even avoid surgery [3].

Surgical techniques are not always convenient to perform, their use will depend on the type of hernia and the patient's conditions.

Disc herniation is defined as an injury to the intervertebral disc in which a prolapse of the nucleus pulposus occurs through the fibrous annulus which produces a neurological root compression picture which is clinically manifested by the presence of low back pain or sciatica.

Types of herniated disc:

- **Disc protrusion:** The nucleus pulposus exits, but it only partially injures the fibrous annulus forcing it to exert pressure against the posterior longitudinal vertebral ligament.
- **Disc extrusion:** Here the nucleus pulposus passes through the annulus fibrosus and the posterior longitudinal vertebral ligament.
- **Sequestered prolapse rupture** of the extruded disc material is evident, in some cases the free fragments may move towards the vertebral canal.

Classification

These are classified into central and lateral, according to the direction of the prolapse, either by the central portion of the medullary canal where the spinal cord is compressed, or by lateral prolapse, to the left or right of the medullary canal, where it is compressed an isolated nerve root. There is another classification that is based on the intervertebral space where, for example, hernias of the third, fourth and fifth lumbar space occur [4-9].

Spondylolysis and spondylolisthesis: They are two pathologies that are related to each other and most frequently affect the lower back [10].

These osteoarticular alterations involve both soft tissues and neurovascular bundles in different states and that these are directly related to each other, since the other can generally be triggered as a result of one.

Spondylolisthesis: Spondylolisthesis consists of a displacement of one vertebra over another, this being more common in L5 over S1 and especially in young people. As the vertebra slides forward, it is called "anterolisthesis" or backward "retrolisthesis". This is a condition with greater compromise since it leads to a decrease in the conjunction holes and the vertebral foramen, giving rise to radicular compression that is manifested by lumbo-sciatic pain.

Spondylolysis: Spondylolysis is a stress fracture of the lamina that connects the vertebral body to the facet joint. They usually occur generally at the level of the lumbosacral joint in the fifth lumbar vertebra, followed by the fourth lumbar vertebra, which is why it is defined as a defect in the pars interarticularis of the vertebral arch. Most cases of spondylolysis affect both vertebral pedicles (bilateral) 21.84% of the lesions are unilateral and seem to be related to asymmetric sports. The evolution of this fissure leads to a spondylolisthesis.

Surgical treatment in:

- **Children and adolescents:** It is indicated with slip greater than 50%. In lists greater than 75%, a previous reduction is practiced.

- **Adults:** Lack of pain relief is the most common reason for switching from medical treatment to surgical treatment. In Sciatica and Lumbociatalgia, the treatment regimen is basically the same as in pure low back pain, when the pain does not subside, it is changed from conservative to surgical treatment and, in this case, we make a clear difference between the adult under 40 years of age. and the oldest of this age. Surgical treatment prevails in patients under 40 years of age.

Etiology of spondylolysis:

- Isthmic rupture.
- Congenital defects in the area.
- Due to direct trauma.
- Due to excessive lumbar hyperlordosis.
- Due to the presence of sustained spinal flexion.
- By repetition of movements on the vertebral arch, which favors the appearance of a stress fracture.
- Due to muscular work overload.

Etiology of spondylolisthesis:

- Due to acute traumatic factors: Where traffic accidents and sudden movements stand out during combat sports such as judo and karate.
- Due to chronic traumatic factors: These are related to the repeated and frequent performance of movements of the spine during the activities of daily life, work and sports activities.
- Due to anatomical factors: Such as narrowing of the intervertebral disc, spina bifida and exaggeration of lumbar lordosis, the decrease in the vertical height of the vertebral body and the relaxation of the supporting ligaments and muscles (these factors favor the approximation of the lower lumbar vertebrae and the contact of the articular processes with the isthmus).
- Morphological factors: Such as congenital conditions, osteoarthritis and other degenerative diseases.
- Pathological factors: Such as oncological neoplastic processes, pedicle rupture and localized or generalized bone diseases.
- Contracture of the hamstring muscle group in children: These contractures produce an extension of the sacrum where the articular processes produce a shear on the isthmus of the 5th lumbar vertebra by the hyperextension mechanism described above.
- Loss of balance of the center of gravity in the sagittal plane: In this case, the line that transmits the weight of the body and that passes under normal conditions through the anterior border of the body of the 5th lumbar vertebra experiences a displacement due to anterior translation of the line which causes hyperextension of the lumbar spine to compensate for possible loss of body balance and reloading the L5 pars interarticularis with which would produce a fracture due to overexertion.

