Diagnostic mistakes involving tendonitis: medical, social, legal, and economic impact

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ABSTRACT

Evidence of the clinical, social, and economic impact of mistaken diagnoses of tendonitis and other chronic painful disorders are analyzed. The objective of this review is to call attention to the possible diagnostic hyper valuation of tendonitis, especially those supposedly multiple or refractory, based on evidence. A review of the literature on chronic painful disorders, such as fibromyalgia, in the context of mistaken diagnosis of tendonitis, as well a review of false positive and ultrasonographic (US) scan diagnostic parameters, is presented. Evidence of therapeutic mistakes were found in 41% and diagnostic mistakes in 70 to 85% of the cases, with proven unpreparedness regarding those disorders in up to 93.7% of the physicians. The diverse repercussions of this epidemic of mistakes are discussed.

Keywords: tendonitis, repetitive strain injuries, work-related osteomuscular disorders, ultrasound.

INTRODUCTION

The word "tendonitis" presupposes inflammation of a tendon; it might be associated with some controversies due to the absence of local inflammatory cells in many cases,[1-3] low local levels of prostaglandins,[4,5] and questionable efficacy of the isolate use of anti-inflammatories and corticosteroids in the treatment of this disorder. The controversy is reinforced when we consider the treatment of "tendonitis" with the isolate use of anti-inflammatories or corticosteroids, which are not always effective.[6,7] However, local levels of cytokines, such as IL-1, and other inflammation-related compounds are increased,[8,9] and when the tendon is exposed to prostaglandin E2 *in vitro*, it can develop inflammation and degeneration.[10] Therefore, "tendonitis" is somehow related with a peculiar inflammatory process with unique characteristics.

Major controversies involving tendonitis are not related with basic research, but with the diagnosis, which involves several clinical and imaging exams considerations. Diagnosis of multiple chronic refractory tendonitis based solely on US scan reports have been common in the medical-legal field. The set of evidence presented in this review demonstrates the need of better training on patient interview and physical exam, as well as greater caution on interpreting US scan in this context.

The high prevalence of the morbidities involved (social impact), the impressive costs (economic impact), the frequent involvement of tendonitis in the forensic field (legal impact), and the deficiency of the medical training programs on this subject (medical impact) are reviewed.

GENERAL CLINICAL ASPECTS

The over diagnosis of tendonitis reflects the lack of technical knowledge for the correct diagnosis of musculoskeletal morbidities and inadequate training on detailed anamnesis and physical exam pertinent to musculoskeletal disorders, especially in the forensic field, which involves expectations of secondary gains.[11-13]

The abusive use of controversial or non-recognized terminology in the diagnosis shows the distance between judicial conclusions and evidence-based medicinal technique.[14-18] In

Received on 11/08/2008. Approved on 05/29/2009. We declare no conflict os interest.
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some countries, discussions on this subject were concluded more than two decades ago, justifying the absence of current bibliographic references on this subject in the international literature.[19-21] However, in Brazil, the same controversial or wrong nomenclature is still used in medical-legal exams. The retrograde disparity of Brazilian forensic medicine, when compared to the rest of the world, is not based on any technical justification, leaving speculations on the influence of cultural factors, political interests, or the lack of incentive for updating and training of Brazilian forensic physicians. The exact quantification of this diagnostic distortion in the forensic field in Brazil lacks current formal documentation. Reviews like the present study might stimulate future quantification of appropriate statistical data.

Detailed anamnesis and the encompassing use of clinical signs can contribute with 90% of the correct diagnosis of shoulder tendonitis, with 91.3% sensitivity and 88.9% specificity (confirmed by surgery) without complementary tests.[22]

Those levels of diagnosis based solely on the clinical technique are more reliable than the ultrasonographic diagnosis of the same shoulder lesions. Therefore, in this case, good clinical background is superior to imaging exams.[23,24] Somehow, this decreases the importance of the US scan, but it constitutes evidence against its improper hyper valuation.

CLINICAL PECULIARITIES OF THE FALSE DIAGNOSIS OF MULTIPLE REFRACTORY TENDONITIS

Anamnesis requires encompassing musculoskeletal knowledge that is not within the scope of this review. Imprudent aspects of the physical exam that can be related with mistaken diagnosis of tendonitis will be analyzed.

