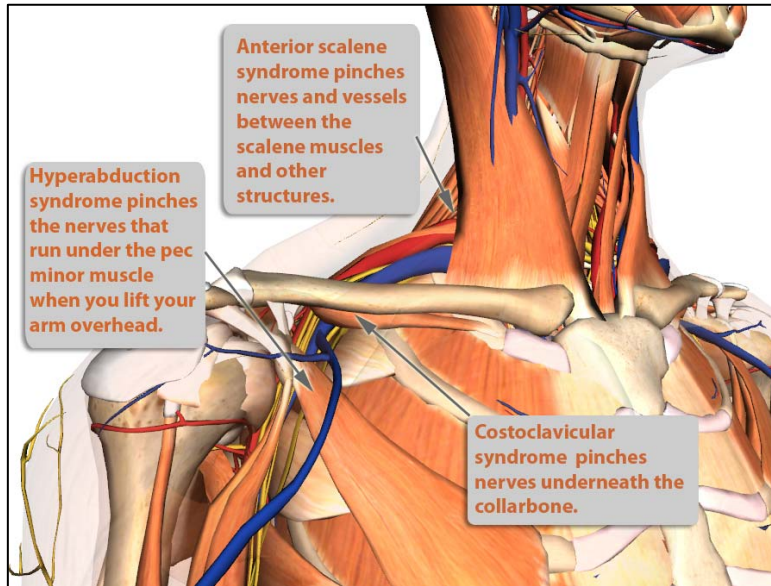


Brachial Plexus Impairments & A Thoracic Outlet Syndrome Diagnosis

Entrapment/compression neuropathies are rated when an objective verifiable diagnosis is present, supported by positive clinical findings and loss of function. The diagnosis should be documented by electromyography as well as sensory and nerve conduction studies. AMA Guides 5th (pg.493)



What is Thoracic Outlet Syndrome (TOS) ?

Thoracic Outlet Syndrome (TOS) is one of the diagnoses related to Brachial Plexus Injuries. Others include Erb Palsy, Burner Syndrome and Parsonage-Turner Syndrome.

The thoracic outlet is bordered by the scalene muscles, first rib, and clavicle. Neurovascular structures pass from the neck and thorax into the axilla through this space.

TOS is an umbrella term that encompasses a variety of conditions. TOS is caused by compression of the brachial plexus or subclavian vessels as they pass through narrow

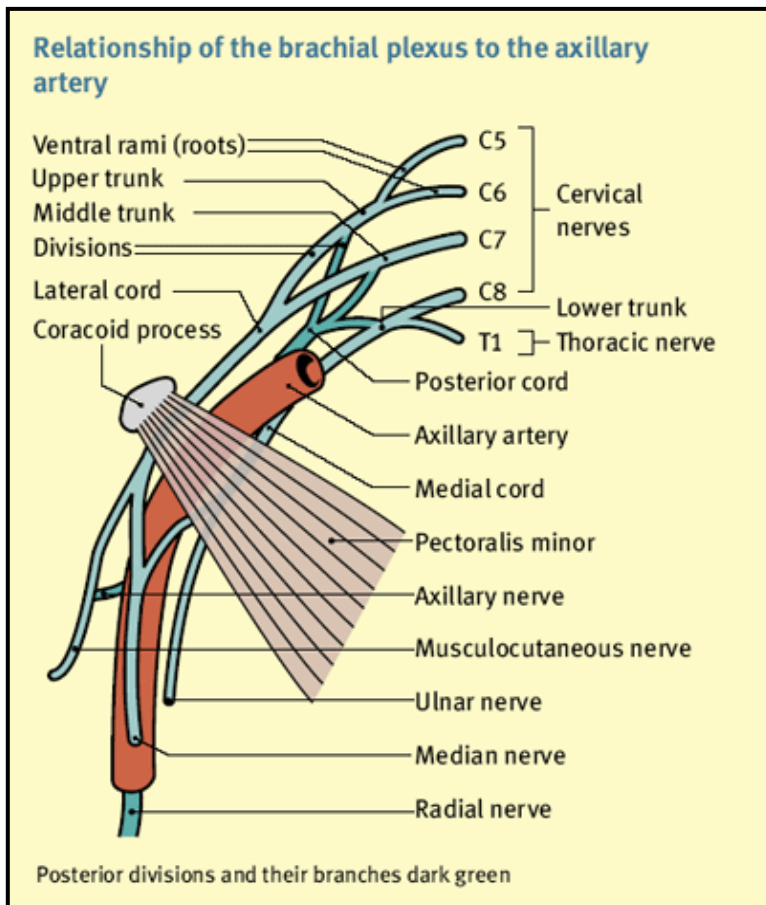
passageways leading from the base of the neck to the armpit and arm. They cause pain in the arm, shoulder and neck,

