

<b>Subject: Triangle Tilt and Mod Quad Surgery for Treatment of Obstetric Brachial Plexus Injury</b>		<b>Original Effective Date:</b> 10/14/2014
<b>Policy Number:</b> MCP-208	<b>Revision Date(s):</b>	
<b>Review Date:</b> 12/16/2015, 9/15/2016, 9/19/2017, 7/10/2018, 6/19/2019		
<b>MCPC Approval Date:</b> 7/10/2018, 6/19/2019		

**DISCLAIMER**

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**DESCRIPTION OF PROCEDURE/SERVICE/PHARMACEUTICAL**

Neonatal brachial plexus palsy (also known as obstetric brachial plexus palsy) is generally caused by excessive traction on the brachial plexus from the forces of labor, fetal position, and maternal pushing. Possible risk factors include large maternal weight gain, maternal diabetes, multiparity, fetal macrosomia/high birth weight, and breech position. The etiology of neonatal brachial plexus palsy has been attributed to iatrogenic lateral traction on the fetal head, typically when shoulder dystocia impedes delivery. However, many cases of brachial plexus injury are not due to shoulder dystocia or excessive force by the provider. Treatment for brachial plexus injuries includes orthosis/splinting, occupational or physical therapy. Surgical intervention has been proposed in select cases if functional recovery does not occur in three to nine months, however there is no consensus regarding the utility or timing of surgery. <sup>3</sup>

Triangle tilt (TT) surgery is used to treat obstetric brachial plexus injury (OBPI) in infants and children by the correction of scapular elevation through the bony realignment of the clavicle and scapula. It is performed by altering small areas of bone on the scapula and clavicle. The objective of the surgery is to detach the distal acromioclavicular triangle-humeral head complex from the abnormally positioned scapula, reversing the anterior tilt of these structures and realigning the bony structures back toward a normal position to restore anatomy, function, and range of motion. The triangle tilt presents with marked internal rotation of the arm and poor supination. TT surgery is performed by a board-certified orthopedic surgeon, plastic surgeon, or neurosurgeon. Surgery takes approximately 2 hours and patients are hospitalized overnight and monitored to

ensure proper splinting and positioning of the arm. The surgery is followed by splinting for 6 weeks, after which the splint is worn only at night for another 3 to 6 months.<sup>2</sup>

The Mod Quad procedure is considered a secondary surgery in children with brachial plexus injury used to correct muscle imbalances. Among the muscles injured in Erb's palsy are the abductors of the shoulder as well as the external rotators. For this muscle imbalance, there is a group of muscle releases and transfers known as the mod-quad which can put the arm in a more natural position and help to lift the arm over the head. The mod quad involves the following four components: latissimus dorsi muscle transfer for external rotation and abduction, teres major muscle transfer for scapular stabilization, subscapularis muscle release and axillary nerve decompression and neurolysis.

#### RECOMMENDATION

Triangle tilt surgery and the Mod Quad procedure for treatment of obstetric brachial plexus injury are considered experimental, investigational and unproven because of insufficient evidence in the peer reviewed medical literature.

#### SUMMARY OF MEDICAL EVIDENCE<sup>4-12</sup>

There is insufficient published evidence to assess the safety and/or impact on health outcomes or patient management for triangle tilt surgery and the mod quad procedure for treatment of obstetric brachial plexus injury. There are no randomized controlled trials, no studies comparing TT surgery with other methods of treating OBPI, and no information on perioperative or postoperative complications or safety outcomes. The published evidence consists of meta-analysis, prospective, retrospective studies and case series.<sup>4-12</sup> Below is a summary of the most relevant evidence based studies.

The largest prospective comparative study evaluated outcomes in children undergoing TT surgery for OBPI, using the Pediatric Outcomes Data Collection Instrument (PODCI). 130 consecutive patients (62 boys and 68 girls; age range 2 to 10 years) presenting for routine office visits in the Texas Nerve and Paralysis Institute whose parents completed the data survey were included in the study. The study included 63 children who had undergone TT surgery  $\geq 1$  year previously (TT Surgery group; mean age 6 years) and 67 children who were candidates for TT surgery (Non-TT Surgery group; mean age 5 years). In the TT Surgery group, 48 patients had Erb palsy and 15 had complete palsy. In the Non-TT Surgery group, 49 children had Erb palsy and 18 had complete palsy. After surgery, the TT Surgery group had significantly higher mean scores than the Non-TT Surgery group for upper extremity function (73.2 versus 54.1;  $P=0.0033$ ), sports/physical function (70.8 versus 54.8;  $P=0.013$ ), basic mobility (77.6 versus 50.7;  $P<0.0001$ ), and global functioning (70.36 versus 52.38;  $P=0.0048$ ). Mean scores were higher in the TT Surgery group for improved pain/comfort (66.9 versus 61.3;  $P=0.3592$ ) and happiness (57.7 versus 52.2;  $P=0.3514$ ). Among patients in the Second TT Surgery group, compared with mean preoperative scores, mean postoperative scores increased significantly for upper extremity function (62.0 versus 73.4;  $P<0.03$ ), pain/comfort (80.8 versus 94.8;  $P<0.05$ ), basic mobility (88.0 versus 94.1;  $P=0.002$ ), and global functioning (78.5 versus 85.9;  $P<0.03$ ). The authors commented that the higher mean age in the TT Surgery group may have contributed to better upper extremity function scores. Some improvement with age is expected, regardless of surgical intervention.<sup>6</sup>

