

# Prevalence of latent and manifest suprascapular neuropathy in high-performance volleyball players

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The aim of the present study was to evaluate the prevalence of latent and manifest suprascapular neuropathy in high-level male volleyball players. Thirty subjects were examined clinically and electrophysiologically. Suprascapular neuropathy, most probably at the level of the suprascapular notch, was demonstrated in 12 subjects, being latent in eight. Taking into account our clinical findings in a further 36 international-level players, a remarkably high overall prevalence of suprascapular nerve lesion of 33% (22 of 66 subjects) was found. All cases involved the side of the body with the player's smashing arm. These findings suggest that careful monitoring of suprascapular nerve function may be useful in high-performance volleyball players, as early diagnosis is essential to prevent more severe damage.

**Keywords:** Suprascapular neuropathy, volleyball, shoulder

Acute isolated lesions of the suprascapular nerve most often result from direct trauma, e.g. fracture of the scapula<sup>1</sup> or dislocation of the shoulder<sup>2</sup>. Chronic damage to the nerve, however, occurs mainly as an entrapment neuropathy with the nerve being compressed as it traverses the suprascapular notch<sup>3</sup> or, less frequently, the spinoglenoid notch<sup>4</sup>. The cause may be repetitive microtrauma due to a variety of occupational activities involving forceful movements around the shoulder joint. This mechanism has been invoked in tennis players<sup>5</sup>, volleyball players<sup>6,7</sup>, weightlifters<sup>8</sup> and boxers<sup>9</sup>.

Suprascapular neuropathy, first described by Kopell and Thompson<sup>10</sup>, is characterized by weakness of abduction and external rotation of the arm due to supraspinatus and infraspinatus muscle denervation, frequently accompanied by ill-defined shoulder pain. As the functional impairment is limited, the disorder may escape the patient's attention for a long time.

The objective of the present study was to screen high-level volleyball players for the prevalence of latent and manifest suprascapular neuropathy using clinical and electrophysiological criteria.

## Materials and methods

Thirty men who play volleyball for the first German men's volleyball league agreed to participate in this study. None of the subjects had a history of neurological disease.

Besides a history and clinical examination, concentric needle electromyography (EMG) recordings were taken from five different regions of the supraspinatus and infraspinatus muscles on both sides.

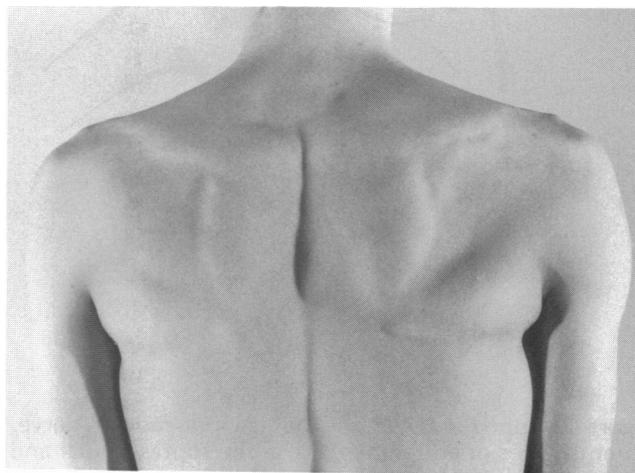
In addition, we had the opportunity to examine clinically another 36 international-level men volleyball players.

## Results

### Clinical observations

Four players showed a severe atrophy of the infraspinatus muscle (*Figure 1*) and reported a dull pain in the lateral shoulder region. Despite a marked paresis of external rotation of the arm, they denied any impairment when playing volleyball. Yet, all had noticed some difficulties concerning daily activities, e.g. when using a comb. Clinical examination yielded completely normal results in 26 subjects.

In the second group, ten of the 36 players were found to have severe atrophy of the infraspinatus muscle with subsequent weakness of external rotation of the arm, indicating suprascapular neuropathy.



**Figure 1.** Severe atrophy of the infraspinatus muscle. EMG indicated complete denervation

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## Neurophysiological findings

The aforementioned four players with severe atrophy of the infraspinatus muscle showed more than three fibrillations and a loss of recruitable motor unit potentials on EMG examination, indicating complete denervation. EMG of the supraspinatus muscle showed bizarre polyphasic and prolonged motor unit potentials suggesting chronic nerve damage. In a further eight players, neurophysiological examination indicated partial denervation of both supraspinatus and infraspinatus muscle despite normal clinical findings. In all cases of suprascapular neuropathy, the nerve lesion was found on the same side of the body as the player's smashing arm. Of the subjects, 18 showed no pathological results.

