Role of High Resolution Sonography and Interventional Sonography in Diagnosis and Management of Diabetic Hand Tendinopathy

Thesis

Submitted in partial fulfillment of **M.D.** degree in Radiodiagnosis

By:

Abo El-Magd M. El-Bohy.

M.B.B.Ch., M.Sc.

UNDER SUPERVISION OF

Prof. Dr./ Sahar Mostafa El-Mashad

Prof. of Radiodiagnosis, Faculty of medicine

Cairo University.

Prof. Dr./ Khaled Tahseen El-Hadidi

Prof. of Rheumatology and Rehabilitation

Faculty of medicine, Cairo University.

Prof. Dr./ Reda Saad Abd Al-Lateef

Ass. Prof. of Radiodiagnosis

Faculty of medicine, Cairo University.

Faculty of medicine

Cairo University.

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ABSTRACT

Objective: To assess the role of high resolution sonography and interventional sonography in diagnosis and management of diabetic hand tendinopathy.

Methods: One hundred and two consecutive diabetic patients, along with ٤٠ normal controls without a known history of diabetes were examined in the study. Of the diabetic patients, (٧٦)females & (٢٦)males, mean age years = ٥٣,٨٣±٩,٦yrs, ٩١ had NIDDM and ١١ had IDDM. All patients were subjected to clinical examination to assess the presence of diabetic cheiroarthropathy(DCA) by measuring the angle of extension at the PIPJ using a goniometer, examined for trigger fingers(TF), tendon nodules, thickened indurated skin over the dorsum of the hand & for Tinel's sign. High-resolution ultrasonography was used to examine the digital flexor tendons, as well as, their synovial & fibrous sheaths, median nerve and skin thickness. In this study, ٣٤ patients with DCA and/or TF were subjected to injection of their flexor tendon sheaths, using a mixture of corticosteroid & local anesthetic; ١٧ patients were injected blindly while the other ١٧ patients were injected under ultrasound guidance. A time series design was employed in which individual patients served as their own control before and after injection.

Results: Our patients were classified into three groups; group A with DCA, group B with TF and group C with neither DCA nor TF. Cheiroarthropathy was found in ٢٤/١٠٢ patients(٢٤٪). Diabetic patients with cheiroarthropathy had significantly increased frequency of retinopathy (٥٨٪ versus ٠٪), nephropathy (٥٨٪ vs ٤٪), and peripheral neuropathy (٤٢٪ vs ١٢٪) and were more often on insulin treatment(٢٥٪ vs ١٧٪).. They showed significantly increased synovial sheath thickness on ultrasonography (١,١±٠,١٩mm vs ٠,٧٢ ±٠,١٢mm in the diabetic patients without DCA, versus ٠,٢٨ ±٠,١mm in the control group). Trigger finger was found in ٧١/١٠٢ patients (٧٠٪):. Diabetic patients with TF had significantly increased frequency of retinopathy (٣٧٪ vs ٠٪), nephropathy (٣٢٪ vs ٤٪), and peripheral neuropathy(٤١٪ vs ١٢٪) and were more often on insulin treatment(٤٤٪ vs ١٧٪). They showed significantly increased A١ pulley thickness on ultrasonography (١,١٧±٠,١٩mm vs ٠,٧٦ ±٠,١١mm in the diabetic patients without trigger finger). No differences in the tendon itself could be detected between the different groups(A, B & C groups). Diabetic patients with DCA and/or TF (group A & B) had increased frequency of CTS, sclerodactyly & lower extremity ischemia, compared with group C but these differences were also statistically insignificant. In patients with clinical evidences of carpal tunnel syndrome (CTS), the mean median nerve cross-sectional area was ١٨±٣,٨٤ mm٢, compared to ٩,٤±٢,٢ mm٢ in patients without clinical evidences of CTS. Ultrasonography of the median nerve showed significant caliber change across the carpal tunnel and/or cross-sectional area >١٥ mm٢ in ٩٢٪(٥٧/٦٢) of these patients with clinical evidences of CTS. Response rate to corticosteroid injection, defined as complete resolution of the abnormal diabetic finger after injection were ٣٤/٣٧ (٩٢٪) at one month post-injection, which is significantly different from pre-injection (P value <٠,٠٠١). Response rate for trigger finger injection alone was ٢٩/٣٢ (٩١٪) & response rate for DCA injection alone was ٥/٥ (١٠٠٪). Response rate for ultrasound-guided injection was ٩٤٪(١٦/١٧) while response rate for blind injection was ٩٠٪(١٨/٢٠).

