International Journal of Research and Review
[Indexed, Peer-Reviewed Journal]
Volume 13; Issue: 1; January 2026
Website: www.ijrrjournal.com
Case Report *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Surgical Management of Congenital Muscular Torticollis in an Adult: A Case Report on Bipolar Release and Z-Plasty Technique

Adhi Satriyo Utomo

Department of Orthopedic and Traumatology, Faculty of Medicine,
Universitas Brawijaya – Dr. Saiful Anwar General Hospital, Malang, Indonesia

Corresponding Author: Adhi Satriyo Utomo

DOI: https://doi.org/10.52403/ijrr.20260139

ABSTRACT

Introduction: Congenital Muscular Torticollis (CMT) is a common musculoskeletal deformity in infants, typically diagnosed early in life. However, in some cases, it remains undiagnosed and untreated until adulthood. This report describes a case of adult-onset CMT and its management.

Case Presentation: A 27-year-old female presented with a longstanding neck deformity first noticed at age 3. Despite a slight spontaneous improvement during adolescence, the deformity persisted into adulthood. She complained of neck and back stiffness, particularly with physical activity. Clinical examination revealed a right-sided head tilt, limited range of motion, and a fibrotic mass in the sternocleidomastoid (SCM) muscle. Radiological assessment confirmed levoscoliosis cervicalis and secondary postural scoliosis in the upper thoracic region.

Discussion: Surgical intervention was considered due to the persistence of the deformity despite spontaneous improvement in adolescence. Bipolar SCM release combined with Z-plasty on the sternal head of the SCM muscle was chosen as the surgical approach. This technique aims to restore muscle length and eliminate abnormal tension. Postoperative rehabilitation focused on active and passive neck stretching exercises to maintain the range of motion and prevent scarring. The patient showed significant improvement in both functional and cosmetic outcomes, with reduced head tilt and enhanced neck mobility.

Conclusion: This case demonstrates the importance of early diagnosis and intervention in CMT. For adults with long-standing, untreated CMT, surgical correction remains a practical option, with favorable outcomes when combined with a structured rehabilitation program.

Keywords: bipolar release, congenital muscular torticollis, neck muscles, z-plasty

INTRODUCTION

Congenital muscle torticollis (CMT) ranks as the third most prevalent congenital musculoskeletal defect in children, after hip dislocation and clubfoot. CMT is characterized as a cervical deformity predominantly stemming from unilateral shortening and fibrosis of the sternocleidomastoid (SCM) muscle, leading to head tilt toward the ipsilateral side, with the face and chin rotating toward the contralateral side. The afflicted muscle exhibits fibrosis, fiber shortening, and degenerative alterations histopathologically.

The precise process is not fully elucidated; nevertheless, the prevailing idea posits that a vascular disruption or ischemia injury to the sternocleidomastoid (SCM) muscle during the neonatal period results in a compartment syndrome-like condition, subsequently leading to progressive fibrosis. Intrauterine malposition, birth trauma, and local compression are suspected contributing factors, however conclusive causative evidence is scarce. When identified promptly, the majority of CMT cases exhibit favorable responses to conservative treatment, such as physical therapy, directed passive stretching, active range-of-motion exercises, and postural education, leading to predominantly good to exceptional functional and aesthetic results.[1,2]

For patients who arrive late or do not exhibit sufficient improvement during conservative treatment, surgical surgery becomes the principal choice to avert more severe secondary deformities, including facial asymmetry, compensatory scoliosis, or global postural abnormalities. Documented standard surgical techniques encompass bipolar release of the sternocleidomastoid muscle (at its insertion and/or origin), unipolar tenotomy, and muscle lengthening by Z-lengthening methods. The objective of these techniques is to eradicate the pathological tension, reinstate the neck's physiological range of motion, and enhance the musculoskeletal equilibrium between the affected and opposite sides. A study indicated that the ideal age for surgical intervention is between 1 and 4 years, when the tissues remain relatively flexible and secondary abnormalities have not yet become firmly set, thus enhancing the probability of favorable functional and aesthetic results. Nevertheless, numerous case studies suggest that surgical surgery may still result in substantial improvement in adult patients with neglected CMT, even in cases where the deformity has become chronic. A study reported the efficacy of unipolar SCM tenotomy in a 28-year-old patient, leading to marked improvement in neck rotation and lateral flexion, along with a better quality of life. These data confirm that while the "golden window" for optimal therapy occurs in early childhood, surgical correction is still pertinent for newly diagnosed instances or individuals seeking treatment in adulthood.[3]

