Lipid profile, Beta-lipoprotein shift ratio and serum glucose in metabolic syndrome patients

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ABSTRACT

Objectives: (a) To determine the change in the lipid profile, β-lipoprotein shift ratio (B-LSR) and serum fasting glucose (SG) in metabolic syndrome(MS) and control.(b) To determine the effects of age and body mass index (BMI) on the measured parameters.

Methods: This study was conducted in AL-Darkeslea area in Mosul province. during the period from January to April ٢٠٠٧. Fasting blood samples were collected from١٠٠ patients, ٦٠ patients with metabolic syndrome MS according to WHO criteria and ٤٠ apparently healthy subjects. The collected data were analysed by ٢- sample t-test and the effects of the age and BMI on the measured parameters were determined by correlation coefficient.

Results: B-LSR was higher in MS patients than in the control group (P<٠.٠٠١), Total serum cholesterol (TC), triglycerides (TG), Low density lipoprotein-cholesterol (LDL-C), Very low density lipoprotein-cholesterol (VLDL-C) and atherogenic index (AI)showed significant increases in MS patients when compared to the controls (P< ٠.٠٥), while serum high density lipoprotein-cholesterol (HDL-C) showed significant reduction in MS than controls (P<٠.٠٠١), also SG showed same increase (P<٠.٠٠١).TC and LDL-C were significantly correlated with the age in controls while no significant correlation were seen in the MS patients. No significant correlation was noticed between BMI and the measured parameters, in both MS patients and control group.

Conclusion: MS is associated with significant changes in B-LSR, lipid profile and SG. Age and BMI showed no significant correlation with theses parameters in the MS patients.

الخلاصة

أهداف الدراسة : بيان التغير الحاصل في واجهة شحوم الدم ، ونسبة تحول البروتين ألشحمي-بيتا و مستوى السكر في الدم بين المصابين بالمتلازمة الايضية بالمقارنة مع الأصحاء. إضافة إلى ذلك شملت الدراسة توضيح تأثيرات عاملي العمر ومعامل كتلة الجسم على المعايير السابقة.

طرق العمل : أنجزت هذه الدراسة في منطقة الدركزلية في محافظة نينوى إثناء الفترة من كانون الثاني ولغاية نيسان ٢٠٠٧.تم جمع عينات الدم في حالة الصوم لكافة الاختبارات المأخوذة من مئة شخص، ستون شخصا منهم مصابين بالمتلازمة الايضية (حسب تعريف منظمة الصحة الدولية) و أربعين شخص يبدون أصحاء. وتم تحليل البيانات باستخدام اختبار-t كما قيس تأثير كل من العمر ومعامل كتلة الجسم على المعايير المأخوذة بواسطة معامل الارتباط .

النتائج: كانت نسبة تحول البروتين ألشحمي-بيتا أعلى بشكل معنويا في عند المصابين بالمتلازمة الايضية بمقارنتها مع الأصحاء عند (ب <٠.٠٠١). كما لوحظ ارتفاع في كل من مستوى الكوليستيرول الكلي، الشحوم الثلاثية، كوليستيرول البروتين ألشحمي خفيض الكثافة ، كوليستيرول البروتين ألشحمي الوضيع الكثافة و معامل التصلب الشرياني للمصابين عند (ب < ٠.٠٥) وذلك على عكس كوليستيرول البروتين ألشحمي رفيع الكثافة والذي لوحظ انخفاضة بشكل معنوي عند (ب< ٠.٠٠١) في المصابين بالمقارنة مع الأصحاء. كما أظهرت الدراسة ارتفاعا معنويا في مستوى السكر بالدم للمصابين بالمتلازمة عند (ب < ٠.٠٠١). كذلك أظهرت الدراسة ارتفاعا معنويا في مستوى الكوليستيرول الكلي و كوليستيرول البروتين ألشحمي خفيض الكثافة مع زيادة العمر عند الأصحاء في حين لم يلاحظ تأثير لزيادة العمر عند المصابين بالمتلازمة كما لم يلاحظ تأثير لزيادة معامل كتلة الجسم على المعايير السابقة عند المصابين بالمتلازمة الايضية.