Most semiologic maneuvers used in the diagnosis of tendonitis are guided by the development of pain. It is dangerous to consider those diagnostic maneuvers positive only based on this subjective allegation. Other characteristics of the symptoms should be considered before giving a diagnosis of tendonitis.

Subjective reference of pain during the physical exam, interpreted as supposedly positive for tendonitis, leads to the differential diagnosis with other common painful disorders. It is up to the examiner to recognize and exclude other common painful disorders that can also trigger pain during those maneuvers.

Fibromyalgia stands out regarding both pain and prevalence. It is a condition that has a huge potential for pain during diagnostic maneuvers, interfering directly with the interpretation of their results.

Pain, the main characteristic of fibromyalgia, can lead to false-positive results during those maneuvers if the other clinical characteristics are ignored.

The prevalence of painful disorders, such as fibromyalgia, is very high, affecting up to 2.22% in Italy[25] or 3.6% in Turkey.[26] A Norwegian study with women between the ages of 20 and 49 years found a prevalence of fibromyalgia of 10.5% among all causes of chronic musculoskeletal pain.[27] In Brazil, a similar prevalence, 10.2%, was observed.[28] In the United States, fibromyalgia has a prevalence of 3.4% among women and 0.5% in men (2% for both genders).[29]

This high prevalence implies the risk of underdiagnosis of fibromyalgia when only regional or axial pain is reported by the patient.

The Gansky group reported that 5.6% of the individuals interviewed complained of generalized pain, 22% regional axial pain, and 16% non-axial pain; 41% of those who complained of chronic regional axial pain also had 11 or more tender points with characteristics similar to those of patients with classification criteria for fibromyalgia.[30] Evaluation of those patients by non-trained professionals can lead to false-positive results of multiple tendonitis due to pain with specific maneuvers and, consequently, they are not correctly identified as having psychosomatic pain with characteristics similar to those of fibromyalgia.

Simply recording the spontaneous complaints of patients does not characterize good anamnesis and it is not enough for a precise diagnosis. Lay people and non-expert physicians should not expect the patient to tell a history typical of fibromyalgia; the report of their symptoms might be disorganized, partial, and apparently atypical. Evidence indicates the importance of detailed anamnesis and careful physical exam for the diagnosis or correct exclusion of tendonitis.[22]

EVIDENCE OF PATENT DIAGNOSTIC MISTAKES

Out of the forensic environment, the time necessary to heal a tendonitis secondary to biomechanical overload ranges from one to three weeks.[31-33] However, countless Brazilian workers with this diagnosis have remained away from their jobs for several years without any improvement. Many report progressive worsening of their symptoms, despite the elimination of said work-related biomechanical overload, and receive a certificate on the irreversibility of this disorder and, consequently, retire, as if tendonitis secondary to efforts were a long-lasting, progressive condition, and/or without cure, which goes against the evidences.

The employee who receives a diagnosis of work-related tendonitis and, especially, a certificate of disability has, by law,

several rights. However, an incorrect diagnosis involving the disorders discussed here has led to the abuse of those rights, which is damaging to society, government, and the individual, on a vicious and deplorable cycle in which the medical focus on physical rehabilitation and improvement of the patient disappears, being replaced by the exaggerated consideration of disability and inadequate renovation of benefits instead of the real recovery of the health of the individual, the most important asset.

The group of patients with the incorrect diagnosis of "work-related tendonitis" and, mainly, chronic refractory tendonitis, implies a social iatrogenicity characterized by an increase in work-related law suits, missing work days, administrative costs, and direct and indirect expenses, including the payment of large indemnifications with significant impact in the economy of the country.

Brazil has poor statistics on this disorder, but it is clear that the number of diagnosis of work-related tendonitis is expressive. The Labor and Health Departments, as well as Social Security, do not have specific data on the number of patients, time away from work, recovery indices, number of paid retirements, and direct and indirect costs of those disorders. The number of cases recorded is amid typical cases of work-related accidents. Although reliable data are not available, it is possible to state, with absolute certainty, that our country has an epidemic of this diagnosis.

From 1987 on, when tendonitis in typists was recognized as a work-related disorder (Administrative Rule 4062/878), a dramatic rise in the prevalence of this diagnosis has been seen. Countless painful disorders in different types of job have been labeled occupational tendonitis, without any judicious analysis, stimulating the desire for secondary gains.

While in the USA those musculoskeletal disorders are responsible for a mean of 32 days away from work,[34] the majority of Brazilian workers stop contributing with society for a much prolonged period of time, and some retire early in life due to a factitious disability.