Classification according to the percentage or degree of displacement:

- Grade I: Displacement less than 25% of the anteroposterior diameter of the 1st sacral somatic segment.

- Grade II: Displacement between 25 and 50%.
- Grade III: Displacement between 50 and 75%.
- Degree VI: Displacement between 75 and 100%.
- Grade V: Displacement greater than 100%, the body of the 5th lumbar vertebra has lost all relationship with the body of the 1st sacral vertebra and slides along the anterior aspect of the sacrum (spondyloptosis) [11,12].

Objective of the Study

Establish guidelines for pre and post-operative rehabilitation treatment to be applied to patients with spinal conditions: lumbar disc herniation, Spondylolysis and Spondylolisthesis.

Methods

An electronic and library search of national and foreign medical journals indexed in Scielo, Imbiomed, Pubmed, Web of Science, and Evidence-Based Physiotherapy (PEDro) that had been published for less than 5 years was carried out. The search strategy was developed in the period of July and September 2021. For the search, the following keywords were used: Spinal conditions, Physiotherapy, Lumbar Disc Herniation, Spondylolysis and Spondylolisthesis, Rehabilitation treatment.

Developing

Protocol users:

- Specialist doctors: Physical medicine and rehabilitation, orthopedic.
- Consultant physicians: Internal medicine.
- Technician or graduate in physical medicine and rehabilitation.
- Nursing graduates.

Universe

It will be applied to all patients hospitalized in the spine service room who are going to receive this type of surgical treatment.

Origin of patients

The orthopedic and physiatrist, in a multidisciplinary team, will determine and select patients with a diagnosis of spinal pathology who are going to receive surgical treatment admitted to the orthopedic ward, with the criteria of a pre and post-operative rehabilitation program.

Inclusion criteria

Patient with clinical and radiological diagnosis of lumbar hernia, spondylolysis or spondylolisthesis

Exclusion criteria

Patient with multiple pathologies in other levels of the spine (other than lumbar disc herniation, spondylolysis or spondylolisthesis).

Resources to use

Human resources

- Specialist in orthopedics - traumatology.
- Medical specialist in physical medicine and rehabilitation.
- Technician and graduates in physical therapy and rehabilitation.
- Nursing graduates.

Material resources

- Stretcher or treatment bed
- Chair
- Adult parallel bars
- Analgesic and/or electromotive current generating equipment
- Vibrator
- Rollers
- Pillow
- Walker
- Foam wedges.

Consultation and evaluation

At the beginning of the rehabilitation process, the patient is evaluated by the multidisciplinary team that prepares the clinical history where the following data are collected:

- General data of the patient and the companion.
- Informed consent for the legal document.
- Preparation of clinical history.
- Date of admission to the institution.
- Consultation evaluation date: 4 - 7 days.
- Main clinical diagnosis.
- Main diagnosis of the disability for which it is rehabilitated.

- Other diagnoses of interest.
- History of the current disease.
- Positive data on questioning.
- Positive data on physical examination.
- Rehabilitating prognosis.
- Objectives of the rehabilitative treatment.
- Rehabilitation treatment guidelines.

Questionnaires

The Oswestry disability index (ODI), together with the Rolland Morris Disability Questionnaire (RMDQ), is the most widely used and recommended worldwide to measure disability due to low back pain.

The Oswestry low back pain disability scale is a self-administered questionnaire specific to low back pain that measures limitations in daily activities. The scale has 10 questions with 6 possible answers each. Each item is valued from 0 to 5, from least to greatest limitation. If the first option is marked, it is scored 0 and 5 if the one indicated is the last option. The total score, expressed as a percentage (from 0 to 100%).

The visual analog scale (VAS). The purpose is to provide a simple way of collecting subjective estimates of pain intensity.

Procedures

Preoperative: Functional rest of the posterior intervertebral and interapophysial joints of the lumbar spine in the Williams or fetal position. It is also possible to advocate for the immobilization of the lumbar spine by means of a lumbar girdle. The physiotherapist should educate and train the patient in postural hygiene and sanitary measures.