الاستنتاج: إن الإصابة بالمتلازمة الايضية يصاحبه تغير ملحوظ في نسبة تحول البروتين ألشحمي-بيتا، وواجهة شحوم مصل الدم و مستوى السكر في الدم .كما لم تجد الدراسة تأثيرا لزيادة كل من العمر ومعامل كتلة الجسم على هذه القياسات عند المصابين بالمتلازمة الايضية.

Metabolic syndrome (MS), is insulin resistance syndrome or syndrome X, it also includes abdominal obesity, elevated blood pressure, and lipid abnormalities and microalbuminuria.[١,٢,٣] World health organization (WHO) defined metabolic syndrome as: the co-occurrence of any three of the abnormalities: central obesity with body mass index (BMI) > ٢٥ Kg/m^{٢}, high blood pressure > ١٤٠/١١٠ mm Hg, serum fasting glucose >٧ mmol/L, total serum cholesterol>٥.١٨ mmol/L.[٤,٥]
Epidemiology and prevalence of metabolic syndrome varies by definition used and population studied.[٦] Based on data from the Third National Health and Nutrition Examination Survey (١٩٨٨ to ١٩٩٤), the prevalence of metabolic syndrome varies from ١٦ - ٣٧ percent[٧]. The prevalence of metabolic syndrome increases with aging and body weight.[٨,٩] The etiology of the metabolic syndrome has not been established definitely. One hypothesis presumed that the primary cause is insulin resistance. Insulin resistance correlates with visceral fat measured by waist circumference , waist to hip ratio or BMI.[٩] The link between insulin resistance and cardiovascular disease probably is mediated by oxidative stress, which produces endothelial cell dysfunction, promoting vascular damage and atheroma formation.[١٠]The second hypothesis blamed hormonal changes for the development of abdominal obesity.[٨,٩] Patient with elevated levels of serum cortisol (caused by chronic stress) developed abdominal obesity, insulin resistance and lipid abnormalities.[١١] This study was conducted to evaluate the changes that occur in MS patients in β-lipoprotein shift ratio (B-LSR), lipid profile and serum fasting glucose (SG). Also the study included the correlation between of age or BMI and the measured parameters.

Subjects and methods

This study was conducted in period from January through April ٢٠٠٧ in Private clinics in Al- Drkeslea area in Mosul. One hundred subjects were divided into two groups: The first group included ٤٠ apparently healthy individuals as controls and ٦٠ individuals with MS according to the WHO criteria.[٤,٥] Serum fasting glucose was assayed by glucose oxidase /peroxidase colorimetric method [١٢], TC by Richmond-enzymatic method[١٣], high density lipoprotein- cholesterol(HDL-C) measured by Lopez-Virella method[١٤]and triglycerides (TG) were measured by Fossati-enzymatic method[١٥].While Low density lipoprotein-cholesterol (LDL-C), Very low density lipoprotein-cholesterol (VLDL-C), atherogenic index (AI), β-LSR were calculated using equations.[١٦,١٧]Data were presented as mean ±SD, ٢-sample t-test and the effects of increase age, BMI on measured parameters were determined by correlation.

Results

Table ١ shows that, B-LSR in MS patients was higher than controls (P<٠.٠٠١), furthermore, lipid profile parameters showed significant increase in MS patient (P<٠.٠٥) while HDL-C showed significant decrease in MS when compared to the controls(P<٠.٠٠١).Serum glucose level demonstrated significant increase in MS patients(P< ٠.٠٠١) when compared to the controls.
This study included evaluation the effects of aging on measured parameters and compared these value to the control value. The results revealed that with increasing the age, TC and LDL-C showed significant increase in control group, while no significant changes occur in the measured parameters with aging in MS patients.
The study also used BMI as indicator for increase in the body weight to show its effect on the on measured parameters. The results showed that there were no significant changes with increase BMI in MS patients.

