Metabolic Syndrome in the Spectrum of Hair Graying

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ABSTRACT

Background: Hair graying is an aging sign that was found to be associated with several systemic diseases like ischemic heart disease, osteopenia, and autoimmune diseases. Metabolic syndrome was applied to the clustering of risk factors that often associate with increased risk for atherosclerotic cardiovascular disease.

Aim of Study: Our work aimed to test retrospectively the association between onset of hair graying and risk of metabolic syndrome.

Patients & Methods: Four hundred and eighty one gray hair individuals, with no history of any type of atherosclerotic disease, participated in the study. The participants were divided into two groups according to the presence or absence of criteria of metabolic syndrome into control and metabolic syndrome groups, and each individual in both groups was asked about the decade (2nd-6th) when he/she firstly noticed that he/she had a gray hair. A comparison was made regarding the age of onset of graying between the two groups.

Results: There was a significant difference in decades between individuals with metabolic syndrome and the control group and was found in the 4th and 5th decade of life (P =0.045 & 0.024 respectively) while the difference was not significant in the 2nd, 3rd and 6th decades of life. The mean age of onset of hair graying in metabolic syndrome was 36.207 ± 8.30 year and the control group was 38.434 ±8.31 year, there is also a significant difference between the two groups (P value=0.003).

 Conclusion: patients with metabolic syndrome have an earlier age of onset of gray hair.

Key words: Metabolic Syndrome, Hair graying.

المتلازمة الايضية في نطاق مشيب الشعر

اساس الدراسة: ظهور المشيب هي علامة لتقدم السن وجدت انها تقترن بالعديد من الامراض الجهازية كالقصور الشرياني للقلب ونخر العظام والامراض المناعية. المتلازمة الايضية هي مايطلق على مجموعة عوامل الخطورة التي غالبا ماتزيد من مخاطر الاصابة بتصلب الشرايين.

الهدف: اختبار الاقتران بين العمر الذي يبدأ به ظهور الشيب والعرضة للإصابة بالمتلازمة الايضية.

الطرق: اربعمائة وواحد وثمانون شخص اشيب الشعر اشتركوا في الدراسة ممن لم يعانوا مسبقا من اي من امراض تصلب الشرايين. المشاركون كانوا من المرضى الراقدين في الردهات الجراحية والباطنية والمراجعين للعيادة الاستشارية للأمراض الجلدية والزهرية في مستشفى بغداد التعليمي. الدراسة امتدت من كانون الاول ٢٠١٦ ولغاية مايس٢٠١٧. المشاركون قسموا الى مجموعتين ،على اساس وجود مواصفات المتلازمة الايضية فيهم والتي تلاحظ بالفحصين السريري والمختبري ، مجموعة الضبط ومجموعة المتلازمة الايضية ، وكل شخص من كلا المجموعتين سؤل عن العمر الذي لاحظ فيه لأول مرة ظهور الشيب في شعره واجاب باختيار واحدة من خمس حقبات تمثل عقود الحياة الممتدة من العقد الثاني الى العقد السادس. واجريت المقارنة بين المجموعتين على اساس عمر الظهور الاول للشيب.

النتائج: وقد اظهرت تلك الدراسة فرق مهم احصائيا بين المجموعتين مجموعة الضبط ومجموعة المتلازمة الايضية في العقدين الرابع والخامس من الحياة وقيمة P كانت ٠,٠٤٥ و ٠,٠٢٤ بالتتابع. اما الفروق بين المجموعتين للعقود الثانية والثالثة والسادسة فلم تكن ذو مغزى احصائي. معدل عمر ظهور المشيب ± الانحراف المعياري لمجموعة المتلازمة الايضية كان ٣٦,٢٠٧ سنة ± ٨,٣ بينما مجموعة الضبط ممن لم تظهر لديهم مواصفات المتلازمة الايضي فالمعدل ± الانحراف المعياري لديهم كان ٣٨,٣٤٣ سنة ± وقيمة P بين المعدلين كانت ٠,٠٠٣ اي ان المصابين بالمتلازمة الايضية يظر لديهم مشيب الشعر بعمر اقل.

الاستنتاج: المرضى المصابين بالمتلازمة الايضية يبدأ عندهم مشيب الشعر بعمر اقل من سواهم.