Conclusion: Diabetes-associated hand conditions including diabetic cheiroarthropathy, trigger finger, diabetic sclerodactyly & carpal tunnel syndrome are common in Egyptian diabetic patients and commonly associated with diabetic microvascular complications (namely; retinopathy, nephropathy and peripheral neuropathy) as well as, lower extremity ischemia. High resolution ultrasonography is the modality of first choice for assessment of DCA, TF, CTS and sclerodactyly, being easy, rapid, inexpensive, widely available and accurate. Corticosteroid injection is an effective safe underused therapy for diabetic hand conditions and should be considered in all patients with DCA and/or TF while surgery should be considered only after repeated failure of corticosteroid injection.

Key word

Diabetes mellitus- limited joint mobility- diabetic cheiroarthropathy- contracture- tenosynovitis- trigger finger-hand, high resolution ultrasonography.

Acknowledgement

First and foremost, I feel indebted to Allah, the kind and merciful.

I would like to express my sincere appreciation and deepest gratitude to ***Prof. Dr./ Sahar Mostafa Al-Mashad****, professor of Radiodiagnosis, faculty of medicine, Cairo university, for her supervision, constructive criticism and generous support throughout every step of this work. It has been a great pleasure for me to proceed with this work under her kind supervision.*

I'm particularly and greatly obliged to ***Prof. Dr./ Khaled Tahseen Al-Hadidi,*** *professor of Rheumatology and rehabilitation, faculty of medicine, Cairo university, for all his help and support without which, this work couldn't have been achieved. I would like to express my sincere thanks and appreciation to him for his thorough clinical assessment of the patients, injection of the patients and for his invaluable suggestions, creative advice and criticism.*

My profound thanks are due to ***Prof. Dr./ Reda Saad Abd Al-Lateef,*** *Assist prof. of Radiodiagnosis, faculty of medicine, Cairo university, as this work wouldn't come to light without his endless effort, continuous encouragement, creative advices and fruitful guidance.*

No words can fulfill the feeling of gratefulness and respect I carry to ***Prof. Dr./ Mahmoud Abd-Alla Sharaf,*** *Chairman of the radiology department, faculty of medicine, Cairo university, for his endless support, continuous encouragement and for his sincere fatherly attitude. His guidance and advice will always be fingerprinted on my heart and soul.*

I would like to thank all ***my professors, the senior staff and all my colleagues,*** *without their help, support and cooperation, this work couldn't have been completed.*

I would like to thank ***all the staff of the diabetic outpatient clinic of the faculty of medicine, Cairo university,*** *for their help, support and cooperation.*

Lastly, I would like to thank ***the patients who participated in this work, the backbone of this study,*** *who despite their pains, showed a great pure spirit of bravery and cooperation.*

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LIST OF ABBREVIATIONS

*A١, ٢, ٣, ٤ & ٥… Annular pulleys number ١, ٢, ٣, ٤ & ٥

*AGEs……Advanced glycation end-products.

*APLT……..Abductor pollicis longus tendon.

*C١, ٢ & ٣… cruciate pulleys number ١, ٢ & ٣.

*CMCJ….Carpo-metacarpal joints.

*CML……Carboxy-methyl-lysine.

*CT……..Computed tomography.

*CTS……Carpal tunnel syndrome.

*DCA……..Diabetic cheiroarthropathy.

*DIPJ….. distal interphalangeal joints.

*DM……. Diabetes mellitus.

*EFOV……Extended field of view.

