Evaluation of Cortisol Level in Hair and Stress in Premature Hair Graying

Thesis

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By

Eman Mahmoud Fathallah Barakat
M.B.,B.Ch.
Faculty of Medicine- Ain Shams University

Supervisors

DR. MOSTAFA MOKHTAR KAMEL
Professor of Dermatology, Venereology and Andrology
Faculty of Medicine- Ain Shams University

DR. SAMAR ABD ALLAH SALEM
Professor of Dermatology, Venereology and Andrology
Faculty of Medicine- Ain Shams University

Faculty of Medicine
Ain Shams University
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Eman Barakat

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List of Abbreviations

Abb.	Mean
%	Percent
*	Chi-Square Tests
**	Fisher exact tests
^	Reference male
‡	Student t tests
Ab	Antibody
ACTH	Adrenocorticotropic hormone
CBG	Corticosteroid-binding globulin
Cm	Centimeter
CNS	Central nervous system
CRH	Corticotropin releasing hormone
DHI	Dihydroxyindole
DHICA	Dihydroxyindole carboxylic acid
DNA	Deoxy ribonucleic acid
DOPA	Dihydroxyphenylalanine
ELISA	Enzyme linked immunsorbent assay
Fig.	Figure
GHQ	General Health Questionnaire
Gm	Gram
HPA	Hypothalamic pituitary adrenal
HS	High significant
HSD	Hydroxysteroid dehydrogenase

List of Abbreviations(Cont....)

Abb.	Mean
HZ	Hertz
LOrF	Left Orbitofrontal Cortex
Mg	Milligram
Min.	Minute
Ml	Milliliter
MSH	Melanocyte-stimulating hormone
Ng	Nanogram
No.	Number
NS	Non significant
OCs	Oral contraceptives
OR	Odds ratio
PC	Personal compute
ROS	Reactive oxygen species
RPFC	Right Parieto-Frontal Cortex
S	Significant
SD	Standard deviation
SPSS	Statistical package for Social Science
T3	Thyroid hormones trioodothyronine
T4	Levorotatory thyroxine
TRP	Tyrosine related protein
Ul	Micron liter
USA	United States of America
β	Beta

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Evaluation of Cortisol Level in Hair and Stress in Premature Hair Graying

Abstract

Background: Stress can be defined as "a state of bodily or mental tension resulting from factors that tend to alter an existent equilibrium. Skin and hair pigmentation systems are also significant elements of the response to stress. Stress can be assessed by several scales. Perceived chronic stress can be measured by the German version of the Trier Inventory for the Assessment of Chronic Stress. **Aim:** The aim of this study is to investigate the relationship between chronic stress and level of hair cortisol in cases of premature hair graying. **Subjects:** This study included two groups: the first group included 20 subjects with premature hair graying. They were 10 males and 10 females with ages ranging from 18 to 30 years in males and from 23 to 30 years in females. The second group included 20 sex matched subjects with normal hair color as controls. They were 10 males and 10 females with ages ranges from 18 to 30 years. An informed consent was taken from all subjects before participating in the work. **Results:** The results of the present study showed a significantly higher mean age among patients with premature hair graying than controls as a whole and also among female patients than female controls, suggesting an important role of age in premature hair graying. Also, the present study demonstrated a significantly higher percentage of positive family history among patients with premature hair graying than controls and in female patients than female controls. Moreover, our results concerning the interpretation of life events questionnaire and showing a significantly higher percentage of moderate and high risk of illness in patients of premature hair graying than in controls as a whole and in male patients than male controls, suggest a role for psychological stressors and lack of coping with them in the occurrence of premature hair graying. **Conclusion:** In conclusion, the present work shows a relation between psychological stressors and lack of coping with them with premature hair graying especially in males. This lack of coping seems not to be related to hair cortisol level at least on the long term level. Increasing age and positive family history are possibly important factors in premature hair graying. **Recommendations:** Our recommendations include further studies on hair cortisol level in male subjects (normal and with premature hair graying).

Keywords: Stress, Skin, hair graying, lack, hair cortisol.