## Discussion

The suprascapular nerve arises from the superior trunk of the brachial plexus formed by the C5 and C6 nerve roots. It passes downward to the upper border of the scapula and then traverses the suprascapular notch under the superior transverse ligament to innervate the supraspinatus muscle, also providing sensory branches to the glenohumeral and acromioclavicular joints. The nerve then continues over the lateral aspect of the scapula to the spinoglenoid notch, passing under the inferior transverse ligament (present in 50%<sup>11</sup>) to reach the infraspinous fossa. Here, the nerve supplies the infraspinatus muscle (Figure 2).

The nerve is relatively fixed at three points – the origin, the suprascapular notch and the lateral edge of the scapula. Being mobilized during any shoulder movement<sup>12</sup>, the nerve is especially vulnerable to mechanical injury. Thus, it is not surprising that suprascapular neuropathy has been reported to occur in a variety of sporting activities. In the present study, 30 high-level volleyball players were screened

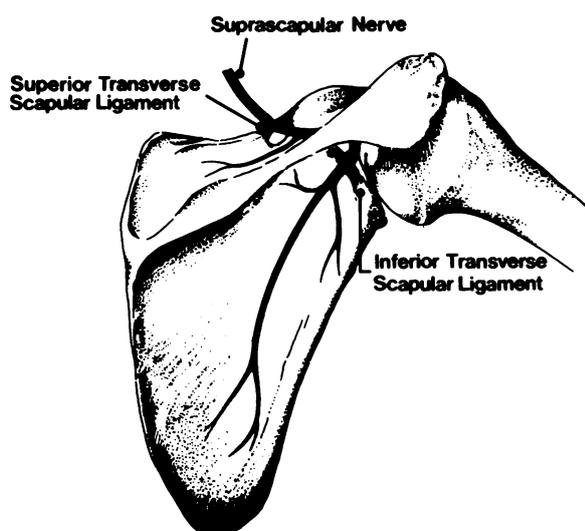


Figure 2. Topography of the right suprascapular nerve. Potential sites of entrapment are at the suprascapular and spinoglenoid notches, where the nerve passes under the superior and inferior transverse scapular ligaments, respectively

for latent or manifest suprascapular nerve damage, using clinical and electrophysiological criteria. We found a prevalence of 40% (12 of 30 subjects). It should be stressed that in four of these subjects, our data indicated complete denervation of the infraspinatus muscle, while the supraspinatus muscle was invariably involved to a much lesser degree. In eight players, neurophysiological examination revealed latent suprascapular nerve damage.

If one takes into account the results of our clinical examination in another 36 players, indicating suprascapular neuropathy in ten cases, an overall prevalence of suprascapular nerve damage of 33% (22 of 66 subjects) must be assumed. Thus, our study demonstrates that this type of nerve lesion is a remarkably frequent finding in high-performance volleyball players. With regard to the site of the lesion, the suprascapular notch must be considered the most likely candidate, taking into account the combined lesion of the supraspinatus and infraspinatus muscles. The extent of training time, usually exceeding 20 h per week in our subjects, has to be regarded as being the most important pathogenic factor. While serving the player hits the ball with maximum strength at least 1000 times per week with a stereotypical movement of hyperretroflexion with subsequent forceful antepulsion of the arm. With regard to the precise pathomechanism, Sunderland<sup>13</sup> postulated that the nerve is subjected to friction at the suprascapular notch with subsequent inflammatory swelling and constriction. Rengachary *et al.*<sup>14</sup> conducted anatomical studies in cadavers and found the nerve to be closely opposed to the suprascapular ligament with depression, retraction and hyperabduction of the shoulder. Thus, they hypothesized that the mechanism of nerve injury might involve kinking of the nerve against the ligament ('sling effect').

It is interesting to note that none of the affected subjects had noticed any functional disability when playing volleyball, though several players with severe atrophy of the infraspinatus muscle reported some shoulder pain and a slight impairment of daily routines, e.g. using a comb. Thus, professional volleyball players and their physicians should at least be aware of this disorder, because early diagnosis is the best means of avoiding more severe damage. We suggest that repeated electrophysiological studies may be useful to monitor the state of the suprascapular nerve.

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