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Adult Idiopathic Scoliosis: Correction or Not?

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ABSTRACT

Background: The author presents a view of adult idiopathic scoliosis (AIS), etiology, epidemiology, clinical and radiology assessment, conservative management and surgery, including the pitfalls that are often encountered. Although the author's experience in handling AIS is entirely new, given the desire to share the difficulties and obstacles encourage the author to publish the review. Aims: The author does not intend to teach but to share and start doing scoliosis surgery and should be studied properly.

Results: The success of surgery in these patients, the results were encouraging for both patient and doctor. Calculation of appropriate

corrections, outsmart wedge vertebra and hemivertebra, mounting screw with anatomy based on landmarks and straighten the curve of the spine is the most interesting part. If all can be done with either the patient can have a near normal curve and is free from the difficulty of expanding lung or neurological deficits.

Conclusions: Scoliosis correction should also be done by the neurosurgeon's spine because the cases are, very challenging and encouraging results so worth doing. Thorough knowledge of the anatomy of the spine landmarks and strict selection of cases as indicated would maximize the results of patient outcomes.

Keywords: Adult Idiopathic Scoliosis, Correction, neurosurgeon spine.

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INTRODUCTION

Scoliosis is not a disease but an abnormal form or structure or curvature of the spine. Scoliosis is the bending of the spinal axis to the lateral in the coronal plane of more than 10 degrees measured using the Cobb method.¹ Most common is the Adult Idiopathic Scoliosis (AIS). Approximately 2% of the population. The term idiopathic means a condition or disease with no known cause. Sign and symptoms consist of the bending of the spine, not symmetrical of the shoulder, not proportional waistline, one pelvis higher than other. Treatment of scoliosis is still challenging, especially for neurosurgeons, in Indonesia, still a few of us who are involved in its handling.²⁻⁴ Scoliosis is classified into 3 types based on the onset: children (0-3 y.o), adolescents (4-9 y.o), and adults (10 y.o to mature skeletally).⁵

The etiology is still in debate and scientists lately are thinking about innate factors that may affect the development of scoliosis. A delayed diagnosis can lead to severe spine curvature in the coronal and lateral plane, including the ribs, waist asymmetry, and imbalance of shoulder. Patients themselves feel uncomfortable regarding spinal pain and unexpected appearance. The risk of damage to the curve is usually the reason for the correction surgery. Conservative management mainly involves strengthening the muscles to postpone the curvature worsening or stop the process during the growth period and if possible, avoiding corrective surgery.⁶

ETIOLOGY

AIS has multi-factors etiology with bone growth contributes to its appearance and development of the spinal curve.⁶ Relative anterior spinal overgrowth (RASO) has been proposed as one of the main trigger factors in the development of AIS by several authors.^{7,8} Different growth velocity between the anterior and posterior spinal parts creates a side shear force so that there is a shift of the apical vertebra from the mid line resulting in changes in the costovertebral joints and the unique ribs.⁶ The influence of hereditary factors has been reported by other researchers; however, but its inheritance model is still unclear.⁹

EPIDEMIOLOGY

The AIS prevalence approximately between 0.9 - 12% of the population with a minimum 10% of patients are needed for care. Severe curve requires active intervention 7.2 times higher in women.¹⁰ For the curve more than 30 degrees, the ratio of women and men approaching 10: 1. Men are generally present at older ages (12-15 y.o) than women (11-14 y.o) and seemly have a more rigid curve.¹¹ Scoliosis severity also depends on the size of the curve and the appearance, including the remaining spinal growth. Skeletal maturity is usually assessed with Risser marks (radiographic measurements on the iliac growth plate apophysis), triradiate Tanner index, closure cartilage, and menarchal status.¹²⁻¹⁴

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CLINICAL AND RADIOLOGY ASSESSMENT

Scoliosis can be assessed by Adam's test in which the patient in an upright position shows a sharp spinal curve and the prominence of the ribs moment the patient bowed forward to 90° until it becomes horizontal.⁶ Conventional thoracolumbar X-ray is done for diagnostic, etiology and measurement using the Cobb Method, is the imaginary angle measured between the proximal superior and inferior surface of the vertebra that maximally tilted, thus determine the severity of scoliosis and progression of the angle.¹

CLASSIFICATION SYSTEM

The Scoliosis Research Society (SRS) proposed the Classification of Severity of Scoliotic Curvature Using the Cobb Angle. There are 7 groups Angle of Curvature, i.e., I 20°; II 21–30°; III 31–50°; IV 51–75°; V 76–100°; VI 101–125°; VII 125°.¹⁵ In 2001, Lenke proposed a classification for AIS consist of 6 types including thoracolumbar/lumbar curves, as Table 1 below.