From a therapeutic standpoint, it is crucial to distinguish CMT from other types of torticollis with unique pathophysiological causes, particularly those that emerge in maturity. Torticollis in the adult population is frequently classified as part of adult torticollis, encompassing cervical dystonia (spasmodic torticollis). This syndrome is a movement disorder marked by involuntary, prolonged, and frequently painful contractions of the neck muscles, leading to repetitive movements (twisting), aberrant postures, or a combination thereof. Clinical signs may encompass head rotation, lateral flexion, retroflexion, or intricate combinations that impair daily activities and induce considerable psychological suffering. Adult torticollis can be characterized etiologically as acute, chronic, congenital (residual), idiopathic, or secondary (e.g., resulting from medicine, anatomical lesions, or trauma). Idiopathic cervical dystonia (ICD) is the most prevalent type of focal dystonia in adults, exhibiting diverse prevalence rates across different populations: approximately 11.1 per 100,000 for early-onset cases among Ashkenazi Jews in New York, 60 per 100,000 for late-onset cases in Northern England, and as high as 300 per 100,000 in elderly populations in Italy. The age distribution reveals a peak incidence in the 31-40 years age bracket, signifying that adult-onset idiopathic cervical dystonia mostly impacts the working-age population.[4,5]

The pathophysiology of ICD remains largely unexplained; however, multiple lines of evidence suggest the involvement of genetic factors, trauma, and anatomical brain abnormalities. From a genetic standpoint, several critical observations bolster the hypothesis of hereditary

predisposition: (i) in families with idiopathic torsion dystonia in children, other relatives may exhibit signs of focal or segmental cervical dystonia, (ii) since the late 19th century, it has been observed that torticollis can affect siblings and manifest across generations, and (iii) the incidence of focal dystonia or tremor in first-degree relatives of ICD patients is elevated compared to the general population. Neck trauma has been identified as a trigger in 5-21% of instances, with patients generally suffering severe discomfort after the trauma, subsequently leading to the development of cervical dystonia. This syndrome is marked by nearly complete neck immobility within days, lacking morning relief or respite during sleep, and exhibiting a poor response to pharmacological treatment or botulinum toxin injections. Alongside genetic and trauma factors, advanced imaging studies have revealed T2 abnormalities in the lentiform nucleus and heightened echogenicity of the pallidum on transcranial sonography, corroborating the hypothesis of basal ganglia dysfunction as the structural basis for adult-onset focal dystonia.[5,6]

Consequently, whereas CMT and cervical dystonia may both manifest as torticollis, they constitute essentially distinct nosological entities. CMT is predominantly a localized musculoskeletal condition characterized by fibrosis and contraction of the SCM muscle, with treatment emphasizing structural rectification by physical therapy and/or surgical intervention. Conversely, adult cervical dystonia is regarded as a movement disorder characterized by the impairment of central motor circuits, with treatment strategies focusing on neuromuscular modulation, including botulinum toxin injections, supplementary pharmacotherapy, sensorimotor rehabilitation, and, in certain cases, neuromodulation techniques. A comprehensive understanding of the distinctions in pathophysiology, clinical presentations, and therapeutic responses is crucial for precise diagnosis and the formulation of suitable management strategies for adult patients with a history of childhood torticollis, including those suspected of having neglected congenital muscular torticollis into adulthood.[7,8] This study aims to explore the clinical distinctions between congenital muscular torticollis and adult cervical dystonia, emphasizing differences in pathophysiology, treatment approaches, and outcomes, and to provide insights into the management of CMT, especially in patients presenting later in life.