A retrospective uncontrolled study evaluated 5-year outcomes in children undergoing TT surgery for OBPI. The study included 22 children (13 boys and 9 girls) with OBPI who had completed a mean of 62 months of follow-up. The mean age at surgery was 5.8 years (range 2.1 to 11.8). The site of injury was C5-C6 in 11 patients, C5-C7 in 7, and C5-C8 or C5-T1 in 4. All patients had undergone soft tissue release procedures as well as previous surgeries such as primary nerve surgery, humeral osteotomy, and posterior glenohumeral capsulorrhaphy. Mallet scoring was performed by a trained observer independent of the primary investigator. On modified Mallet scoring, patients demonstrated significant improvements when comparing preoperative scores with postoperative scores: mean external rotation (2.5 versus 4.1 at 5 years; P<0.0001), hand-to-neck (2.7 versus 4.3; P<0.0001), hand-to-spine (2.5 versus 3.4; P<0.005), hand-to-mouth (2.3 versus 4.2; P<0.0001), supination (2.6 versus 4.1; P<0.0001), and total score (14.1 versus 20.3; P<0.0001).<sup>4</sup>

Another small retrospective comparative study evaluated outcomes of TT surgery for OBPI in children operated on at < 2 years of age versus those treated at later ages. The study included 36 children. Patients < 2 years of age (Group 1; n=16) were treated at a mean age of 18 months (range 9 to 23). Those > 2 years of age (Group 2; n=20) were treated at a mean age of 6 years (range 26 months to 9 years). Outcome measures were performed by trained observers independent of the principal investigator at a mean follow-up time of 2.5 years after TT surgery. Mean preoperative to postoperative changes in overall Mallet scores were significantly greater in Group 1 (6.6 versus 3.8; P=0.0002), as were mean changes in scores for external rotation (1.5 versus 0.69; P=0.0029), hand-to-mouth (2.0 versus 1.0; P=0.0035), and supination angle (78° versus 20°; P=0.0061). Children in Group 1 had significantly lower preoperative overall Mallet scores (12.1 versus 13.8; P=0.003) and supination angle (-18.4 versus 8.5; P=0.02). The investigators believe that younger children may have greater potential for anatomical remodeling after TT surgery than older children.<sup>5</sup>

**CODING INFORMATION:** THE CODES LISTED IN THIS POLICY ARE FOR REFERENCE PURPOSES ONLY. LISTING OF A SERVICE OR DEVICE CODE IN THIS POLICY DOES NOT IMPLY THAT THE SERVICE DESCRIBED BY THIS CODE IS A COVERED OR NON-COVERED. COVERAGE IS DETERMINED BY THE BENEFIT DOCUMENT. THIS LIST OF CODES MAY NOT BE ALL INCLUSIVE.

CPT	Description
23929	Unlisted procedure shoulder
64999	Unlisted procedure, nervous system

HCPCS	Description
	N/A

ICD-10	Description: [For dates of service on or after 10/01/2015]
P14.0	Erb's paralysis due to birth injury
P14.3	Other brachial plexus birth injuries
S14.3	Injury of brachial plexus

**REFERENCES**

**Government Agency**

1. Centers for Medicare & Medicaid Services (CMS). Medicare Coverage Database. National coverage determination (NCD) Search. Accessed at: <http://www.cms.gov/medicare-coverage-database/search/advanced-search.aspx>.

#### **Other Resources**

2. Hayes Medical Technology Brief. Triangle Tilt Surgery for Treatment of Obstetric Brachial Plexus Injury. Winifred Hayes Inc. Oct 2013. Updated August 2015. Archived.
3. UpToDate: [website]. Waltham, MA: Walters Kluwer Health; 2019. Bromberg M. Brachial plexus syndromes. Updated 2019.

#### **Peer Reviewed Literature**

4. Nath RK, Somasundaram C. Extended long-term (5 years) outcomes of triangle tilt surgery in obstetric brachial plexus injury. *Open Orthop J.* 2013;7:94-98. Available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3664462>.
5. Nath RK, Somasundaram C, Mahmooduddin F. Comparing functional outcome of triangle tilt surgery performed before versus after two years of age. *Open Orthop J.* 2011a;5:59-62. Available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3092491>.
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11. Nath RK, Somasundaram C. Triangle tilt and humeral surgery: Meta-analysis of efficacy and functional outcome. *World J Orthop.* 2015 Jan 18;6(1):156-60. doi: 10.5312/wjo.v6.i1.156. eCollection 2015.
12. Nath RK, Somasundaram C. Improvements after mod Quad and triangle tilt revision surgical procedures in obstetric brachial plexus palsy. *World J Orthop.* 2016 Nov 18; 7(11): 752–757.

#### ***Review/Revision History:***

*10/14/14: Policy created*

*12/16/15, 9/15/16, 9/19/17, 7/10/18 & 6/19/19: Policy reviewed, no changes.*