Isolated Suprascapular Nerve Palsy: a Review of Nine Cases

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ABSTRACT: ***Background*:** In nine patients, suprascapular nerve palsy followed serious accidents associated with fractures of the cervical vertebrae, clavicle or scapula and after weight lifting, wrestling and a fall on the elbow or shoulder. ***Method*:** All patients were examined as to muscle wasting, weakness and shoulder fixation. EMG examination was done in all cases and six patients underwent surgical exploration. ***Results*:** The palsy was incomplete on clinical and EMG examination in all patients. On exploration, scarring, entrapment, tethering or kinking at the suprascapular notch was found in four and two had post-traumatic neuromas. ***Conclusions*:** In contrast to published studies, none of our patients presented with shoulder pain, a spontaneous onset nor with involvement limited to the infraspinatus muscle. The differential diagnosis should include C5 root lesion, brachial plexus neuritis, frozen shoulder and tear of the rotator cuff.

RÉSUMÉ: Paralysie isolée du nerf sus-scapulaire: revue de neuf cas. ***Introduction:*** Chez neuf patients, la paralysie est apparue suite à un accident grave avec fractures de vertèbres cervicales, de la clavicule ou de l'omoplate, suite à la pratique de l'haltérophilie ou de la lutte, suite à une chute sur le coude ou l'épaule. ***Méthode:*** Nous avons vérifié l'atrophie musculaire, la faiblesse et la fixation de l'épaule chez tous les patients. Ils ont tous subi un EMG et six patients ont subi une exploration chirurgicale. ***Résultats:*** L'examen clinique et l'EMG ont montré une paralysie incomplète chez tous les patients. L'exploration a mis en évidence du tissu cicatriciel, une séquestration, une fixation ou une coudure du nerf au niveau de l'échancrure coracoïdienne chez quatre patients et deux avaient un neurome post-traumatique. ***Conclusions:*** Contrairement aux études déjà publiées, aucun des patients de notre étude ne s'est présenté avec une douleur à l'épaule, une apparition spontanée des symptômes ou une atteinte limitée au muscle sous-épineux. Le diagnostic différentiel de cette affection inclut la lésion de la racine nerveuse C5, la névrite du plexus brachial, l'épaule gelée et la rupture de la coiffe des rotateurs.

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Suprascapular nerve palsy occurs as a result of injury at or distal to its origin from the upper trunk of the brachial plexus, by entrapment at the suprascapular notch (SSN)[1-5] and it has also been described in entrapment more distally, at the spinoglenoid notch (SGN).[6] Bateman[7] has described injury to the nerve after blows to the suprascapular region in sporting accidents. Suprascapular nerve palsy has been reported after intensive exercises as in weight lifting[8] and also following repair work on a ceiling.[9] Isolated nerve palsies have been described after trauma,[10] fracture at the suprascapular notch,[11] and in association with a rotator cuff tear[12] and shoulder dislocation.[13] Weaver[14] has reviewed the anatomical features and the published literature on isolated suprascapular nerve lesions.

We have reviewed our experience with suprascapular nerve palsy seen in our laboratory since 1980. In 31 patients, the palsy followed trauma and more than one nerve was involved in 22 patients; there was combined involvement of the suprascapular and accessory nerves in 11 and, in the remainder, the suprascapular nerve was involved along with the radial, long thoracic, musculocutaneous, accessory or pectoral nerves in differing combinations. The suprascapular nerve was also involved in 18 patients with brachial plexus neuritis but we did not encounter any cases of isolated paralysis on this basis. This review consists of the 9 patients in which the palsy was isolated to the suprascapular nerve. The majority were due to accidental trauma and the remainder occurred after weight lifting and wrestling during which there was strenuous effort but without any identifiable injury.

Anatomic Considerations

The suprascapular nerve arises from the posterior aspect of the upper trunk of the brachial plexus. Its fibres derive from the fourth, fifth and sixth cervical roots. The nerve lies above the cords of the plexus and it courses downward and laterally toward the superior border of the scapula where it passes through the suprascapular notch (SSN) and then under the suprascapular ligament to the dorsum of the scapula. It supplies the supraspinatus muscle and passes through the spinoglenoid notch (SGN) to terminate in the infraspinatus muscle.

The suprascapular nerve is the only branch of the upper trunk and it is involved in isolation or along with injuries to the brachial plexus. The nerve is relatively fixed at the suprascapular foramen and is subject to traction there.[6,13] Rengachary,[15] in

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studies on cadavers, demonstrated that shoulder movement with abduction and cross adduction will tense the nerve in the suprascapular foramen and result in compression by the transverse suprascapular ligament.