Table ١. Lipid profile, beta-lipoprotein shift ratio and serum glucose in metabolic syndrome patients and controls.

Parameter	Controls N=٤٠	Metabolic syndrome patients N=٦٠
Total serum cholesterol mmol/L	٥.٣٤±٠.٤٦	٦.٤٨± ٠.٦٩***
Triglycerides mmol/L	١.٦٥±٠.٢٥	١.٨١±٠.٤٥**
High density lipoprotein mmol/L	١.٠٤±٠.١٦	٠.٨٨±٠.١١***
Low density lipoprotein mmol/L	٣.٥٦±٠.٣٩	٤.٨± ٠.٥٥ ***
Very low density lipoprotein mmol/L	٠.٧٤± ٠.١٢	٠.٨١±٠.٠٢*
Atherogenic index	٥.٢٤±٠.٨٨	٧.٥±١.٢٧***
Beta-lipoprotein Shift ratio	٢.١٨± ٠.٣٦	٢.٨١± ٠.٦٦***
Serum glucose mmol/L	٥.١٤±٠.٣٦	٧.٢٩±٠.٢٥***

* <٠.٠٥, ** P<٠.٠١ , *** P<٠.٠٠١

Discussion

In the present study the increase in the B-LSR in the MS patients may be due to the increase in the serum TG. The increase in the flux of free fatty acids (FFA)from the periphery to the liver causes stimulation of hepatic TG synthesis.[١٨] Insulin resistance and hyperglycemia increase intracellular Malonyl Co-A concentration which intern inhibit Carnitine Palmitoyl Transferase (CPT١) that responsible for entrance of FFA to mitochondria leading to more VLDL formation.[١٩] B-LSR reflect the hepatic lipase (HL) activity the compensatory mechanism to decrease dyslipidemic effect of the disease, so the continuous increase in the serum VLDL formation will lead to continuous stimulation HL-activity.[٢٠]

The high TC in the present MS patients are consistent with Mazzone and Sandhfer[٢١] could be explained by increase in Apo-B lipoprotein assembly, that produce by conversion of VLDL to IDL and LDL by the action of HL[٢٠] Also the down regulation of Apo-B receptor that lead to significant decrease in the LDL clearance[٢٢], moreover increase in cholesteryl ester transferring protein (CETP).[٢٣]

The present study showed significant reduction in the HDL-C level in the MS patients and this probably are due to either decrease number of HDL particle or the carrying capacity. Reilly and Rader [٢٤] described similar reduction, this reduction occurs secondarily to increase in the TG that occur with increase in the CETP to form TG-rich HDL particle that prone to catabolism more than binding. Another possible mechanism described also by Reilly and Rader[٢٤] which relate the decrease in the HDL to the reduction in hepatic Apo-A formation. Brewer et al[٢٥] described a third possible mechanism, the significant reduction in the HDL occur as a result of defect in the ATP-dependent binding cascade A١ transporting system (ABCA١) leading to destabilization of HDL-particle.

Hyperglycemia in the present MS-patients can be explained by increase in the insulin resistance that in turn cause intracellular deprivation of glucose as described by Ruderman[٢٦]. The increase in both serum glucose and fructose provided substrate for more FA and glycerol synthesis leading to increase in serum TG.[٢٧,٢٨] The change in the intracellular cytoplasmic Mg^{++}/Ca^{++} ratio can also interfere with normal insulin secretion and its normal activity.[٢٩,٣٠] The abnormal high adrenergic activity is due to low intracellular–cytoplasmic Mg^{++} which lead to increase serum glucose and increase gluconeogenesis, glycogenolysis and lipolysis.[٣٠]

This study shows no significant correlation on the measured parameters with age and BMI in MS patients and this result controverts the result obtained by Scott. [٣١] In conclusion MS patients have significant changes in B-LSR, lipid profile and SG that lead to increase in the morbidity and mortality. Age show no

significant correlation to MS in this group of patients.

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