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# Rehabilitation of adolescent idiopathic scoliosis after corrective surgery: A case report

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***Abstract*---**A 18-year-old college student presented with a worsening back pain and difficulty to breath since 2 months before being referred. The result of the physical and radiological examination showed scoliosis s-shaped curve at thoracolumbar area. Surgical treatment was required to correct the scoliosis. The rehabilitation program after corrective surgery for spinal deformities had an important role in the advancement of therapy. Rehabilitation was needed to implement an adequate exercise program for different clinical conditions due to the complex anatomy and biomechanics of the spine.

***Keywords*---**adolescent idiopathic scoliosis, surgery, rehabilitation.

## Introduction

Scoliosis is a structural or postural deformity of the spine that results in a lateral (coronal) deviation or curve and is associated with rotation of the vertebral bodies that lie within that curve (Thomas & Wang, 2008). The Scoliosis Research Society defines a medically meaningful curve in the frontal plane (scoliosis) as any curve greater than or equal to 10º with or without rotation (Paul, 2010). The prevalence of scoliosis in the general population is 0.3%-15.3% (Kowalski & Protasiewicz, 2001). The prevalence of Adolescent idiopathic scoliosis (AIS) is 2-3% in children aged 10-16 years (Lenssinck et al., 2005). The prevalence rate of AIS in Surabaya, Indonesia is 2.93% and the 7° cut-off point of inclination angle is suitable for school-based screening (Komang-Agung et al., 2017).

The goal of scoliosis surgery is to straighten the vertebral alignment as far as possible with a safe procedure, balance the back and pelvis area and maintain

correction in the long term (Rullander et al., 2013). Indications for surgical therapy are: already wearing the brace correctly but the curve continues to grow, the curve is more than 40º and very progressive, severe pain associated with the scoliosis, psychological decompensation of the scoliosis, progressive thoracic lordosis and rib hump greater than 5 cm and curves are not balanced significantly (Calliet, 1980; Thamrinsyam, 2002, Cuccurullo et al., 2020). Pedicle screws and rods are routinely inserted in the vertebrae thoracic to lumbar in scoliosis reconstruction surgery to gain deformity correction and fusion (Irianto & Tumbelaka, 2020).

The main goal of a rehabilitation program after correction of a spinal deformity is to return the patient to full function as early as possible without compromising the integrity of the surgical intervention. General principles of postoperative rehabilitation should be applied by physiatrist to help restore patients to normal daily functioning of life. This includes prevention of secondary deformities (such as contractures due to decreased mobility), adaptation to activities of daily living when the patient has limited mobility or while wearing an orthosis, understanding the underlying pathological condition and its implications for function, and reconditioning the patient once the spine has stabilized. Rehabilitation programs include exercises that do not stress the healing area (Paul, 2010; Norbury et al., 2016).

**Case Description**

A 18-years-old female referred from Orthopedic ward with adolescent idiopathic scoliosis, preparing for correction surgery. Her chief complaint was pain on her left lower back since 2 months before being referred. The Wong-Baker faces pain rating scale was 4-5. Her mother noticed that she had a hump on her left lower back since a year ago. The patient also complained about difficult to breath and felt tired easily. From physical examination and supporting examination, she had a hump on her lower left back, paravertebral muscle spasm, decrease of chest expansion, decrease of trunk flexibility, and she was diagnosed with adolescent idiopathic scoliosis S-shaped curve thoracic right convexity T8-T12 apex T10, MOE 1, cobb's angle 42˚, lumbar left convexity L1-L5 apex L3, MOE 2, cobb's angle 45˚. Based on the complaints and severity of scoliosis and the consideration that the patient was at the end of her growth period, surgery was planned.

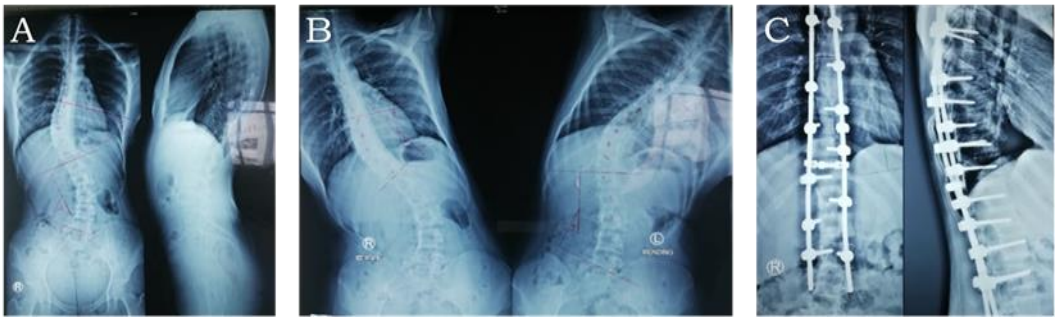


Figure 1. Radiological examination. A. Anteroposterior and lateral view B. Right and left bending C. After corrective surgery

Rehabilitation was started before the surgery. This preoperative period is also known as phase 1. Patient and family education is very important, which emphasizes the reason and purpose of surgery, as well as problems that may occur after surgery such as complications in the bowel-bladder system, unusual pain, feeling of thick and tingling in the legs, discharge from the wound and the occurrence of post operative fever. Many of the potential post operative frustrations at home can be avoided with preparations that were made beforehand. The bed should be at a height where the patient can log roll. Patients should use a bedroom on the ground floor (if available) and avoid climbing stairs for the first month of recovery. Healthy nutrition planning to help the healing process, planning for the bathroom (such as raising the toilet), planning activities and their modifications and maintaining environmental hygiene are important to do.

