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Clinical Outcomes of Bipolar Release in Patients with Congenital Muscular Torticollis: A Prospective Study

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ABSTRACT

Background: Congenital muscular torticollis (CMT) results from unilateral fibrosis of the sternocleidomastoid (SCM) muscle, leading to neck deformity. While surgical outcomes are favorable in young children, the effectiveness of bipolar release in older patients remains debated.
Methods: This prospective study was conducted at the Department of Orthopaedics, BMCRC, Ballari, India, between January 2022 and December 2024. 20 patients (8-14 years) with unresolved CMT despite ≥6 months of conservative treatment were enrolled. Bipolar SCM release was performed. Patients were assessed preoperatively and at 3-, 6-, and 12-months using Cheng's clinical scoring system. Data were analyzed with SPSS v25.0 using paired t-tests.
Results: Mean age was 11 ± 3 years; 12 (60%) were male. Right-sided involvement was more common (60%). Cervical rotation improved from 45.3° ± 8.1° to 78.6° ± 7.4° ($p < 0.01$). Lateral bending improved from 25.2° ± 6.2° to 52.1° ± 5.8° ($p < 0.01$). Mean Cheng's score improved from 6.8 ± 0.7 to 12.5 ± 1.1 ($p < 0.001$). Outcomes were Excellent (40%), Good (40%), and Fair (20%).
Conclusion: Bipolar release in patients with persistent CMT provides significant functional and cosmetic improvement with low complication rates. Even late surgical intervention can yield favorable outcomes.

Keywords: Congenital muscular torticollis, Bipolar release, Sternocleidomastoid, Cheng's criteria, Prospective study

INTRODUCTION

Congenital muscular torticollis (CMT) is characterized by fibrosis and contracture of the sternocleidomastoid (SCM) muscle, producing a characteristic tilt of the head to the affected side with contralateral rotation of the chin. [1] It is one of the most common musculoskeletal anomalies in children, with a prevalence ranging from 0.3–2%. Early recognition and conservative management, including physiotherapy and stretching, often lead to excellent outcomes.[2],[3]

However, 10–15% of patients fail to respond to conservative measures, requiring surgical intervention.[4] Surgical techniques include unipolar release, bipolar release, and Z-

lengthening of the SCM.[5] Bipolar release, involving detachment of both sternal/clavicular and mastoid attachments, is favored in older children and adolescents with long-standing fibrosis.[6]

Several studies have reported excellent outcomes in young children following early surgery.[7],[8]. Concerns exist regarding limited soft tissue adaptability, craniofacial asymmetry, and cosmetic satisfaction.[9],[10] Yet, some studies demonstrate that functional and cosmetic benefits can still be achieved in this age group.[11,12,13, 14]

This prospective study evaluates the clinical outcomes of bipolar SCM release in patients 8-14 years using Cheng's clinical criteria, with an emphasis on functional improvement, cosmesis, and patient satisfaction.

METHODS

Study Design & Setting:

A prospective study was conducted at the Department of Orthopaedics, BMCRC, BALLARI, India, between January 2022 and December 2024.

Ethical Approval:

Approval was obtained from the Institutional Ethics Committee (IEC No: BMCRC/ORTHO/2022/017). Informed consent was obtained from all participants or guardians.

Sampling Technique:

Convenience sampling was applied. All consecutive patients with unresolved CMT and no improvement after ≥6 months of physiotherapy were included. A total of 20 patients met the criteria.

Inclusion Criteria:

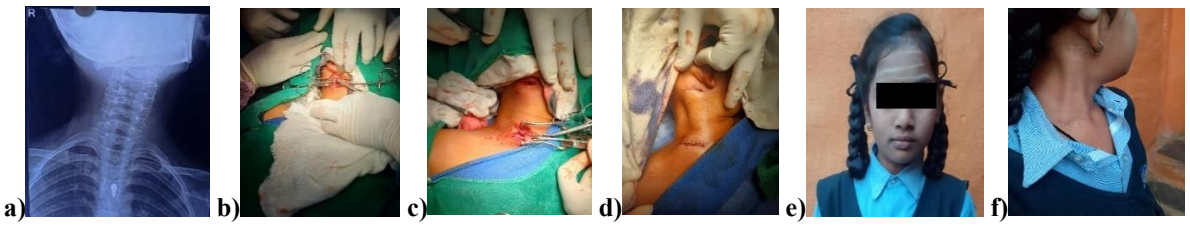
Age 8-14 years
Clinically diagnosed CMT
Failure of ≥6 months conservative management
Willingness for surgery and follow-up

Exclusion Criteria:

Secondary torticollis (neurological, ocular, or bony causes)
Previous neck surgery

Surgical Technique:

All patients underwent bipolar release of SCM (mastoid and sternal/clavicular attachments) via two incisions. The patient is positioned supine with shoulder roll and head turned to the opposite side, then through a lower transverse incision just above the clavicle/SC joint the clavicular and sternal heads of SCM are identified and released (tenotomy/Z-lengthening) with fascial bands, after which a small upper incision near the mastoid is made to identify the SCM insertion, protect the spinal accessory nerve, and release SCM from the mastoid/superior nuchal line until full correction of head tilt and rotation is achieved; finally hemostasis and closure are done, followed by collar/brace and early aggressive physiotherapy to prevent recurrence.



Xray and intra operative pics of a 10-yr child with torticollis.
(a)cervical spine X-ray, b) upper incision near mastoid area, c) lower incision just above sternoclavicular joint, d) wound closure, e) post operative corrective image of the patient and f) surgery scar)

Postoperative Protocol:

Cervical brace for 3 weeks
Physiotherapy (ROM and strengthening) for 3 months
Regular follow-up at 3, 6, and 12 months

Outcome Measures:

Cheng's clinical scoring system: Neck movement (0–4), head tilt (0–3), lateral band (0–2), facial asymmetry (0–2), patient satisfaction (0–3).

