



The Spinal Accessory Nerve Injuries

Subhadra Nori

M.D Regional Medical Director Department of Rehabilitation Medicine, Queens Health Network, Elmhurst Hospital Center, Queens Hospital Center, Associate Professor ICAHN school of Medicine at Mount Sinai N.Y, 79-01 Broadway Elmhurst Queens N.Y 11373

ABSTRACT

The Spinal accessory nerve, (SAN) the 11th cranial nerve is the main nerve supply to the trapezius muscle. During surgical dissections, i.e. Radical and Modified Radical neck dissections, for cancer of the head and neck or during lymph node biopsies or other neck injuries, this nerve can be damaged in part or whole. As a result disabling shoulder syndrome can occur. Frequently it can be misdiagnosed as frozen shoulder, impingement or rotator cuff syndrome. This article reviews anatomic variations of SAN, identification of injury, signs and symptoms, Rehabilitation and other surgical treatment options available to reduce the disability and improve functional outcomes.

KEYWORDS

Case;

A 68 year old male, presented to the Rehab Clinic with a chief complaint of right shoulder pain for 4 months. The pain is deep-seated in the shoulder worse on movement and is constant. He is unable to perform overhead activities. The pain is a 5/10 on a VAS scale. The pain temporarily improves with analgesics. Pain does not radiate to elbow or wrist. No history of tingling or numbness in his upper extremity. No inciting incidents reported. No history of fever.

Past medical history:

On further questioning patient reported that he had a lymph node biopsy 3 months ago on the right side. The results are positive for submandibular gland squamous cell carcinoma. Patient will be receiving chemotherapy soon. There is no other medical history.

Social history:

Patient is a smoker 2 PPD since his teens and works as a plumber.

Examination; Reveals a WD, WN, WM in moderate distress. He has atrophy of right shoulder upper quadrant. Range of motion (ROM) of the shoulder is decreased by 30° in abduction/ and forward flexion. Elevation of the shoulder above the head is also painful and incomplete. No deficits found in rotation. No Horner's. MMT 3/5 power in shoulder abduction /forward flexion. Additionally, weakness of shoulder shrug on right side in the 3/5 range. Sensory exam was intact to LT and PP. Reflexes - 2+ symmetrical biceps, BR triceps. A small healing biopsy scar in the right posterior triangle next to SCM muscle was present. Neer impingement test, Hitch hiker test, and Hawkins tests were negative.

Differential diagnosis:

DJD of glenoid humeral joint; the presenting patient is usually older, with complaints of insidious onset of pain on active motion. They have deficits in Active ROM. X-rays reveal positive findings as joint space narrowing, osteophytes, and sclerosis.

Rotator cuff (RTC) tears; Patient presents with a history of trauma. signs and symptoms involve pain, and deficits in shoulder flexion. External rotation is impaired more than internal. Examination may be positive for drop arm test. Pa-

tient is unable to sustain arm in elevation. Even a slight tap on the arm leads to a "drop". MRI is positive for complete or partial tears of supra and infraspinatus.

Impingement syndrome; Patient presents with a protracted history of pain and discomfort. Signs of impingement such as pain on active abduction, and presence of painful arc between 30 – 60° of arm abduction are present. Neer's impingement sign and Hitchhiker's sign are helpful. X-rays might be positive for calcium deposition in the supra spinatus tendon.

Nerve damage involving brachial plexus; (upper trunk) involves all the muscles supplied by the upper trunk, i.e. deltoid, biceps, brachioradialis, triceps, and supraspinatus. Axillary nerve involves deltoid and teres minor muscles. Suprascapular nerve involves suprascapular and infra scapular muscles. EMG, NCV studies are helpful for diagnosis.

The patient underwent an MRI of the shoulder which was negative for RTC tears, glenoid/labral tears or Glenohumeral joint DJD.

An EMG (Electromyography) was positive for spinal accessory nerve damage.

This case is an example of spinal accessory nerve injury, commonly seen after procedures as cervical lymph node biopsy for head and neck cancers.