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INTRODUCTION

Graying of hair (canities) is usually a manifestation of the natural aging process and is thought to be due to progressive depletion in functioning follicular melanocytes, so color of hair relies on the presence or absence of melanin incorporated into the growing hair shaft.[1] The timeframe of normal canities is different. In Caucasian populations, the age of onset was found to be 34.2 ± 9.6 years. In African Americans, onset is shifted to slightly later in life at 43.9 ± 10.3 years, whereas the late 30's are the rule for Asians. [2] Onset is defined as premature when graying starts before 20 in Caucasian, 25 in Asian, and 30 in Negro.[3,4] Canities may affect individual hair follicles with either gradual loss of pigment over time and over several cycles, gradual loss of pigment along the same hair shaft i.e. within the same anagen phase of a single hair cycle, or, the hair fiber may grow in fully depigmented. All studies to date have confirmed that pigment loss in graying hair follicles is due to marked reduction in melanogenically-active melanocytes in the hair bulb of gray anagen hair follicles. The net effect of this reduction is that fewer melanosomes are incorporated into cortical keratinocytes of the hair shaft.[4] Graying process maybe understood as an easily accessible and quite obvious indicator of the overall oxidative stress and antioxidant capacity.[5] Graying of hair may be an additional risk factor for myocardial infarction. [6] The term metabolic syndrome was applied to the clustering of risk factors that often associate with increased risk for atherosclerotic cardiovascular disease. One advantage of identifying this particular cluster of risk factors is that it should bring together the fields of cardiovascular disease and diabetes for a concerted and unified effort to reduce risk for both conditions simultaneously. [7] In 2001, the National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III) introduced the metabolic syndrome as a risk factor,[8,9] it is an attempt to represent the main pathophysiologic processes; visceral obesity, dyslipidemia, insulin resistance, and essential hypertension.[10] We aimed to assess the correlation between the onset of hair graying and risk of metabolic syndrome. A case-control study was undertaken to explore retrospectively the age distribution of hair graying onset for individuals meeting the criteria of metabolic syndrome.

SUBJECTS AND METHODS

A case-control study were 481 individuals with gray hair participated in the present study, and they were recruited during the period extending from September 2016 to May 2017, as inpatients from the medical and surgical wards in addition to outpatients from Department of Dermatology and Venereology of Baghdad Teaching Hospital . Exclusion criteria were:-

• Those who are known to have ischemic heart disease because of the suspected modification of metabolic syndrome criteria by therapies and/or by changing life style.

• Those with other known atherosclerotic diseases like strokes or peripheral vascular ischemia.

According to the Adult Treatment Panel III (ATP III) criteria[8,9] of metabolic syndrome, those who met at least 3 criteria were included in a group called metabolic syndrome group. These criteria are as following:-

1. Fasting plasma glucose ≥ 100
2. Waist circumference ≥ 102 cm for men, and 88 cm for women
3. Triglycerides ≥ 150 mg/dl
4. High density lipoprotein < 40 mg/dl in men, and < 50 in women
5. Blood pressure ≥ 130/85

During interrogation with each individual or participant, blood pressure was measured, waist circumference was measured and the 3

biochemical tests: high density lipoproteins (HDL), serum triglycerides (TG), and fasting blood sugar (FBS) were done after 12 hour fasting state in the next morning. Those who fail to meet at least three criteria were included in a sex and age-matched control group. To clarify the particularly important point regarding onset of hair graying, each individual in both groups was interrogated carefully and was asked one particular question "At which decade of life did you firstly noticed that you have gray hair?"

Statistical analysis was done by comparing the data in terms of chi square and P values and the calculated mean of each group were compared using the t-test, P value less than 0.05 and chi square more than 4 means significant result.

The ethical approval of the scientific committee of the local Scientific Council of Dermatology & Venereology-Iraqi Board for Medical Specializations was taken.

RESULTS

Depending on the Adult Treatment Panel III (ATP III) criteria it was possible to detect (232) individuals, having metabolic syndrome. Those who failed to meet at least three Adult Treatment Panel III criteria were (249) as a control group. Age and sexes are elucidated in (Table-1). The decade of onset of hair graying and number and percentage of individuals in each decade was demonstrated in (Table-2).