Classification: Excellent (13–14), Good (10–12), Fair (7–9), Poor (<7).

STATISTICAL ANALYSIS

Data were analyzed using SPSS v25.0 (IBM Corp., USA). Continuous variables expressed as mean ± SD. Paired t-tests compared pre- and postoperative values. $p < 0.05$ was significant.

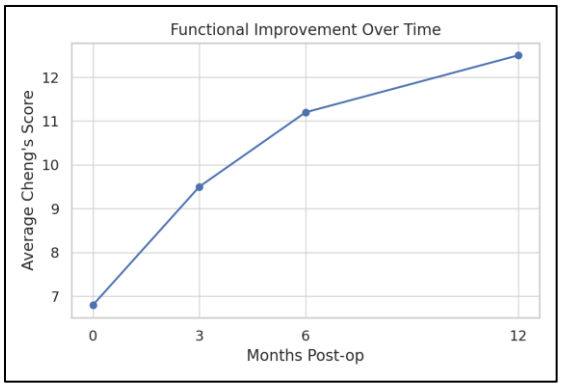
RESULTS

Table 1): Demographic and Clinical Characteristics (n=20)

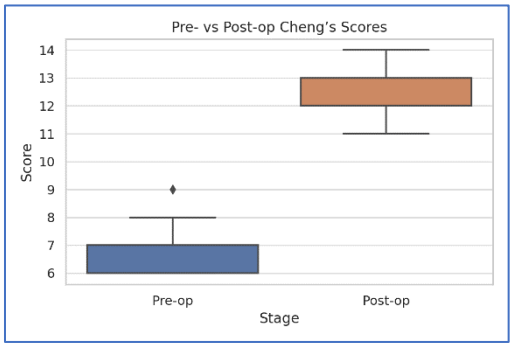
Variable	Value
Age (years)	11 ± 3yrs
Gender (Male/Female)	12(60%) / 8 (40%)
Side affected (Right/Left)	12(60%) / 8 (40%)
Symptom duration (years)	11.5 ± 2.8
Follow-up (months)	16.5 ± 3.2

Table 2): Outcomes According to Cheng's Criteria (12 months)

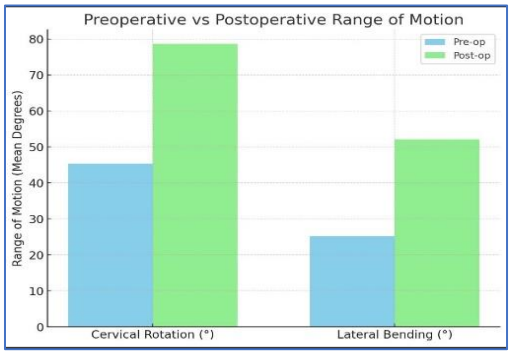
Outcome	Number (%)
Excellent	8 (40%)
Good	8 (40%)
Fair	4 (20%)
Poor	0 (0%)



Graph 1): showing functional improvement over time



Graph 2): Cheng's Scores:
Pre-op: 6.8 ± 0.7
Post-op: 12.5 ± 1.1 ($p < 0.001$)



Graph 3): ROM Improvement:
Cervical rotation: Pre-op 45.3° ± 8.1 → post-op 78.6° ± 7.4 ($p < 0.01$)
Lateral bending: Pre-op 25.2° ± 6.2 → post-op 52.1° ± 5.8 ($p < 0.01$)

Complications:
No patient experienced significant complications such as infection, nerve injury, or hypertrophic scarring. One patient had minor residual head tilt that improved with extended physiotherapy. No recurrences were observed during the follow-up period.

DISCUSSION

Our prospective study demonstrates that bipolar SCM release is effective in improving cervical ROM, cosmetic appearance, and satisfaction in patients with persistent CMT. More than 80% achieved good-to-excellent outcomes, consistent with previous studies.[7],[11]

The Cheng clinical scoring system allowed us to assess outcomes in a structured and quantifiable manner. Improvements in neck range of motion and appearance were statistically significant. More than two-thirds of the patients achieved good to excellent results. Notably, even patients with long-standing deformities benefited from the procedure, particularly in terms of pain relief, range of motion, and cosmetic satisfaction.

Although younger patients typically have better outcomes, older patients still benefit significantly from surgery, particularly in terms of functional improvement and self-perception. Our results align with Minamitani et al.[6] and Omidi-Kashani et al.[11] who reported favorable long-term outcomes in adolescents and adults.

The low complication rate and high satisfaction emphasize the role of bipolar release as a safe and reliable option. However, limitations include small sample size and short follow-up. In our setup, resource constraints limited the sample size but the trend of improvement was clear.

Postoperative rehabilitation and adherence to physiotherapy played a vital role in optimizing results. Patients who consistently followed exercise protocols had better scores on Chengs criteria. This underscores the importance of a multidisciplinary approach including surgery, rehabilitation, and follow up.

While the sample size of 20 patients is limited, the consistent improvements observed across clinical parameters support the utility of bipolar SCM release in this age group. Larger studies and long-term follow-up would help validate and generalize these findings.

CONCLUSION

Bipolar SCM release in patients with unresolved CMT leads to significant functional and cosmetic improvement. Despite delayed surgery, good-to-excellent outcomes can be achieved with appropriate postoperative rehabilitation. (in our setting compliance with physiotherapy was an important factor in maintaining correction)

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

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