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Case Report

Application of Ultrasonography in the Diagnosis and Treatment (5% Dextrose Hydrodissection) for Entrapment of Spinal Accessory Nerve: A Case Report

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The anatomical structure of the neck area is exceedingly complex; thus, cervical nerve damage during surgical procedures is not uncommon. A 25-year-old woman underwent excisional biopsy for neck lymphadenopathy. The patient reported left upper back pain and left shoulder weakness 1 day after the surgery. Physical examination revealed weakness of the left upper trapezius muscle and winging of the left scapula. A nerve conduction study indicated decreased compound muscle action potential amplitude on stimulation of the left spinal accessory nerve (SAN); electromyography also revealed denervation changes with the presence of voluntary motor unit action potentials in the left upper trapezius muscle. The findings indicated an incomplete SAN injury. A musculoskeletal (MSK) ultrasound found adhesion between the SAN and the surrounding scar tissue. In addition to conventional physiotherapy, the authors performed ultrasound-guided hydrodissection of the left SAN with 5% glucose. Subsequently, the patient exhibited considerable improvement. In this case report, the authors demonstrate the use of MSK ultrasound for the diagnosis and treatment of peripheral nerve entrapment in the cervical region after an iatrogenic event. (Tw J Phys Med Rehabil 2022; 50(2): 153 - 158)

Key Words: hydrodissection, accessory nerve, ultrasound, electromyography, nerve conduction study

INTRODUCTION

The spinal accessory nerve (SAN) is commonly injured during surgeries such as cervical lymph node biopsy or excision, neck tumor resection, carotid endarterectomy, or cervicofacial lift. In Taiwan, the most common cause of cervical accessory nerve injury is cervical neck lymph node dissection and radiation therapy for head and neck cancer. Other causes include blunt or penetrating cervical trauma, neck stretch injury, weight handling, or tumor compression.[1,2] SAN injury results in trapezius and/or sternocleidomastoid (SCM) weakness and atrophy, scapular dyskinesia, impairment of shoulder abduction, and neck or shoulder pain. Diagnosis of SAN injury is typically confirmed through electromyography (EMG) and nerve conduction study (NCS). In recent years, musculoskeletal ultrasound has become more common in clini-

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cal diagnosis. High-resolution ultrasound can be used to identify SAN from the cervical nerve plexus, visualize branches that innervate the trapezius muscle, and detect SAN lesions in the nerve's course in the posterior neck region.[3-7] In addition, ultrasound-guided hydrodissection of the injured nerve can be performed safely and precisely.

The current patient has provided written informed consent for the publication of case details and images. Because no identifiable information is used in this case report, the requirement of institutional review committee's approval was waived.

CASE REPORT

A 25-year-old woman underwent excisional biopsy for left cervical lymphadenopathy, and the pathologic study revealed a benign lesion. However, the patient reported left upper back pain and left shoulder weakness 1 day after the surgery. One month later, the patient was transferred to our clinic for further evaluation and rehabilitation.

Physical examination revealed weakness (manual muscle test: grade 3+) and atrophic change of the left upper trapezius muscle and winging of the left scapula. NCS revealed decreased amplitude of the compound muscle action potential (CMAP) of the left SAN (left: 0.7mV, right: 2.8mV), and prolonged distal motor latency (left side: 4.45ms, right side: 1.33ms). EMG of the left upper trapezius muscle revealed signs of denervation, increased proportion of polyphasic potentials, and decreased recruitment; however, we recorded voluntary motor unit action potential (MUAP) (Table 1). EMG studies of other muscles indicated an increased proportion of polyphasic potentials in the left sternocleidomastoid and left C4 paraspinal muscles, whereas the left levator scapulae and left rhomboideus major were unremarkable.

Under the impression of SAN injury, we performed musculoskeletal ultrasound examination for the investigation. The right spinal accessory nerve is located between sternocleidomastoid muscle and levator scapula muscle in its short-axis and long axis view (Figure 1A and 1B) under ultrasound. Compared to the contralateral side, the ultrasound image revealed swelling in the left SAN and the loss of its architecture beneath the hypoechoic scar tissue in the subcutaneous layer (Figure 2A, 2B, 2C).