Table 1. Ages and sex distribution of gray hair individuals both in control and metabolic syndrome groups

Group	Total No.	Age		Sex	
		Range	*Mean ± SD*	*Male*	*Female*
Metabolic syndrome	232	46-61	53.3 ± 5.612	138 (59.5%)	94 (40.5%)
Control	249	45-63	52.6 ± 6.692	150 (60.2%)	99 (39.8%)
Total	481				

Regarding the onset, hair graying started in 4.31%, 20.26% and 37.5% of individuals in the metabolic syndrome group in each of the 2nd, 3rd and 4th decades of life respectively in comparison to 2.81%, 16.06% and 28.92% of the control group within same decades of life, while the onset was in the 5th and 6th decades in 47.39% and 4.82% respectively within the control group in comparison to 36.21% and 1.72% in the metabolic syndrome group (Table-2). Slope of metabolic syndrome group graph is shifted to the left as shown in (Figure-1). There were accumulative percentages of individuals who have gray hair with increasing age also shows different slope, i.e. left-shifted for metabolic syndrome group (Figure-2). In the bar chart it is clear that in each decade

before 50 year age, where all eventually get canities, there is more percentage of gray hair individuals in metabolic syndrome than in control group. The statistically significant difference in terms of chi square and P value and the Yates a corrected value was calculated and (Table-3) reveals the results in each decade of life. The 4th and 5th decades show significant difference in hair graying onset between the two groups, (P values were 0.0455 and 0.0243 respectively). In terms of odd ratio, it is also significant and increasing after each decade of life (Table-2). In each decade of life there are individuals who have no gray hair yet, while others had it at earlier age whether in the same decade or previous decades, so odd ratio can be obtained by

quantifying the association of this property (gray hair) with the other property (metabolic syndrome). At the age of 50 and more the odd ratio is of no significance as all individuals have already gray hair, i.e. this property has got present in all individuals included in this study.

Table 2. Age of onset of gray hair in metabolic syndrome group and control group.

Age group	No. of individuals Control	%	No. of individuals Metabolic Syndrome	%	Odd ratio
< 20	7	2.81	10	4.31	1.557
20-29	40	16.06	47	20.26	1.4
30-39	72	28.92	87	37.50	1.76
40-49	118	47.39	84	36.21	2.89
≥ 50	12	4.82	4	1.72	
Total	**249**	**100.00**	**232**	**100.00**	
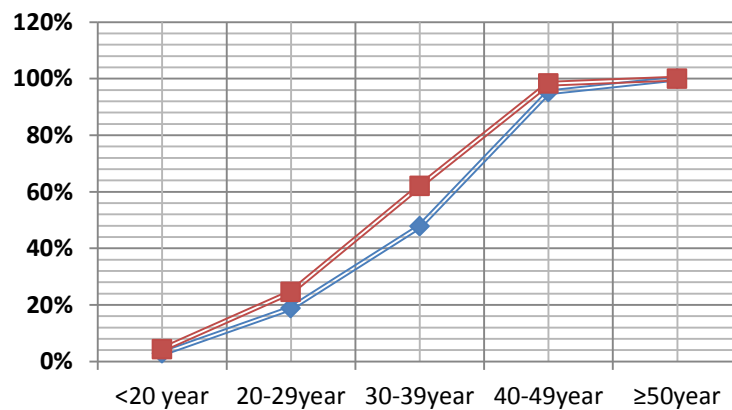
Fig 1. Positive correlation of hair graying with aging for control (blue) and metabolic syndrome (red) groups
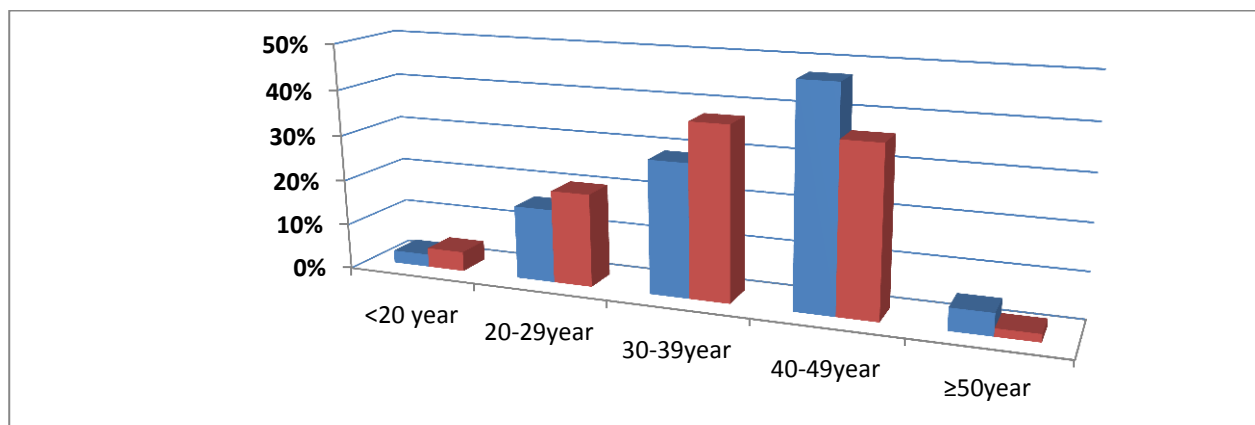
Fig 2. Onset of graying in percentile for different age groups in metabolic syndrome (red) and control (blue) groups.

