

Functional outcome in severe idiopathic scoliosis patients treated operatively with posterior stabilization (Cantilever Bending Technique) at Sardjito General Hospital

Yudha Mathan Sakti, Ronald Iskandar, Rahadyan Magetsari, Tedjo Rukmoyo, Reza Muttaqin

ABSTRACT

Aims: Severe and rigid scoliosis is difficult to treat. It requires extensive surgical intervention, which cause many clinical and neurological complications. Single-stage operation in rigid scoliosis will decrease morbidity in patients. The aim of this study was to evaluate radiological, clinical, and functional outcome patients with severe and rigid scoliosis treated with a single-stage operation. **Methods:** This was a descriptive analytical study was conducted in patients with scoliosis treated operatively with posterior stabilization (cantilever bending technique) that came to Orthopaedic and Traumatology department of Sardjito Hospital from January 2015 – December 2016. Data measured were radiologic parameter (Cobb Angel), enhancement body height and the functional outcome were measured by radiologic parameter (Cobb Angel) and non-radiologic parameter as Barthel Index, Instrumental Activities of Daily Living (IADL), Rosenberg Self-Esteem Scale. **Results:** There were 7 eligible subjects aged 13–18 years old, 6 were females. We performed single-staged operation in the operating theatre setting 37–520 reduction Cobb angle and 5–13 cm body height enhancement were achieved. There were

statistically significant differences functional outcome pre-operative and post-operative treatment ($P < 0.001$). One of the patient suffer from pulmonary problem requiring pulmonary support in the ICU. **Conclusion:** This study showed that single-stage operation with Cantilever technique was beneficial, important, complex and need team approach for the treatment of in severe and rigid scoliosis. The patient had better functional outcome post operatively based on radiologic and non-radiologic parameter.

Keywords: Cantilever technique, Functional outcome, Severe scoliosis

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INTRODUCTION

Adolescent idiopathic scoliosis is a structural 3-dimensional deformity of the spine and trunk that occurs in otherwise healthy children aged 10-18 years old. This is the most common form of scoliosis [1]. Historically, Cobb angle more than 50° is the indication for surgery, but this limit of Cobb angle varies greatly

within the surgical community. Severe rigid idiopathic scoliosis is described as <25 % of correction on lateral bending films and major curve over 90 [2].

The management of severe rigid deformities has always been a major challenge to spine surgeons. There is a high risk of permanent or transient neurologic injury in the surgical correction for severe rigid scoliosis. Usually the spine surgeon use conventional staged surgery that performed first stage procedure anterior release then second stage posterior spinal fusion and instrumentation [3]. In recent years, posterior vertebra collum resection is used to treat severe and rigid scoliosis, and a correction rate of 51% to 59% can be achieved [4].

Single-stage operation in rigid scoliosis will decrease morbidity in patients The cantilever bending technique provides powerful corrective forces for overcoming the rigidity of the deformity and with this technique will decrease the need for anterior release procedures. There are some significant psychological consequences in treating patient with idiopathic adolescent scoliosis. Adolescence patients need some degree of adaptation when they had a chronic illness because of their sensitive phase of person's development [1].

The purposes of this study was to evaluate radiological, clinical, and functional outcome patients with severe and rigid scoliosis in Sardjito General Hospital treated with a single-stage operation with Cantilever operation technique.

MATERIALS AND METHODS

This was a descriptive analytical study was conducted in patients with scoliosis were treated with operatively with posterior stabilization (cantilever bending technique) that came to Orthopaedic and Traumatology department of Sardjito Hospital from January 2015 – December 2016. Data measured were radiologic parameter (Cobb Angel), enhancement body height and functional outcome were measured by and non-radiologic parameter as Barthel Index (Figure 1) [5], Instrumental Activities of Daily Living (IADL) (Figure 2) [6], Rosenberg Self-Esteem Scale (Table 1) [7].

Cobb angle was used in this study to quantify the magnitude of spinal deformities. It was used as a standard measurement to determine and track the progression of scoliosis. To evaluate the Cobb angle, first we decided which vertebrae were the end-vertebrae of the curve deformity (vertebrae at the upper and lower limits of the curve) and the Cobb angle was defined by the intersection of the two lines (line that parallel to the end plate of the superior end vertebrae and another line that parallel to the endplate of the inferior end vertebrae). Severe and rigid scoliosis was defined if the patient has Cobb angle more than 70 degrees.