The initial presentation of thoracic outlet syndrome is dependent on whether the compression is primarily vascular, neurogenic, or a combination of both. It is also dependent on the underlying continuum of histopathologic changes noted with chronic nerve compression, ranging from intermittent to constant debilitating symptoms

Rating Brachial Plexus Impairment under the AMA Guides - AMA 5th Section 16.5.c, pg. 488

- **AMA 5th, pg. 435:** Evaluating Physician must provide a Complete and detailed examination of the upper extremities: Impairment evaluation must address abnormal ROM, Ankylosis, Amputation, Peripheral Vascular & Nerve System and other disorders.
- **AMA Guides 5th Section 2.6b, pg. 22: Evaluating Physician compares the medical findings with the impairment criteria** listed within the *Guides* and calculate the appropriate impairment rating. Physician must Discuss how specific findings relate to and compare with the criteria described in the applicable *Guides* chapter. Physician must Refer to and explain the absence of any pertinent data and how the physician determined the impairment rating with limited data.
- **Section 16.5b, AMA 5th Ed., page 481 Impairment Evaluation Method:**
The upper extremity impairment is calculated by multiplying the grade of severity of the sensory deficit (Table 16-10a) and/or of the motor deficit (Table 16-1 la) by the respective maximum upper extremity impairment value resulting from sensory and/or motor deficits of each nerve structure involved, as listed in Section 16.5c, Regional Impairment Determination: spinal nerves, Table 16-13; brachial plexus, Table 16-14; and major peripheral nerves, Table 16-15. When both sensory and motor functions are involved, the impairment values derived for each are combined (Combined Values Chart, p. 604).

Brachial Plexus Impairments & A Thoracic Outlet Syndrome Diagnosis



Brachial Plexus – AMA 5th, pg. 489

The brachial plexus innervates the shoulder girdle and upper extremity and is formed by the anterior primary divisions of the fifth through eighth cervical roots and the first thoracic root.

These roots anastomose (connect) to form three primary trunks which produce specific findings resulting from the involvement of these structures.

- upper trunk (C5 and C6),
 - middle trunk (C7), and
 - lower trunk (C8 and T1)
- **AMA Figure 16-50, pg. 490 – Brachial Plexus Drawing**

Each trunk splits into a **division**. Half the **divisions** globally supply flexor muscles (that lift and bend the arm). The others supply the extensor muscles (that straighten the arm and bring it down). The position of the arm as the injury occurs will define the levels involved. If

the arm was held at the side, a lower trunk paralysis (C8, T1) is usual. If the arm is abducted C7 (middle Trunk) is commonly involved.

Total brachial plexus paralysis is manifested by flail arm, paralysis of all muscles of the hand, and no sensibility. Sudorific function is intact when the lesion is preganglionic.

- **In upper trunk paralysis** (C5, C6, Erb-Duchenne), the arm hangs in adduction and internal rotation with the elbow in extension and the forearm in pronation; the biceps, deltoid, brachialis, supraspinatus, infraspinatus, and rhomboid muscles are paralyzed; the triceps, pectoralis major, and extensor carpi radialis brevis and longus muscles are weak; most finger movements are intact; biceps reflex is absent; and a sensory deficit in the C5 and C6 dermatomes is present (Figure 16-49).
- **In Middle Trunk paralysis** (C7) functional loss is associated with weakness of wrist flexors, triceps and pronators. C7: mainly a sensory trunk. (Produces generalized loss of movement in the arm, without total paralysis in any given muscle group. Always supplies the latissimus dorsi.)
- **Lower trunk paralysis** (C8, T1, Dejerine-Klumpke) is manifested by paralysis of all intrinsic muscles of the hand; weakness of the flexor carpi ulnaris and flexor digitorum profundus of the little finger; Horner syndrome (ptosis, myosis, enophthalmos) if the T1 root is avulsed from the spinal cord; and a sensory deficit of the C8 and T1 dermatomes (Figure 16-49, pg. 490).