Method

This series consists of 9 patients with isolated suprascapular nerve palsy who were referred to the electrophysiology laboratory of a large urban teaching hospital. Patients with multiple nerve involvement, irrespective of cause, were not included. Details of the cause, EMG examination, operative findings, treatment and eventual outcome are summarized in Table 1. The supraspinatus and infraspinatus muscles were examined by inspection and palpation. Shoulder movements were observed, with particular attention to the first 30 degrees of abduction (supraspinatus), to external rotation (infraspinatus), and motor power was assessed. Limitation of glenohumeral movement as evidence of a complicating frozen shoulder was looked for. Evidence of injury to adjacent nerves was also sought; the bulk and power of the trapezius, deltoid, biceps and other shoulder girdle and upper limb muscles were assessed in order to exclude involvement of adjacent nerves.

Electrophysiological examination was done by the use of a DISA 1500 Digital EMG System. Findings of fibrillation and positive sharp waves as evidence of denervation, the presence of motor units under voluntary control, the completeness of the interference pattern and the appearance of polyphasic motor nascent potentials on serial examinations as evidence of recovery were noted. The number of preserved motor units under voluntary control and the degree of denervation was graded on a scale of 0 to 4+. Follow-up information was obtained when possible by clinical examination and through the records of referring physicians.

Results

The series consists of 9 patients, all of whom were males. The details of causation, electromyographic changes, findings at operation, treatment and outcome are recorded in Table 1. Three had been in serious automobile accidents complicated by fractures of the clavicle, cervical vertebra, scapula or by severe head injury with prolonged unconsciousness. Two patients developed shoulder pain while weight lifting, another while wrestling, and this was followed by weakness and wasting. One patient suffered cervical compression fractures in a diving accident. In 2 patients, the palsy followed an otherwise uncomplicated fall on

Table 1:

Px	Duration (months)	Cause	EMG		Nerve at operation	Procedure	Recovery
			supra-	infra- spinatus			
VC	5	wrestling	D 2+ MU 4+	D 2+ MU 2+	no surgery		improving at 5 mos
SG	7	fall on elbow	D 2+ MU 4+	D 2+ MU 2+	no surgery		complete at 1 yr
JL	8	weight lifting	D 2+ MU 2+	D 1+ MU 0	kinked at SSN	S/S ligament divided	complete 18 mos post-op
SE	4	weight lifting	D 2+ MU 4+	D 1+ MU 0	scarred, tethered at SSN	S/S divided	slight
RK	5	fall on shoulder	D 2+ MU 3+	D 2+ MU 3+	Entrapment at SSN	S/S ligament divided	none after 1 mo
EW	5	MVA 1 week coma	D 1+ MU 3+	D 1+ MU 0	scarring at SSN	Neurolysis S/S divided	unknown
SR	2	Diving accident. C1,7 fracture	D 1+ MU 2+	D 2+ MU 2+	no surgery		unknown
SJ	4	MVA C1,clavicle fracture	D 2+ MU 2+	D 1+ MU 2+	Neuroma 2 cm distal to origin	explor-ation	good 11 mos post-op
MB	6	MVA: scapula fracture, coma	D 2+ MU 3+	D 2+ MU 0	Neuroma at origin	explor-ation	partial 6 mos post-op

D: fibrillation and positive sharp waves, graded 0-4+
MU: Motor units under voluntary control, graded 0-4+
S/S: suprascapular ligament SSN: suprascapular notch
MVA: Motor vehicle accident

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the elbow or shoulder. The type of trauma is listed in Table 2. The palsy was incomplete on clinical examination in all patients. The complication of a partially frozen shoulder, as evidenced by significant limitation of internal rotation, was present in 4 patients.

Although there appeared to be selective involvement of the infraspinatus muscle on clinical examination in 2 patients, EMG examination showed fibrillation and positive sharp waves in the supraspinatus muscle as evidence of nerve injury to that muscle and the palsy had followed wrestling and a fall on the elbow respectively. The remaining 7 patients had obvious clinical involvement of both supra and infraspinatus muscles. Six patients underwent surgical exploration and the findings are noted in Table 3. In the two patients who had developed the palsy after weight lifting, there was kinking at the suprascapular notch in one and scarring with angulation at that site in the other. The ligament was surgically sectioned in both. Of the 3 patients who had suffered severe automobile accidents, a post-traumatic neuroma with preserved conduction to electrical stimulation across the neuroma was found at operation in 2 patients and the other had scarring at the suprascapular notch.

Discussion

The diagnosis of isolated suprascapular nerve palsy is usually an obvious one. There is a history of a serious accident with head or neck injury with or without local fractures, of a minor strain, of blunt trauma at the time of a fall or of the onset after weight lifting or wrestling. The patient complains of weakness of the shoulder and there is often a history of transient pain at the onset. Upon examination several weeks later, there usually is wasting of both spinatus muscles although this may occasionally appear to be confined to the infraspinatus muscle and there is weakness in initiation of abduction (supraspinatus action) and of external rotation (infraspinatus action) of the shoulder.