Discussion:

The spinal accessory, (SAN) or eleventh cranial nerve is composed of two distinct parts. (Fig 1). The Cranial part, or the accessory portion (ramus internus), is the smaller of the two, and is accessory to the vagus. It arises from the cells of nucleus ambiguus and the dorsal efferent nucleus and then emerges from the medulla below the roots of the vagus. It leaves the skull through the jugular foramen. The major portion of the eleventh nerve is the spinal portion (ramus externus). Several rootlets unite to form a single trunk, which enters the skull through the foramen magnum, where it joins the cranial portion of the nerve for a short distance. It leaves the skull, through the jugular foramen. Although it lies within the same dural sheath as the vagus nerve, it is separated from it by a fold of arachnoid. It descends in the neck behind or in front of

the internal jugular vein and behind the digastricus and stylohyoid to the upper part of the sternocleidomastoid (SCM) which it supplies and then descends to end in the deep surface of the trapezius. (Ref 1).

The trapezius is a large muscle consisting of 3 distinct parts: upper, middle and lower. Each part serves complementary, yet different roles. The simultaneous actions of the upper and lower parts exert a rotational action of the scapula. (Ref 4, 5). This upward rotation of the scapula accompanies abduction of the arm at the glenoid-humeral joint and produces elevation of the arm above shoulder level. (Ref 6, 7)

Lesions of the SAN:

Cranial nerves unlike peripheral nerves, lack of epineurium and are unable to stretch, they also have less collagen and therefore are more vulnerable to injury. (Ref 8, 9) The accessory nerve can be damaged intra cranially at the skull base, or at the jugular foramen or in the neck. (Ref 3). According to Donner and Kline. (Ref 10) 71% are iatrogenic and 24% traumatic. The most common iatrogenic cause is the lymph node biopsy in the posterior triangle due to its superficial location. Other causes include neck dissections for the treatment of head and neck cancers, parotidectomy, carotid endarterectomy and gunshot wounds. Other non-traumatic causes include Vernet's syndrome i.e. lesions of cranial nerves 9-11 with or without the involvement of 12, head injury, herpes zoster, brachial neuritis and schwannoma. Severance of the SAN is associated with the well-recognized shoulder syndrome (Ref 11). Loss of shoulder function due to resection of the SAN and denervation of the trapezius muscle is the most disturbing complication of neck dissection. The incidence of paralysis of this nerve has been reported as high as 63% (Ref 12) in neck dissections. (Table)

Symptoms and signs of Paralysis;

Patients complain of dull aching discomfort, experienced along the upper margin of scapula, frequently described as resembling tooth ache. (Ref 13, 14) This pain is due to the stretching of scapula retractors (rhomboids) and the elevator (elevator scapulae), initiated by the unbalanced pull of the serratus anterior. In addition, arm abduction is limited to 90° with stiffness and weakness with overhead activity causing difficulties even with simple tasks such as combing one's hair. (Ref 15, 16).

Trapezius weakness causes downward displacement of the scapula with a downward and forward drop of the shoulder (Ref 17). With the abduction of the arm scapular winging also called lateral winging is seen, where in the inferior boarder of scapula is rotated away from the spine due to the unopposed action of the serratus anterior muscle. Eventually frozen shoulder may develop. Atrophy of the trapezius ensues. SCM muscle is usually unaffected unless the proximal portion of the nerve is cut.

Differential Diagnosis;

Lesions of the long thoracic nerve of Bell: Paralysis of this nerve leads to medial -

Scapular winging. The nerve supplies the serratus anterior muscle which stabilizes the Medial boarder of scapula. Lesions of this nerve can result in translation of the scapula Medially because of the unopposed action of trapezius. This winging is accentuated by forward flexion and in SAN injury by abduction of the affected Upper extremity. (Ref 19)

Myofascial pain syndromes of the shoulder girdle

region: Patients usually give a history of Chronic pain, frequently related to overuse and poor posture techniques. The absence of Significant neurological deficits accompanied by presence of tender spots called "Trigger points" Are found in scapular, trapezius, neck muscles and rhomboids. Lack of muscular atrophy and Weakness

in the absence of scapular winging differentiate this syndrome from SAN injury.

Whiplash injury: In whiplash injuries, symptoms are limited to the neck. Usually there is a history of an accident. Pain and limitation of neck movements in the absence of neurologic deficits assist in the diagnosis.

Diagnosis;

Diagnosis is made by clinical presentation. Electromyography and nerve conduction Studies can confirm the diagnosis.