Brachial Plexus Impairments & A Thoracic Outlet Syndrome Diagnosis

AMA Guides Figure 16-50, pg. 490 – The Brachial Plexus (In Color)

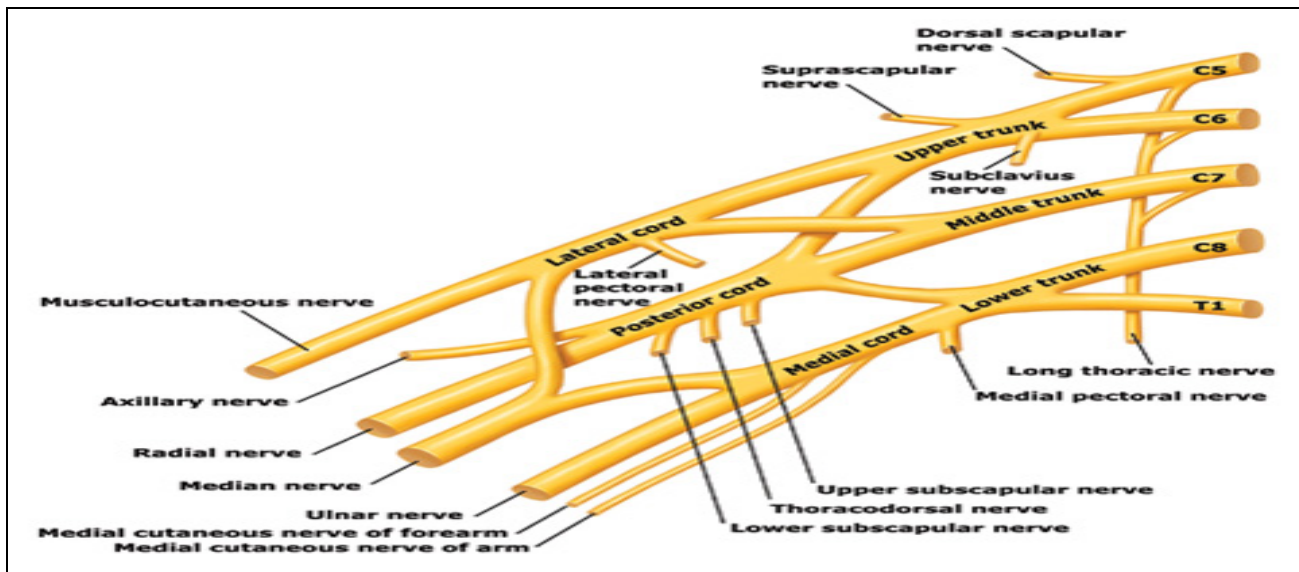


Table 16-14 provides maximum upper extremity impairment values resulting from unilateral sensory or motor deficits of the brachial plexus, or to combined deficits. **A brachial plexus-related impairment is determined according to the method described in Section 16.5b.**

AMA Guides, pg. 490: Table 16-14 - Maximum Upper Extremity Impairment Due to Unilateral Sensory or Motor Deficits of Brachial Plexus or to Combined 100% Deficits			
Brachial Plexus and Trunks	Maximum % Upper Extremity Impairment Due to:		
	Sensory Deficit or Pain*	Motor Deficit †	Combined Motor/Sensory Deficits
Brachial Plexus (C5-6 thru C8, T1)	100	100	100
Upper Trunk (C5, C6 Erb-Duchenne)	25	75	81
Middle Trunk (C7)	5	35	38
Lower Trunk (C8, T1)	20	70	75

***Table 16-10a is used to grade sensory deficit or pain. / †Table 16 11a to grade motor deficit.**

From Swanson AB de Groot Swanson G Evaluation of permanent impairment in the hand and upper extremity In Dotge TC ed *Guides to the Evaluation of Permanent Impairment* Fourth Ed. Chicago 111 American Medical Association 1993.

