# Suprascapular Neuropathy Combined with Massive Rotator Cuff Tears: Clinical Signs, Diagnostics, Treatment

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**ABSTRACT**

*Suprascapular neuropathy is a type of disease, which up until recently was considered quite rare and observed mainly among the athletes. On the contrary, this problem is observed quite often, especially as a professional disease among the individuals involved in heavy manual labour. The syndrome of suprascapular nerve compression is a complex problem, combining a multitude of reasons and resulting in the atrophy of the supraspinal and infraspinous muscles. The compression of the suprascapular nerve is developing due to its complex anatomy, the presence of additional bony and other types of structures in the area of the scapular notch, as well as due to the traumatic lesions of the rotator cuff and of the scapular spine. There is an opinion that the contraction of the damaged supraspinal and infraspinous muscles may cause contusion- related changes in the suprascapular nerve, which may persist after the reconstruction of the rotator cuff. The provided research summarizes the data available on the suprascapular neuropathy, especially combined with massive rotator cuff tears, as well as on the reasons of its development, the clinical manifestations, the diagnostics and the comparative results for various treatment methods. An analysis was conducted of the main research results obtained using the surgical treatment for suprascapular neuropathy, in particular, the arthroscopic decompression combined with the treatment of rotator cuff abnormalities. The analysis of literature data has shown that, in case of the presence of space-occupying masses or bone deformities in the area of the scapular notch, surgical correction shows significant positive results. In case of damaged rotator cuff, the combination of arthroscopic release of the suprascapular nerve with its reconstruction provides good clinical results, promoting to the decrease of the pain syndrome during the postoperative period, however, no significant differences were reported when restoring the rotator cuff both with the release procedure and without it. Most part of the patients with chronic pain syndrome and degenerative changes can be successfully treated conservatively. Despite the fact that the relation of rotator cuff tears and suprascapular neuropathy is undoubtful, many researchers describe the absence of statistically significant difference in the clinical results of reconstructing the rotator cuff together with arranging the procedure of arthroscopic release and without it. Thus, probably, the indications to arthroscopic release of the suprascapular nerve should be clearly limited to cases of its neuropathy based on the data obtained during the research including larger samples of patients.*

***Keywords:*** *suprascapular neuropathy; rotator cuff; suprascapular nerve; arthroscopic decompression of the suprascapular nerve.*

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## INTRODUCTION

Pain in the shoulder joint is a quite widespread orthopedic problem. Shoulder pain is the third most widespread complaint related to the musculoskeletal system in the primary medical aid [1, 2]. Complaints of pain related directly to the shoulder joint most frequently are a consequence of damaging the bone and cartilage structures of the shoulder, the acromioclavicular or sternoclavicular joints, as well as of the rotator cuff or other soft tissues of the shoulder complex. The incidence of shoulder pain in the society varies widely and, according to the data from latest research works, it equals 16% (ranging from 0.67 to 55.2%). The parameters are higher for women comparing to men. The incidence of shoulder pain varies from 7.7 to 62 per 1000 persons a year (with the mean values of 37.8 per 1000 persons a year) [3]. Notably, 20–40% of the patients show asymptomatic ruptures of the rotator cuff, indicating that the structural abnormality may not always manifest clinically, also impairing the function of the shoulder



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# Нейропатия надлопаточного нерва в сочетании с массивными разрывами вращательной манжеты плеча: клиническая картина, диагностика, лечение