Scoliosis correction surgery was done with reduction pedicle screw at L3 and L1 and pedicle screw installment at the apex thoracal (Left VTh 9,10,11). After undergoing surgery, the patient enters the second phase, post operative active rest period, lasts from the first day to the sixth weeks post operative. The goal of the rehabilitation program in this phase is pain control and mobilization. The patient did proper positioning, turning/2 hours, doing active breathing exercise, active range of motion exercise at both extremities and abdominal drawing in exercise. Patient education was continued in this phase, especially about posture, principles of spinal protection and positions to avoid excessive stress on the spine. The patient should not bend over, lift heavy objects (> 8 pounds), and twist (twisting). The patient wore the spinal orthosis most of the day.

The next phase is maximum protection. This period lasts from 6-12 weeks postoperatively. During this period, exercises for spinal stabilization was performed only by moving the upper and lower limbs in a supine position, and should avoid excessive movement of the spine. Pelvic tilt exercises in the supine and standing positions began in this phase. Patient was able to return to a sedentary or desk job after 6 weeks. After 12 weeks, the duration of wearing the spinal orthosis was reduced gradually.

The fourth phase is minimal protection. This phase starts from 3-6 months postoperatively. The goal of this phase is to activate various muscle groups, starting from the deep muscles around the vertebrae through anatomical connections. Core muscle stabilization exercises and exercises of all types of kinetic chain are important during this period. Early-phase lumbar dynamic stabilization exercises were started because radiographic appearance of fusion formation. Exercises such as swimming and walking that cause most of the muscles to work simultaneously were also programmed. After 6 months, the patient was no longer wearing a spinal orthosis.

Phase fifth is dynamic phase. In this phase, complete fusion has occurred. This period lasts between 6 months-1 year postoperatively. Dynamic lumbar stabilization exercises in the supine, prone and standing positions were performed. Most of the activities the patient had been involved in before surgery can be resumed. However, the patient must be careful. Patients were advised not to do dance or gymnastics movements or to do them with modifications. High

impact activities such as rides, amusement parks, bungee jumping and full contact sports are best avoided. Patients were educated to strictly adhere to the principles of spinal protection.

Patient got pre and post surgery rehabilitation program consist of prescription of exercises, using of post surgery orthosis, modification of activities post surgery, posture correction and comprehensive education with the aim of returning to normal life well and quickly. The pain was reduced. The chest expansion and general physical endurance were improved. The patient followed rehabilitation program from pre surgery period until 7 months post surgery. Patient had good compliance so that each stage of the rehabilitation program could be done properly. The patient had returned to her activities as a college student without significant adaptation difficulties.

**Discussion**

The role of physical medicine and rehabilitation experts is very important in providing comprehensive management of adolescent idiopathic scoliosis patients undergoing corrective surgery. The process of osseointegration must be understood by the rehabilitation team because of the use of instruments and fusion in deformity surgery. The surgeon and the rehabilitation team must always work together and exchange information. Osseointegration is a direct functional and structural relationship between living bone tissue and load-bearing implant surfaces, where the process occurs without fibrosis and can be seen through an optical microscope. Osseointegration of the implant is complete when there is no movement between the implant and the bone in direct contact (Canbulat, 2014).

Osteogenesis occurs around the implant in the bone gap – the implant and new bone formed will surround the implant surface (peri-implant osteogenesis). Osteoblasts and mesenchymal cells migrate to the implant surface one day after implantation. Trabecular bone formation occurs within 10-14 days after implantation. Lamellar bone and woven bone were seen on titanium implants within 3 months after implantation. The remodeling process in the bone around the implant will continue for up to a year. The osseointegration process should be supported by a rehabilitation program. Instrumentation can be detached if an aggressive rehabilitation program is carried out before the osseointegration process is complete (Brånemark et al. 2001; Mavrogenis et al. 2009). Postoperative immobilization is necessary to keep the arthrodesis constant with the use of plaster cast or costum molded polypropylene body jackets. The use of thoracolumbosacral orthosis (TLSO) has advantages compared to plaster cast such as lighter weight, better cosmetically, and the patient can bathe. Braces or casts can be worn for 6 months to 1 year (Cailliet, 1980).

The core muscle stabilization exercise program aims to strengthen the inner muscles that function to stabilize the spine and lumbo-pelvis muscles. The muscles that are activated are the multifidus, transversus abdominus, internal oblique, paraspinal and pelvic floor muscles. The multifidus and transversus abdominus muscles are the most important to strengthen through this exercise. Stabilization of the lumbo-pelvic area is ideal, making the multifidus muscle get special attention because this muscle is important as a lumbar extensor and

stabilizer. The transverse abdomen contributes to spinal stabilization by working with the external and internal oblique muscles through the thoracolumbar fascia (McFarland, 2002; Canbulat, 2014).

The goal of core stabilization exercises is to strengthen key muscles and provide load transfer from the upper to lower body by forming a corset of muscles at the lumbopelvic junction. This transfer is carried out by the muscles of the body that have been strong which continues during activities such as standing, sitting, walking, body movement and carrying weights. Not only the waist area but also the pelvis, spine and shoulders should be trained together. Exercises such as swimming and walking that activate many parts of the body at the same time should be included in a rehabilitation program (Akuthota et al., 2014).

**Conclusion**

The role of physical medicine and rehabilitation specialists is very important in providing appropriate management of adolescent idiopathic scoliosis patients undergoing corrective surgery. Rehabilitation is carried out thoroughly starting from the preoperative phase to the postoperative phase. Rehabilitation is carried out specifically for each phase so that it can support healing and maintain the integration of surgical results.

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