

**CASE REPORT**

**Early Experience in Surgical Treatment of Adolescence Idiopathic Scoliosis:  
A Report of Four Cases**

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**ABSTRACT**

Adolescent idiopathic scoliosis (AIS) is the most common spinal deformity among teenager. For those indicated, early surgical intervention allows better surgical correction due to flexibility of the spine during teenage years, hence good functional outcome and better cosmetic can be expected. In this case report, there is the management of four patients surgically using the posterior spinal instrumentation and fusion. Pre-operatively patients were examined at IIUM Medical Centre spine clinic, all necessary investigations were carried out. A thorough explanation was done to patient and parents regarding procedure, risk and benefit. All patients were treated using the same surgical technique. Neuromonitoring was used throughout the whole surgery until skin closure. All patients were hospitalized around one week. Post-operatively patients were followed up at two weeks, six weeks, three months, and every six months thereafter. It is important for clinicians to identify patients with AIS as early detection and timely treatment will change the natural history of curve progression. Surgical intervention when necessary will be easier and with less risk of complications when surgery was carried out during teenage years as the spine is more flexible and the deformity is less severe.

**INTRODUCTION**

Being described by Greek physicians as early as 460 – 370 BC by Hippocrates, scoliosis is a direct term for crookedness. Scoliosis is defined as a three-dimensional deformity of the spine where the lateral curvature in a coronal plane is more than 10 degrees<sup>1</sup>. Scoliosis is categorised

into three major types which are congenital which is caused by abnormally formed vertebra, syndromic which are part of certain associated disorders or idiopathic where the cause is not known. Idiopathic scoliosis can be further be divided into infantile affecting 0 – 3 years old, juvenile 4 – 10 years of age and adolescent, aged more than 10 years old<sup>1</sup>. Being the most common spinal deformity, adolescent idiopathic scoliosis (AIS) affects 0.47 to 5.2 % of children aged 10 – 16 years old<sup>2</sup>.

## CASE PRESENTATION

### First Case

A 16-year-old female initially presented to the hospital in 2016 with a complaint of back deformity. Her mother noticed the deformity incidentally when she was changing clothes and noticed a hump over her right upper back two years prior. Her Mother also noticed her left shoulder level was higher than her right. The right-sided hump deformity worsened over the period and she complained of occasional mild dull aching pain especially after standing for a long duration. Her pain was partially relieved by rest. The pain does not affect her

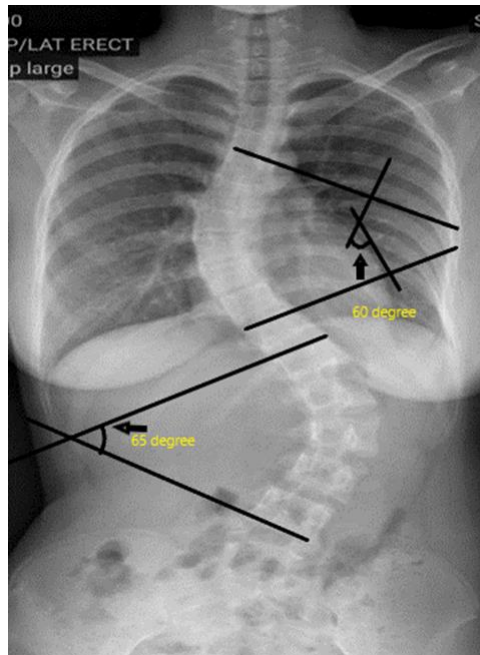
daily activity or sleep. She has no weakness or numbness. There was no history of bowel or bladder incontinence. She did not notice any skin changes. There was no history of shortness of breath or breathing difficulties. There was no history of trauma or fall. She does not have a complaint of headache, vomiting or seizure. There was no history to suggest an underlying infective cause. There is no similar complaint among family members, no family history of malignancy and no history of a tuberculosis contact. She attained menarche at the age of 14 with regular cycles of menstruation. Upon examination, she was tall with a height of 172 cm and well-nourished. Her vital signs were stable. There were no neurocutaneous stigmata, wasting of muscle, deformity of feet or toes to suggest neuromuscular disease. She was walking with a normal gait. On standing, her head and neck are tilted to the right side. There was no tenderness or swelling over the cervical region. Posteriorly there was the prominence of a right scapular region with left shoulder slightly elevated compared to the right. There was an obvious right-sided thoracic hump which appears more prominent on the Adams forward bending test. There were left-sided thoracic crease and right lumbar crease (Figure 1).



