

قال تعالى

{أَلَمْ تَرَ إِلَى رَبِّكَ كَيْفَ مَدَّ الظِّلَّ وَلَوْ شَاءَ لَجَعَلَهُ سَاكِنًا ثُمَّ جَعَلْنَا الشَّمْسَ عَلَيْهِ دَلِيلًا *
ثُمَّ قَبَضْنَاهُ إِلَيْنَا قَبْضًا يَسِيرًا } سورة الفرقان 45 - 46

DEDICATION

I dedicated this project to soul of my father and mother, to my wife Soha Mansour, to my son Ali, for their patience, encouragement and support throughout this endeavor.

My sincere gratitude and dedication for brothers, sisters, teachers, friends and Collogues in Ribat Hospital, for their endless support and great motivation in my journey to complete this thesis.

Best Regards for all.

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Abstract

Diabetes Mellitus is one of risk factors that cause carotid arteries atherosclerosis which occurs when lipoprotein accumulates in the intima of the artery. As atherosclerosis progresses it may completely occlude the artery lumen or plaque may rupture sending thrombus more distal, resulting in Transient Ischemic Attack or stroke. The aim of this study was to assess the Carotid Arteries in adult Sudanese patients with Diabetes Mellitus, 200 participants were enrolled in the study; they were scanned using ultrasound machine Siemens Sonoline G 60S with linear probe of (7-10 MHz) in Ribat Hospital from 11/2014 to 11/2016. The sample scanned to visualize the carotid arteries in the supine position with knee support, the neck scanning was enhanced by titling and rotating the head away from the side being examined as with possible adjustment for the position of the head and neck during the examination to facilitate visualization of the carotid arteries. Intima-Media-Thickness (IMT), Caliper, peak Systolic Velocity (PSV), End Diastolic Velocity (EDV), pulsatility index (PI) and Resistive Index (RI) were measured. Maximum value of IMT in CAs increased with age and duration of DM, in Rt CCA it begins at 1.2 mm in first age group and ended in 1.9 mm for age and duration in last age group, while for Lt CCA from 1.4mm to 2mm for age and 1.4mm to 2.1mm for duration, the external calipers like IMT increased with increased in age and duration while there is no correlation with PSV, EDV, RI and PI in normal participants while in plaques conditions IMT show positive correlation with Doppler parameters. The outcomes of this study suggest that gray scale and Doppler ultrasound are a good tools to evaluate and assessment carotid arteries in diabetic patients and predict the degree and severity of atherosclerosis.

Statistically IMT and carotid calipers showed strong positive correlation with age and duration of diabetes and they consider as a good marker of subclinical atherosclerosis. While there is no correlation between PSV, EDV, RI and PI with age and duration of diabetes in healthy participates while in plaques conditions there is a linear correlation between PSV, EDV and IMT.

الخلاصة

يعتبر مرض السكرى احد الامراض التى تتسبب فى تصلب الشرايين السباتية وذلك عندما يتراكم البروتين الدهنى فى البطانيه الداخليه للشريان وعند تطور تصلب الشرايين فانه قد يودى الى قفل الشريان تماماً واحيانا قد يحصل تمزق للتصلب ونزوح الجلطة للامام مما قد يودى الى سكتة دماغية عابره او سكتة دماغية دائمه. ان الهدف من هذه الدراسه هو تقييم الشرايين السباتية لدى مرضى السكرى السودانيين، عدد المرضى الذين اجريت عليهم الدراسه مائتان مريض يعانون من مرض السكرى بمستشفى الرباط فى الفتره من 2014/11م الى 2016/11م واستخدم فيها جهاز موجات صوتيه ماركة سيمينز (Sonoline G 60S) عبر مسبار خطى يتراوح بين 7—10 ميغاهيرتز وكل المرضى مسحوا بتقنية الوضع البطنى مع دعم الركبه ومد الراس وزاحته عكس الجانب الذى يراد مسحه وذلك لقياس سمك البطانية الداخليه للشريان السباتى وقطر الشريان والسرعه القصوى والدينيا ومقياس الانقباض ومقياس المقاومه كذلك فى الشرايين السباتية .