Table 1: Rosenberg Self-Esteem Scale [7]

Circle one response for each of the following ten items					
		Strongly Agree	Agree	Disagree	Strongly Disagree
1	I feel that I am a person of worth, at least on an equal basis with others	1	2	3	4
2	I feel that I have a number of good qualities	1	2	3	4
3	All in all, I am inclined to feel that I am a failure	1	2	3	4
4	I am able to do things as well as most other people	1	2	3	4
5	I feel I do not have much to be proud of	1	2	3	4
6	I take a positive attitude toward myself	1	2	3	4
7	On the whole, I am satisfied with myself	1	2	3	4
8	I wish I could have more respect for myself	1	2	3	4
9	I certainly feel useless at times	1	2	3	4
10	At times I think I am no good at all	1	2	3	4

RESULTS

There were seven eligible subjects from January 2015 – December 2016. Six females aged 13–18 years old, one male aged 14 years old (Figures 3–9). We performed single-staged operation in the operating theatre setting. Cobb angle decrease from 85° to 35°, 75° to 35°, 72° to 25°, 82° to 30°, 98° to 47° and 82° to 45°. Increasing body height with result 145 cm to 150 cm, 150 cm to 154 cm,

149 cm to 151 cm, 145 cm to 150 cm, 147 cm to 153 cm, 126 cm to 139 cm, 142 cm to 147 cm, with mean increase about 2–6 cm post operatively. There were statistically significant differences functional outcome in Barthel Index, Activities of Daily Living and Rosenberg Self-Esteem Scale pre-operative and post-operative treatment using paired T-test (P<0.001) (Figures 10–12). Only one patient seems not require ICU treatment. Despite this successful outcome, one of the patient suffered from

Barthel Index of Activities of Daily Living

Instructions: Choose the scoring point for the statement that most closely corresponds to the patient's current level of ability for each of the following 10 items. Record actual, not potential, functioning. Information can be obtained from the patient's self-report, from a separate party who is familiar with the patient's abilities (such as a relative), or from observation. Refer to the Guidelines section on the following page for detailed information on scoring and interpretation.

The Barthel Index

- | | |
|--|---|
| <p>Bowels
0 = incontinent (or needs to be given enemas)
1 = occasional accident (once/week)
2 = continent
Patient's Score: _____</p> <p>Bladder
0 = incontinent, or catheterized and unable to manage
1 = occasional accident (max. once per 24 hours)
2 = continent (for over 7 days)
Patient's Score: _____</p> <p>Grooming
0 = needs help with personal care
1 = independent face/hair/teeth/shaving (implements provided)
Patient's Score: _____</p> <p>Toilet use
0 = dependent
1 = needs some help, but can do something alone
2 = independent (on and off, dressing, wiping)
Patient's Score: _____</p> <p>Feeding
0 = unable
1 = needs help cutting, spreading butter, etc.
2 = independent (food provided within reach)
Patient's Score: _____</p> | <p>Transfer
0 = unable – no sitting balance
1 = major help (one or two people, physical), can sit
2 = minor help (verbal or physical)
3 = independent
Patient's Score: _____</p> <p>Mobility
0 = immobile
1 = wheelchair independent, including corners, etc.
2 = walks with help of one person (verbal or physical)
3 = independent (but may use any aid, e.g., stick)
Patient's Score: _____</p> <p>Dressing
0 = dependent
1 = needs help, but can do about half unaided
2 = independent (including buttons, zips, laces, etc.)
Patient's Score: _____</p> <p>Stairs
0 = unable
1 = needs help (verbal, physical, carrying aid)
2 = independent up and down
Patient's Score: _____</p> <p>Bathing
0 = dependent
1 = independent (or in shower)
Patient's Score: _____</p> <p>Total Score: _____</p> |
|--|---|

(Collin et al., 1988)

Figure 1: Barthel index [5].