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**АННОТАЦИЯ**

*Нейропатия надлопаточного нерва — вид патологии, который до недавнего времени считался довольно редким и наблюдался в основном у спортсменов. На самом деле данная проблема встречается достаточно часто, особенно в качестве профессионального заболевания у людей, занимающихся тяжёлым физическим трудом. Синдром сдавления надлопаточного нерва — проблема комплексная, сочетающая множество причин, приводящая к атрофии надостной и подостной мышц. Компрессия надлопаточного нерва обусловлена его сложной анатомией, наличием дополнительных костных и других образований в области вырезки лопатки, а также травматическими повреждениями вращательной манжеты плеча и ости лопатки. Существует мнение, что сокращение повреждённых надостной и подостной мышц могут вызывать контузионные изменения надлопаточного нерва, которые могут сохраняться после реконструкции вращательной манжеты плеча. В представленной работе обобщены имеющиеся данные о нейропатии надлопаточного нерва, особенно в сочетании с массивными разрывами вращательной манжеты плеча, а также о причинах возникновения, клинических проявлениях, диагностике, сравнительных результатах различных методов лечения. Проведён анализ основных результатов хирургического лечения нейропатии надлопаточного нерва, в частности артроскопической декомпрессии в сочетании с лечением патологии вращательной манжеты плеча. Анализ литературы показал, что при наличии объёмных образований, костных деформаций в области вырезки лопатки хирургическая коррекция имеет значимые положительные результаты. В случае повреждения вращательной манжеты плеча сочетание артроскопического релиза надлопаточного нерва с её реконструкцией даёт хорошие клинические результаты, способствует уменьшению болевого синдрома в послеоперационном периоде, однако значимых различий при восстановлении вращательной манжеты как с процедурой релиза, так и без неё не выявлено. Бóльшая часть пациентов с хроническим болевым синдромом и дегенеративными изменениями могут успешно лечиться консервативно. Несмотря на то, что связь разрывов вращательной манжеты плеча и нейропатии надлопаточного нерва не вызывает сомнений, многие исследователи описывают отсутствие статистически значимой разницы в клинических результатах реконструкции вращательной манжеты плеча с проведением процедуры артроскопического релиза и без таковой. Таким образом, вероятно, следует более чётко ограничить показания к артроскопическому релизу надлопаточного нерва при его нейропатии на основании данных исследования на бóльших выборках пациентов.*

***Ключевые слова:*** *нейропатия надлопаточного нерва; вращательная манжета; надлопаточный нерв; артроскопическая декомпрессия надлопаточного нерва.*

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joint [4]. The disease of the suprascapular nerve recently has become one of the widespread reasons of pain and weakness in the shoulder joint [4, 5].

Recently, a multitude of scientific articles were published on the incidence, the causes, the risk factors and the possible variants of conservative and surgical treatment for suprascapular neuropathy combined with massive ruptures of the rotator cuff, however, no unified opinion on the treatment tactics was compiled based on the literature data.

In the provided review, we have summarized the data available as of today on suprascapular neuropathy, especially when combined with massive rotator cuff tears, as well as on the reasons of its development, on the clinical manifestations, on the diagnostics and on the comparative results of various treatment methods.

**Methodology of searching the sources**

The present review included the publications from the Pubmed database submitted before the year of 2024 (inclusive). The search was carried out using the following key words: “suprascapular nerve”, “suprascapular neuropathy”, “suprascapular notch”, “spinoglenoid notch”, “arthroscopic decompression (release) of the suprascapular nerve”, “massive tears of the rotator cuff”. An analysis was conducted on the main clinical results of surgical treatment.

## SUPRASCAPULAR NEUROPATHY COMBINED WITH MASSIVE ROTATOR CUFF TEAR: REASONS OF DEVELOPMENT, RISK FACTORS, TREATMENT VARIANTS

### Anatomic features

The suprascapular nerve compression syndrome is to a great extent caused by the complex anatomical structure of the nerve itself, which is formed by the branches of the upper trunk of the brachial plexus [6–8], innervating the supraspinal and the infraspinous muscles, the acromioclavicular joint, the skin of the posterior surface of the shoulder. Within the structure of the suprascapular nerve, there are two possible areas of entrapment — the area of the suprascapular notch (Fig. 1) and the area of the spinoglenoid notch [9]. The variant of the anatomical structure of the suprascapular notch can be the reason of possible compression of the suprascapular nerve. There are six types of the suprascapular notch structure: type 1 — recess; type 2 — shallow V-shaped notch; type 3 — U-shaped notch; type 4 — deep V-shaped notch; type 5 — U-shaped notch with partial ossification of the ligament; type 6 — complete ossification of the transverse ligament [10]. Specifically this anatomical variant determines the complexity of diagnostics of suprascapular neuropathy, which more often develops in cases of type 5 and type 6 scapular anatomy variants.

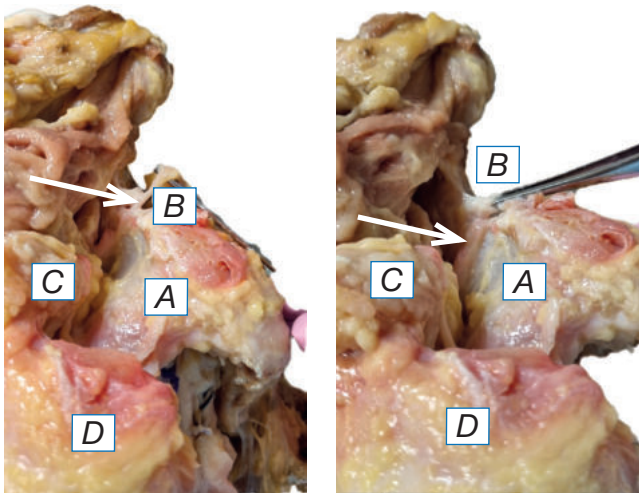


**Fig. 1.** The area of the suprascapular ligament. The scapula (*A*), the transverse ligament of the scapula (*B*), which is dissected on the left and intact on the right, the diverted supraspinatus muscle (*C*), the acromion (*D*). The arrow indicates the suprascapular nerve.