During functional examination, she had scapula winging on shoulder abduction from 0 to 90 degrees, with shoulder shrugging and limited ROM to 90 degrees. During manual muscle test for shoulder girdle region, poor muscle power was noted in the left upper, middle trapezius, and left serratus anterior. Therefore, the patient received physical therapy, including heat therapy; functional electric stimulation to the left trapezius, infraspinatus, supraspinatus, anterior deltoid, and middle deltoid; ball massage; stretching exercises of left serratus anterior and proximal part of upper trapezius; left shoulder range of motion (ROM) exercises; and resistance training of infraspinatus, rhomboid, biceps, supraspinatus, upper trapezius, middle trapezius, and lower trapezius muscles 3 times a week for 6 weeks. However, after 1 month of physical therapy, the patient exhibited only minimal improvement. Thus, we performed ultrasound-guided perineural injection (hydrodissection) of the left SAN and the scar tissue in its short-axis through in-plane approach from posterior to anterior of the neck. The injectate was 10ml 5% dextrose (1ml 50% glucose, 8ml normal saline and 1ml 1% lidocaine solution). The injection repeated monthly for 3 sessions (Figure 2D). One month after the first injection, the patient exhibited considerable improvement in terms of symptoms and shoulder function. The patient had active ROM of left shoulder flexion of 125°to 180° and left shoulder abduction of 90° to 180°. Muscle power in left shoulder abduction and the left upper trapezius also improved from poor to good. Thus, a follow-up NCS of the left SAN was performed and revealed improvement of the electrophysiological parameters regarding the amplitude and onset latency of the CMAP (Table1), while physical examination 7 months later showed left shoulder ROM and muscle power return to normal with no deformity.

DISCUSSION

The estimated incidence rate of SAN injury was 3% to 8%.[8-10] During full shoulder abduction, the thoracic spine extends 10-15 degrees naturally. However, trapezius weakness may reduce the magnitude of this thoracic extension, thus indirectly distort overall scapulothoracic kinematics. The SAN injury causing SCM and trapezius muscle atrophy may also relate to compensatory hyper-

trophic change of other shoulder muscles. The serratus anterior muscle, if unopposed due to the weakness of trapezius will excessively protract the scapulothoracic joint, allowing the patient unable to flex the shoulder above the head.[15] However, the typical pattern of SAN palsy related scapular lateral winging is the scapular moving lateral and downward; and the patient will have difficulty of pure frontal plane shoulder abduction.[10-11,15]

The treatment for complete SAN injury includes surgical nerve exploration, nerve repair, nerve grafting, or dynamic muscle transfer, whereas conservative treatment is indicated for partial nerve injuries. However, conservative management has not revealed consistent benefits.[12] The failure of conservative treatment is largely due to inadequacy in strengthening the surrounding muscle groups to compensate for the weakness of the upper trapezius. If adequate functional recovery is not observed after conservative treatment for a minimum of 1 year, further conservative treatment is unlikely to be beneficial.[12]

Hydrodissection of the nerve involves injecting fluid into spaces around the nerve to dissect the surrounding tissue adhesions. This procedure has been proven to have favorable outcomes in treating entrapment neuropathies, such as carpel tunnel syndrome, cubital tunnel syndrome, and lateral femoral cutaneous nerve entrapment.[13] Using 5% dextrose solution on peripheral entrapment was proved to have pharmacological, mechanical effects, such as downregulation of several pain pathway and remobilization of the compressed nerve by separating from adhesion. Possible neuroregeneration may subsequently developed.[14] However, to date, no study has reported the use of hydrodissection for SAN injury.

Table 1. Nerve conduction study results of the spinal accessory nerve

	SAN	Stimulation site	Recording site	Latency (ms)	CMAP amplitude (mV)	Area (mVms)
1 month after injury	Left	1cm posterior to the SCM at the level of upper margin of the thyroid cartilage	Upper trapezius, 5cm lateral to C7 spinous process	4.45	0.7	5.56
	right	As above	As above	1.33	2.8	19.61
3 months after injury	Left	As above	As above	1.72	0.9	5.52
	right	As above	As above	1.72	2.8	21.1
5 months after injury	Left	As above	As above	1.56	1.0	9.43
	right	As above	As above	1.56	1.9	26.37
7 months after injury	Left	As above	As above	1.56	3.0	21.79
	right	As above	As above	1.95	2.5	20.24