Physical agents

- Cryotherapy applying cold water bags or cryomassage using an ice cube and rotating rubbing movements for 10 minutes on the lumbar region.
- Local magnetotherapy with coplanar placement method or magnetic bed at the level of the lumbar region.
- Thermotherapy by superficial or deep heat. Using the infrared bulb lamp or the electromagnetic lamp at the level of the lumbar region with a distance of 60 cm for 10 minutes for the surface heat and the microwave diathermy for the deep heat.
- Light therapy. Low power infrared laser therapy with a pointer or using the shower mode at the level of the lumbar region.
- Low or medium frequency analgesic electrotherapy [13-15].
- Kinesiological treatment: Muscle relaxant massage for the lumbar paravertebral muscles in a possible state of nociceptive reflex contracture applying the friction, friction, kneading, vibration and sliding maneuvers of the fingers on the skin.

- Corrective, flexible and strengthening exercises according to the Williams method for the lumbar region. Complete performance of the Williams program exercises is not recommended, mainly those exercises that induce a flexor kinetic and postural pattern on the trunk, due to the worsening of the symptomatic picture by favoring the intensification of the posterior prolapse of the nucleus pulposus and the consequent Compressive phenomena of the same on the previously affected nerve roots. The foregoing is based on a biomechanical mechanism that explains the relationship between the flexor movement of the trunk and the kinetics of the nucleus pulposus.

Next, the exercises of the Williams program are described where the biomechanical mechanism explained above is revealed:

- a) Starting from the Williams position, lift both upper extremities of the table, and then bring the forehead to touch one knee, actively flexing the ipsilateral hip, the trunk, neck and head.
- b) Starting from the Williams position, with the hands clasped behind the neck, touch one knee with the opposite elbow.
- c) Starting from the Williams position, with the arms crossed on the chest, make as if you were going to sit down:
 1. Free and resisted active kinesiotherapy attending to the muscle note present for all the arches of movements belonging to the joints of the affected lower limb.
 2. Proprioceptive neuromuscular facilitation techniques. Basic procedures Hand contacts Traction and joint approximation. Stretching as a stimulus.

Mechanotherapy for lower limbs. Where the following devices will be used:

- a) Quadriceps bench using progressive resistance according to the Delorme method with the therapeutic purpose of potentiating the quadriceps femoris muscle in addition to increasing its trophism, tone and resistance.
- b) Inverted quadriceps bench with the therapeutic purpose of increasing the strength, tone, trophism and resistance of the hamstring muscle group.
- c) Kinetic pedal using progressive resistance to strengthen the dorsi flexor muscles, the extensors of the talocrural joint, as well as the supinator and tester muscles of the subtalar joint.

Postoperative treatment of herniated disc

The rehabilitation that begins after the surgical treatment of a herniated disc has the following purposes:

- Avoid complications
- Decrease inflammation
- Recover muscle tone
- Restore joint movement
- Recover function
- Achieve functional and aesthetic gait [16].

Regardless of the surgical technique used, the day after surgery the following are indicated:

- Postural treatment: Bloc decubitus changes and sleeping in the fetal position. Sitting and standing initially guided by the patient's orthopedic surgeon will be performed early.
- Breathing exercises.
- Isometric quadriceps and glute exercises every hour for 10 minutes.
- Free active exercises without causing pain in the upper limbs.
- Assisted active exercises of both lower limbs.
- We proceed to the re-education of the gait according to its phases, both inside and outside the parallel bars, keeping in mind the evolutionary stage of the patient.
- Williams exercises the same as the previous one.
- Use of physical agents if necessary according to the patient's symptoms. (Superficial or deep thermotherapy will never be used in the immediate postoperative period).

At hospital discharge, guidelines are recommended for the home:

- a) Avoid performing in terms of excess weight bearing with the upper limbs.
- b) Adopt suitable postures during the execution of activities of daily life.
- c) Alternate postures during compositions, preferably bipedal and sitting position.
- d) Do not expose yourself to long walks.
- e) In case of body overweight, reduce the weight will be directed.
- f) When reaching an object located on a surface, it is advisable to approach it first and then pick it up.
- g) To pick up an object on the floor, it is recommended to do a semi-squat with the knees or semi-flex the hips and knees, keeping the trunk aligned in the vertical.
- h) Trunk hyperextensions and abrupt rotations will be avoided.
- i) The trunk must always be kept in a posture aligned with its longitudinal or vertical axis during activities of daily life and work.
- j) It is advisable to perform the therapeutic exercises indicated in the treatment at least three times a week.
- k) Exercises that are not indicated in the treatment by medical prescription should not be performed.

Spondylolysis preoperative rehabilitation treatment

Functional rest of the vertebral lumbar region by immobilization with a modified Boston brace (antilordotic) of all the posterior intervertebral and interapophyseal joints of said affected region.