**Figure 1** Pre-operatively note the patient left-sided thoracic crease. There was no midline skin defect such as hairy patch, dimples or naevi. Her shoulder was asymmetrical causing cosmetic issues

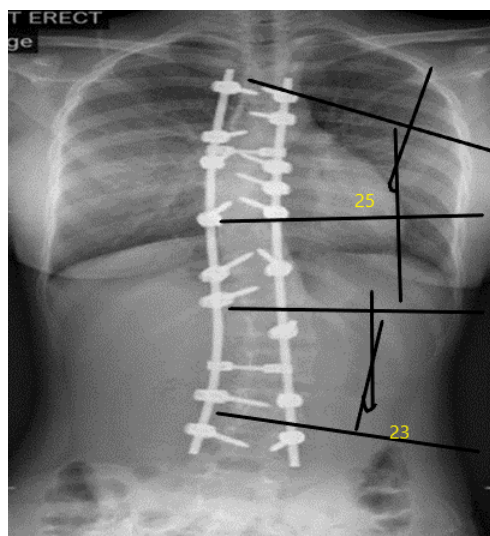
There was no midline skin defect such as hairy patch, dimples or naevi. Her right hip was tilted to the right side. There was no local rise in temperature, tenderness or paravertebral muscle spasm. Cervical, thoracic and lumbar spine motions were normal. Powers of upper and lower limbs were 5/5, the sensation was intact, and reflexes were normal. There was no

limb length discrepancy. Examination of other systems was grossly normal. The routine blood investigation was performed which revealed normal full blood count, coagulation studies, renal and liver profile. The thoracic and lumbar Cobb's angle measured on neutral AP position was 60 degrees and 65 degrees respectively (Figure 2).



**Figure 2** Pre-operative X-ray in one of our patients with thoracic and lumbar Cobb's angle measurement of 60 and 65 degrees respectively

She had successfully undergone posterior spinal instrumentation and post-operative correction for thoracic and lumbar percentage is 64% and 58% (Figure 3, Tables 1 and 2).



**Figure 3** In the same patient, post-operative X-ray showed deformity correction of thoracic and lumbar Cobb's angle of 64% and 58% respectively

**Table 1** Correction of thoracic cobbs angle curvature

Thoracic	Pre-operative	Post-operative	Improvement in lateral curvature (%)
Patient 1	60	25	64
Patient 2	64	24	65
Patient 3	63	28	55
Patient 4	57	19	67

**Table 2** Correction of lumbar cobbs angle curvature

Lumbar	Pre-operative	Post-operative	Improvement in lateral curvature (%)
Patient 1	65	23	58
Patient 2	33	3	90
Patient 3	30	12	60
Patient 4	10	3	70

Good cosmetic results achieved after the operation (Figure 4). Currently, she is comfortable and living an active lifestyle.



**Figure 4** Post-operatively good cosmetic results achieved with surgical correction

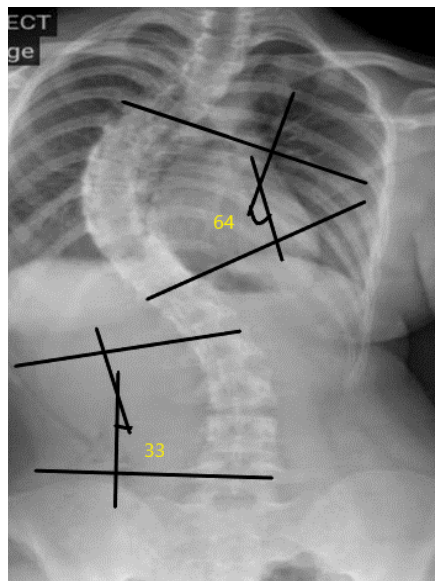
**Second Case**

A 15-year-old female initially presented our centre with an incidental finding of scoliosis during follow up at a community clinic at 13-year-old. In the next 3 years, the scoliosis degree becoming more deformed thus causing her to have back discomfort. It was not associated with neurological problems. There are no skin changes, and she is very active in school. There was no history of trauma headache vomiting and seizure. There was no