CASE PRESENTATION

A 27-year-old female patient approached with a primary complaint of aberrant neck posture, evident from the age of 3. At that age, the family observed that her neck inclined to the right, nearly contacting her shoulder, and this abnormality got increasingly pronounced as she progressed into childhood. The patient indicated that the tilt diminished marginally around approximately 14 years of age, however never completely resolved. The patient reported neck and back stiffness, particularly during strenuous physical activities, in addition to the deformity; however, she did not experience fatigue or dyspnea. The familial medical history indicated a comparable condition in her paternal great-grandmother. The patient's pregnancy and perinatal history, as well as growth and development, were entirely normal, with no congenital anomalies, delivery problems, injuries, or infections reported. The patient is capable of performing daily tasks and exercising effectively.

A physical examination of the neck revealed a deformity, accompanied by tension in the right sternocleidomastoid (SCM) muscle and a restricted range of motion (ROM) in the neck. An examination of the back also indicated a postural scoliosis deformity in the upper thoracic region. Multiple ancillary assessments indicated an elevated right shoulder, a 15 mm deviation of the plumb line to the right, and a right rib hump observed during the Adam Forward

Bending Test, a characteristic indicator of mild structural scoliosis. A comprehensive neurological assessment indicated motor strength of 5/5 in all extremities, normal sensitivity, and sufficient physiological reflexes, with no pathological reflexes detected. The cervical X-ray revealed levoscoliosis cervicalis, aligning with the clinical observations (Figure 1). The patient was diagnosed with Congenital Muscular Torticollis (CMT) accompanied by postural scoliosis in the upper thoracic area following a comprehensive examination.

The planned therapeutic plan entails the administration of analgesics, focused physical therapy, supplementary scoliosis X-rays, and surgical correction using Z-plasty of the sternocleidomastoid muscle. Surgery was deemed necessary as the patient had attained adulthood, and the abnormality persisted despite minor spontaneous improvement during adolescence. The objective of surgical intervention is to alleviate muscle fibrosis, diminish the aberrant tension inducing rotation and lateral flexion deficits, and enhance postural equilibrium. Postoperatively, the patient will participate in an extensive rehabilitation program that includes both active and passive neck rotation and flexibility exercises, commencing on the first postoperative day, to avert scar tissue formation that could compromise the corrective outcomes.

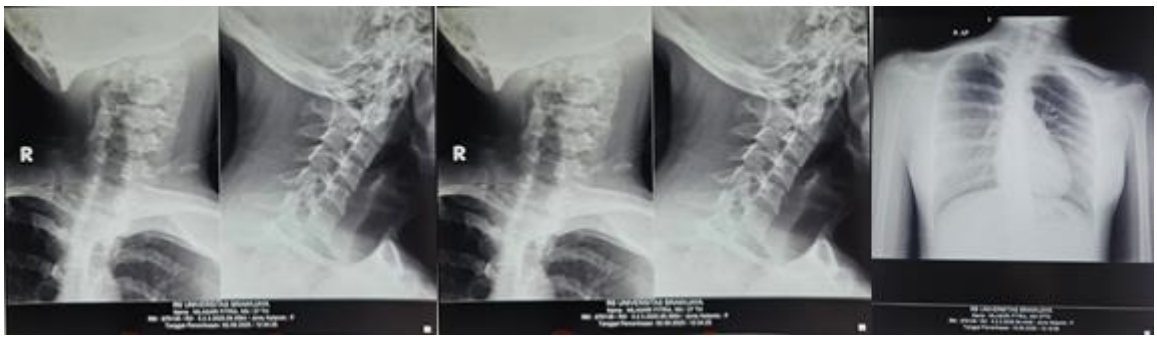

Figure 1. X-ray results of the patient

Therapeutic outcomes will be assessed utilizing a modified scoring system that evaluates cervical mobility, the existence of lateral bands, the extent of head tilt, and aesthetic factors, including surgical scarring, with a maximum score of 18. In this approach, scores of 17-18 are classified as exceptional, 15-16 as good, 13-14 as fair, and below 12 as poor. Due to limited mobility and considerable deformity prior to surgery, the patient's preoperative score was categorized as low. Through Z-plasty correction and systematic rehabilitation, the postoperative objective is anticipated to achieve a good-to-excellent range in both functional and aesthetic results. Consequently, this intervention is anticipated to optimize neck functionality, improve upper-body symmetry, and yield increased aesthetic satisfaction for the patient.[3]