CONSERVATIVE TREATMENT

Conservative treatment of scoliosis recommended the only use of a brace, while there is no evidence base on the effects of chiropractic, acupuncture,

osteopathic, electrical stimulation of scoliosis improvement. Mild curvature at 20 degrees or below will only need monitoring and observation. Meanwhile, greater than 20 degrees may require treatments, such as nonsurgical (brace for scoliosis) or surgical treatment (scoliosis surgery) to stop the developmental of the curvature^{2-4,6}

Bracing

The principle of using the brace is to install a supporter device outside the skin to inhibit the progression of scoliosis, delay surgical correction and trigger the improvement of anteroposterior spine growth. There are 3 types of bracing; 1. Milwaukee brace (Cervico-Thora-co-Lumbo-Sacral-Orthosis/CTLSO) for the apex of scoliosis above T8; 2. Thora-co-Lumbo-Sacral-Orthosis (TLSO-generally named Boston brace); 3. Charleston Bending Brace (Nightmare brace): a more optimal brace correction, specifically used at night and used for sleep.^{17,18} Indications of brace use generally in patients whose bone growth has not stopped or immature. Brace used on Cobb angle 25-45 degrees, can also for angles less than 25 degrees but progressive 5 degrees 6 months interval.¹⁹ Use of the optimal brace is recommended full time including during sleep, means only removed when cleaning the body. In the first 4-6 weeks, the use of the brace must be adjusted to the firmness and position of the padding and made a standing x-ray photograph. Adjustment is routinely done every 6 months along with x-ray photos. Brace is released gradually when bone growth has stopped or mature. Side effects that need to be explained when the use of a brace is the pain, itching, skin rash, pressure sore, difficulty in breathing, urinary disorders to psychological disorders.²⁰⁻²² Danielson et al., reported the use of a full-time brace that patients who did not use brace had a degree of curve progression at 6 degrees per year while zero degrees in patients who obeyed brace (16-year follow-up study).²³ In contrast, other reports mentioned similarity results between the use of a brace and the surgical correction that was finally performed.^{24,25}

SURGERY

The indication of surgery is intended for scoliosis with Cobb angle 50° or more in patients with mature growth with significant deformity, with or without associated pain or patients with Cobb angle below 50 degrees in non-mature patients, progressive thoracolumbar/lumbar curves produce sagittal imbalances, and the curves do not improve with a brace. The purpose of surgery is to correct the curve and ribs deformities, restores sagittal balance and

Table 1 Lenke Classification¹⁵

Curve Type	Curve Name
1	MT
2	Double Thoracic (DT)
3	Double Major (M)
4	Tripe Major (TM)
5	TL-L
6	TL/L-MT

Table 2 King Classification for Adolescent Idiopathic Scoliosis¹⁶

Type	Description
I	S-shaped curves of thoracic and lumbar curves cross mid-line. Lumbar curve is larger than the thoracic curve.
II	S-shaped curves of thoracic and lumbar curves cross mid-line. Thoracic curve is equal to or larger than the lumbar curve.
III	Single Thoracic curve and lower level not crossing mid line.
IV	Single long thoracic curve in which L5 is centered over the sacrum but L4 tilts into the long thoracic curve.
V	A double thoracic curve in which T1 is tilted into the convexity of the upper curve.

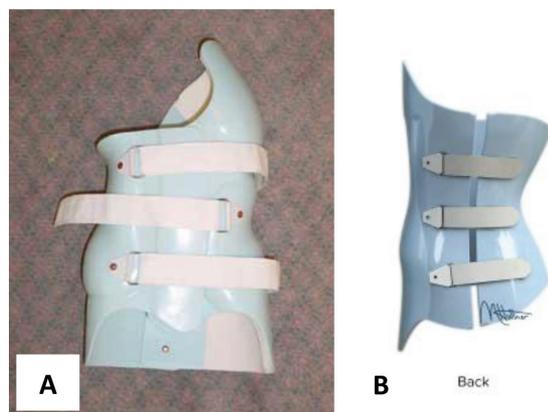


Figure 1 Types of Scoliosis Braces. (A) Charleston brace (B) Boston brace. (Available at <http://www.spine-health.com/conditions/scoliosis/types-scoliosis-braces>)