family history of malignancy or tuberculosis contact. Attained menarche at the age of 12-year-old she has a regular cycle every month. Upon examination, she is a moderate build girl. Her vital signs were stable. There were no neurocutaneous stigmata, wasting of muscle, deformity of feet or toes to suggest neuromuscular disease. She was walking with a normal gait. There was no tenderness or swelling over the cervical region. Posteriorly there was the prominence of a right scapular region with left shoulder slightly elevated

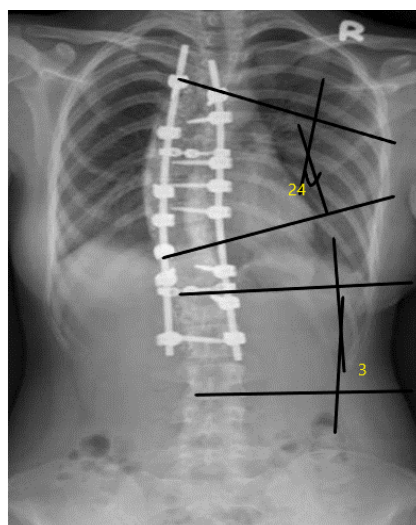
compared to the right. There was an obvious right-sided thoracic hump which appears more prominent on the Adams forward bending test. There was no thoracic crease and lumbar crease. There was no midline skin defect such as hairy patch, dimples or naevi. Her right hip was tilted to the right side. There was a normal motion of the spine with minimal limitations. Powers of upper

and lower limbs were 5/5, the sensation was intact, and reflexes were normal. There was no limb length discrepancy. Examination of other systems was grossly normal. The routine blood investigation was performed which revealed normal full blood count, coagulation studies, renal and liver profile. The thoracic and lumbar Cobb's angle measured on neutral AP position was 64 degrees and 33 degrees respectively (Figure 5).



**Figure 5** Pre-operative X-ray with thoracic and lumbar Cobb's angle measurement of 64 and 33 degrees respectively

She had successfully undergone posterior spinal instrumentation and post-operative correction for thoracic and lumbar percentage is 65% and 90% (Figure 6).



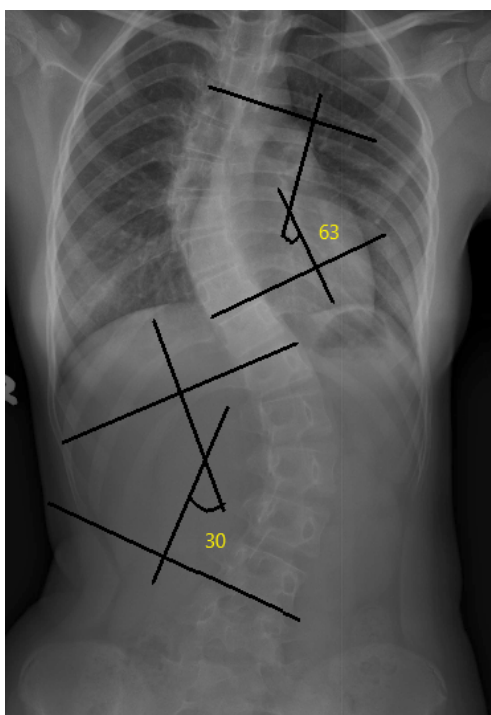
**Figure 6** In the same patient, post-operative X-ray showed deformity correction of thoracic and lumbar Cobb's angle of 65% and 90% respectively

The operation was uneventful and she recovered well from the operation.

