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Painful Hemiplegic Shoulder: Mechanical Factors

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Abstract **Original Research Article**

Shoulder pain is a frequent complication of hemiplegia. Eighty-four percent of patients may be affected. Etiology is not well-established, although a complex interaction between mechanical and neurological factors is suspected. The practitioner is therefore often confrontedby failure in patient care. This article is a literature review of mechanical factors linked to pain, their effects and relative importance. Understanding these mechanisms will allow more precise classification of hemiplegic shoulder pain.

Keywords: hemiplegia, Shoulder pain, Etiology, mechanical and neurological factors.

INTRODUCTION

Pain is a symptom frequently reported by hemiplegic patients, and shoulder pain is the most frequent. Its prevalence varies in the literature from 9% to 84%. Two recent prospective studies indicate that around 30% of patients develop shoulder pain in the first year after stroke.

These pains have a major functional impact, disrupting sleep, rehabilitation, morale and patients abilities. The ineffectiveness of current treatments is partly due to the fact that the causes of this pain are poorly understood.

For Example

The latest recommendations on the subject from the French health authority (Haute Autorité de Santé) date back to 2002. A lack of high-quality studies makes it impossible to conclude on the efficacy of specific techniques.

This work is a literature review aimed at highlighting the mechanical factors that lead to pain.

METHOD

The causes of pain are not well known today, but several publications attest to the fact that pain is multifactorial. Some factors are specific to the hemiplegic person, while others can affect the whole family general population. These factors include musculoskeletal disorders, as well as sensory and neurological disorders, which we won't go into here. In 2005 [1], Chaory *et al*., stressed the need for a classification of pain etiologies.

For this review, the keywords "Painful" AND "hemiplegic" AND "shoulder" were used using the search engines *Pubmed*, *Science direct*, *Google scholar* and *Cochrane*. The bibliography was completed using that of the articles found by this first search. The recommandations of good practice published by the Haute Autorité de Santé were also processed.

RESULT

Subacromial Impingement

Subacromial impingement occurs during elevation of the upper limb, when one of the anatomical structures present in the subacromial space - the bursa or rotator cuff tendons - snags against the acromion. The presence of a subdeltoid bursa lesion was not investigated in the articles selected, unlike the presence of a rotator cuff lesion.

The arthrographic study by Sui Foon-Lo *et al*., found a rotator cuff lesion in 22% of hemiplegic patients presenting with shoulder pain [2]. This figure corresponds roughly to the proportion of rotator cuff lesions in non-hemiplegic patients with shoulder pain [3]. However, as the number of hemiplegic patients with shoulder pain is greater than in the healthy population, the prevalence of rotator cuff damage is actually greater in hemiplegic than in healthy individuals.

This increase in the prevalence of subacromial impingement could be explained by changes in upper

limb elevation kinetics and glenohumeral subluxation.

Spasticity

This is a disorder affecting a muscle that contracts reflexively in response to its own stretching. This disorder is due to the lack of voluntary control over medullary reflexes following damage to the corticospinal motor pathway.

The prospective study by Roosink *et al*., showed that patients with shoulder pain had greater spasticity in the shoulder internal rotators and elbow flexors than pain-free patients [4].

Surprisingly, internal rotator spasticity was not significant in this study, whereas elbow flexor spasticity was. However, a previous literature review concluded that internal rotator spasticity was a likely cause of pain [5]. On the other hand, the use of botulinum toxin in the subscapularis muscle has proved effective against pain in two different studies [6, 7].

The responsibility of the elbow flexors could be explained by the fact that the biceps brachii muscle is bi-articular, passing just in front of the humeral head in the inter-tuberosity groove of the humerus, after passing inside the joint capsule of the glenohumeral joint (but outside the synovial membrane).

Glenohumeral Subluxation

It corresponds to the downward and/or forward displacement of the humeral head relative to the scapular glenoid, driven by its own weight following paralysis of the vertical fixator muscles.

The literature is divided on the subject, but the most methodologically sound studies find subluxation to be more frequent in painful patients than in indolent patients [4, 8, 9]. The arthrographic study by Sui Foon-Lo *et al*., provides an interesting clarification: in their study, 63% of painful patients had only one mechanical factor, but subluxation was rarely isolated.

This could indicate that, despite its probable link with pain, it is not a sufficient cause.

It could also mean that it is likely to lead to other disorders that themselves cause pain. Indeed, while the precise role of subluxation has never been clarified, it could anatomically damage the rotator cuff or the lower part of the joint capsule through prolonged overstretching. Its link with pain could also be due to stretching of the brachial plexus, which passes beneath the humeral head.

Capsular Retraction

The joint capsule is a richly innervated fibrous sleeve surrounding the joints. Its role is to mechanically limit joint amplitudes and inform the brain about the position of body segments in space. Occasionally, the capsule can retract, causing stiffness and pain. In the case of the shoulder, its retraction limits joint amplitudes in all directions, but to a greater extent in external rotation.