The Lawton Instrumental Activities of Daily Living Scale

- | | |
|---|---|
| <p>A. Ability to Use Telephone
1. Operates telephone on own initiative; looks up and dials numbers..... 1
2. Dials a few well-known numbers..... 1
3. Answers telephone, but does not dial..... 1
4. Does not use telephone at all..... 0</p> <p>B. Shopping
1. Takes care of all shopping needs independently..... 1
2. Shops independently for small purchases..... 0
3. Needs to be accompanied on any shopping trip..... 0
4. Completely unable to shop..... 0</p> <p>C. Food Preparation
1. Plans, prepares, and serves adequate meals independently..... 1
2. Prepares adequate meals if supplied with ingredients..... 0
3. Heats and serves prepared meals or prepares meals but does not maintain adequate diet..... 0
4. Needs to have meals prepared and served..... 0</p> <p>D. Housekeeping
1. Maintains house alone with occasion assistance (heavy work)..... 1
2. Performs light daily tasks such as dishwashing, bed making..... 1
3. Performs light daily tasks, but cannot maintain acceptable level of cleanliness..... 1
4. Needs help with all home maintenance tasks..... 1
5. Does not participate in any housekeeping tasks..... 0</p> | <p>E. Laundry
1. Does personal laundry completely..... 1
2. Launders small items, rinses socks, stockings, etc..... 1
3. All laundry must be done by others..... 0</p> <p>F. Mode of Transportation
1. Travels independently on public transportation or drives own car..... 1
2. Arranges own travel via taxi, but does not otherwise use public transportation..... 1
3. Travels on public transportation when assisted or accompanied by another..... 1
4. Travel limited to taxi or automobile with assistance of another..... 0
5. Does not travel at all..... 0</p> <p>G. Responsibility for Own Medications
1. Is responsible for taking medication in correct dosages at correct time..... 1
2. Takes responsibility if medication is prepared in advance in separate dosages..... 0
3. Is not capable of dispensing own medication..... 0</p> <p>H. Ability to Handle Finances
1. Manages financial matters independently (budgets, writes checks, pays rent and bills, goes to bank); collects and keeps track of income..... 1
2. Manages day-to-day purchases, but needs help with banking, major purchases, etc..... 1
3. Incapable of handling money..... 0</p> |
|---|---|

Figure 2: Instrumental activities of daily living (IADL) [6].

pulmonary problem requiring respiratory and pulmonary support in the ICU. This patient was discharged 26 days after operation. Seven other patient were discharged in 2 until 4 days post operation.

DISCUSSION

According to Silva et al, severe rigid idiopathic scoliosis is described as <25 % of correction on lateral bending films and major curve over 90 [2]. Only one of

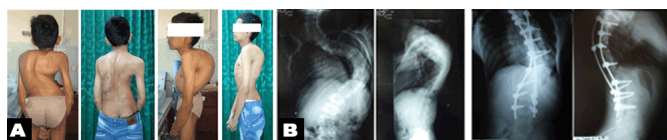


Figure 3(A and B): First patient case presentation: clinical picture (A) and X-ray (B) pre- and post-operative.



Figure 4(A and B): Second patient case presentation: clinical picture (A) and X-ray (B) pre- and post-operative.

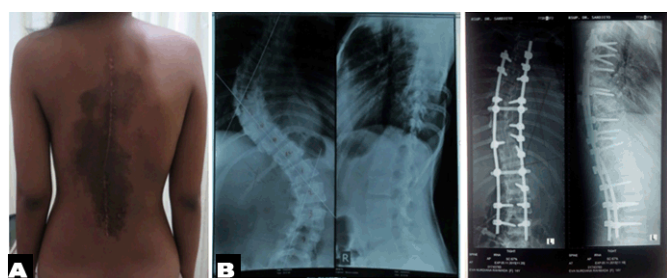


Figure 5(A and B): Third patient case presentation: clinical picture post-operative (A) and X-ray (B) pre- and post-operative.

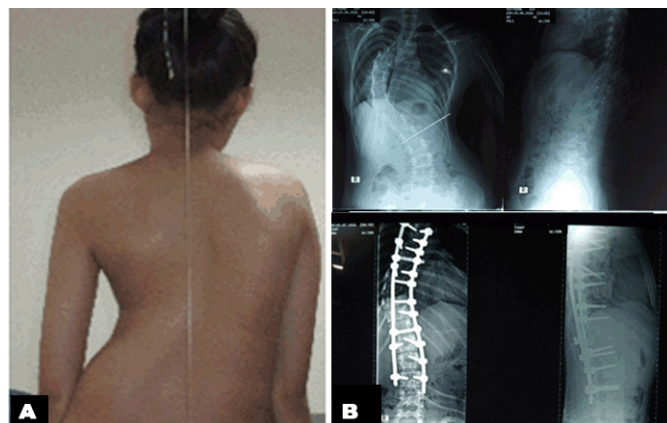


Figure 6(A and B): Fourth patient case presentation: clinical picture pre-operative (A) and X-ray (B) pre- and post-operative.