### Third Case

A 25-year-old female defaulted her orthopaedic follow up during her teenage years. Initially diagnosed with scoliosis at 15-year-old. She presented to us at 24 years old due to cosmetic issues. She did not complain of weakness and her urinary and bowel function is normal. There are no skin changes. There was no history of trauma headache vomiting and seizure. There was no family history of malignancy or tuberculosis contact. Attained menarche at the age of 13-year-old she has a regular cycle every month. Upon examination, she is a moderate build woman. Her vital signs were stable. There were no neurocutaneous stigmata, wasting of muscle, deformity of feet or toes to suggest neuromuscular disease. She

was walking with a normal gait. There was no tenderness or swelling over the cervical region. The right shoulder was grossly elevated compared to the left. There was an obvious right-sided thoracic hump which appears more prominent on the Adams forward bending test. There is a prominent thoracic crease. There was no midline skin defect such as hairy patch, dimples or naevi. Her right hip was tilted to the left side. There was a normal motion of the spine with minimal limitations. Powers of upper and lower limbs were 5/5, the sensation was intact, and reflexes were normal. There was no limb length discrepancy. Examination of other systems was grossly normal. The routine blood investigation was performed which revealed normal full blood count, coagulation studies, renal and liver profile. The thoracic and lumbar Cobb's angle measured on neutral AP position was 63 degrees and 30 degrees respectively (Figure 7).



**Figure 7** Pre-operative X-ray of the patient with thoracic and lumbar Cobb's angle measurement of 63 and 30 degrees respectively

She had successfully undergone posterior spinal instrumentation and post-operative correction for thoracic and lumbar percentage is 55% and 60% (figure 8)

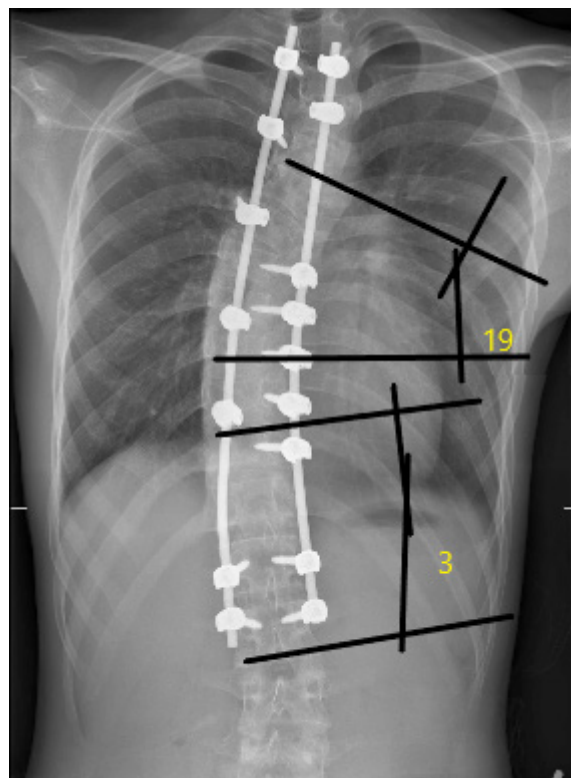
X-rays showed deformity correction of thoracic and lumbar Cobb's angle of 55% and 60% respectively.

The operation was complicated with surgical site infection and she was treated with antibiotics and recovered well from the operation.

#### Fourth Case

A 20-year-old male presented at our clinic when her mother noticed her son hump is becoming more prominent at 18-year-old. She detected the problems when he is 14 years old. There was no history of trauma, malignancy, tuberculosis contact or skin disease. Upon examination, he is a well-built man. His vital signs were stable. There were no neurocutaneous stigmata, wasting of muscle, deformity of feet or toes to suggest neuromuscular disease. He was walking with a normal gait. There was no tenderness or swelling over the cervical region. Posteriorly