CMAP: compound muscle action potential
SCM: Sternocleidomastoid muscle

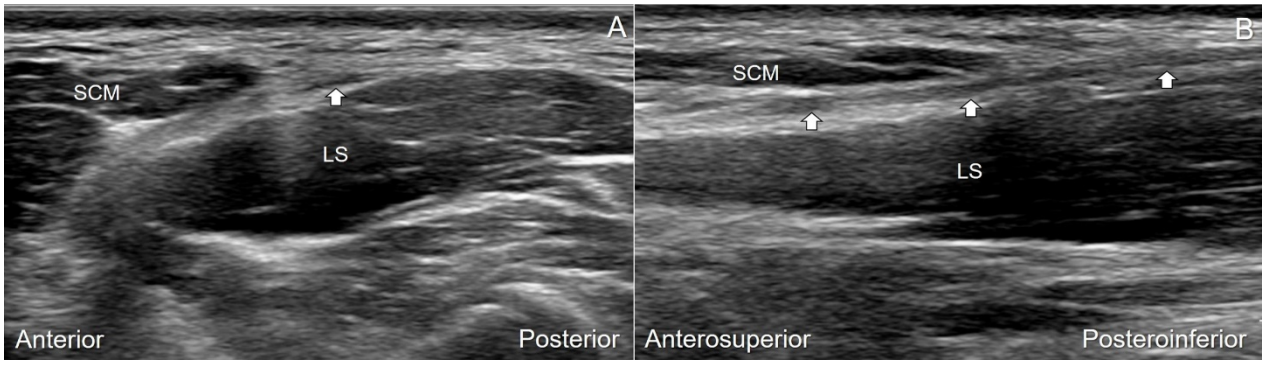

Figure 1. Ultrasonography of the right spinal accessory nerve (white arrow) in its short-axis (A) and long axis (B). SCM, sternocleidomastoid muscle; LS, levator scapula muscle.

