The Egyptian Rheumatologist (2012) **34**, 167–178

Egyptian Society for Joint Diseases and Arthritis

The Egyptian Rheumatologist

www.rheumatology.eg.net
www.sciencedirect.com

ORIGINAL ARTICLE

Hand function in systemic sclerosis: A clinical and ultrasonographic study

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Received 20 May 2012; accepted 26 August 2012
Available online 9 October 2012

KEYWORDS

Systemic sclerosis;
Hand function;
Disability;
Ultrasonography

Abstract *Aim of the work:* To evaluate hand impairment and functional disability in scleroderma patients using clinical and ultrasonographic (US) measures.

Patients and methods: Fifteen scleroderma patients and 10 age and sex-matched healthy controls were studied. Patients underwent clinical examination including modified Rodnan skin score. Hand function assessment included pinch and grip strength measurement, finger range of motion (ROM) assessment, Hand Mobility in Scleroderma (HAMIS) test and Hand Functional Index (HFI). Hand disability was assessed by Health Assessment Questionnaire (HAQ), Scleroderma HAQ Visual Analogue Scale (SHAQ VAS) and Cochin scale. US hand examination included measuring hand skin thickness, screening of the finger flexor and extensor tendons, measuring cartilage thickness of the 2nd MCP joint, anteroposterior thickness of the flexor retinaculum, and surface area of the median nerve.

Results: Nine patients had healed digital ulcers while only one patient had active ulcers. Seven patients had arthralgia in the hand joints. The patients had a significant decrease in grip strength and finger ROM. By US, patients showed significant increase in hand skin thickness and flexor retinaculum thickness and a significant decrease in median nerve surface area. Hand disability measures showed variable significant correlations with pinch and grip strength and hand mobility measures which were significantly correlated with US skin thickness of the 2nd inter-metacarpal web space.

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Peer review under responsibility of Egyptian Society of Joint Diseases and Arthritis.

ELSEVIER Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.ejr.2012.08.005

Conclusions: Hand disability in scleroderma was mainly related to impaired hand mobility and also diminished strength. The use of US in adjunct to clinical examination refines the evaluation of hand impairment in scleroderma.

1. Introduction

Systemic sclerosis (SSc) is a connective tissue disease characterized by excessive collagen deposition, vascular hyper-reactivity and obliterative micro-vascular phenomenon involving the skin and internal organs [1,2]. SSc results in skin, tendon, joint and vessel damage leading to worsening of life's quality [3,4] due to problems of functioning and restricted participation in society [5]. The focus of attention when assessing a patient with SSc is often based on physiological measurements [6] which do not necessarily relate to the true impact of the disease on patient's lifestyle or functional capacity [7].

The ability of the hand to grasp and manipulate objects is necessary for accomplishing many tasks of daily living [8] and hence leading a normal life. Using the hands normally depends on their anatomical integrity, sensation, coordination, strength and dexterity and is influenced by age, gender and motivation of the individual, together with the presence or absence of disease or injury [9,10].

Hand involvement is often the first clinical manifestation during the course of SSc [11]. It occurs mainly due to skin and periarticular thickening causing significant contracture and limitation of finger movements and hand deformity. Hand functions are also compromised because of the overlapping of Raynaud's phenomenon and pain due to arthralgias, arthritis, tenosynovitis, ulcers and calcinosis [12–14]. Thus, owing to the multi-factorial etiology of hand functional disability in SSc, it is important to define the contribution of each factor or structure to this problem as a requirement for rehabilitation-oriented approach to disease management.

Since a successful rehabilitation program of a rheumatic disease patient starts with an appropriate evaluation [15], the International Classification of Functioning, Disability and Health (ICF) [16] provides a good framework to conduct the rehabilitation evaluation by defining six domains of interest [17].

Although hand dysfunction was investigated in SSc using different indices and instruments [4,18,19], the associated structural changes as detected by ultrasound (US) were not thoroughly investigated. High-frequency US was used as a quantitative tool assessing skin thickness and echogenicity [20], median nerve [21] and other structures in SSc [22]. However, to date there is no multi-elemental ultrasonographic assessment of hand structures in SSc patients. This work aimed at evaluating hand impairment and functional disability in SSc patients using clinical and ultrasonographic measures.

2. Patients and methods

This study included 15 SSc patients fulfilling the criteria for the classification and diagnosis of progressive systemic sclerosis [23] who attended the rheumatology outpatient clinics at the Faculty of Medicine, Alexandria University. The study also included ten healthy controls for the clinical examination and ultrasonographic study. Each patient was subjected to history taking and thorough clinical examination including evaluation of skin involvement using the modified Rodnan skin score (mRSS) of 17 sites [24]. Patients were then sub-grouped into diffuse and limited types [23]. The upper limb sub-score of mRSS was also determined for each patient.

In the present study, evaluation of sclerodermic hand was guided by ICF in the domains of impairment, activities and participation to define the defect in each domain and their mutual relationship. Thus, the following hand assessment measures were determined for each patient:

2.1. Hand impairment measures

They were implemented to assess the impact of SSc disease process on the anatomical and functional components of the hand.

2.1.1. Hand structure measures (clinical and US examinations)

In addition to skin thickness assessment by mRSS, hand structure measures included counting the number and position of digital ulcers and their status (active or healed i.e. pitting scars) [25], presence of Raynaud's phenomenon, calcinosis, joint(s) swelling and tenderness as well as tendon friction rub assessed by palpation during active and passive motion of extensors and flexors of both the fingers and the wrists [26]. Ultrasonographic examination was carried out by a musculoskeletal radiologist to assess the anatomical structures of the hand. Examination was performed by using a 10–12 MHz linear array transducer (En Visor MCMD02AA; Phillips, Amsterdam; Netherlands). This frequency was selected for its wide availability in clinical practice in developing countries. It offers axial and lateral resolution of 0.2 mm and an ultrasonic depth of up to 7 cm [27], showing a good correlation between US measured dermal thickness and clinical skin score in patients with SSC [28] and reveals metacarpophalangeal (MCP) and interphalangeal (IP) joint hyaline cartilage surfaces well [29].

The US examination was conducted at same time between 11a.m. and 1p.m. to eliminate diurnal variation in dermal edema [30]. Subjects were comfortably seated on a chair facing the examiner. The arms were extended; wrists were rested on a hard flat surface, forearms were alternatively supinated and/or pronated, for imaging of areas of interest. An adequate amount of sonographic gel was used to allow optimal visualization of the most superficial structures. Standoff pads were not used as no substantial improved image quality was depicted in controls. B-mode images in both axial and sagittal planes were used where the whole skin thickness extending between gel-epidermis and dermis-subcutis interfaces was measured [31].

- Eight skin sites (approximating to those of the upper limb mRSS) were identified by the following landmarks on each side: middle finger (dorsum of the middle phalanx), dorsum