Table 2: Isolated Suprascapular Nerve Palsy – 9 patients.

CAUSES		number of patients
Trauma/Accidental		6
Motor vehicle accident	3	
Fall	2	
Diving	1	
Sports-related		3
Wrestling	1	
Weight lifting	2	

Table 3: Findings at operation – 6 patients.

Entrapment or kinking at suprascapular notch	2
Scarring, tethering at suprascapular notch	2
Post-traumatic Neuroma	2

The nerve is subject to direct injury when there is severe local trauma and this is accompanied by scarring, tethering, or neuroma formation. Our experience would also show that the nerve can be involved as a form of "activity palsy", that is, after the physical effort of a sport, without obvious injury and we have also seen palsies of the lateral popliteal[16] and the long thoracic nerve[17] on this basis.

The main differential diagnosis includes C5 root lesion, brachial plexus neuritis (neuralgic amyotrophy) and frozen shoulder. A C5 root lesion is usually on the basis of cervical disc disease with neck pain and limitation of movement; there is involvement of the supra- and infra-spinatus, the deltoid, biceps, and brachioradialis muscles. The biceps and brachioradialis reflexes are diminished and there is a dermatomal sensory loss. Brachial plexus neuritis is of sudden onset, with severe pain, followed by the development of weakness, wasting and at times, sensory loss, with involvement of several muscles about the shoulder including the deltoid, the biceps, triceps and at times the forearm muscles, often preceded by a systemic illness or a surgical procedure, and without a history of trauma. Polymyositis is a cause of weakness and wasting of the shoulder girdle muscles, but it is bilateral, symmetrical and is unrelated to trauma.

A partly frozen shoulder (tendinitis) is frequently overlooked as a cause of pain, limitation of movement and apparent shoulder weakness. Unless the condition has been longstanding, there is no muscle wasting and the milder forms are best detected by a loss of glenohumeral internal rotation (the interscapular reach test).** Callahan et al.[18] have described 23 patients with chronic shoulder pain; of these, six had undergone thoracic outlet procedures and three had had anterior cervical discectomies without relief of pain. It was recommended that an EMG and a nerve block be done in all patients and that temporary but complete relief of pain by the nerve block was considered to be the most diagnostic. All 23 eventually underwent a surgical release of the nerve at the suprascapular foramen and, although three required further surgery because of a recurrence, overall, 20 patients had excellent results with complete relief of pain and resolution of weakness. This observation is contrary to our experience and we have not found persistent pain to be a feature of suprascapular nerve palsy unless there should be a complicating frozen shoulder. We have no definite explanation of this difference in experience other than to question whether nerve entrapment was the basis of the problem. With the exception of the median nerve at the wrist, nerve entrapments generally do not present with pain as a major symptom although they cause numbness and weakness; a minor degree of tendinitis, bursitis or acromioclavicular arthritis is often overlooked as a cause of shoulder pain and the altered usage of the limb can result in secondary muscle wasting and apparent weakness. Although the authors claim excellent results in the majority, several of their patients had already undergone unsuccessful surgical procedures for chronic pain, a feature which would raise the question of a chronic pain state and its complex determinants rather than that of a simple nerve entrapment which can be treated by decompression.

The supra- and infra-spinatus muscles are readily accessible for electromyographic (EMG) sampling. The presence and

** This is a test of internal rotation of the glenohumeral joint in which the patient places the arm behind the back and reaches upward as high as possible between the shoulder blades. Most patients can reach up to about the mid scapula and the height of reach can be compared with the normal side. In our experience, it is the earliest limitation and most sensitive test in frozen shoulder.

number of surviving motor units under voluntary control, the appearance of fibrillation and positive sharp waves at about the fourteenth day after onset and the eventual appearance of polyphasic potentials as evidence of reinnervation are looked for and they permit an assessment of the degree of involvement and of recovery. Nerve conduction to the supra- and infra-spinatus muscles can be measured, as a latency value, upon stimulation of the lateral aspect of the brachial plexus at the base of the neck. These latency determinations are easy to obtain and are prolonged in incomplete nerve injuries. We have not found them to provide any useful information beyond what is available on EMG sampling.

As with other isolated nerve palsies, treatment is determined by the severity of the lesion and its cause.[19] An incomplete palsy can be managed conservatively and improvement can be expected over the next months. The shoulder should be moved daily, through a full range, in order to avoid the complication of frozen shoulder. When the lesion is complete clinically and electromyographically, follow-up examinations should be done in order to detect recovery. The "pace of recovery rule"[20] dictates that, for a nerve of this length (approximately 3 inches), evidence of recovery and reinnervation should appear by about 3 months. If this pace of recovery is not fulfilled and the history is one of local trauma, then complete severance or severe neuroma formation can be suspected and surgical exploration should be considered.