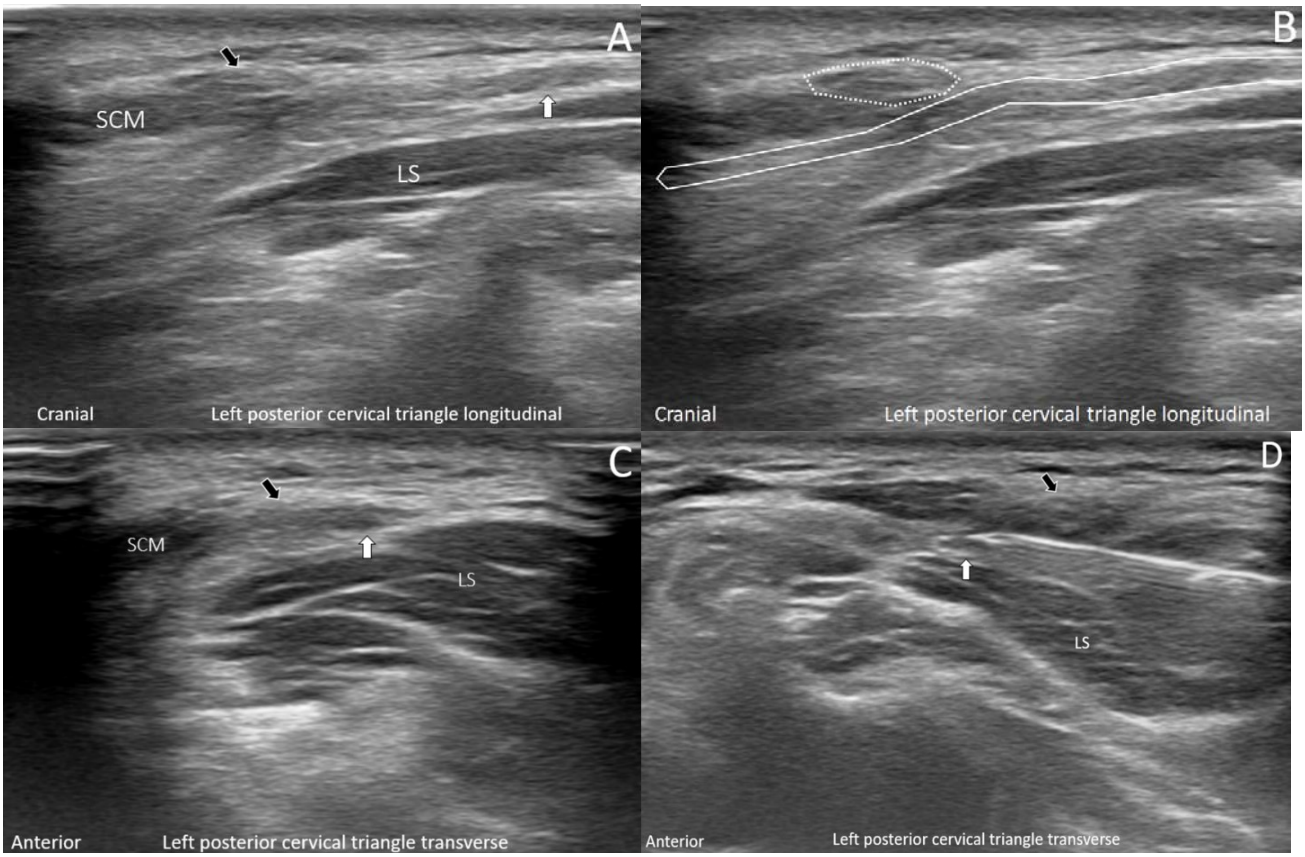

Figure2. (A)(B) Longitudinal scan of the left spinal accessory nerve (SAN) (white arrow and solid white line). The swelling of the SAN is 3 to 5 mm away from the scar tissue (black arrow and dashed white line), suggesting compression-induced retrograde swelling of the SAN. Unlike direct injury, where the swelling or neuroma is formed right beneath the scar, the left SAN is partially damaged because of scar adhesion after surgery. (C) Transverse scan along the left SAN revealed adhesion between the left SAN and the surrounding tissue of the surgical scar. The swollen SAN is in the posterior cervical triangle, which is located posterior to the SCM and anterior to the trapezius muscle. (D) Hydrodissection of the SAN was performed under ultrasound guidance (transverse scan, in-plane approach, posterior to anterior). SCM, sternocleidomastoid muscle; LS, levator scapula muscle.

Our patient presented with weakness, decreased CMAP amplitude, and the presence of denervation changes and voluntary MUAPs in the left upper trapezius, indicating an incomplete SAN injury. In addition to the patient undergoing local massage, functional electric stimulation, stretching and strengthening exercises, and motor control exercise for scapular muscles, the authors performed 3 sessions of ultrasound-guided hydrodissectionon the left SAN by using 5% dextrose solution; the patient exhibited considerable improvement shortly after the first injection. The NCS also indicated substantial improvement in onset latency and CMAP amplitude of the left SAN in follow-up studies.

CONCLUSION

High-resolution musculoskeletal ultrasound may help practitioners define the lesion of the SAN injury as well as complement EMG and NCS for the diagnosis of SAN injury. In addition, ultrasound-guided hydrodissection of the injured nerve may improve the treatment outcome.

DISCLOSURE

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超音波於脊椎副神經損傷之臨床應用：個案報告

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近年來骨骼肌肉、神經超音波在臨床診斷的應用上日益廣泛，合併超音波及神經傳導檢查更能精準地掌握周邊神經損傷的部位與嚴重度。25 歲女性無意間發現左側頸部有 2 公分的腫塊，因疑似淋巴瘤，故接受淋巴結切除術。術後一天自覺左上背疼痛及左肩無力，身體檢查發現左上斜方肌肌力下降，且呈現翼狀肩胛(winged scapula)。神經傳導檢查發現左側脊椎副神經(spinal accessory nerve)複合肌肉動作電位波(compound muscle action potential)振幅較右側下降了 96%，傳導潛期延長 3.34 倍。肌電圖檢查發現左上斜方肌有去神經(denervation)現象，多相波增加和肌肉徵召下降(reduced recruitment)，但尚可偵測到主動收縮運動神經元電位波。左側胸鎖乳突肌(sternocleidomastoid)和第四頸椎旁肌肉也有多相波比率增加現象。超音波檢查發現左側脊椎副神經與周圍組織手術後疤痕有沾黏現象，且產生逆行性腫脹。診斷為左側脊椎副神經因頸部淋巴結切片後之沾黏造成部份損傷。

病人接受物理治療，每週三次，總共六週。開始復健一個月後回診發現症狀只有些微改善，便於一個月後給予超音波導引神經解套術(hydrodissection)，每月一次，共三次。病人表示注射後一個月，肩膀症狀、功能和肩關節活動度大幅改善。追蹤神經傳導檢查也有明顯改善。

高解析度的肌肉、骨骼、神經超音波對於脊椎副神經損傷的診斷及治療均有助益。（台灣復健醫誌 2022；50(2)：153 - 158）

關鍵詞：神經解套術(hydrodissection)，脊椎副神經(accessory nerve)，超音波(ultrasound)，肌電圖(electromyography)，神經傳導(nerve conduction study)

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