Among the diseases involved in those mistaken diagnosis, fibromyalgia is, without a doubt, the most important. The literature reports gross mistakes involving fibromyalgia and somatic symptoms associated with psychogenic disorders[35], which are directly related with the inappropriate diagnosis of tendonitis or multiple chronic refractory tendonitis.[36] Approximately 20% of the patients seen in clinics have anxiety disorders, but 41% of them do not receive any specific treatment for their disease, representing mistaken diagnoses and treatment in a marked number of cases with those comorbidities.[35]

The high number of mistaken diagnosis of fibromyalgia and myofascial syndrome is even higher in forensic or work-related field, reaching up to 70 and 85% of mistaken diagnosis or inappropriate and polemic diagnostic terminology in patients with those disorders.[37-39]

The lack of professional training related with those disorders is emphasized by Blotman *et al*., who revealed disappointing numbers related with the lack of training for the correct diagnosis of fibromyalgia;[40] 93.7% of internists and 73.7% of rheumatologists did not have any training in medical school on fibromyalgia or chronic fatigue syndrome.

Higher rates of mistakes or lack of training con be seen in the forensic field, maybe due to the lack of specialists in the locomotor system, leading to potential relevant losses for society and justice.

The evidence on the lack of training and mistaken diagnosis is dramatic and cannot be ignored. The lack of knowledge on fibromyalgia and other painful syndromes constitutes a pillar involved with the mistaken diagnosis of multiple or chronic refractory tendonitis.

A peculiar example of this tendency for errors can be found on the isolated polemic conclusions of Genç *et al*., who were guided solely by the pain referred by patients with fibromyalgia, concluding that 95% of those patients had tendonitis, including multiple tendonitis.[41] However, imaging exams, or the gold-standard for confirmation of tendonitis, i.e., arthroscopy, were not performed in any patient (n = 0). Valid confirmation of the presence of tendonitis was not undertaken, which invalidates the conclusions of the study. The diagnosis of multiple tendonitis solely based on pain referred by the patient, the use of semiologic maneuvers without the original description, and the total lack of confirmation by the gold-standard or any other method, reduce dramatically the quality of this study. Studies confirming those results have not been published in any scientific periodicals and, therefore, the diagnosis of multiple tendonitis (and especially chronic refractory) is not justified when facing symptoms and signs suggestive of fibromyalgia.

INCREASED REQUESTS OF COMPLEMENTARY EXAMS IN FIBROMYALGIA AND ITS ASSOCIATION WITH INCREASED COSTS AND DIAGNOSTIC MISTAKES

The lack of knowledge and training related with disorders like fibromyalgia can lead to an increase in the requests of complementary exams. The increased use of health care services by patients with fibromyalgia was demonstrated by

McBeth *et al*.,[42] and it can translate in more frequent request of complementary exams, which increases with the growing number of complaints of each patient, according to the same authors. Higher number of painful anatomic sites and symptoms lead to higher number of exams and increase in costs.

The presence of an additional painful site can be mistakenly interpreted as "one more tendonitis", repeating the mistake of Genç *et al*.[41] Unsatisfactory response to treatment can be misinterpreted as refractoriness of factitious multiple tendonitis, Evidence demonstrating that patients are not correctly diagnosed because they are approached as having multiple episodes of regional pain,[43] when in reality they have a clinical presentation similar to that of fibromyalgia when examined lately by trained experts, support this thinking. This proves not only the risk of the false diagnosis of multiple tendonitis, but also the false diagnosis of repetitive tendonitis. In this study, patients had fibromyalgia and not multiple refractory tendonitis.

Patients with mistaken diagnosis are the same that consume exorbitant amounts of financial resources in health care. The increased search for resources is supported by the gigantic expenses observed in other studies:[44-47] fibromyalgia, a benign syndrome, costs more than twice the costs of ankylosing spondylitis. The astronomic costs of fibromyalgia have been compared to those of cancer and cardiovascular diseases and, despite that, any indication of the proportional attention from authorities regarding the financial resources involved, as well as the diagnostic and therapeutic mistakes, do not exist.