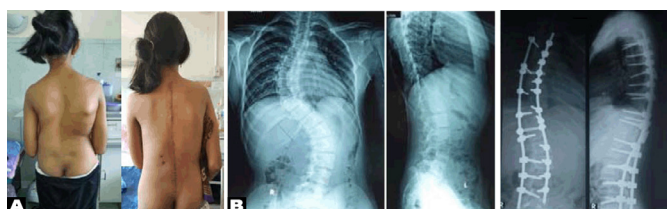


Figure 7: Fifth patient case presentation: clinical picture (A) and X-ray (B) pre- and post-operative.

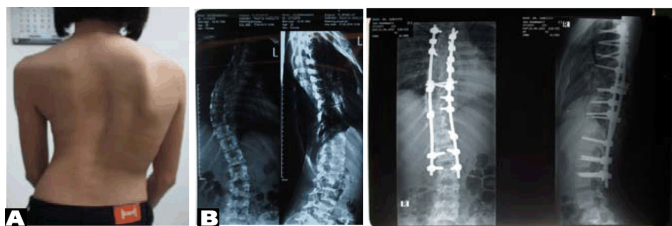


Figure 8(A and B): Sixth patient case presentation: clinical picture pre-operative (A) and X-ray (B) pre- and post-operative.

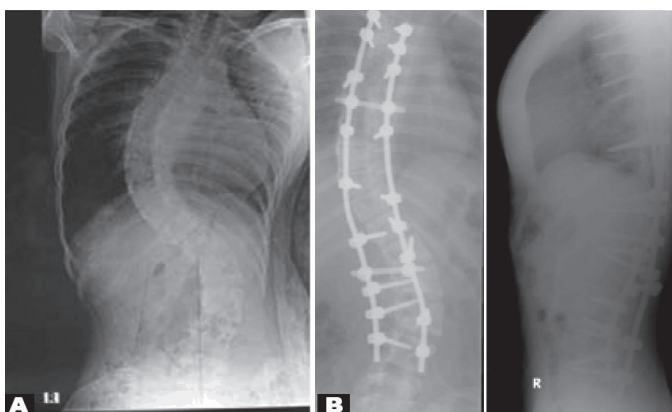


Figure 9(A and B): Seventh patient case presentation: X-ray pre- (A) and post-operative (B).

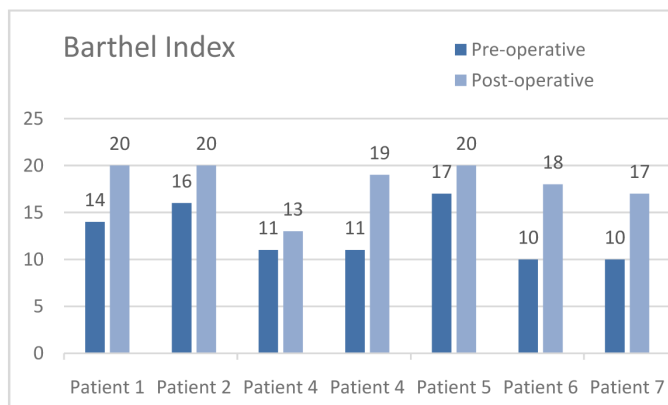


Figure 10: Barthel index result.

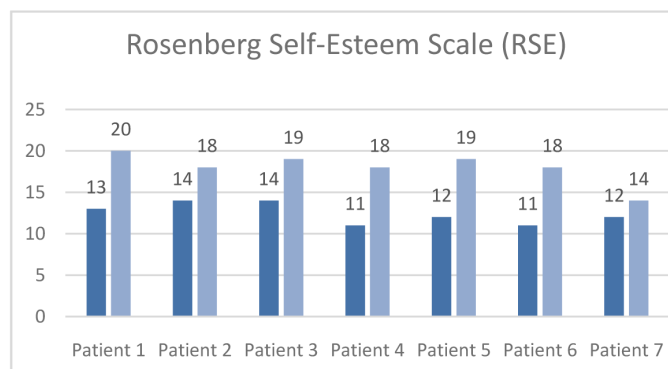


Figure 11: Instrumental activities of daily living (IADL) result.

