



Original Contribution

Occupational stress of anesthesia: Effects on aging☆



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ABSTRACT

Background: Anesthesiology has been identified as a stressful specialty. Chronic psychological stress may lead to biological aging and skin aging.

Study objective: The primary outcome was to measure physical health and emotional well-being. Secondary outcomes include skin aging analysis, telomere shortening in anesthetists.

Design: This is a prospective observational study.

Settings: University of Alexandria.

Patients: Study was carried out on 366 ASA I–II physicians 30–50 yr.

Interventions: Physicians were categorized into two equal groups, Group A (183) were anesthesia physicians and Group B (183) were physicians in less stressful specialties (laboratory specialties). Subgroup analysis was performed comparing 10 years' intervals from (30–40) and from (40–50).

Measurements: Physical health and emotional well-being were evaluated. All physicians were exposed to validated assessment scales for the upper face and the lower face for skin aging analysis. Blood sampling were drawn from all physicians during their working hours for analysis of telomere length, markers of oxidative stress.

Results: The two studied groups showed comparable demographic data and years of work. Physical health score and emotional health score showed higher values in Group A than Group B. Upper and lower face aesthetic unit summary score showed higher values in Group A than Group B. Telomere (TTAGGG) repeats for terminal restriction fragments (TRF) of Group A individuals revealed a significant decrease of TRF compared to Group B ($p = 0.001^*$).

Conclusion: Biological and skin aging is evident in anesthetists who are chronically exposed to occupational stress, with obvious shorter telomere length, higher lower and upper face scores, and free radicals.

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1. Introduction

Psychological stress occurs when people are under mental, physical, or emotional pressure, perceived by releasing stress hormones such as corticotrophin-releasing hormone (CRH), glucocorticoids, and epinephrine which triggers a wide range of physiological changes in response to stress [1–3]. Anesthesiology has been identified as a stressful specialty. In the field of anesthesiology, there are many factors that cause chronic stress [4–6]. The responsibility imposed on considered as stress factor for the professional on duty, possibility of clinical complications in the perioperative period, medical legal aspects, prolonged work shifts,

responsibility for any complications, and unrealistic professional expectations [7,8].

People who are stressed over long periods tend to look haggard [9]. Skin has immune and important barrier functions, maintaining homeostasis between external environment and internal tissues [10]. The link between psychological stress and skin aging is intuitive. Chronic psychological stress stimulates the hypothalamic-pituitary-adrenal axis, renin-angiotensin system, and the autonomic nervous system. Prolonged activation of these pathways with chronic stress exposure results in chronic immune dysfunction, increased DNA damage, and production of reactive oxygen species, which contribute to the aging of skin and other tissues [11,12]. Telomeres are DNA-protein complexes that cap chromosomal ends, promoting chromosomal stability. Telomeres shorten with age in all replicating somatic cells thus, telomere length can serve as a biomarker of a cell's biological age versus chronological age. Stress has been linked to oxidative DNA damage in leukocytes [9,13]. Declines in the telomere/telomerase activity may play a

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causal role in aging; serve as a biomarker of aging, or both. Several studies have reported associations between telomere biology and high levels of psychosocial stress exposure or stress biomarkers [14–18].

The present study hypothesized that chronic psychological stress may lead to biological aging and skin aging. The primary outcome was to measure physical health and emotional well-being. Secondary outcomes include skin aging analysis, telomere shortening in anesthetists who are exposed to chronic occupational stress, and markers of oxidative stress.

2. Methods

This prospective observational study was carried out in Alexandria Main University Hospital on 366 ASA I and II physicians 30–50 yr, after approval of the Medical Ethics Committee and an informed written consent from all participants. Physicians were categorized into two equal groups, Group A (183) were anesthesia physician and Group B (183) were physician in less stressful specialties (laboratory and academic specialties). Because the wide range of age; subgroup analysis was performed comparing 10 years' intervals from (30–40) and from (40–50). To avoid potential confounding variables physician who had any known systemic illness such as hypertension, coronary artery disease, diabetes mellitus, or affective disorders were not enrolled in this study. Chronic smokers, physician who had any skin cosmetic procedure (Botox, filler or platelets rich plasma injections), subjects taking steroids or NSAID (for previous 3 months) or vitamin supplements and pregnancy in female doctors were also excluded from the study.

