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Suprascapular nerve entrapment. A meta-analysis

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Abstract We performed a review of the literature between 1959 and 2001. We found 88 cases of suprascapular nerve entrapment, which fulfilled our inclusion criteria. Suprascapular nerve entrapment is rare and mainly occurs in patients under 40 years of age. Males are more likely to suffer from a ganglion compressing the nerve than females. If the patient's history reveals a trauma, it is more likely that the ligament is compromising the nerve. Ganglions usually cause isolated infraspinatus atrophy, whereas a combined atrophy of the supra- and infraspinatus muscles is more common in cases in which the nerve is compressed by the ligament.

Résumé Nous avons fait une révision de la littérature entre 1959 et 2001 et avons trouvé 88 cas de compression du nerf suprascapulaire remplissant nos critères d'inclusion. La compression du nerf suprascapulaire est rare et se produit surtout chez des patients de moins de 40 ans. Il est probable que les hommes ont, plus volontiers que les femmes, une compression ganglionnaire qui comprime le nerf. Si l'histoire du malade révèle un traumatisme, il est vraisemblable que le ligament est en cause. Habituellement les ganglions causent une atrophie isolée du muscle infraspinatus, alors qu'une atrophie combinée des muscles supra – et infraspinatus est plus commune lorsque le nerf est comprimé par le ligament.

Introduction

Isolated suprascapular nerve entrapment is well described in the literature but is a relatively rare entity [30, 39]. Of all shoulder pain, 1–2% is caused by entrapment of the suprascapular nerve and therefore can be easily overlooked in the differential diagnosis of shoulder discomfort. The main symptoms are pain, weakness and atrophy of the supraspinatus or infraspinatus muscles (Fig. 1). However, these symptoms are also related to other pathologies around the shoulder such as rotator cuff tears or impingement syndrome. The rare occurrence of this entity, and the similarity of symptoms to those related to other pathologies around the shoulder, may cause difficulty in revealing suprascapular nerve entrapment. The purpose of this meta-analysis was to summarize the data of surgically confirmed cases to demonstrate the common features of this entity and to reveal factors enabling discrimination between the two most frequent causes – ganglion and suprascapular notch.

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Anatomy

The suprascapular nerve develops out of the upper trunk of the brachial plexus and is a mixed motor and sensory nerve that carries pain fibers from the glenohumeral and acromioclavicular joints and provides motor supply to the

Fig. 1 Isolated atrophy of the right infraspinatus muscle caused by nerve compression in the scapular notch

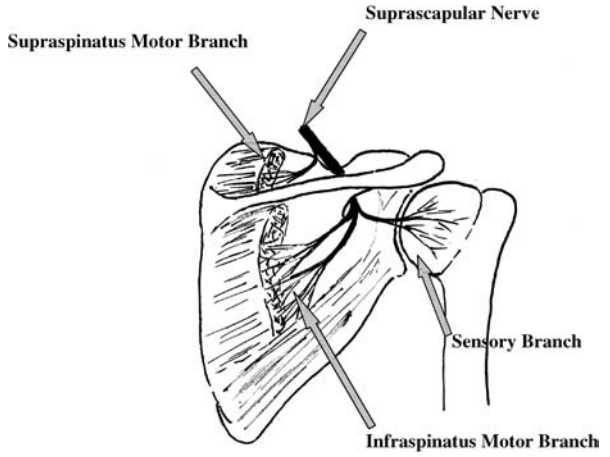

Fig. 2 Posterior view of the scapula with the course of the suprascapular nerve and spreading in motor and sensory nerve fibers

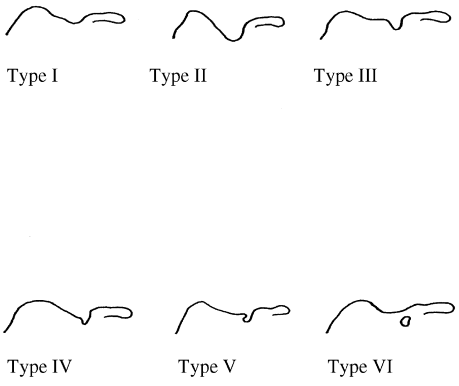

Fig. 3 The six types of the suprascapular notches

supraspinatus and infraspinatus muscles (Fig. 2). There are no skin sensory fibers attached. The nerve supplies the supraspinatus muscle with one or two motor branches, and sensory nerve fibers provide and acromioclavicular joint. After passing the lateral edge of the scapular spine, the nerve divides in several motor branches to supply the infraspinatus muscle and sensory nerve fibers to provide the dorsal capsule of the glenohumeral joint.

