

The Novel Assessment Tool for Scoring of Functional Outcomes after Surgical Release in Congenital Muscular Torticollis

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ABSTRACT

Objective: Congenital muscular torticollis, characterized by unilateral shortening of the sternocleidomastoid muscle that results in the head tilting towards the affected side, is the third most common musculoskeletal anomaly. Subjective assessment using the Lee scoring system has been the most common method for evaluating the surgical outcomes. The aim of this study was to investigate the efficacy of a novel assessment tool for scoring of functional outcomes after surgical release in congenital muscular torticollis.

Methods: This study enrolled the patients aged 5-15 years who were diagnosed with congenital muscular torticollis and treated by surgical release at the Department of Orthopaedic Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand during 1998-2011. An image processing program was used to measure all evaluated parameters. Craniofacial asymmetry, neck rotation deficits, neck flexion/extension deficits, and degree of head-tilting were graded as poor, fair, good, or excellent by 2 observers. The results of the Lee scoring system and the new scoring system were then compared.

Results: Nineteen patients (7 males, 12 females) with a mean age of 7.2 ± 2.57 years were included. Photographs of the patients were evaluated and categorized by outcome score using both outcome scoring systems. All intraclass correlation coefficients were higher than 0.6 for both scoring systems, which suggests good inter-operator reliability ($p < 0.05$). Percentage agreement was higher in the new system than in the Lee system (63.16% vs. 52.63%, respectively).

Conclusion: The new outcome scoring system which focuses on functional outcomes after surgical release was found to be less subjective and more reliable than the Lee scoring system.

Keywords: Thailand; novel assessment tool; scoring; functional outcome; surgical release; congenital muscular torticollis (Siriraj Med J 2018;70: 272-277)

INTRODUCTION

The word *torticollis* is derived from two Latin words. The word *tortus* means crooked or twisted, and the word *collum* means neck.¹ Congenital muscular torticollis is the third most common musculoskeletal anomaly.² The overall incidence of this disorder ranges from 0.3% to 1.9%.³ The shortening of the sternocleidomastoid muscle

results in the head being tilted towards the affected side, while the face and chin are pulled or rotated to the opposite side.⁴ Patients normally present with a palpable mass in the sternocleidomastoid muscle (SCM) on the affected side. Non-operative treatment is the gold standard treatment for patients less than 1 year of age, with treatment consisting of physical therapy and orthosis.

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Operative treatment is indicated in neglected cases, and in cases with residual deformity after physical therapy. The surgical techniques are bipolar or unipolar release and subperiosteal lengthening. The optimal surgical window is between 1 and 4 years of age. The surgical outcome is less predictable after 4 years of age, with permanent craniofacial deformity developing in some cases.⁵

The Lee scoring system⁶ and the modified Lee scoring system⁷ are both currently used to evaluate surgical outcome in congenital muscular torticollis. These systems are both based on subjective evaluation of functional and cosmetic outcomes. However and until now, no scoring system has been introduced that facilitates the objective evaluation of surgical outcome in patients with congenital muscular torticollis.

Accordingly, the aim of this study was to investigate the efficacy of a novel assessment tool for scoring functional outcome of surgical release in congenital muscular torticollis.

MATERIALS AND METHODS

This study enrolled and evaluated pediatric patients aged 5-15 years that were diagnosed with congenital muscular torticollis and treated by surgical release at the Department of Orthopaedic Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand during the 1998 to 2011 study period. Siriraj Hospital is Thailand's largest national tertiary referral center. Patients who had undergone previous neck surgery, and those who were diagnosed with congenital muscular torticollis caused by other syndromes were excluded. This study was approved by the Siriraj Institutional Review Board (Si 049/2013).