### Pathophysiology and reasons of developing the suprascapular neuropathy

The impaired functions of the shoulder joint can be resulting both from the damage of the rotator cuff and from the impairment of its innervation. Two possible levels are described for damaging the suprascapular nerve — the proximal one (between the scalene muscles and the Erb’s point, i.e. the place of origination of the brachial plexus) and the distal one (between the suprascapular notch along the upper margin of the scapula and the infraspinous muscle). When moving the shoulder forward during the external rotation, the fibers of the suprascapular nerve become dislocated along with the stretching of the nerve: the area of its cross-section decreases, while pressure inside the nerve bundles builds up [5, 11]. If, upon the stretching of the nerve, its limit of elasticity does not get exceeded, the nerve restores its initial length, but if its extension limit gets exceeded, the nerve deforms, not being capable of restoring its original length. Thus, repeated rotation motions in the shoulder are the reason of repeated injury or compression of the suprascapular nerve [5]. Nerve compression can also develop in case of bone tissue traumatic changes and in case of additional bone tissue formation in the scapula, in case of space-occupying cysts or tumors in the area of the scapular notch [12–14].

Currently, a strong interest is noted in terms of the relation between the suprascapular neuropathy and the massive retraction of the fibers in cases of rotator cuff tears. M.J. Albritton et al. [15] in their research have focused the attention on the fact that medial retraction of the supraspinal muscle tendon drastically increases the tension in the nerve. It was found that there is a tension limit in cases of lateralization of the supraspinal and infraspinous muscles when conducting the surgical treatment of the rotator cuff suture, for this may lead to excessive tension in the branches of the suprascapular nerve. In turn, there is an opinion that, in patients with increased range of motion in the shoulder joint and with isolated injuries of the subscapular muscle, there is a risk of developing suprascapular neuropathy [16].


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**Clinical manifestations**

The clinical manifestations of neuropathy mainly depend on the location of the lesion and on the reasons of compression [9, 13]. Upon the detailed survey and assessment of the patient, it is possible to find the presence of impaired dermal sensitivity in the area of the posterior segments of the shoulder, as well as the location of pain in the scapular area, which can increase upon the adduction of the humeral bone with it simultaneous inward rotation, or when flexing the shoulder joint with simultaneous adduction of the shoulder, also when turning the head to the opposite side [17]. On palpation, the area of the supraspinal fossa can be sharply painful, other findings may include positive hyperextension tests [18] and the tests of arm adduction in the transverse direction (the test described by Planche: the patient is asked to move the hand backwards and to turn it inwards, if the patient has complaints of increased pain in the posterior part of the shoulder, the test is considered positive) [19]. Upon visual examination, attention should be paid to the contralateral side: in cases of suprascapular neuropathy, the findings include a pronounced hypotrophy in the supraspinal and infraspinous muscles. The compression of the nerve in the suprascapular notch may lead to the loss of more than 75% of strength of abduction and external rotation [20]. In case of nerve injury in the area of the spinoglenoid notch, there are no sensitivity disorders or pain syndrome observed, only isolated hypotrophy of the subscapular muscle and weakness of external rotation can be noted [21].

The differential diagnostics of this disease should include the radiculopathies at the C5 level in the cervical spine, the disease of the brachial plexus, the spinal muscular amyotrophies, as well as other various secondary neuropathies [19].

**Diagnostic methods of examination**

When suspecting the abnormalities in the rotator cuff, including the combination with suprascapular neuropathy, for the purpose of ruling out the bone tissue lesions, standard radiology should be carried out using frontal projection, this procedure should be supplemented with the image of the Stryker suprascapular notch view — an image obtained using special positioning (the patient should be positioned supine, placing the palm of the impaired limb on the forehead, while the X-ray beam should be directed at a 15° angle to the head) for the evaluation of the suprascapular notch and of the spinoglenoid notch (Stryker's method) [12].