Several psychiatric disorders than can be associated with pain also generate costs to health care systems. When painful points are associated with psychiatric morbidities, costs are higher, and they are considerably higher when they are associated with fibromyalgia.[48]

Several authors include social security costs among the total costs of fibromyalgia. Disability or supposedly important functional limitation of fibromyalgia is not supported by the evaluation of incapacity of this syndrome by the American Medical Association, which has been confirmed by 30 respected medical entities.[49]

PRUDENCE WHEN INTERPRETING EXAMS IN THIS CONTEXT

Unnecessary complementary exams in the context of fibromyalgia and possible tendonitis reflects the futile attempt to hide the lack of specialized medical training and they are directly related with the increase in the above mentioned costs.

Professional anxiety in the attempt to suppress the lack of training with exaggerated request of exams ignores the conclusion that complementary imaging exams can, occasionally, be wrong. With or without imaging exams, the diagnosis does not imply absolute certainty, but it carries an implicit probability.[50]

Exaggerated request of any exam is not proof of better medical diligence.51-53 The probability of false-positivity of any exam increases in the following proportion:

A	B
1	5%
6	26%
12	46%
20	64%

A = Number of exams requested for any patient.
B = Probability of a false result in a healthy individual.

The chart reveals that, for every 20 exams requested for the same individual, approximately 13 of them can have a false result.[51] This result can be even worse, depending on the performance of the test.[50]

False-positivity can increase even more if it is associated with the consideration of Gilbert *et al*.[50] of a large prevalence of fibromyalgia in the population (it is even higher in the forensic field). According to the authors, the value of a test to predict a condition depends of the pre-test probability (probability of the presence of the diagnosis) and test performance (sensitivity and specificity). The probability of someone with “several regional pains” having fibromyalgia is much higher than that of multiple refractory tendonitis, increasing considerably the chance of false-positivity. The proven lack of medical training involving those disorders[35,40] translates into poor performance of anamnesis and physical exam, increasing even more the rate of false-positivity (mistaken diagnosis of tendonitis).

In this scenery of frequent mistakes and unnecessary costs, a positive US scan has little basis to confirm the hypotheses of multiple simultaneous tendonitis (as well as chronic refractory).

DISCUSSION

The invasive and expensive aspect of arthroscopy, associated with the even more expensive and less readily available MRI, make those options unfeasible in daily practice to confirm the diagnosis of tendonitis, leaving the US scan as the most accessible exam to clear any doubts regarding this diagnosis, but the inherent characteristics of musculoskeletal

US scan do not allow this exam to completely substitute the data gathered during anamnesis and physical exam.

The ultrasound has relevant peculiarities capable of influencing its correct appreciation, especially high dependency on the operator for the interpretation of the findings.[54,55] This dependency is seen with any diagnosis, but evidence indicates that its variability tends to increase even more with specific musculoskeletal diagnoses, such as shoulder and upper limb tendonitis. The inter-observer disparity regarding the results of the US scan was reviewed by several authors.[56,57]

Even when considering a lower variability in the detection of a rupture, a considerable variability (20%) is still present when describing whether a tendon or the rotator cuff is torn. The relatively good performance of US scan to detect ruptured tendons in the shoulder is arguable and subject to high false-positive rates with age.[58]

The US scan has a high sensitivity in the diagnosis of tendon ruptures in the rotator cuff;[59] however, high sensitivities can be associated with lower specificities, implying higher rates of false-positives results and, therefore, mistaken diagnoses of tendonitis.

Wallny *et al*. demonstrated that the US scan has only a 42.9% specificity in those conditions, leading to a substantial rate of false-positives results (positive predictive value of only 63.6%).[58]

Other authors reported even more pessimistic results, indicating only a 38% diagnostic accuracy and 61% specificity, considering those levels as "non-accurate and very poor".[60]

Most studies that emphasize the accuracy of the US scan focused on complete tendon rupture (severe cases) and, despite this, they hide the rate of false-positive results or consider them disappointing.[58,59] Those rates of mistakes are higher when analyzing tendonitis. The reproduction of some tendons by the US scan can be limited, which can contribute to the diagnostic failures of tendonitis.[61] This corroborates the findings of several studies regarding operator-dependency and inter-operator disparity.[54-57]

Ultrasound reports can disagree even among international experts in the field. Those experts disagreed in 16% of the cases of tenosynovitis, 16.5% of bursitis, and 19% of arthritis.[62] The highest level of disagreement was seen in tendinitis/tenosynovitis.