Electromyography: Surface electrodes are placed on all 3 parts of the Trapezius muscle and the nerve is stimulated, in the posterior triangle of the neck, next to the posterior boarder of SCM. A compound muscle action potential (CMAP) is obtained. Two parameters are studied. 1) Latency which is the time taken from stimulation to the onset of CMAP. Any delays in conduction latency indicate demyelination, which can be temporary due to traction or compression of the nerve. 2) Amplitude which is a measure of intact axons as evidenced by peak to baseline measurement of the CMAP. Needle electromyography is done by inserting thin monopolar needle electrodes into the muscles. Presence of denervation potentials such as positive sharp waves and fibrillation potentials and any drop out of motor units indicates more severe axonal damage. (Ref 18)

Rehabilitation Interventions

Rehabilitation Interventions aim at 1) reduction of pain by using deep heating modalities as therapeutic ultrasound, and Electrical stimulation 2) proximal scapular stabilization exercises, shoulder strengthening exercises with elastic stretch bands, and supine shoulder rotation exercises 3) neuromuscular education using the principles of proprioceptive neuromuscular facilitation (PNF), neuromuscular electrical stimulation (NMES), 4) Strengthening of rotator cuff using active exercises and progressing to resistive exercises. (Ref 19)

Orthotic interventions: A shoulder bracing techniques to stabilize the shoulder and prevent the effects of winging have been attempted with limited success.

Surgical interventions; In performing surgical dissections one should avoid removing any nerve, including cervical plexus nerves each of which may have sensory as well as motor function. In unavoidable circumstances and severe nerve injuries surgical re anastomosis techniques such as cable grafting, end to end anastomosis may be useful.

In Conclusion

We present a case of a 68 y/o male who has had a recent lymph node biopsy as a diagnostic procedure. A few months later he presented with classical signs and symptoms of Spinal accessory nerve damage. This is a rarely encountered situation in routine clinical work. Accessory nerve palsies lead to shoulder dysfunction which can be a debilitating and painful condition. This can result from neck dissection surgeries and other procedures as lymph node biopsies. It is important to recognize this condition so that proper interventions can be applied to reduce morbidity.

Figure Legends

Fig 1 Anatomy of the Spinal accessory nerve

Sp.Acc; spinal accessory Nerve, J.F Jugular Foramen, G.Ph Glossopharyngeal Nerve

F.M foramen magnum C.1 Cranial nerve one C.2 Cranial nerve Two C.3 Cranial nerve three C.4 Cranial nerve four S.M Sternocleido mastoid muscle, T.M Trapezius Muscle, Va- vagus, R, ganglion of the root; T, ganglion of the trunk

Source; Cunningham, D.J. *Textbook of Anatomy* (New York, NY: William Wood and Co., 1903)

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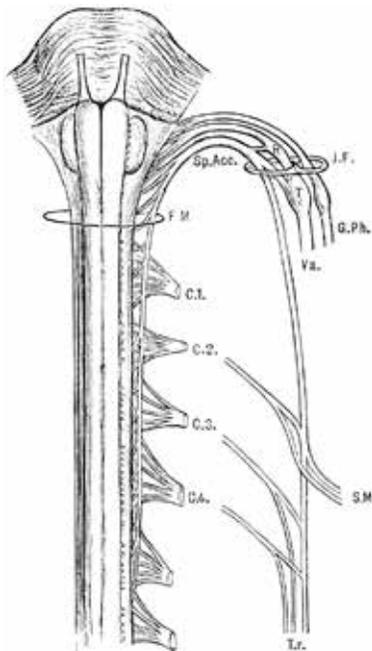


Figure 1. Spinal accessory nerve anatomy
 C1, C2, C3, C4 - Cranial nerves 1 to 4
 Tr - branch to trapezius
 SM - branch to sternocleidomastoid
 JF - jugular foramen
 Va - vagus nerve
 G Ph - glossopharyngeal nerve
 Sp Acc - spinal accessory nerve
 FM - foramen magnum
 R - ganglion of the root
 T - ganglion of the trunk

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| Traumatic | Non traumatic |
|-------------------------------------|---------------------------|
| Lymph node Biopsy | Vernet's syndrome |
| Radical Neck Dissection | Brachial Neuritis |
| Parotidectomy | Head injury |
| Carotid endarterectomy | Herpes Zoster |
| Internal Jugular venous cannulation | Radiation Therapy |
| Plastic surgical procedures of face | Carotid artery dissection |
| Shoulder Dislocation | Schwannoma |
| Blunt/penetrating injuries | |
| hanging | |
| Wrestling | |
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Table; Causes of Spinal Accessory nerve injury

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