How To Rate a Brachial Plexus Impairment

“The pathology that affects the peripheral nerve system (PNS) produces signs and symptoms in the extremities that are specific to the level of area of injury.” Only unequivocal and permanent sensory deficits are given permanent impairment ratings. Lesions of an individual nerve produce symptoms and signs in the distribution of the involved nerve.” AMA 5th Section 16.3 pgs. 445, 446; Section 16.5, pg. 480 & AMA Disability Evaluation 2nd Edition, pg. 481

The origins and functions of the peripheral nerves that serve the upper extremities are summarized on Table 16-12, pg.484. The motor innervation of the upper extremity is shown in Figure 16-47, pg. 487. The cutaneous innervation and related nerves are shown in Figure 16-48, pg. 488 the dermatomes of the upper extremities in Figure 16-49, pg. 490. **Figure 16-50, pg. 490 shows the Brachial Plexus.**

Brachial Plexus Impairments & A Thoracic Outlet Syndrome Diagnosis**How To Rate a Brachial Plexus Impairment** (Cont.)

A brachial plexus-related impairment is determined according to the method described in Section 16.5b, pg. 481. Example 16-60 on AMA 5th, pg. 491 shows the proper steps to determine an impairment for a brachial plexus injury. This example addresses a rating for an injury to the Upper Trunk (C5-C6) of the Brachial Plexus.

Example 16-60 – AMA 5th Ed., pg. 491

Exam: A 22-year-old man was driving a pickup truck that flipped over during a crash. Days later the man could not move his left arm. After a period of months, he had recovered hand and forearm function but had total paralysis along the C5 and C6 root distribution. As a result of grafts from C5 and C6 to truncal divisions, he was partially recovered within 4 years.

Analysis: In the C5 and C6 distributions, the motor function of individual muscles was graded as follows:

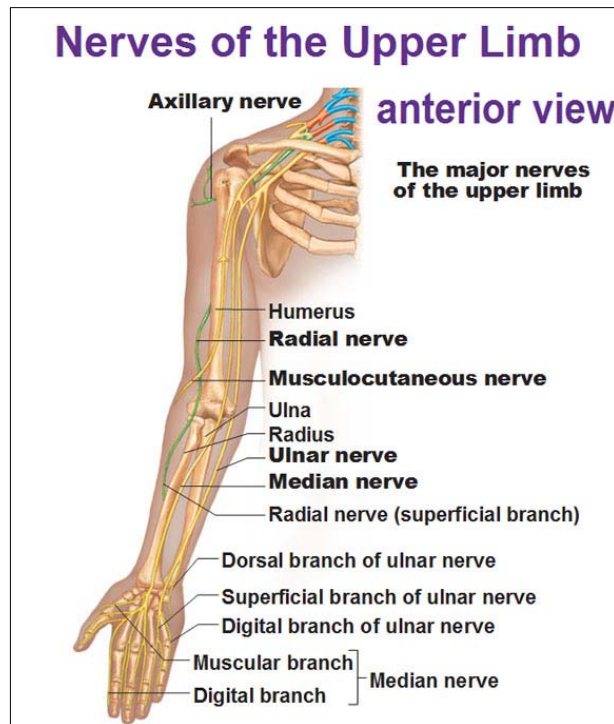
Supraspinatus – 4	Deltoid - 3	Brachioradialis - 3
Infraspinatus - 3	Biceps brachialis - 4	Supinator - 3

Table 16-12 (pg. 485) and Figure 16-47 (pg. 487) describe the motor nerves of the upper extremity. The whole person impairment was derived from the following:

1. Supraspinatus and infraspinatus muscles (suprascapular nerve, C5-6): a motor function grade of 4 was estimated to be 25% motor deficit (Table 16-1 la). The maximum upper extremity impairment for motor deficit of the suprascapular nerve is 16% (Table 16-15). The upper extremity impairment was estimated to be 25% x 16%, or 4%.
2. Deltoid muscle (axillary nerve, C5-6): a motor function grade of 3 was estimated to be 50% motor deficit (Table 16-1 la). The maximum upper extremity impairment for motor deficit of the axillary nerve is 35% (Table 16-15). The upper extremity impairment was estimated to be 50% x 35% or, rounding off, 18%.
3. Biceps brachialis muscle (musculocutaneous nerve, C5-6): a motor function grade of 4 represented 25% motor deficit (Table 16-1 la). The maximum upper extremity impairment for motor deficit of the musculocutaneous nerve is 25% (Table 16-15). The upper extremity impairment was estimated to be 25% x 25%, or 6%.
4. Brachioradialis and supinator muscles (radial nerve C5-6): a motor function grade of 3 was estimated to be 40% motor deficit (Table 16-1 la). The maximum upper extremity impairment for motor deficit of the radial nerve with sparing of the triceps is 35% (Table 16-15). The upper extremity impairment was estimated to be 40% x 35%, or 14%.