there was the prominence of the left scapular region with left shoulder slightly elevated compared to the right. There was an obvious left-sided thoracic hump which appears more prominent on the Adams forward bending test. There was no thoracic crease and lumbar crease. There was no midline skin defect such as hairy patch, dimples or naevi. his right hip was tilted to the left side. There was a normal motion of the spine with minimal limitations. Powers of upper and lower limbs were 5/5, the sensation was intact, and reflexes were normal. There was no limb length discrepancy. Examination of other systems was grossly normal. The routine blood investigation was performed which revealed normal full blood count, coagulation studies, renal and liver profile. The thoracic and lumbar Cobb's angle measured on neutral AP position was 57 degrees and 10 degrees respectively (Tables 1 and 2). He had successfully undergone posterior spinal instrumentation and post-operative correction for thoracic and lumbar percentage is 67% and 70% respectively (Figure 8).



**Figure 8** Post-operative X-ray showed deformity correction of thoracic and lumbar Cobb's angle of 67% and 70% respectively

## DISCUSSION

The prevalence of gender are equal in the small curve but an increase in female prevalence with larger and progressive curves<sup>3</sup>. The natural course of scoliosis was demonstrated in a study where thoracic curves more than 50 degrees progressed at around 1 degree a year, thoracolumbar curves progressed at 0.5 degrees a year and lumbar curves 0.24 degrees a year while thoracic curves less than 30 degrees was found not to progress<sup>4</sup>. The exact pathogenesis of scoliosis is not known but several abnormalities have been identified as associated factors such as genetics, growth of the skeletal system, metabolism of bone, metabolic pathways, biomechanics, central nervous system and others<sup>5</sup>. Most of the patients with AIS are asymptomatic and are detected during screening exams. Those that seek treatment usually presents with unequal shoulder levels, waistline asymmetry or rib prominence, which are typically identified by close ones. Back pain is a common complaint affecting 26 – 51% of patients<sup>6</sup>. The severity of pain was found to have a direct association with the degree of curvature and lumbar curves significantly more painful than thoracic curves. It is reported that back pain in scoliosis is primarily discogenic in nature but several other factors such as facet joint arthritis, degenerative disc disease, spinal stenosis, nerve root entrapment and muscular causes do contribute to the pain<sup>6</sup>. Physical examination should be thorough to look for neurocutaneous stigmata's that may point to other cause of scoliosis such as café au lait spots in neurofibromatosis, hairy patch or dimples in spinal dysraphism and hyperlaxity in Marfan syndrome. Maturity of the patient is assessed using the Tanner stage to determine remaining skeletal growth. Adam's forward bending test is performed to assess the degree of rotational deformity and rule out postural scoliosis followed by a detailed neurological examination. Asymmetrical reflex including abdominal reflex could point towards an intraspinal disorder<sup>7</sup>.

Cobb angle is attained by identifying the angle formed between the intersection of lines perpendicular to tangential lines along superior endplate of the superior-end vertebra and the inferior endplate of the inferior end vertebra. The lateral bending view is important as preoperative evaluation to identify flexible curves. Magnetic resonance imaging is done selectively in presence of left thoracic curve, atypical pain, early-onset scoliosis, thoracic kyphosis greater than 40 degrees or abnormal neurological finding which may identify the presence of tumours or lesions such as syrinx and Arnold-Chiari malformations<sup>8</sup>. Skeletal age using Risser score of iliac apophysis ossification should be done to estimate the curve progression.

Management of AIS primarily involves observation, bracing or surgery. Observation combined with physiotherapy is advocated for mild deformity where Cobb angle is less than 25 degrees<sup>9</sup>. Bracing is advocated for skeletally immature adolescents with Cobb angle of 25 – 40 degrees and goal is to prevent progression of the curve that may require surgery. Milwaukee brace also is known as cervical-thoraco-lumbo-sacral orthosis (CTLSSO) can be used in high thoracic and cervicothoracic scoliosis with success rate of up to 77 per cent<sup>10</sup>. Others include thoraco-lumbo-sacral orthoses (TLSO), soft braces and night time braces with varying success rate. Eventually, up to 10 per cent of patients with adolescent idiopathic scoliosis will require surgical consideration<sup>11</sup>. The general objective of surgery is to halt progression, achieve three-dimensional correction of spinal curvature, relieve pain or functional disability due to curvature and correct unacceptable cosmetic problems. Surgery is advocated for Cobb angles more than 30-60 degrees in thoracolumbar region and the thoracic region at end of growth. Posterior instrumentation is the mainstay surgery of most idiopathic curves as done in our patient. Anterior instrumentation is used mainly for thoracolumbar and lumbar curves however



is related to disadvantages such as implant breakage, pseudarthrosis, unfavourable scar and effect on lung function<sup>12</sup>.