Common causes of the suprascapular nerve entrapment are direct nerve compression in the suprascapular notch or compression of the nerve distal to the suprascapular notch by a dorsally located ganglion from the glenohumeral joint. Rengachary et al. [32] described six different types of notches, depending on the bony configuration and enclosures (Fig. 3). Depending on the shape of the notch, shoulder motion causes an angulation of the nerve, pressing it against the suprascapular ligament or a bony edge, resulting in irritation of the nerve.

Clinical findings are deep and diffused pain. In many cases, a dull ache over the posterior and lateral area of the shoulder is reported, which may irradiate down the arm. In many cases, weakness of external rotation and abduction is reported, especially in those with marked atrophy (Fig. 1).

Materials and methods

The literature was searched through Medline and Index Medicus to make a thorough review of the English, German, and Japanese literature for the years 1959–2001. Inclusion criteria were as follows: (1) Surgically confirmed cases where explicit and detailed description of the onset of symptoms, specification of possible muscle atrophies, and time between onset of symptoms and surgical treatment was given for each particular case. Articles with summarized description of several cases were not included. (2) Number of patients per publication, information on gender, and age at onset of symptoms. (3) Clinical outcome was evaluated if available.

Statistical analysis was performed by employing Chi-square test of equal proportions (X^2). A P value less than 0.05 was considered significant. In case of numeric data, Wilcoxon test was performed due to uneven distribution of data.

Results

We found 88 cases (83 patients) [2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47], which fulfilled the inclusion criteria. These cases were divided into two groups based on the cause of nerve entrapment. In group 1, the ganglion compression group (n=38, Table 1), a dorsally located ganglion was found to compress the nerve distally to the suprascapular notch. In group 2, the ligament compression group (n=50, Table 2), nerve entrapment was a result of the suprascapular ligament in the bony notch.

We found some significant differences between the groups: In group 1, patients were predominantly male (36 male/1 female, P<0.001, X^2), while in group 2, 34 were males and 11 females.

In both groups, the onset of symptoms typically included insidious pain with or without a history of trauma. In group 2, 33 patients complained of an insidious onset of pain while 17 gave a history with some degree of trauma. In group 1, none of the 38 patients gave a history of trauma (P<0.001). The overall mean time span between the onset of symptoms and surgery was 14.4 (1–108) months. Patients group 1 were slightly younger (mean 31 years) than patients in group 2 (mean 37 years) (P=0.13, Wilcoxon 2 sample test). Isolated atrophy of the infraspinatus muscle was found in 83% of patients group 1 but only in 8% of patients in group 2 (P<0.001, X^2). A combined atrophy of infra- and supraspinatus muscles was reported in 48% of patients in group 2 but only in 13% of patients in group 1 (P<0.001, X^2). No atrophy was reported in 35% of patients group 2, but only in 3% of patients in group 1 (P<0.005, X^2).

Five bilateral cases were observed, all in group 2 [2, 11, 34, 45]. Time between onset of symptoms and surgical treatment was significantly shorter in group 1 (mean 8 months) than in group 2 (mean 17 months) (P<0.01, Wilcoxon test).

