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Mini Review

Serratus Palsy – An Update

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Isolated serratus palsy is a rare condition with lack of adequate fixation of the scapula against the rib cage during active flexion and abduction causing decreased strength and motion in these movements [1,2]. Multiple pathologies can lead to SP, but injury to the long thoracic nerve caused by trauma or strenuous exertion has been considered as the most common cause [3,4]. Damage to this periscapular muscle results in uncoordinated scapulohumeral rhythm during shoulder elevation and can potentially cause subsequent glenohumeral and subscapular pain, subacromial impingement, muscle fatigue, and glenohumeral joint instability [5]. Patients with serratus palsy have trouble with activities of daily living, they must diminish sports activities and they complain of major negative impact on quality of life. Complete recovery is possible within 2 years [1,6,7] but recovery is often only partial [8]. This article only deals with ENMG-verified serratus palsies.

Parsonage Turner syndrome

In recent years, thanks to improved imaging methods, it has been possible to show that serratus palsy is quite often actually of Parsonage-Turner origin. Parsonage Turner syndrome (PTS) is a peripheral nervous system disorder that manifests itself as severe pain and paralytic symptoms in the shoulder region and upper extremity, and that begins for no apparent reason. Severe pain usually lasts a couple of weeks. Along with palsies, muscle atrophies also develop. The basic causes of the disease are not yet known exactly, but with the current techniques of magnetic and ultrasound examinations, it is often possible to image the damage to the nerve, so that microsurgical healing treatment can be aimed at it. The diagnosis of PTS will be more common than it is today, when nerve damage can be demonstrated more successfully, and the diagnosis becomes more precise. Left untreated the disease leaves at least half of the patients with some kind of permanent disability. It is important that the attending physician remembers Parsonage Turner syndrome when a patient presenting with unexplained severe shoulder pain and also seems to have a lack of upper extremity strength appears to seek treatment.Parsonage Turner syndrome was described for the first time already in 1887 by J. Dreschfeld [9], professor of pathology at Victoria University of Manchester. However, the disease did not get its name until 60 years later, when Parsonage and Turner published their material in the Lancet in 1948 [10]. Since then, numerous researchers have dealt with the etiology, prognosis and treatment of the disease in a variety of ways [11-13]. There is still uncertainty about both the etiology and the treatment, but more is known about the prognosis based on large patient records. The reported incidence of PTS varies widely, from 1-2 cases per 100,000 per year to 20-30 cases [14-16]. The large differences may be due to the fact that the diagnostic criteria for the disease have varied over time. Thanks to new imaging methods, the prevalence of the disease will of course rise. PTS has both an idiopathic and a hereditary form, with similar clinical symptoms to the idiopathic form but usually an earlier age of onset. In Parsonage Turner syndrome, the nerves most often affected are the suprascapular, thoracicus longus, interosseus anterior, and interosseus posterior nerves.

High resolution ultrasound

Neuromuscular ultrasound is currently a standard tool in clinical work when evaluating peripheral nerve diseases. Ultrasound with modern high-frequency sensors and image processing provides excellent visualization of the peripheral nerve. Ultrasound has the additional advantage that a skilled researcher can painlessly and non-invasively evaluate the nerve along its entire length in real time. Thus, high-resolution ultrasound (HRUS) has become a valuable tool in the diagnosis and evaluation of PTS. Pathological HRUS findings can be grouped into four categories: nerve swelling, swelling with incomplete nerve narrowing, swelling and complete nerve narrowing, and as the most severe form, complete nerve narrowing and fascicular hourglass twisting. Certain ultrasound findings can help predict the likelihood of spontaneous recovery, in which case surgical treatment is at least not immediately necessary [17,18].

Magnetic resonance imaging of the nerve

The magnetic examination of the nerve (magnetic resonance neurography, MRN) refers to the direct imaging of the nerves by optimizing the selectivity for the nerves' own water content, resulting in a detailed image of the nerve and not so much of the surrounding tissues [19,20]. MRN with diffusion-weighted whole-body imaging with background body signal suppression can visualize the peripheral nerves of the whole body.

We now have a new window into the evolution of inflammatory changes involving the nerve roots, brachial plexus, and the peripheral nerves in inflammatory diseases of the nerves.

Not only can these imaging modalities exclude other structural pathologies, but they can also localise disease of the brachial plexus and outline the extent of disease [21].