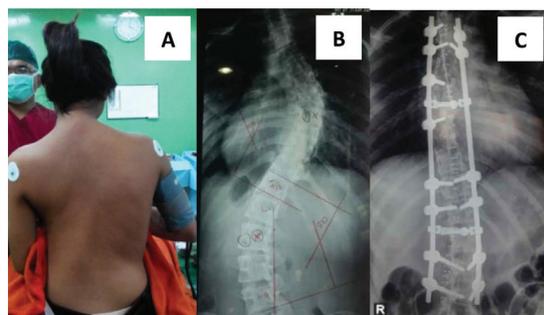


Figure 2 (A,B) Patient back view and plain X-ray of a female AIS patient shows a severe curvature producing right thoracic scoliosis, right shoulder elevation, scapula prominence and ribs adjacent to the convexity; (C) Instrumentation of thoracolumbar spine with fusion using pedicle screw-rod system and using autologous iliac graft with acceptable correction

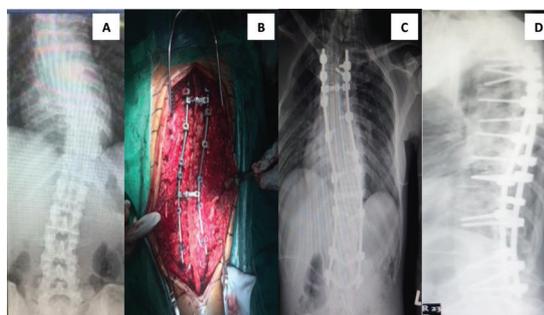


Figure 3 (A) Spinal plain x-ray of another AIS patient show scoliosis of right thoracic, ribs prominence adjacent to the convexity; (B) intraoperative view of scoliosis surgery; (C, D) postoperative radiograph views of pedicle screw-rod system

achieves stability throughout instrumentation. It should be safe with minimal complications to allow early mobilization and prevent complication, as well as improved lung function.²⁶⁻²⁸

ANTERIOR SURGICAL APPROACH

The advantages such as; segments infusion are not as much as the posterior approach; more mobile segments are preserved; reduce the risk of chronic pains and arthritis pain; cosmetically better. The main disadvantage of the anterior approach is difficult to do for thoracic scoliosis.¹⁵

POSTERIOR SURGICAL APPROACH

This approach was introduced by Hibbs and Albee, since then various instrumentation and systems are used with bone graft, among others; Harrington instrumentation, Luque rod instrumentation, Combination of Harri-Luque system, Wisconsin system, Derotation (CD/Cotrel-Dubouset) system, Texas-Scottish-Rite-Hospital (TSRH)-Colorado system, and Universal-Spine-System.²⁹⁻³⁷

In these approaches, subperiosteal is generally performed with lateral exposure to the transverse process and then the facet joint capsule is removed, the posterior decortication of the element to place the bone graft, sometimes spinous process is divided into two then cut on its base as an autologous bone graft material and then the instrumentation is positioned in such a way correction of deformity and sagittal balance correction. Pedicle subtraction osteotomy needs to be performed for deformity correction and sagittal balance.⁶

PITFALLS

Discectomy can be done for a better reduction effect also lead to a better fusion but sometimes too risky. The anterior columns are sometimes still growing compared to posterior columns that have been done fusion resulting in new scoliosis called crank shafting.¹⁵ Somewhat difficult when using a C-arm mounting screw for anatomical changes, preferably using only anatomical landmarks. Fusion levels are key to preventing decompensation, it should be taken into account which segments should be fused.¹² Distal fusion levels are very important based on which vertebra is stable.¹⁵

CONCLUSION

The cause of AIS is still debated, if diagnosed it is necessary to monitor and observation, the use of a brace and even correction surgery.^{2-4,15} Curve classification is required for proper management. Fusion must be selective at all times when it meets the

indications 15. Dealing with this deformity patient is a challenging and necessary job of carefulness so scoliosis deficiency, such as decompensation and worsening of the curve, can be avoided.¹⁵

CONFLICT OF INTEREST

The author declares there is no conflict of interest regarding publication of this manuscript and have got patient's permission in this article.

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