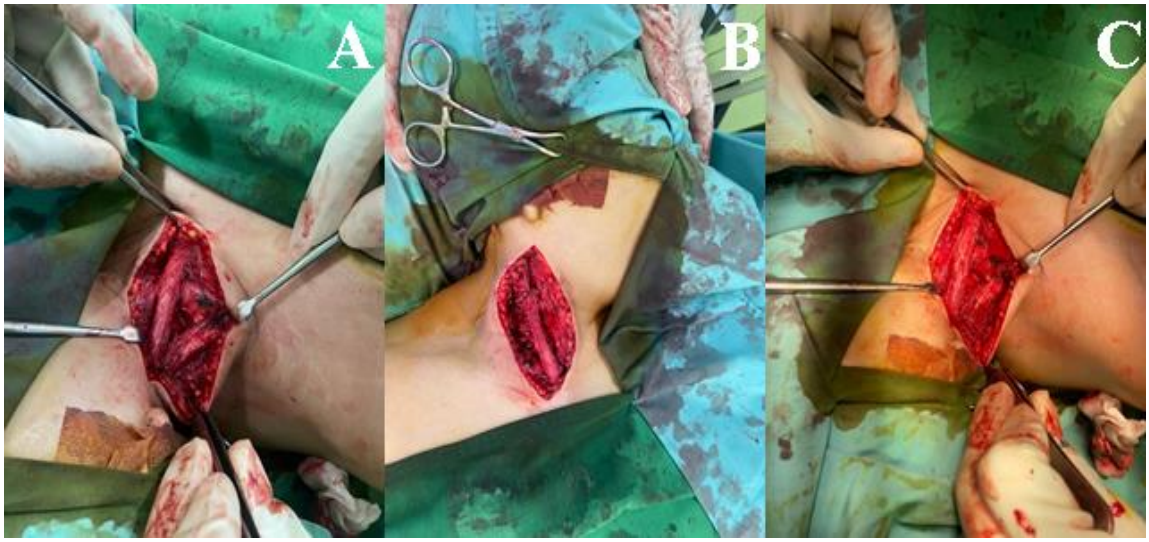

Figure 2. (A) Initial exploration of the Sternocleidomastoid (SCM) muscle through a right supraclavicular incision. The muscle appears thickened and fibrotic. (B) Separation of the clavicular and sternal heads of the SCM muscle, with retraction revealing the muscle structure clearly. (C) Application of the Z-lengthening technique on the sternal head of the SCM muscle after zig-zag cutting. This Z-plasty configuration aims to lengthen the muscle, maintain its continuity, and preserve the neck's aesthetic 'V' contour.

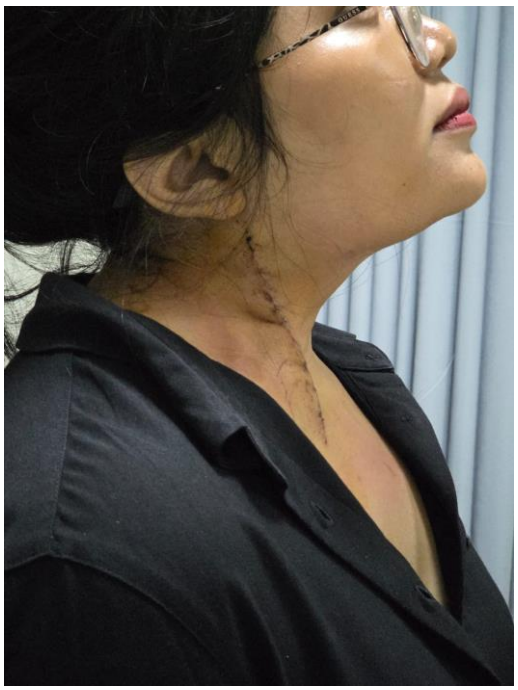

Figure 3. Postoperative appearance of the patient after the Modified Bipolar Release procedure with Z-Plasty on the right SCM muscle. The incision wound is in the healing phase, with a zig-zag direction following the Z-lengthening technique.