Introduction

Stress can be defined as "a state of bodily or mental tension resulting from factors that tend to alter an existent equilibrium" ***(Lovallo et al., 1997; de Weerth et al., 2005)***. The normal human response to a stressor is modulated by several complementary systems, the principle components of which are the autonomic nervous system and the hypothalamic-pituitary adrenal axis ***(Mastorakos et al., 2003)***.

According to numerous reports, both systemic and local stressors associated with CNS functions induce or exacerbate various diseases of the skin and its appendages (e.g., hair) ***(Sitez et al., 2012)***. Psychological stress is now regarded to be an important etiological factor in psoriasis, atopic dermatitis, pruritus and urticaria ***(Kimyai-Asadi and Usman, 2001; Kmieć and Broniarczyk-Dyła, 2008).*** Stress may also affect hair growth or even cause its loss ***(York et al., 1998; Arck et al., 2001, 2003)***.

Skin and hair pigmentation systems are also significant elements of the response to stress ***(Tobin and Kauser, 2005).*** Hair graying is a physiologic process that occurs with age in both men and women. The average age of onset of hair graying is 34 to 44 years depending on race

(Boas et al., 1935; Straile et al., 1964). Although there is no precise definition for the premature canities, it is defined as the occurrence of the hair graying before the age of 20 in whites, 25 in Asians, and 30 in Africans ***(Naieni et al., 2011)***.

According to the literature, emotional stress also affects hair pigmentation ***(Navarini et al., 2009; Weissmann, 2009; Paus, 2011)***. Regarding premature hair graying, many references in the scientific literature claimed it to be induced by psychoemotional stressors and our lack of capacity to cope with it ***(Peters, 2010)***. It is suggested that melanogenesis suppression in hair follicles may involve substance P (a stress-related neuropeptide), which may be responsible for the increased susceptibility of melanocytes to an autoimmune attack ***(Paus et al., 2006; Paus, 2011)***.

The application of human scalp hair analysis to the field of psychobiology promises to be most valuable, as biological markers of stress exposure are currently covering time periods of only up to 24 h (urinary excretion rates). Moreover, there is great research interest in the effects of chronic stress over longer periods of time (e.g., several months). Therefore, the development of a reliable and valid

technique to determine stress hormones in human scalp hair would fill a methodological gap ***(Kirchbaum et al., 2009)***.

The glucocorticoid hormone cortisol is a frequently assessed parameter in psychoneuroendocrine stress research. While in some of this research the primary focus lies in measuring dynamic changes in acute cortisol levels, research into the effects of chronic stress and its implications on health is often particularly interested in assessing long-term cortisol exposure. This, however, has been difficult, given that common measurement strategies only reflect acutely circulating cortisol levels (blood or saliva) or assess cortisol secretion over short time periods, usually not exceeding 24 h (urine) ***(Dettenborn et al., 2011).*** In this context, the analysis of cortisol in human hair is assumed to present a major methodological advancement, providing an easily obtainable retrospective index of cumulative cortisol exposure over extended periods of time up to several months ***(Gow et al., 2010).*** One centimetre of hair represents the accumulation effects of stress for approximately 1 month ***(Gow et al., 2010)***.

In addition, several studies have now shown the utility of hair cortisol as a marker of chronic stress ***(Kalra et al., 2007; Yamada et al., 2007; Dettenborn et al., 2010; Fairbanks et al., 2011; Laudenslager et al., 2011)***,

psychological disease ***(Dettenborn et al., 2011; Steudte et al., 2011)*** and health risk ***(Pereg et al., 2011).***

Stress can be assessed by several scales. Perceived chronic stress can be measured by the German version of the Trier Inventory for the Assessment of Chronic Stress ***(Schulz and Schlotz., 1999).*** Psychological distress can be measured with the 12-item General Health Questionnaire (GHQ12***) (Goldberg, 1988)***. Perceived self-efficacy can be measured using the German version of the General Self-Efficacy Scale ***(Schwarzer, 1995).*** Stress due to life events can be measured by The Social Readjustement Rating Scale ***(Holmes and Rahe, 1967).***