Impairment Rating: The upper extremity motor deficit impairments are *combined* by means of the Combined Values Chart (p. 604): 4% *combined* with 18% is 21%, 21% *combined* with 6% is 26%, and 26% *combined* with 14% is 36%. The total impairment of the upper extremity is 36%, which represents 22% whole person impairment (Table 16-3).

Brachial Plexus Impairments & A Thoracic Outlet Syndrome Diagnosis



AMA Guides Section 16.5 & 16.5a, pg. 480

“Accurate diagnosis of peripheral nerve disorders is based on a detailed history, a thorough physical examination with special emphasis on the nervous and vascular system, and appropriate diagnostic tests including a variety of electrical and imaging studies.

The evaluation of permanent impairment resulting from peripheral nerve disorders is based on the anatomic distribution and severity of loss of function resulting from (1) sensory deficits or pain and (2) motor deficits or loss of power. “

AMA Guides requires that physicians, before estimating the extent of any impairment, establish an accurate diagnosis. The primary requirement is the confirmation of the presence or absence of specific pathology or loss of organ function. **Neurodiagnostic studies are an integral part of this process.**

Table 5.6 - Clinical Evaluation & Diagnostic Tests For Neuromuscular Disorders

Compression Site and Typical Clinical and Nerve Conduction Features of Common Compression Neuropathies

Table Is Modified to Reflect Reported Impairment Factors

Syndrome	Entrapment Site	Typical Clinical Features	Classical EMG/Nerve Conduction Studies Findings
Median nerve			
Anterior Interosseous Syndrome	At its origin from the median nerve	Pure motor weakness of the flexion of the middle phalanx of the first three fingers	Denervation in the flexor pollicis longus and pronator quadratus, abnormal anterior interosseous nerve conduction
Pronator Syndrome	At the level of pronator teres	Entire median motor and sensory neuropathy with pronator teres spared, pronator muscle tenderness and ' Tinel's sign on it	Denervation in the median innervated muscles with pronator teres spared, slow motor and sensory-mixed NCS in the forearm and elbow
Ulnar nerve			
Tardy Ulnar Palsy And Cubital Tunnel Syndrome	Elbow	"Claw hand", motor deficit on hypothenar muscles, sensory impairment over the dorsal and palmar aspects of the last 1 5 fingers	Slow NCV across elbow, abnormal mixed and sensory <u>Nerve Conduction Studies / EMG</u> , over finger-elbow
Guyon's Canal	Wrist	Same as above except sensory impairment over palmar aspects of the last 1 5 fingers	Prolonged terminal latency, slow sensory NCV over finger-wrist segment
Thoracic Outlet Syndrome (Brachial Plexus)	Thoracic Outlet	Sensory impairment over the ulnar side of the entire arm and hand, motor deficits in the hyper- and hypomuscles.	Prolonged F wave, abnormal ulnar sensory NCS, low median compound muscle action potential, abnormal medial antebrachial NCS
Radial Nerve			
Saturday night palsy	Spiral groove	Wrist drop	Denervation in the radial innervated muscles except triceps
Posterior interosseous syndrome	Arcade of Frohse	Finger drop	Denervation in the extensor digitorum communs and indices, extensor carpi and radials spared

CMAP = compound muscle action potential, EMG = electromyography, NCS = nerve conduction study, NCV = nerve conduction velocity

Luis Pérez-Cordero & Craig Andrew Lange - Wednesday, February 19, 2014

Certified, AMA Guides Impairment & California Disability Rating Specialists

American College of Disability Medicine & Board of Independent Medical Examiners