DISCUSSION

Congenital Muscular Torticollis (CMT) is a congenital abnormality characterized by a unilateral head tilt due to sternocleidomastoid (SCM) muscle contraction. The predominant acknowledged cause is intrauterine vascular injury, resulting in SCM compartment syndrome and subsequent muscle fibrosis.[1] A study presented MRI evidence supporting the idea that in utero head posture, which compresses the sternocleidomastoid muscle, can result in lesions akin to those observed in compartment syndrome.[9] This vascular injury is frequently linked to fetal malposition and challenging births. CMT

clinically presents as a head tilt toward the affected side and neck rotation in the contralateral direction, accompanied by a fibrotic mass in the sternocleidomastoid muscle. Unilateral SCM fibrosis results in facial asymmetry and ipsilateral plagiocephaly, along with secondary cervicothoracic scoliosis due to postural correction.[10,11] Familial instances are uncommon, with certain publications indicating a positive family history on a limited scale (e.g., reports of consanguineous CMT families); however, the "3-10%" statistic is challenging to corroborate in primary sources.[9]

In individuals with chronic CMT, clinical observations reveal restrictions in lateral flexion and contralateral neck rotation, accompanied by the palpation of a complicated, shortened sternocleidomastoid muscle. Conversely, non-muscular torticollis, exemplified by cervical dystonia, is characterized by fluctuating or spasmodic symptoms, frequently engaging additional neck muscles and accompanied by pain, without the presence of permanent fibrotic masses. Differentiation is established through historical context (from birth versus adulthood) and neurological assessment. Imaging is employed to rule out other etiologies: cervical-thoracic X-rays (anteroposterior/lateral) to examine deformities (e.g., clicking vertebral joints), dynamic CT to test atlantoaxial subluxation, and MRI of the cervical region/upper spinal cord if central anomalies are suspected. The ultrasound of the sternocleidomastoid (SCM) reveals muscle hypertrophy and hypo- or hyperechoic regions attributable to fibrosis on the congenital muscular torticollis (CMT) side. An advanced radiographic assessment of the entire spine is crucial for evaluating subsequent scoliosis. Cervicothoracic scoliosis occurs in 82.1% of patients with Charcot-Marie-Tooth disease.[11]

Numerous investigations have established the correlation between chronic CMT and secondary scoliosis. A research indicated that cervicothoracic scoliosis was present in 82.1% of patients with CMT (n=106). The head tilt consistently contrasts with the convexity of the scoliosis curve, and the degree of the cervicomandibular angle (CMA) is correlated with the Cobb angle. Post-SCM release surgery, the average Cobb angle shown a considerable reduction (e.g., from 15.5° to 7.4°).[11] A research noted irreversible morphological alterations in the cervical vertebrae of adults with untreated CMT, including a prominent rotational-bending deformity at the atlas/axis junction, including modifications to the superior facet of the axis (upper joint layer).[12] These modifications underscore the necessity for prompt identification and rectification of torticollis to avert spinal abnormalities.

The surgical technique for adult CMT often entails bipolar SCM release in conjunction with Z-lengthening. This procedure involves releasing the SCM muscle through two incisions: the inferior incision, located approximately 1 cm above the collarbone, to fully release the clavicular head, and the superior incision at the mastoid tip to release the mastoid head.[13] The sternal head undergoes Z-plasty to elongate it while maintaining muscle continuity, so keeping the "V" form at the neck's base. The complete fibrotic sheath is meticulously detached to prevent damage to the neurovascular bundle (accessory nerve).[1,13] This treatment offers the benefits of esthetic enhancement of the neck (restoring the typical contour) and functional improvement (muscle relaxation) without significant problems. A study highlighted that sternal Z-plasty reinstates the "V-shape" at the neck's base, enhances aesthetic results, particularly in women, and that this method is comparatively safe, with no notable problems.[13] A separate study indicated favorable outcomes in 12 adult patients following bipolar release + Z: all patients exhibited enhanced neck range of motion and head tilt; 11 out of 12 expressed satisfaction with the aesthetic effects.[14] The primary problems associated with this method include disturbances of the auxiliary