*ESR……..Erythrocyte sedimentation rate.

*FA…….Flip angle(MRI).

*FL…….. Flexor retinaculum.

*FOV……Field of view.

*FS…….Fat suppression MR image.

*FSE…….Fast spin echo MR image

*FSTIR…….Fast short tau inversion recovery Mr images.

*GAGs…..Glycosaminoglycans.

*GRASS…Gradient recalled acquisition in the steady state(MRI).

*GRE…Gradient recalled echo(MRI).

*IDDM…..Insulin dependant Diabetes mellitus.

*kHz…….. kilo hertz.

*LS……..Longitudinal section.

*MCPJ….Metacarpo-phalangeal joints.

*mg……..milligram.

*mHz……..megahertz.

*mL……..milliliter.

*MN……..Median nerve.

*MRI……Magnetic resonance imaging.

*NEX…. Number of excitations(MRI).

*NIDDM…..Non-Insulin dependant Diabetes mellitus.

*NMR……..Nuclear magnetic resonance.

*PDC……Palmar digital crease.

*PIPJ….. proximal interphalangeal joints.

*ROM……Range of movement.

*SE…….Spin echo MR image

*SLJM…….Syndrome of limited joint mobility.

*STIR…….Short tau inversion recovery Mr images.

*T١WI……..T١ weighted MR image.

*T٢WI……..T٢ weighted MR image.

*TF…….Trigger finger.

*THI……Tissue harmonic imaging.

*TS……..Transverse section.

*US……..Ultrasonography.

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Investigator: Abo El-Magd Mohamed El-Bohy, M.Sc..

Supervisor: Prof. Dr./ Khaled Tahseen El-Hadidi

Assist. Prof. Dr./ Reda Saad Abd Al-Lateef

Principal Supervisor: Prof. Dr./ Sahar Mostafa El-Mashad

Rational and Background::

Diabetes mellitus leads to structural changes in tendons that were detected by electron microscopic studies in the form of increasing packing density of collagen fibrils and decreasing fibrillar diameter, with abnormal fibrillar morphology showing foci of twisted, curved, overlapping, highly disorganized collagen fibrils due to non-enzymatic glycation of collagen over many years. These changes lead to tightening and consequent shortening of the tendons; the short Achilles tendon is an example ***(Grant et al.,*** ١٩٩٧***)***.

Carpal tunnel syndrome, Dupuytren's contracture, flexor tenosynovitis, trigger finger and limited joint mobility syndrome are more prevalent in diabetic patients than in the general population. These changes have higher incidence in IDDM than in NIDDM with positive correlation with increasing age of the patient, increasing

duration of DM and with the presence of microangiopathy ***(Gamstedt et al.,*** ١٩٩٣***).***

Infective tenosynovitis is common in diabetic patients and needs early diagnosis, followed by surgical treatment, sheath irrigation and appropriate antibiotic ***(Gonzalez,*** ١٩٩٩***).***

High resolution sonography is currently the only real-time cross-sectional imagining technique for tendons. It is the direct competitor of MRI, since sonograms can be quickly obtained in virtually any plane with exquisite spatial and contrast resolution, in addition to short examination time, low cost and lack of ionizing radiation making it ideal as a screening tool ***(Gibbon & Wakefield,*** ١٩٩٩ ***and Fornage,*** ١٩٩٨***).***

Sonographically, all tendons are echogenic with characteristic fibrillar echotexture on longitudinal scans. Tendon tears are diagnosed if there is partial or complete interruption of fibers. In tendinitis, the tendon is thickened, hypoechoic with blurred margin and distended synovial sheath by hypoechoic fluid in acute tenosynovitis and diffuse hypoechoic synovial thickening in chronic tenosynovitis ***(Neuhold et al.,*** ١٩٩٢ ***and Fornage,*** ١٩٩٨***)***.

Power Doppler sonography plays a pivotal role in the diagnosis and follow up of tendinitis, tenosynovitis and peritendinitis. Objective quantification of hypervascularity by power Doppler sonography permits