Mean follow-up in group 1 was 12.4 (3–48) months. There was only information on the clinical outcome in 17 cases. In eight of those cases there was a complete re-

Table 1 Patients with suprascapular nerve entrapment caused by ganglion; *SS* supraspinatus muscle, *IS* infraspinatus muscle, *SS+IS* supraspinatus and infraspinatus muscle

Author year	Gender	Mean age (years)	Absence of paralysis	Muscle paralysis			Average duration of symptom (months)	Symptoms at onset	Clinical outcome
				SS	IS	SS+IS			
Aratani, 1970 [3]	1 m	32			1		8	1 pain	–
Okida, 1974 [28]	2 m	29.5			2		3.5	2 pain	–
Maruyama, 1973 [23]	1 m	24			1		7	1 pain	–
Hirayama, 1981 [16]	1 m	28				1	3	1 pain	–
Ganzhorn, 1981 [10]	1 m	26			1		1	1 atrophy	–
Minami, 1982 [24]	1 m	38			1		1	1 pain	–
Thompson, 1982 [43]	1 m	37			1		5	1 pain	1 atrophy
Yoshida, 1984 [47]	1 m	37				1	2	1 pain	–
Ozaki, 1984 [29]	1 m	36			1		2	1 pain	–
Usui, 1985 [44]	1 m	33			1		36	1 pain	–
Tamai, 1985 [41]	1 m	35			1		3	1 pain	–
Hadley, 1986 [12]	1 m	37.1			1		15.2	1 pain	1recurrence
Neviaser, 1986 [26]	1 m	21			1		5	1 pain	1 recovery
Sugimoto, 1986 [37]	1 m	41			1		2	1 pain	–
Hama, 19867 [13]	1 m	29				1	16	1 pain	–
Terwaki, 1987 [42]	1 m	17			1		5	1 pain	–
Hara, 1989 [14]	1 m	33			1		3	1 pain	–
Watanabe, 1989 [46]	1 m	32	1				4	1 pain	–
Ogino, 1991 [27]	3 m	21.6			3		8	3 pain	3 recovery
Takagishi, 1991 [39]	1 m	26			1		2	1 pain	1 atrophy
Takagishi, 1994 [40]	3 m	30			3		2	3 pain	3 recovery
Skirving, 1994 [36]	3 m	28			3		10	3 pain	2 atrophy, 1 recurrence
Ianotti, 1996 [18]	3 m	32			3		15.7	3 pain	1 atrophy
Fehrmann, 1995 [8]	5 m	41.7	1	1	1	4	11.5	6 pain	2 atrophy, 1 recovery

Table 2 Patients with suprascapular nerve entrapment caused by the ligament; *SS* supraspinatus muscle, *IS* infraspinatus muscle, *SS+IS* supraspinatus and infraspinatus muscle

Author year	Gender	Mean age (years)	Absence of paralysis	Muscle paralysis			Average duration of symptom (months)	Symptoms at onset	Clinical outcome
				SS	IS	SS+IS			
Clein, 1975 [6]	4 m	41		4	1		6	1 trauma, 3 pain	2 recovery, 2 atrophy
Rask, 1976 [31]	2 f	–	2				42	2 trauma	2 atrophy
Garcia, 1981 [11]	1 m, 1 bilat	69				1	48	2 pain	1 atrophy
Swafford, 1982 [38]	1 f	22				1	6	1 pain	1 atrophy
Laulund, 1984 [21]	3 m, 2 f	31.8				5	13.8	4 pain, 1 trauma	1 recovery, 4 atrophy
Post, 1986 [30]	5 m, 4 f	43.8	8			1	38.4	5 trauma, 4 pain	6 atrophy, 3 pain
Hadley, 1986 [12]	5 m	37.1				5	15.2	1 pain, 4 trauma	2 atrophy
Alon, 1988 [2]	1 f, 1 bilat	35				1	12	2 pain	1 atrophy
Jerosch, 1987 [19]	1 m	30			1		11	1 trauma	1 atrophy
Mizumo, 1990 [25]	1 f	23				1	7	1 trauma	1 atrophy
Ringel, 1990 [33]	2 m	30.5			2		9	2 pain	2 atrophy
Shupek, 1990 [34]	3 m, 1 bilat	32.6				3	11	4 pain	–
Kiss, 1990 [20]	1 m	52			1		24	1 pain	1 atrophy
Sjöström, 1992 [35]	1 m	25		1			7	1 pain	1 pain free
Vastamäki, 1993 [45]	4 m, 2 bilat	32.5			2	2	7	6 pain	
Heuss, 1993 [15]	1 m	37				1	24	1 pain	1 pain free
Cohen, 1997 [7]	2 m	45.5				2	11	1 pain, 1 trauma	
Wurnig, 1997	1 m	32				1	12	1 pain	1 atrophy

covery, in two a recurrence, and in seven muscle atrophy was unchanged. In group 2, the clinical outcome was reported in 33 cases after a mean follow-up of 20.6 (1–120) months. Complete recovery was reported in five cases. There was a recurrence in three cases and atrophy was unchanged in 25 cases.