In our series, all of the lesions were incomplete on EMG examination and this indicated a degree of anatomical continuity. Although 6 patients underwent surgical exploration, we would have to say, in retrospect, that the indications for exploration in the patient with an incomplete palsy and the value of neurolysis or relief of an apparent entrapment is not definitely established. As a general guide to the management of nerve palsies, surgical exploration is not indicated when the lesion is incomplete and when there is no reason to suspect a partial section of the nerve as in a penetration injury nor a mechanical impediment to recovery and reinnervation. Although pressure or entrapment by the suprascapular ligament was an operative finding in 2 of our patients in which the palsy followed exertion and trauma, respectively, we cannot say that the the natural course was affected by the surgery.

We did not encounter any examples of isolated involvement of the infraspinatus. Liveson et al.[13] had reported three cases of isolated infraspinatus involvement which followed athletic activity, with recovery, apparently on the basis of a lesion at the spinoglenoid notch. They regarded this as the commonest form of suprascapular nerve palsy but we have not encountered any patients with this condition. Mass lesions[13,21] have also been reported without any relation to trauma but we have not seen any examples of this.

In our series, six patients with severe but incomplete palsy underwent surgery. Five were found to have significant structural changes or lesions, with entrapment at the SSN in 3, post-traumatic neuromas in 2, and were treated with division of the suprascapular ligament and neurolysis, respectively. The post-operative outcome was generally favourable.

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References

1. Kopell HP, Thompson WAL. Pain and the frozen shoulder. Surg Gynecol Obstet 1959, 109: 92-96.
2. Kopell HP, Thompson WAL. Peripheral Entrapment Neuropathies. Baltimore: Williams & Wilkins, 1963: 130-142.
3. Ford FR. Diseases of the Nervous System in Infancy, Childhood and Adolescence. 6th Ed. Springfield, Ill: Charles C. Thomas, 1973: 1313.
4. Clein LJ. Suprascapular entrapment neuropathy. J Neurosurg 1975; 43: 337-342.
5. Kiss G, Komar J. Suprascapular nerve compression at the spinoglenoid notch. Muscle & Nerve, June 1990, 556-557.
6. Ganzhorn RW, Hocker JT, Horowitz M. Suprascapular nerve entrapment: a case report. J Bone Joint Surg 1981; 63A: 492-494.
7. Bateman JE. Nerve injuries about the shoulder in sports. J Bone Joint Surg 1967; 49A: 785-792.
8. Agre JC, Ash N, Cameron MC, House J. Suprascapular neuropathy after intensive progressive resistive exercise: case report. Arch Phys Med Rehabil 1986; 00: 236-238.
9. Montagna P. Suprascapular neuropathy after muscular effort. Electromyogr Clin Neurophysiol, Sept-Oct 1983; 23: 553-557.
10. Foerster O. Die Symptomatologie der Schussverletzungen der peripheren Nerven. *In*: Lewandowsky M. Handbuch der Neurologie. Ergänzungsband, Part 2, Berlin: Springer, 1929.
11. Solheim LF, Roaas A. Compression of the suprascapular nerve after fracture of the scapular notch. Acta Orthop Scand 1978; 49: 338-340.
12. Kaplan PE, Kernahan WT Jr. Rotator cuff rupture: management with suprascapular neuropathy. Arch Phys Med Rehabil, May 1984; 65: 273-275.
13. Liveson JA, Bronson MJ, Pollack MA. Suprascapular nerve lesions at the spinoglenoid notch: report of three cases and review of the literature. J Neurol Neurosurg Psychiatry 1991; 54: 241-243.
14. Weaver HL. Isolated suprascapular nerve lesions. Injury: Br J Accident Surg 1983; 15(2): 117-126.
15. Rengachary SS, Neff JP, Singer PA, Brackett CE. Suprascapular entrapment neuropathy: a clinical, anatomical and comparative study. Neurosurgery 1979; 5: 441-455.
16. Berry H, Richardson M. Common peroneal nerve palsy: a clinical and electrophysiological review. J Neurol Neurosurg Psychiatry 1976; 39(12): 1162.
17. Berry H. Traumatic peripheral nerve lesions. *In*: Bolton C, Brown WF, eds. Clinical Electromyography, 2nd edition. Stoneham, Mass.: Butterworth/Heinemann Medical Publishers, 1993: 352.
18. Callahan JD, Scully TB, Shapiro SA, Worth RM. Suprascapular nerve entrapment. A series of 27 cases. J Neurosurg 1991; 74: 893-896.
19. Berry H. *Op. cit.* (Ref. 17): 325.
20. *Ibid.*: 328.
21. Fritz RC, Helms CA, Steinbach LS, Gerant HK. Suprascapular nerve entrapment: evaluation with MR imaging. Radiology 1992; 182: 437-444.