For the purpose of ruling out the bone tissue lesions in the scapula, it is also possible to use computed tomography, including the one with 3D-reconstruction, which can show the presence of specific anatomical structures damaging the nerve [22]. Thus, K. Honoki et al. [22] have found that the ossification of the transverse ligament in the scapula was significantly more commonly found in elderly patients, which rather indicates the age-related changes. Besides, there was no direct correlation found between the narrow scapular notch, the ossification of the abovementioned ligament and the development of suprascapular neuropathy.

The gold standard of examination is the magnetic resonance imaging (MRI) as the most accurate method of detecting abnormalities in the soft tissues of the shoulder joint. MRI allows for evaluating the changes (the damage) in the rotator cuff muscles, the degree of dislocation (retraction) of tendons, for detecting the fatty degeneration/hypotrophy/atrophy in the supraspinal and infraspinous muscles, as well as the presence of additional mass lesions in the area of the scapular notch — the ganglionic cysts, tumors etc. [23, 24]. For the MRI, the pathognomonic signs shall include the swelling in the area of the supraspinal and the infraspinous muscles, the fatty degeneration, the presence of fluid-containing lesions in the area of the supraspinal scapular notch [23, 25, 26].

When suspecting the presence of the suprascapular nerve compression syndrome, electroneuromyography (ENMG) should be arranged. The main difference in cases of neuropathy is the presence of fibrillations and pathological fluctuations of the M-waves. ENMG allows for detecting the changes in the nerve conductivity and it can indicate the muscle hypotrophy, however, in the differential diagnostics with other diseases of the shoulder, it can be ineffective. It is worth noting that in cases of long-term presence of chronic neuropathy, the ENMG method becomes impractical [27], for it does not allow for detecting the damage of smaller fibers or of a part of the nerve. In addition to that, the negative ENMG results cannot unambiguously rule out the diagnosis of suprascapular neuropathy in case of the presence of the corresponding clinical signs of it [28, 29].

Upon setting the diagnosis of suprascapular neuropathy, it is possible to conduct an ultrasound examination (USE) [26, 30, 31]. According to the data from publications, ultrasound examination is a good method of evaluating the muscle damage, allowing for detecting the damage of muscle fibers at various levels, however, when performing the differential diagnostics procedures, it is necessary to use MRI.

**Treatment**

*Conservative therapy*. The direct reasons of the neuropathy itself, as well as its combination with other pathological changes in the area of the shoulder joint, are the most important factors for selecting proper treatment [27]. The majority of authors tend to believe that the initiation of neuropathy treatment should be conservative if this disease (for example, neoplasms in this zone or scapular fractures) is not resulting from the pathological processes requiring surgical intervention [32]. If conservative therapy does not show results, surgical decompression of the suprascapular nerve is recommended. Nevertheless, the optimal duration of non-surgical treatment remains unclear [33]. The literature data indicate that conservative therapy often has unsatisfactory results in patients with the duration of symptoms being more than half a year, as well as in the individuals with pronounced hypotrophy and atrophy of muscles, with space-occupying lesions and massive rotator cuff tears.

The reasons by which the status of the patients gets improved in cases of conservative therapy are not clearly identified: most probably, they can be related to the compensatory mechanisms in other shoulder girdle muscles [32].

*Surgical treatment.* The indication for surgical treatment include the compression of the nerve with space-occupying lesions, the massive rotator cuff tears, as well as the inefficiency of conservative therapy [32]. It was proven that, in patients with suprascapular neuropathy caused by the compression with soft tissues, surgical treatment provides better results, and, if possible, priority shall be given to arthroscopic intervention, not to the open-access methods [18, 34]. According to the modern outlooks, direct arthroscopic intervention [35–37] is the gold standard of treatment for suprascapular neuropathy [27, 36, 38], as well as for the concomitant diseases of the rotator cuff [23, 39, 40].

According to the data from modern publications, there is no unambiguous opinion on whether the arthroscopic decompression is indicated to patients with massive rotator cuff tears. Previously, the literature sources were reporting the improvement of the functional parameters in patients with massive rotator cuff tears combined with arthroscopic release of the suprascapular nerve. L. Lafoss et al. [34] have analyzed the results of arthroscopic decompression in a series of 10 patients and revealed an improvement of the status and the functions in all the patients. J.G. Costouros et al. [39] reported about six patients with neuropathy associated with vast rotator cuff rupture. The authors have found a stable improvement of the functions in four patients and partial restoration in two. In the research by A.A. Shah et al. [40], 21/24 (87.5%) of patients had deep pain in the posterior part of the shoulder and suprascapular neuropathy according to the data from ENMG. After the decompression of the suprascapular nerve, 17/24 (71%) of patients in 9 weeks after surgery had their pain intensity decreased with improving the parameters of the scale designed by the American Shoulder and Elbow Surgeons (ASES). However, in a series of 75 patients with massive ruptures of the rotator cuff, in which surgeries were conducted for restoring the integrity of the rotator cuff, L. Lafoss et al. [34] have revealed concomitant suprascapular neuropathy by means of ENMG before surgery in 29 (39%) cases. In this group, there were no statistically significant differences detected between patients with the nerve release and the ones not undergoing such an intervention.