## CONCLUSION

Average operating time was 6 to 8 hours. Estimated blood loss ranges from 800 ml to 1.8 L. All our patient received at least one pint of packed cell intra-operatively. One patient developed a superficial surgical site infection over the proximal wound area but treated successively without complication with oral antibiotics for two weeks. All our patient recovered well. In conclusion, early detection and surgical intervention when indicated for adolescent idiopathic scoliosis will yield good outcome and satisfactory correction can be achieved.

## ACKNOWLEDGEMENTS

We would like to acknowledge the patients involved in this study for the cooperation given

## CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this case.

## CONSENTS

Written informed consent was obtained from the patient to publish the case with its related pictures. A copy of the written consent is available for review by the Chief Editor.

## REFERENCES

1. Pasha S, Hassanzadeh P, Ecker M, Ho V. (2019). A hierarchical classification of adolescent idiopathic scoliosis: Identifying the distinguishing features in 3D spinal deformities. *PLoS One* 14 (3): e0213406.
2. Fadzan M, Bettany-Saltikov J. (2017). Etiological Theories of Adolescent Idiopathic Scoliosis: Past and Present. *Open Orthopaedics Journal* 11: 1466 – 1489.
3. Pesenti S, Jouve JL, Morin C et al. (2015). Evolution of adolescent idiopathic scoliosis: Results of a multicenter study at 20 years' follow-up, *Orthopaedics & Traumatology: Surgery & Research* 101 (5): 402 – 405.
4. Choudhry MN, Ahmad Z, Verma R, (2016), Adolescent Idiopathic Scoliosis. *Open Orthopaedics Journal* 10: 143 – 154.
5. Grauers A, Einarsdottir E, Gerdhem P. (2016). Genetics and pathogenesis of idiopathic scoliosis. *Scoliosis Spinal Disorder* 11: 45.
6. Thérout J, Le May S, Fortin C, Labelle H. (2015). Prevalence and management of back pain in adolescent idiopathic scoliosis patients: A retrospective study. *Pain Res Management* 20 (3): 153 – 157.
7. Persson-Bunke M, Czuba T, Hägglund G, Rodby-Bousquet E. (2015). Psychometric evaluation of spinal assessment methods to screen for scoliosis in children and adolescents with cerebral palsy. *BMC Musculoskeletal Disorder* 16: 351.
8. Heemskerk JL, Kruyt MC, Colo D et al. (2018). Prevalence and risk factors for neural axis anomalies in idiopathic scoliosis: a systematic review. *The Spine Journal* 18 (7): 1261 – 1271.
9. Schreiber S, Parent EC, Moez EK et al. (2015). The effect of Schroth exercises added to the standard of care on the quality of life and muscle endurance in adolescents with idiopathic scoliosis—an assessor and statistician blinded randomized controlled trial: “SOSORT 2015 Award Winner.” *Scoliosis* 10 (1): 24.
10. Cheng JC. (2015). “Adolescent Idiopathic Scoliosis.” *Nature Reviews Disease Primers* 1: 15030.
11. de Mauroy JC, Lecante C, Barral F, Pourret S. (2016). Bracing in adult with scoliosis: experience in diagnosis and classification from a 15 year prospective study of 739 patients. *Scoliosis and Spinal Disorders* 11 (2): 29.
12. Vavruch L, Brink RC, Malmqvist M et al. (2019). Surgical Outcomes of Anterior Versus Posterior Fusion in Lenke Type 1 Adolescent Idiopathic Scoliosis. *Spine* 44 (14): 823 – 832.