Patient data were obtained either from direct contact with our patients at our outpatient follow-up clinic or via post/email. Patients that we could not communicate with person-to-person were asked to take photographs of themselves in 9 different views/positions, including (1) front view, (2) neck flexion, (3) neck extension, (4) head tilted left, (5) head tilted right, (6) head rotated to the left from anterior view and (7) lateral view, and (8) head rotated to the right from anterior view and (9) lateral view (Fig 1).

ImageJ® image processing program (National Institutes of Health, Bethesda, MD, USA) was used to measure each parameter

For neck flexion and extension angles, we measured from the lateral view. The angle between a vertical line perpendicular to the ground and a line drawn from the vertex of the head (longitudinal axis) to the middle part of the neck in the flexion and extension positions was evaluated (Fig 2). For head-tilt angle, we measured from the anteroposterior (AP) view with the head tilted left and right. The angle between a line drawn as a longitudinal axis of the face and a vertical line perpendicular to the ground was evaluated (Fig 3). For neck rotation, we measured from the AP view. The distance from the tip of the chin to the tip of the acromion on each side was evaluated (Fig 4). A full frontal facial view was used to evaluate the facial area. The area at the lower half of face between the lines drawn from the tip of the nose to the tip of the chin, and to the lateral edge of each side of the face was evaluated (Fig 5).

After all parameters were evaluated, we compared head-tilt, neck rotation, and facial area data between sides, and calculated the deformity as a percentage compared to the normal side. For neck flexion and extension angles,



Fig 1. Nine photos of each patient in the shown positions were evaluated (neck flexion angles, neck extension angles, head-tilt angles, neck rotation angles, and facial area)

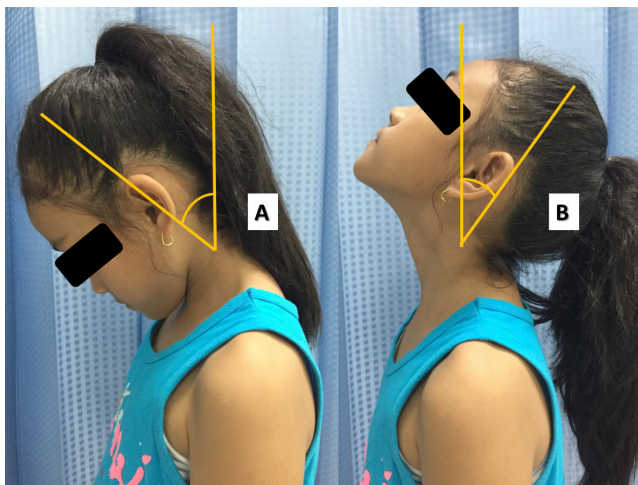


Fig 2. Measurement of neck flexion (A) and neck extension (B) angles



Fig 3. Measurement of head-tilt angle



Fig 4. Measurement of neck rotation deficit distance for the normal (A) and affected (B) sides



Fig 5. Measurement of facial area

we compared the measured value with the normal value, which is 60 degrees.

Scores ranged from 0 to 3 according to the percentage result compared to the normal side (Table 1). The sum of all individual parameter scores was then translated into 1 of the 4 following outcome classifications: poor, fair, good, or excellent (Table 2). All measurements were performed by 2 independent observers. The measurement data for each patient was then compared between the new scoring system and the Lee scoring system.

RESULTS

Nineteen pediatric patients were included. The mean age of patients was 7.2 ± 2.57 years, and the gender proportion breakdown was 7 males and 12 females (Table 3). Nine photographs of each of the 19 included patients were evaluated and categorized by surgical outcome score using both surgical outcome scoring systems. The intraclass correlation coefficients for all measurements in both scoring systems were higher than 0.6, which suggests good interrater reliability ($p < 0.05$). Percentage agreement in the new scoring system was 63.16% (95%CI of 38.63%-82.77%) and ICC is 0.867 (95%CI of 0.66-0.948) (Table 4), which is markedly higher than the percentage agreement of 52.63% in the Lee scoring system (Table 5).