The groups of P. Collin [29] and P. Yang [41] have reported that, among the patients with arthroscopic release of the suprascapular nerve combined with suturing the rotator cuff, there was no statistically more significant decrease in the pain syndrome, assessed using the visual analogue scale (VAS), comparing to the group of patients not undergoing arthroscopic release of the suprascapular nerve, i.e. with only suturing the rotator cuff. Besides, in the decompression group, there was no observed significantly better improvement in the values of patient status evaluation and in the range of motions in the shoulder joint assessed using the UCLA tool comparing to the group without the arthroscopic release of the suprascapular nerve. The research results have demonstrated that additional release of the suprascapular nerve does not bring additional benefit to the arthroscopic surgery aimed at restoring the rotator cuff and that the rate of developing neuropathy in the suprascapular nerve among the patients with ruptures in the posterior-upper part of the rotator cuff is 8.7%.

N.P. Sachinis et al. [27] have arranged a randomized controlled research to find out if the elimination of rupture itself represents a successful treatment method even in patients with diagnosed suprascapular neuropathy. The authors did not find significant differences in the improvement of shoulder functions between eliminating only the rotator cuff tear and fixing the rupture with an additional option of releasing the suprascapular nerve. Besides, the research has shown that shoulder function is inversely proportional to the fatty infiltration in the area of the


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subscapular muscle, which can develop secondary in terms of suprascapular neuropathy.

In the research by K. Yamacado [37], consisting of 31 cases of suprascapular neuropathy combined with rotator cuff tears, no significant differences were detected between the groups with releasing the suprascapular nerve and without it — by all the measurements applied during the final follow-up visit: the parameters of the UCLA and VAS scales did not show statistically significant difference among the two compared groups, however, the results have demonstrated that arthroscopic release of the suprascapular nerve as an addition to the arthroscopic repair of the tendons ultimately leads to the recovery and to improving the status comparing to the pre-operational data.

The research by Dr. A.R. Ginniyatov et al. [36] has shown that the use of arthroscopic release of the suprascapular nerve combined with massive rotator cuff tear has significantly improved the status of the patients within the first three months comparing to the group without the release, along with the highest significance of the methods shown in cases of massive tears.

In turn, the systematic analysis by A.B. Sandler et al. [42] has demonstrated that releasing the suprascapular nerve in the treatment of suprascapular neuropathy improves the functional results, however, more attention should be paid to the clinical symptoms and to the diagnostics of this disease.

Thus, it can be stated that the recent publications describe various results: some research works show the absence of statistically significant difference in the clinical results of reconstructing the rotator cuff with conducting the procedure of arthroscopic release and without it, while the others show positive results of arthroscopic release of the suprascapular nerve combined with suturing the rotator cuff. It is worth noting that the sample used in the proprietary research by the authors was small.

## CONCLUSION

The conducted literature analysis has shown that, in cases of isolated suprascapular neuropathy, the majority of authors tend to conservative therapy, while in cases of abnormalities in the rotator cuff, all the researchers point out the necessity of surgical treatment. Despite the fact that the relation between the suprascapular neuropathy and the rotator cuff tears in the majority of research works is undoubtful, just as the fact that the combination of arthroscopic release of the suprascapular nerve together with the reconstruction of the rotator cuff provides good clinical and functional results, there is no unified opinion on the efficiency of the arthroscopic release of the suprascapular nerve. Publications exist that show the positive results of arthroscopic suprascapular nerve release in cases of a combination with massive rotator cuff tears (especially with the presence of neoplasms in the area of the scapular notch), however, according to the data from other investigators, statistical difference between restoring the rotator cuff with or without the release procedures was not detected. Thus, probably, a more strict limitation is required for the indications to arthroscopic release of the suprascapular nerve in case of its neuropathy based on the data obtained from the research works including larger patient samples.

## ADDITIONAL INFORMATION

**Author contributions.** *O.G. Ushkova*, *A.M. Shershnev*, *V.I. Kuzmina*: search and review of literature, analysis of the data obtained, description of the results obtained; *S.Y. Dokolin:* control and editing of materials. Thereby, all authors provided approval of the version to be published and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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