Another study demonstrated variations in the detection of tendon changes that ranged from 13 to 57%. Higher variations in the interpretation of the US scan of the same patient were seen for the supraspinous, flexor radial of the wrist, and triceps tendons.[63]

Several factors can contribute for the false-positive results of tendon US scan, especially in the shoulder, such as the technique used or angle variations during the exam, personal criteria used in the conclusion, the presence of common artifacts, and others.[64]

A study with asymptomatic individuals showed that the US scan can detect fluid or apparently inflammatory changes in up to 85% of bursas, 27% of biceps tendons, 77% of suprapatellar recesses, 16% of popliteal areas, and 24% of retro calcaneal bursas, besides other articular areas and tendon sheaths, with a variation of up to 28% among US scans.[65] In other words, an US scan report can just mention that "fluid was found" or "findings compatible with inflammatory changes", wrongly concluding that bursitis, tendonitis, and other changes are present where, very often, they do not exist or whose finding is not pathologic, contributing for the false-positive diagnosis of tendonitis.

Besides this mistaken interpretation of physiologic fluid, other scholars add that local echogenicity can change with age,[66] increasing the rate of false-positive results for tendonitis, with a negative predictive value of 69.2% and general accuracy of only 65.2% for specific age groups, with approximately 21% of errors in shoulder US scan.[67]

Besides the shoulder, low US scan specificity was also observed for common extensor tendons of the forearm, with high rates of false-positive results in the analysis of epicondylitis.[68] In fibromyalgia, in which one of the tender points is close to the lateral epicondyle, US scan results, as well as those for the shoulder, should be viewed with caution. Extensor tendons of the wrist can seem hypoechoic in the US scan, simulating tenosynovitis.[69]

Those elevated rates of ultrasound mistakes have raised dissatisfaction among North American orthopedic surgeons, who reported limited acceptance of musculoskeletal US scan of the shoulder.[70] This is most likely due to confirmation of the diagnostic mistake during surgery.

Warnings on the lack of agreement on the definition of terms like tendinosis or the exact definition of partial and total rupture of tendons, with disagreement among reports, have been issued. Different interpretations have been attributed to identical ultrasound scan findings. The establishment of more rigorous standardized ultrasound scanning techniques and diagnostic criteria is urgently necessary to compare results adequately and reduce inter-operator interpretation variability.[62]

CONCLUSIONS

Evidence indicates a tendency for the hyper valuation of the diagnosis of tendonitis in the context of specific painful syndromes, and fibromyalgia is certainly most commonly responsible for those mistakes.

Crude mistakes related to the lack of training for the correct identification of fibromyalgia, generating false diagnoses of multiple tendonitis with significant economic, social, and legal impacts, especially in the forensic environment, were observed.

Vicious behaviors increase fibromyalgia-related costs, which are similar to those of malignancies and cardiovascular disorders, reaching expressive proportions, which are not reported. Those high costs include the increased use of health services by fibromyalgia patients, excessive complementary exams, and early retirement based on wrong diagnoses. Improbable clinical diagnoses, such as multiple chronic refractory tendonitis, have been made, which are not solid, objective, and evidence-based, increasing the concerns on the lack of proper medical training for the recognition of cases of fibromyalgia, as well as the high costs related with those mistakes.

Despite the high diagnostic sensitivity and specificity of clinical methods in tendonitis and fibromyalgia, excessive request for complementary exams for those conditions has been observed, increasing the mathematical chances of false results and false-positive diagnoses of non-existing diseases in a patient.

To worsen the situation, the US scan, the exam requested more often in this context, has a high rate of false-positive results for tendonitis, especially in the upper limbs, areas commonly painful in patients with fibromyalgia.

It has been proven that clinical knowledge can overcome the diagnostic efficacy of the US scan, in this scenery, for specific tendon lesions. This does not diminish the importance of the US scan, but it constitutes evidence against the hyper valuation of this exam.

Scientific evidence demonstrating the presence of an epidemic of work-related multiple tendonitis, simultaneous or concomitantly, does not exist, and the literature does not support the diagnosis of multiple chronic or refractory tendonitis in patients without proven systemic diseases. On the contrary, current evidence indicates that those patients have fibromyalgia, which motivated the medical appointment or the forensic exam.

Official medical entities and governments need to pay more attention to this matter. Human resources in Medicine should be valorized, especially physicians treating the locomotor system, widening the medical training to those disorders, as well as increasing the spread of those alerts and concepts to specialists and non specialists, as well as forensic experts.

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