The patient will be advised not to carry out those physical activities that tend to favor the awakening of the painful condition, such as hyperextension of the vertebral spine.

Treatment by physical agents

Where we can apply cryotherapy either through cryomassage with an ice cube applying it to the lumbar region or water bags and cold water compresses for 10 minutes with a frequency of three times a day.

Sub acute phase

Treatment guidelines for physical agents:

- Local magnetotherapy with coplanar method at the level of the lumbar region.
- Thermotherapy by superficial heat. Using the infrared or electromagnetic heat lamp at a distance of 60 cm at the level of the lumbar region for 10 minutes.
- Low or medium frequency analgesic electrotherapy: Where we can use the TENS or Träbert current for the low frequency and the interferential current for the medium frequency with a bipolar application method and coplanar placement at the level of the lumbar region for 10 minutes.

Kinesiological treatment

Muscle relaxant massage for contracted lumbar paravertebral muscles applying the friction, friction, kneading, vibration and sliding maneuver of the fingers. This procedure will therapeutically favor the relaxation of these muscular structures that are usually in a state of defense contraction.

Progressive passive stretching exercises will be performed for the hamstring muscle group with the therapeutic purpose of reducing the contracture and restoring its length. Exercises will also be performed to strengthen the abdominal muscle group where the execution of trunk flexion and hip flexion with extended knee in the supine position will be avoided since both exercise modalities activate the concentric work of the coxofemoral flexor muscles, which can trigger Harmful disorders in the osteoarticular and ligamentous structures of the dorsolumbar and lumbar spine, which would intensify the underlying symptoms.

Preoperative rehabilitation treatment of spondylolisthesis

Acute phase: Functional rest of the posterior intervertebral and interapophyseal joints of the lumbar region by means of a desalinating lumbosacral brace.

Treatment guidelines for physical agents

Cryomassage will be applied using an ice cube where rotational movements will be made in the painful area for a period of 10 minutes.

The patient will be instructed not to expose himself to physical activities that may trigger the worsening of the existing symptoms.

Sub acute phase

Guidelines by physical agents

- Local magnetotherapy with coplanar placement method at the level of the lumbar region.

- Thermotherapy by superficial or deep heat Using the infrared bulb lamp or electromagnetic lamp for superficial heat, in addition to hot water bottles, pads or electric blankets among other modalities of this form of heat.
- Due to the deep heat we can use microwave diathermy or short wave diathermy.
- Low or medium frequency analgesic electrotherapy. Using the Träbert or TENS current for the low frequency and for the median the interferential current with bipolar application methodology and coplanar placement in the lumbar region for 10 minutes.

Kinesiology treatment guidelines:

- Gentle relaxing massage for the paravertebral muscles applying the maneuver of rubbing, friction, kneading, vibration and sliding of the fingers on the skin.
- Postural reeducation kinesiotherapy according to the Charriere method.
- Kinesiotherapy for the correction of lumbar hyperlordosis, according to the Charriere method.
- Kinesiotherapy for the strengthening of the lumbar paravertebral muscles, through the strengthening exercise program of the Williams method.
- Kinesiotherapy for the strengthening of the abdominal muscles by inhibiting the activity of the hip flexor muscles, through the protocol of strengthening exercises of the Charriere method.
- Other kinesic alternatives to achieve the strengthening of the abdominal muscle group is the application of analytical isometric contraction exercises or radiation exercises through voluntary isometric activity against manual resistance of the flexor muscles of the head and neck.
- Progressive active or passive stretching exercises for the hamstring muscles.

Postoperative treatment of spondylolysis and spondylolisthesis

Regardless of the surgical technique used, the day after surgery the following are indicated: breathing exercises, en bloc decubitus changes, isometric exercises for the quadriceps and glutes, free active exercises without causing pain in the upper limbs, and active quadriceps strengthening exercises.

Sitting, standing or ambulation will not be oriented until the surgeon guides it, not all cases require surgery. The decision of when to carry out the surgical procedure and which technique to use will be made solely by the orthopedic specialist.

Evaluation and control of the protocol

The evaluation and correction of the protocol will be carried out every 2.5 years.

Conclusion

The application of a rehabilitation protocol for patients in the pre and postoperative period of spinal disorders contributes to the improvement of the prognosis and quality of life of these patients. It is imperative to be able to find more effective and less expensive ways to include the person in their activities of daily life with the least functional limitation possible, to achieve greater success after surgery and reduce both hospital costs and rehabilitation time.

Conflict of Interests

The authors declare that they have no conflict of interest.

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