DISCUSSION

The Lee scoring system⁶ was the first generally accepted tool for assessing surgical outcome in congenital muscular torticollis; however, its scoring design is regarded as being excessively subjective. The modified Lee scoring system⁷ that was later introduced included improvements over the original version, but the evaluation of surgical outcome

TABLE 1. Scoring matrix for the new scoring system based on percentage deficit compared to normal side ranges from 0 (0-25%), 1 (26-50%), 2 (51-75%) and 3 (76-100%) of each parameter

	76 – 100%	51 – 75%	26 – 50%	0 – 25%
	(3)	(2)	(1)	(0)
Neck Flexion				
Neck Extension				
Head Tilt				
Neck Rotation				
Facial Asymmetry				

TABLE 2. Scoring and associated outcome classification of the new scoring system

Score	Outcome
13 – 15	Excellent
10 – 12	Good
7 – 9	Fair
≤ 6	Poor

TABLE 3. Demographic and clinical characteristics

Characteristics	(N=19)
Female gender, n (%)	12 (63.2%)
Age (yrs), mean±SD	7.2±2.57
Post-op duration (yrs), mean±SD	5.7±2.26
Affected side (left:right)	9:10

Abbreviation: SD, standard deviation

TABLE 4. New scoring system from 2 observers (N=19)

Patient no.	Observer 1 Total score	Outcome	Observer 2 Total score	Outcome
1	9	Poor	9	Poor
2	11	Fair	11	Fair
3	14	Excellent	12	Good
4	13	Good	13	Good
5	12	Good	15	Excellent
6	11	Fair	11	Fair
7	12	Good	12	Good
8	12	Good	11	Fair
9	12	Good	11	Fair
10	14	Excellent	15	Excellent
11	13	Good	11	Fair
12	10	Fair	10	Fair
13	11	Fair	11	Fair
14	10	Fair	10	Fair
15	13	Good	13	Good
16	11	Fair	11	Fair
17	11	Fair	12	Good
18	9	Poor	13	Good
19	12	Good	12	Good

is still largely subjective. Until now, no system has been introduced that facilitates more objective evaluation of surgical outcome in congenital muscular torticollis.

In this study, we set forth to develop a system that could yield a reliable and more objective for evaluating treatment outcome in this patient population. Our analysis revealed intraclass correlation coefficients for all measurements in both surgical outcome scoring systems to be above 0.6, which indicates good interrater reliability. However, percentage agreement in the new scoring system introduced here was considerably higher than in the Lee scoring system. The new scoring system evaluated in this study was shown to be more reliable for evaluating functional outcome of surgical release in congenital muscular torticollis.

CONCLUSION

The new outcome scoring system, which focuses on functional outcome of surgical release in congenital muscular torticollis, was found to be less subjective and more reliable than the Lee scoring system. Adoption and use of the new system introduced here may improve the accuracy of surgical outcome evaluation in patients with congenital muscular torticollis.

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TABLE 5. Lee scoring system from 2 observers (N=19)

Patient no.	Observer 1 Total score	Outcome	Observer 2 Total score	Outcome
1	9	Poor	8	Poor
2	10	Poor	10	Poor
3	14	Fair	14	Fair
4	15	Good	15	Good
5	15	Good	13	Fair
6	17	Excellent	15	Good
7	17	Excellent	15	Good
8	11	Poor	12	Poor
9	17	Excellent	13	Fair
10	17	Excellent	16	Good
11	14	Fair	14	Fair
12	12	Poor	13	Fair
13	11	Poor	9	Poor
14	15	Good	17	Excellent
15	16	Good	12	Poor
16	10	Poor	10	Poor
17	12	Poor	15	Good
18	12	Poor	11	Poor
19	17	Excellent	17	Excellent

Conflict of interest declaration: All authors declare no personal or professional conflicts of interest, and no financial support from the companies that produce and/or distribute the drugs, devices, or materials described in this report.

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