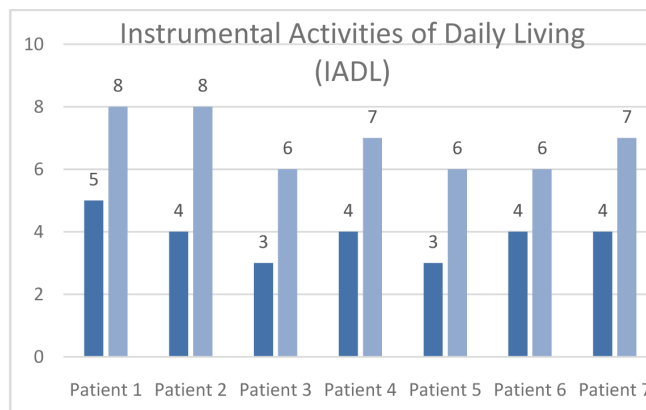


Figure 12: Rosenberg self-esteem scale result.

our patients have Cobb angle > 90°, the chief complain was asymmetrical shoulder with moderate pain.

The therapeutic of scoliosis is influenced by many factors, such as the age, type and severity of deformity, spine flexibility, and combined other deformities. Severe scoliosis is more difficult to treat than usual ones. It is difficult to complete the correction, and the probability of nerve deficit increases. The operation is of relatively high risk, because it is usually combined with heart or lung dysfunctions [3]. In our patient, there was no pulmonary problem preoperatively in all of them.

The treatment of severe and rigid scoliosis brings great challenge to surgeons, and various kinds of correction methods are developed. Shen et al. published a series of 24 patients operated with anterior release and posterior hooks and pedicle screws, with a preoperative Cobb angle of 98.8° and a Cobb angle of 68.0° on preoperative bending films, they achieved a final curve correction of 58.6% [8]. Watanabe et al reported total of 21 scoliosis patients with ≥100° curves use perioperative halo-gravity traction before underwent spinal instrumentated fusion. He reported 27.5% correction of the major curve Cobb angle with preoperative traction and 37.2% correction with staged traction after anterior release [9]. Suk et al. reported a series of 16 patients with severe scoliosis treated with posterior vertebra collum resection. The preoperative average major curve of 109 was corrected to 45.6, showing a 59% of scoliosis correction [10].

In our study we did the posterior approach only with Cantilever bending technique without anterior release. The Cantilever method has some biomechanical advantages with powerful correctives for the rigidity of the deformity so we can avoid performing anterior release procedure. [11]. The major indication for additional anterior release was large (70°) and rigid curvature (30% compensation on lateral -bending radiographs). The anterior release procedure is often used to lessen the rigidity of the deformity and to improve the correctability of the spine with Cantilever technique we achieve correction 30° until 50° and the functional outcome were good.

CONCLUSION

This study showed that single-stage operation with Cantilever technique was beneficial, important, complex, and need team approach for the treatment in severe and rigid scoliosis. The functional outcome of patient with idiopathic scoliosis treat operatively with posterior stabilization by Cantilever operation technique in Sardjito hospital is good based on Cobb Angle, Barthel Index, Instrumental Activities of Daily Living (IADL), Rosenberg Self-Esteem (RSE) Scale and body height evaluation.

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Author Contributions

Yudha Mathan Sakti – Substantial contributions to conception and design, Analysis and interpretation of data, Drafting the article, Final approval of the version to be published

Ronald Iskandar – Substantial contributions to conception and design, Analysis and interpretation of data, Drafting the article, Final approval of the version to be published

Rahadyan Magetsari – Substantial contributions to conception and design, Analysis and interpretation of data, Drafting the article, Final approval of the version to be published

Tedjo Rukmoyo – Substantial contributions to conception and design, Analysis and interpretation of data, Drafting the article, Final approval of the version to be published

Reza Muttaqien – Substantial contributions to conception and design, Analysis and interpretation of data, Drafting the article, Final approval of the version to be published

Guarantor of Submission

The corresponding author is the guarantor of submission.

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Consent Statement

Written informed consent was obtained from the patient for publication of this study.

Conflict of Interest

Authors declare no conflict of interest.

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