Discussion

Entrapment of the suprascapular nerve is a rare cause of pain in the shoulder region [10, 25, 36]. At sympton onset, the diagnosis is often uncertain due to nonspecific symptoms [4, 5, 6, 9]. Imaging techniques, MRI, CT, and ultrasound investigation may depict a ganglion com-

pressing the nerve [7, 21, 22, 36]. However, when entrapment is caused by the ligament none of these imaging techniques will suffice. In advanced cases, electromyographic examination can give further information both when the entrapment is caused by a ganglion and by the ligament [4, 33, 41, 43].

Ganglions compressing the suprascapular notch have been demonstrated to occur predominantly in male patients. While no explanation for this phenomenon can be found in the literature., a gender bias for males developing ganglions seems probable [3, 5, 32].

Onset of pain associated with trauma was found only in group 2. Direct trauma to the suprascapular nerve is unlikely due to its coverage by the trapezius muscle. Traction injury due to the complex motion of the scapula, as described in the literature [26], and the "sling effect" described by Rengachary [32], are much more probable causes of pain. Onset of pain during sports or other strenuous activity has been described by several authors when the entrapment is caused by the ligament [4, 15, 28, 41].

The mean time span between onset of symptoms and the ultimate surgical decompression was twice as long in group 2 as in group 1. This may be due to the deficiencies of imaging techniques to demonstrate a causative lesion. Ligament entrapment becomes evident only with the occurrence of muscular atrophy that occurs long after the onset of symptoms and will usually lead to electromyographic (EMG) investigation demonstrating motor dysfunction [6, 38]. Nonetheless, in 36% of the cases with ligament compression reported in the literature no atrophy was seen, suggesting compression of the sensory nerve fibers only [4, 21, 25, 26, 41, 42]. Preoperative muscle atrophy and poor operative results with persistent postoperative atrophy is, in many cases, based on a delayed diagnosis and therapy. In younger patients with persistent shoulder pain and unsuccessful therapy, entrapment of the suprascapular nerve should be included in the differential diagnosis.

A statistical difference was found between the two groups when comparing location of muscular atrophy. Combined supra- and infraspinatus atrophy was much more common in group 2 and might be due to the fact that the nerve is compressed within the notch where it contains motor fibers for both the supra- and infraspinatus muscles [43]. On the other hand, isolated infraspinatus atrophy is much more likely to occur in ganglion compression patients due to the more common location of the ganglion distal to the suprascapular notch [2, 18, 21, 24, 42]. Discretion between the two causes of nerve entrapment may be identified by the location of the muscle atrophy, as very small ganglions are difficult to reveal by imaging techniques [36].

The relatively high rate of 49% of remaining muscle atrophy in this series suggests an irreversible damage to motor nerve fibers [1, 4, 6, 8, 9, 15, 17, 20, 26, 28, 29, 39, 41]. The majority reported, however, on pain resolution [1, 4, 5, 9, 11, 15, 17, 18, 21, 25, 28, 29, 31, 34, 30, 39]. Unfortunately, the clinical outcome was stated in less than 50% of the studies. Data are therefore incomplete and not valid for statistical analysis or revealing prognostic factors. However, it seems that earlier surgical treatment in both groups might decrease the percentage of remaining atrophy.

Overall suprascapular nerve entrapment is rare and mainly occurs in patients under 40 years of age. If the patient's history reveals a trauma, it is more likely that the ligament is compromising the nerve. The location of muscle atrophy can help to locate the cause of entrapment. Ganglions usually cause an isolated infraspinatus atrophy, whereas a combined atrophy of the supra- and infraspinatus muscles is more often seen in cases with entrapment caused by the ligament.

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