واظهرت الدراسه ان سمك البطانية الداخليه وسمك القطر يزدادان مع تقدم العمر وزيادة مدة الاصابه بمرض السكرى، فسمك البطانيه الداخليه للشريان السباتى الرئيسى الايمن تبدء ب1.2 مليمتر للمجموعه العمريه الاولى وتزداد تصاعديا حتى تنتهى عند 1.9 مليمتر عند المجموعه العمريه الاخيريه وذلك للعمر ومدة الاصابه بمرض السكرى اما فى الشريان الرئيسى الايسر فتبدء للعمر من 1.4 مليمتر وتنتهى عند 2 مليمتر ولمدة الاصابه بمرض السمرى تبدء عند 1.4 مليمتر وتنتهى عند 2.1 مليمتر. اما بخصوص القياسات

الآخري أظهرت الدرآسه انه لا توجد علاقه بينها وتقدم العمر وزيادة مدة الإصابه بمرض السكرى فى المرضى الذين لا يعانون من أى درجه من الانسداد اما أولئك الذين لهم درجات متفاوتة من الانسداد فان سمك البطانیه الداخليه أظهر علاقه قويه مع سرعات الدم.

خلصت الدرآسه ان الموجات فوق الصوتيه (الرماديه + نظام دوبلر) تعتبر اداه فاعله جدا فى تقييم الشرايين السباتيه لدى مرضى السكرى وذلك باظهار درجه التصلب وتقدير درجه خطورة المرض وذلك باظهار التغيرات التى تطرأ على البطانیه الداخليه وقطر الشريان.

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Papers Published:

1/ Sonographic Assessment of Common and Internal Carotid Arteries in Type 1 Diabetic Patients.

2/ Sonographic Assessment of Common and Internal Carotid Arteries in Type 2 Diabetic Patients.

LIST OF ABBREVIATIONS

A	Cross-Sectional Area of a vessel
Am	Ambar
AL	Antero- Lateral
Am	Antero-Medial
A/D	Analog-to-Digital
ADR	Adrenaline
AIUM	American Institute of Ultrasound in Medicine
ARP	Absolute Refractory Period
AS	Atherosclerosis
AV	Atrial valve
B-Mode	Brightness Mode
BIMT	Bifurcation Intima Media Thickness
C	Speed of Sound
$\cos \theta$	Cosine of the Angle
CA	Carotid Artery
CAs	Carotid Arteries
CCA	Common Carotid Artery
CCAs	Common Carotid Arteries
CW	Continuous Wave
CEA	Carotid Endarterectomy
DM	Diabetes Mellitus
DH	Diabetes with Hyperlipidemia
DEDV	Decrease End Diastolic velocity
CVD	Cardiovascular disease
CO_2	Carbon dioxide
CAVATAS	Carotid and Vertebral Arteries Transluminal Angioplasty Study
EDV	End Diastolic Velocity

ECs	Endothelial Cells
EDTA	Ethylene Diamine Tetraacetic Acid
ESR	Erythrocyte Sedimentation Rate
ECA	External Carotid Artery
ECM	Extra cellular matrix
ECST	European Carotid Surgery Trial
Fo	Transmitted Ultrasound Frequency
FA	Femoral Artery
FD	Frequency of the Maximum Doppler
FFT	Fast Fourier Transform
GE	General Electric
HDL	High – Density Lipoprotein
HR	Heart Rate
IHD	Ischemic Heart Disease
IMT	Intima Media Thickness
IPSV	Increase Peak Systolic Velocity
ICA	Internal Carotid Artery
IDDM	Insulin dependent diabetes mellitus
J	Joule
KHz	Kilohertz
KPa	Kilopascal
Kg	Kilogram
L	Length of the Vessel
LDL	Low Density Lipoprotein
Lt	Left
M	Meter
MBP	Means Blood Pressure
MFV	Mean Flow Velocity
MHz	Megahertz

MI	Myocardial Infarction
MV	Mega volt
N	Viscosity of the fluid
NOR	Noradrenaline
NIDDM	Non-Insulin dependent diabetes mellitus
NASCET	North American symptomatic Carotid Endarterectomy Trial
O ₂	Oxygen
P	Pressure
P.L	Postero-Lateral
P.M	Postero-Medial
PAD	Peripheral Arterial Diseases
PD	Power Doppler
PI	Pulsatility Index
PRF	Pulse Repetition Frequency
PSV	Peak Systolic Velocity
PW	Pulse wave
PRP	Relative Refractory Period
Q	Volume Flow
R	Radius of the vessel
R	Resistance
R _t	Right
RAP	Right Atrial Pressure
RI	Resistivity Index
SAA	Serum Amyloid A Protein
SMCs	Smooth Muscles Cells
TIA	Transient Ischemic Attack
UPP	Ultrasound Printing Paper
USD	United State Dollar
V	Reflector Velocity

V_a and V_b	Identical Doppler Signals from the Separate Demodulators
VLDL	Very Low-Density Lipoprotein
V_s	Versus
WHO	World Health organization
Θ	Seta

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