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Prevalence of hypothyroidism in patients with frozen shoulder

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Background: Hypothyroidism and frozen shoulder (FS) have been associated, although this relationship remains uncertain. The main objective of this study was to determine the prevalence of hypothyroidism in patients with FS.

Methods: A case-control study was performed to compare FS patients (cases) with patients who visited an orthopedic service for other clinical conditions (controls). FS was diagnosed according to specific criteria based on anamnesis, physical examination, and shoulder radiographs. A specific questionnaire was applied, and measurements of serum thyroid-stimulating hormone (TSH) and free tetraiodothyronine were performed in all subjects.

Results: We evaluated 401 shoulders from 93 FS patients and 151 controls. The prevalence of hypothyroidism diagnosis was significantly higher in the FS group (27.2% vs. 10.7%; $P = .001$). There was also a tendency for higher prevalence of bilateral FS among patients with elevated TSH levels ($P = .09$). Mean serum TSH levels were higher in patients with bilateral FS compared with those with unilateral compromise (3.39 vs. 2.28; $P = .05$) and were higher in patients with severe FS compared with those with mild and moderate FS together (3.15 vs. 2.21; $P = .03$). Multivariate analysis showed that FS was independently related to a diagnosis of hypothyroidism (odds ratio, 3.1 [1.5-6.4]; $P = .002$). There was a trend toward independent association between high serum TSH levels and both severe (odds ratio, 3.5 [0.8-14.9]; $P = .09$) and bilateral (odds ratio, 11.7 [0.9-144.8]; $P = .05$) compromise.

Conclusion: The prevalence of hypothyroidism was significantly higher in FS patients than in controls. The results suggest that higher serum TSH levels are associated with bilateral and severe cases of FS.

Level of evidence: Level III; Cross-Sectional Design; Epidemiology Study

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Adhesive capsulitis, also known as frozen shoulder (FS), is a pathologic condition characterized by pain and limited articular mobility of the shoulder. It most commonly affects women between the ages of 40 and 60 years.^{3,17,37,38} The current

consensus of the American Shoulder and Elbow Surgeons is that the disease is “a condition of uncertain etiology characterized by significant restriction of both active and passive shoulder motion that occurs in the absence of a known intrinsic shoulder disorder.”^{18,39} FS is estimated to occur in 2% of the population,^{4,21} attaining a prevalence of 5% when only those people treated at a shoulder clinic are analyzed.⁵

Initial stages of the disease mainly involve inflammatory changes to the articular capsule and the synovial membrane, causing intense pain, even when resting.^{5,17,12} Later, there is intense fibroblastic proliferation, leading to thickening and contraction of the shoulder joint capsule, especially in the rotator interval and the axillary recess.^{21,23,24,29} Although Reeves²⁷ suggested that the disease will spontaneously resolve after around 30 months, Shaffer et al³⁰ found residual pain in 50% of patients and mobility deficits in 60%.

Although FS affects a large number of patients, its etiology remains uncertain.⁵ Various pathologic conditions may be related to its occurrence, such as immobilization of the upper limb for orthopedic reasons,^{3,26} cardiac catheterization through the brachial artery,²⁵ heart surgery,³⁴ encephalic vascular accident followed by upper limb motor deficit,^{20,26} cervical radiculopathy,³⁸ diabetes mellitus,^{1,3,4,33,37,38} systemic arterial hypertension,³⁷ dyslipidemia,⁶ and thyroidopathies.^{6,7,22} The association between thyroid dysfunction—both hyperthyroidism³⁶ and hypothyroidism²—and FS is unknown, and autoimmunity may be a contributing factor.^{16,32,35} Studies with small sample sizes have suggested a more specific relationship between hypothyroidism and FS,^{3,7,13,38} but the cause-effect relationship between them remains controversial. Some authors suggested that it could be related to the presence of autoimmunity^{16,32,35} because Hashimoto thyroiditis is the main cause of hypothyroidism in the whole population, whereas most of the few papers on this subject do not attempt to establish this cause-effect relationship.^{3,7,13,38} Finally, as those papers have small sample size and some methodologic issues, one might suspect that the relation between FS and hypothyroidism could be attributed only to a casual association.

Therefore, the main objective of this study was to determine the prevalence of hypothyroidism in patients with a diagnosis of FS. The secondary objective was to evaluate differences in the presentation of FS in patients with and without hypothyroidism, including its severity and incidence of bilateral compromise.

Materials and methods

Study design and ethical considerations

We performed a case-control study to compare the prevalence of hypothyroidism in patients with FS (cases) and in subjects treated by a general orthopedic clinic for other reasons (controls). Consecutive subjects were included in the study, as they were treated in the clinic. All participants signed an informed consent form, in accordance with the Helsinki declaration (2008).

Patient evaluation

Clinical evaluation

All subjects were examined through a case history and a complete physical examination of the shoulders, which was performed by the same physician with expertise in shoulder evaluation. This physician was the only researcher responsible for the clinical evaluations. The range of elevation, external rotation, and active and passive internal rotations were determined. Measurements for the elevation and the external rotation were done in grades, using a manual goniometer. The internal rotation range was determined by counting the vertebral levels, with the hand on the dorsum.

Radiographic evaluation

Simple shoulder radiographs were performed on all patients with FS, in the anteroposterior, lateral scapular, and axillary views.

Laboratory evaluation

Blood samples were collected from all patients to determine blood levels of thyrotropin (thyroid-stimulating hormone [TSH]) and free tetraiodothyronine (F-T₄). The TSH level was determined through an immunometric assay by third-generation chemiluminescence, using a TSH test kit (SDC; Siemens Medical Solutions Diagnostics, Los Angeles, CA, USA) and an Immulite 2000 (Siemens Medical Solutions Diagnostics) automatic machine that had reference values from 0.4 to 4.0 mIU/L, sensitivity of 0.002 mIU/L, inter-trial coefficient of variation (CV) of 4.6% to 12.5%, and intra-trial CV of 3.8% to 12.5%. The F-T₄ level was determined through immunoenzymatic assay by chemiluminescence. An F-T₄ SDC test kit (Siemens Medical Solutions Diagnostics) was used with an Immulite 2000 automatic machine that had reference values from 0.8 to 1.9 ng/dL, sensitivity of 0.15 ng/dL, inter-trial CV of 4.8% to 9%, and intra-trial CV of 4.4% to 7.5%.

Increased TSH with reduced F-T₄ level was defined as clear hypothyroidism. Increased TSH with normal F-T₄ level was defined as subclinical hypothyroidism. We defined subclinical hyperthyroidism on the basis of the presence of reduced levels of TSH together with normal levels of F-T₄.

Inclusion criteria

According to the Harryman and Lazarus criteria,¹⁸ the diagnosis of adhesive capsulitis was made in patients presenting with global limitation of range of movement (ROM), without previous history of significant trauma or surgery and not accompanied by loss of force, instability, or articular crepitation. All patients had normal findings on radiography. Patients who met these criteria were included in the study group.

The control group was composed of patients treated in a general orthopedic clinic, without complaints about their shoulder, and whose physical examination revealed a normal ROM for the shoulders.

Exclusion criteria

Patients were excluded if they had recent (3 months before) hospitalization, previous fracture or surgery in the affected shoulder, and history of trauma with the need of immobilization up to 6 months before the start of symptoms. Patients were also excluded if they had cervical or thoracic surgery performed up to 6 months before

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