nerve in the cervical or clavicular region, cervical hemorrhage, and cosmetic scarring; however, severe complications are infrequently reported in the literature.[15,16]

Numerous case studies have evaluated the results of bipolar SCM release combined with Z-plasty in adults. A study documented 12 adult patients (ages 17-31) with chronic CMT; postoperatively, the majority (50%) attained a "excellent" neck function score, all patients exhibited improvements in range of motion and neck tilt, and 11 out of 12 expressed satisfaction with the esthetic outcomes.[14] A separate study analyzed 31 adult patients (mean age 30) following bipolar release: 71% attained "good" or "excellent" clinical outcomes, demonstrating a substantial enhancement in the cervicomandibular angle (from an average of 15.4° to 6.3°) and a patient satisfaction rate of 93.7%. Only three patients experienced transient lower auricular sensory impairments, with no enduring consequences.[16] The additional study with 14 adolescents (aged over 10 years) likewise observed substantial enhancements in range of motion, tilt, and neck aesthetics in all subjects, with no surgical problems reported.[15] A study demonstrated that Z-plasty enhanced neck aesthetics, with all patients exhibiting less head tilt and improved facial asymmetry, even when the procedure was conducted at a later stage.[1] In these overall studies, complications were minimal, typically only superficial wounds or mild postoperative pain, and no cases of contracture relapse requiring reoperation were reported.

Postoperatively, patients are advised to use a cervical collar to maintain neck position for 3 weeks, accompanied by intensive physical therapy (stretching and active-assisted exercises) for the following weeks.[14,15] A study advised delaying surgery until the patient is prepared to adhere to bracing and postoperative exercise regimens.[14] Analgesics and muscle relaxants are utilized as needed to manage discomfort. Subsequent assessment of scoliosis is crucial, despite the fact that numerous patients exhibit improvement.[11] Nonetheless, patients require ongoing radiological monitoring, as persistent scoliosis may result in chronic issues. The prognosis for adequately treated adults is generally favorable: surgery alleviates chronic contractures, diminishes discomfort and muscular tension, and enhances neck function and aesthetics.[14,16] The likelihood of residual deformity is typically minimal if treatment is maintained with diligence.

CONCLUSION

In conclusion, this case underscores the critical significance of timely diagnosis and intervention in congenital muscular torticollis (CMT) to mitigate the risk of persistent structural complications, including scoliosis and facial asymmetry. For adults in whom CMT is newly diagnosed, surgical intervention—particularly the bipolar release technique combined with Z-plasty on the sternal head of the sternocleidomastoid muscle—has demonstrated substantial efficacy in correcting cervical deformities, restoring range of motion, and achieving satisfactory cosmetic results with a low incidence of complications. Moreover, the role of diligent postoperative physical therapy cannot be overstated, as it is essential for maintaining surgical correction and minimizing the development of scar tissue. Therefore, with a comprehensive and multidisciplinary approach, favorable functional and aesthetic outcomes can be attained even in adult patients with long-standing, previously neglected CMT.

Declaration by Authors

Ethical Approval: This study has been approved by the Dr. Saiful Anwar General Hospital Ethics Commission with number 400/027/CR/102.7/2025, which was issued on December 15, 2025

Acknowledgement: None

Source of Funding: None

Conflict of Interest: No conflicts of interest declared.

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How to cite this article: Adhi Satriyo Utomo. Surgical management of congenital muscular torticollis in an adult: a case report on bipolar release and Z-plasty technique. *International Journal of Research and Review*. 2026; 13(1): 416-424. DOI: *10.52403/ijrr.20260139*

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