In 2003, Sui-Foon Lo *et al*., carried out an arthrographic study of 32 hemiplegic patients reporting shoulder pain. During these arthrographies, they injected contrast medium to determine the articular volume of the capsule and to observe its shape radiologically. According to their results, retractile capsulitis was the most frequent factor found, in 50% of cases. What's more, the majority of cohort studies, whether cross-sectional or prospective, found a major link between loss of external rotation and shoulder pain [4, 10, 11].

Capsular retraction is probably the most important mechanical cause of shoulder pain.

DISCUSSION

Bender's [12, 13] classification of shoulder pain in hemiplegics is as follows:

- Pain of articular origin (linked to subluxation and deficit of the cuff muscles);
- Pain of muscular origin (related to spasticity);
- Pain due to sensory alteration of central origin (thala- mic, spino-thalamo-cortical);
- True "shoulder-hand" syndrome, similar to algo- dystrophy, with pain, limited amplitude and trophic troubles.

The elements we have studied so far allow us to put forward the following hypothesis: the painful hemiplegic shoulder is not a complete entity, involving several factors of varying importance, but always present. The study by Sui-Foon Lo *et al*., showed that clinical factors were sometimes isolated, often mixed, but rarely all present [2].

Our hypothesis is that a hemiplegic individual develops an increased risk of suffering from certain static or kinetic mechanical disorders of the shoulder. These disorders may be associated with sensory disorders of central origin, making pain difficult to assess accurately, giving the clinician the impression that several patients are suffering from the same etiology. Better management of hemiplegic shoulder pain therefore first requires clarification of the etiology of the pain.

The first thing to consider is that any stroke patient is likely to develop hemiplegic shoulder pain. The initial examination must therefore look carefully for certain risk factors:

- Reduced passive amplitude of external rotation. This is the factor most often present, and it can set in quickly. When faced with such a limitation of amplitude, we must first suspect capsular retraction, which will be confirmed by a firm end of stroke and by the absence of any other element that could explain it. The second step is to test the spasticity of the shoulder's

internal rotator muscles;

- A pre-existing pathology affecting the shoulder. The study by Adey-Wakeling *et al*., showed that a history of shoulder pain increased the risk of developing pain after stroke [10];
- Glenohumeral subluxation although its role.

The prospective study by Lind-Gren *et al*., showed that subluxation was much more prevalent in patients with shoulder pain than in those without, finding a proportion of subluxation in the latter group comparable to a previous cross-sectional study [2, 9].

If any of these elements are present in the patient, it is important to implement corresponding preventive measures. Secondly, when a patient complains of shoulder pain, the clinical examination must seek to identify the etiology of this pain: the practitioner must first confirm the pain rhythm. The presence of pain on movement is considered to be an element in favour of a mechanical cause of the pain [10].

A positive Neer test appears to be the most predictive clinical test for the onset of mechanically-induced shoulder pain [14]. The presence of pain on this test indicates the presence of subacromial impingement. In the general population, its sensitivity is 0.79, but its specificity is 0.53 [15]. It is therefore reliable in determining a shoulder problem, but the probability that this problem is a subacromial impingement is only 53%. The meta-analysis carried out by Hegedus et al. does not recommend its use for etiological diagnosis, but its sensitivity can highlight a mechanical shoulder problem if it exists.

Finally, if a mechanical origin is selected, the following elements will help to clarify it:

- Presence of spasticity of the pectoralis major or subscapularis muscles;
- Decrease in shoulder external rotation amplitude. This indicates the presence of capsular retraction. It is pro-Probably the most common cause of shoulder pain;
- Inferior or anterior subluxation of the shoulder. Its involvement in shoulder pain is probable;
- Concerning subacromial impingement, in the absence of sufficiently reliable clinical tests to assess it [15], the reasoning should be a diagnosis of exclusion: around 20-25% of patients may suffer from this pathology. Its involvement is therefore likely, especially if no other cause is found. The etiology can be confirmed by imaging.

This way of assessing the shoulder should help the practitioner choose his or her therapeutic options. Even in the presence of one or more of these factors, it is important to consider that pain may have a neurological component [16, 17].

To the best of our knowledge, there was no French-language literature review on the subject of the hemiplegic shoulder. The weakness of this article lies in the fact that the literature review was carried out by a single reviewer, using a non- standardized method.

CONCLUSION

The shoulder in the hemiplegic patient is a recent subject of research, dating back to the late 2000s, and illustrates that it remains a challenge for practitioners today. However, advances in our understanding of this phenomenon have been made recently, thanks to prospective cohort follow-ups involving hundreds of patients. Level 2 evidence (prospective cohort studies) can be attributed to the following two points:

- Glenohumeral subluxation is a risk factor for the development of shoulder pain;
- Capsular shrinkage is the most common risk factor of shoulder pain.

On the basis of this literature review, spasticity cannot be added to this list, but a similar literature review dating from 2012 concludes to the probable involvement of spasticity [5]. To further clarify knowledge on the subject, studies are still needed to specify the mode of action of glenohumeral subluxation.

Finally, a number of therapeutic approaches have also been tried out, but no scientific presumption of their efficacy has yet been established. Randomized controlled trials should be carried out to evaluate the efficacy of upper limb postures and support slings.

Declaration of interest: The author declares that he has no ties of interest.

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