Table 3. Chi square(x^2) and P value for each decade, yellow shading for significance.

Decades	x^2	Yates corrected	P value	Yates corrected
< 20	0.79	0.41	0.3736	0.5205
20-29	1.43	1.16	0.2324	0.2821
30-39	4.00	3.62	0.0455	0.0571
40-49	5.07	4.67	0.0243	0.0308
≥ 50	3.58	2.68	0.0586	0.1016

DISCUSSION

Metabolic syndrome was a concept established to comprehend the culprit cardiometabolic risk factors which are thought to play major roles in development of atheroma. The effect of oxidative stress is a common hypothesis that found considered in literatures reviewing the pathogenesis of three different entities, metabolic syndrome, hair graying and myocardial infarction. The association between myocardial infarction and hair graying was tested in previous studies, [6,11,12] and the association between metabolic syndrome and oxidative stress was also tested. [13] However the association between metabolic syndrome and hair graying is being tested for the first time in this study. In the present study a single parameter in hair graying, (the age of onset) has been tested in association with metabolic syndrome. A significant difference between individuals with metabolic syndrome and the control group was found in the 4th and 5th decades of life while the difference was not significant in the 2nd, 3rd and 6th decades of life. This may be related to the relatively small sample size in the study. There is also a significant difference between the mean age of onset of hair graying in metabolic syndrome and those who don't have the syndrome, with metabolic syndrome patients having an earlier age of onset of hair graying. In a previous Iraqi study on 60 patients with premature grayness of hair in comparison to sixty healthy individuals, Sharquie et al found for the first time a correlation between premature hair graying and dyslipedemia and glucose intolerance. Patients' ages ranged between (12-29) years with a mean ± standard deviation (SD) of 24.60 ± 3.48 years. Both glycosylated hemoglobin and fasting blood sugar were significantly higher in patients with premature grayness of hair than those of the control. Also, it was found that these parameters were positively correlated to the grade of premature graying. The level of high-density lipoprotein-cholesterol was significantly lower in patients with premature grayness of hair compared to control.[14] In the present study we tested the association between graying hair onset in all ages whether before or after the age of premature hair graying with the metabolic syndrome, the criteria included also waist circumference and blood pressure and not only dyslipidemia and fasting blood sugar. In another Iraqi study, Sharquie et al confirmed the correlation between premature hair graying and oxidative stress markers that can play a pivotal role in aging process. [15] That study conclusion may explain the association found in the present study between graying and metabolic syndrome, which previously found to be associated with higher oxidative stress markers. [16] According to the Norwegian Hunt II Study, [17] the prevalence of the metabolic syndrome increased strongly with age according to both ATP III and the 2005 International Diabetes Federation (IDF) definitions. Target organ damage in terms of

carotid thickening, micro-albuminuria and left ventricular hypertrophy is increasing with age in hypertensive patients and the metabolic syndrome when present amplifies the risk in all ages.[18] In both studies individuals age increases metabolic syndrome prevalence and the suspected damage related to it. In our study the prevalence of hair graying, which is increased with individual's age, is shown to be more amplified if the individual meets the criteria of metabolic syndrome. So these findings may propose common pathogenic factors between aging, metabolic syndrome, and gray hair. Two studies in 1957 and 1978 investigated the association between hair graying and ischemic heart disease. [11, 12] Moreover a 12 year-prospective study tested in 1995 the possible relation between aging signs (such as graying of the hair, baldness, and facial wrinkling) in 750 cases of myocardial infarction in different decades of life [6] and found a significant correlation between graying of hair and baldness and the risk of myocardial infarction in men but not women. The current study confirmed that canities could be a predictor factor for metabolic syndrome, which is the clustering of risk factors that often associate with increased risk for atherosclerotic cardiovascular disease.

In conclusion, a correlation between the onset of hair graying, and the incidence of cardio metabolic risk factors known collectively as metabolic syndrome has been demonstrated and people with metabolic syndrome are more likely to have earlier hair graying.

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