Etiology of serratus palsy

According to data from a few years ago, etiology of serratus palsy is multifactorial, often impossible to prove. Anatomic causes may play some role [22], but the mechanism of injury may exert even more influence. It was speculated that etiology of serratus palsy is mostly related to shoulder trauma or overuse [3,23]. Some factors related to etiology appeared to influence the course of palsy. Traumatic palsies had poorer outcome as did inflammatory causes [24], but other clinical factors did not appear to correlate with recovery of serratus function.

Today we know that probably a significant part of serratus palsies is of Parsonage-Turner origin and may, due to advanced imaging methods of the nerve damage site, be successfully treated microsurgically.

A substantial part of non-surgically managed patients with scapular winging seems to have persistent complaints, which should be part of the information provided to patients. Data pooling demonstrated significant improvements in shoulder function, pain- and shoulder scores after tendon transfer surgery, but higher quality evidence is needed to allow for more robust recommendations and guide clinical decision-making on when to perform such functional surgery. There is no consensus in the literature regarding the best management of isolated long thoracic nerve palsy [25].

Conservative treatment strategies for serratus palsy

Strengthening of muscles supporting the scapula other than the serratus anterior through home exercise and physical therapy has been considered important. It has also been estimated that all movements that cause displacement of the scapula are less permitted, such as lifting heavy loads and lifting even light loads from the front. However, it has not been possible to prove that exercise and physiotherapy would be any more effective than reducing the use of the hand that puts strain on the disabled side to a minimum.

Scapular protecting brace

The most-disabling dysfunction in patients with isolated serratus palsy is the lack of adequate fixation of the scapula against the rib cage during active flexion and abduction. Scapular-protecting bracing may prevent this posterior displacement. Scapula bracing models have ranged from extremely cumbersome plaster shoulder spica models to more comfortable but less-effective models [23], and more recently to the more convenient and effective model [8]. Although brace treatment for patients with serratus palsy has been in use for a century, and therapeutic outcomes of its use have been reported [6,8], the designs of these studies and the braces have varied, therefore the results of these studies are not necessarily comparable. The outcome of serratus palsy after brace treatment is not so benign as has been reported in smaller series and recovery is often only partial and may not be achievable in patients with more-severe presentations [6,8].

Surgical procedures for dynamic stabilization of the scapula

Surgical treatment options typically focus on the mechanical correction of scapular winging, including muscle, tendon, or fascial flap reconstruction. The optimal surgical treatment, however, would preserve the natural serratus anterior motor function [27].

Pectoralis major transfer

Although long thoracic nerve injury typically resolves in 12 to 18 months after a physical therapy regimen, surgical intervention is indicated in patients who fail conservative management. Both direct and indirect pectoralis major tendon transfer techniques have been described in the literature as surgical options for these patients. Indirect transfer of the pectoralis major and augmentation with either allograft or autograft has been shown to successfully restore scapular functioning and glenohumeral stability. Transfer of the pectoralis major muscle for dynamic stabilization of the scapula is an effective treatment for painful scapular winging resulting from LTN palsy [28,29]. However, pectoralis minor turned out to be too weak a muscle for dynamic stabilization of the scapula [30].

Surgical procedures targeting the long thoracic nerve

There are 3 main approaches to the long thoracic nerve: the distal axillary/thoracic approach, proximal or supraclavicular approach, and the 2-level proximal and distal approach. The distal approach has been more commonly described in the literature.

Long thoracic nerve release

When functional treatment by physiotherapy fails to bring recovery within 6 months and electromyography (EMG) shows increased distal latencies, neurolysis may be suggested. The site of compression of the long thoracic nerve may be within the scalene muscles. A supraclavicular neurolysis of the long thoracic nerve may result in correction of the winged scapula [31]. If nerve compression is suspected in the distal segment, neurolysis through a vertical incision on the median axillary line along the entire nerve, removing fibrous formations and fascial expansions may be successful [32-35].

Nerve transfers

Nerve transfers allow nearby healthy axons to reinnervate the injured serratus anterior muscle close to the motor endplates and prior to atrophy. It has been used as a motor nerve a pectoral fascicle of the middle trunk [36], and that combined with a branch of the thoracodorsal nerve [37], or thoracodorsal nerve only [26,27]. Winging scapula has disappeared in the best case already in a few months.

CONCLUSIONS

The etiology of isolated serratus paresis is manifold. Thanks to advanced nerve imaging methods, an effective surgical procedure targeting the long thoracic nerve can be performed at exactly the right spot, which will certainly improve the effectiveness of the procedure. It is also very likely that a much larger proportion of serratus paresis in the future will be assessed as Parsonage Turner type and can be successfully treated with minimally invasive surgical intervention aimed at the right place.

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