All participants in the study were on full scheduler for at least continuous 5 yr. Physical health (17 items) and emotional well-being (seven items) were evaluated by using the relevant variables of the Health and Stress Profile [19]. On the response scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = very often) those who indicated either 'often' or 'very often' were recorded 'often', while those who indicated either 'rarely' or 'never' were recorded 'rarely'.

All physicians were exposed to validated assessment scales for the upper face [20] and validated assessment scales for the lower face [21] for skin aging analysis by two specialized analyzers (an aesthetic dermatologist and a plastic surgeon) both of whom were blinded to the participant profession and to the group that the physician belonged. Data were obtained after clinical evaluation of the upper and lower face of the candidates during live inspection as well as analysis of the high-quality photographs.

2.1. Photography

Two dimensional photographs using (Canon Power Shot SX500 IS) were taken for each enrolled subject. A frontal view and a lateral view were taken at rest for each subject. Next, frontal views were taken for the hyperkinetic forehead lines, glabellar frown lines and lips during pursing respectively. Lateral view was taken with maximum smiling expression. Accordingly, six photographs were taken per subject.

2.2. Validated scoring

Validated assessment scales were employed for the upper face and also for the lower face [20–21].

2.3. For the upper face

Each of the following entities was given a score from zero to four; where zero was for no lines, one for mild lines, two for moderate lines, three for severe lines and four for very severe lines. The entities scored were: forehead lines at rest, forehead lines with maximum frontalis contraction, Glabellar lines at rest, Glabellar lines with maximum muscle contraction, Crow's feet at rest, Crow's feet with smiling to the maximum, Male or female brow positioning at rest. The forehead

aesthetic area comprised forehead lines, glabellar lines and brow positioning. Its score ranged from zero to twenty. The crow's feet aesthetic area score ranged from zero to eight. The upper face aesthetic unit summary score ranged from zero to 28 [20].

2.4. For the lower face

Each of the following entities was given a score from zero to four; where zero was for no lines, one for mild lines, two for moderate lines, three for severe lines and four for very severe lines. The entities scored were: nasolabial folds at rest, marionette lines at rest, upper lip fullness at rest, lower lip fullness at rest, lip wrinkles at rest, lip wrinkles during maximum lip pursing, oral commissures at rest, jawline at rest. The lower face folds aesthetic area comprised the Nasolabial folds and the marionette lines. Its score ranged from zero to eight.

The summary score of the mouth and perioral aesthetic area comprised the upper and lower lip fullness, lip wrinkles, and oral commissures. Its score ranged from zero to twenty. The jaw aesthetic area score ranged from zero to four. The lower face aesthetic unit summary score ranged from zero to thirty-two [21].

Ten milliliter blood samples were drawn from all doctors in the two groups, 4 ml in EDTA tubes (anti-coagulant); for analysis of telomere length, 3 ml in heparinized tubes for determination of; thiobarbituric acid reactive substance (TBARS) marker of oxidative stress. 3 ml in plain sterile tubes (serum) for determination of superoxide dismutase (SOD) anti-oxidant enzyme. All samples were centrifuged at 4000 rpm for 10 min at 4 °C; serum was separated and stored at –70 °C until analysis.

3. Measurement of telomeric DNA

Test for telomere shortening caused by stress mean telomere length were measured in the peripheral blood mononuclear cells (PBMCs). Samples were taken on EDTA then stored frozen at –80 °C.

Terminal restriction fragment (TRF), corresponding to telomere length, was measured by a non-radioactive Southern blot technique. DNA samples were extracted from the cells by the Gene JET Genomic DNA purification kit (Thermo-Scientific) according to the manufacturer's protocol. The integrity of DNA was tested by running DNA samples (10 ng) on a 1% (wt/vol) agarose gel at 200 V for 60 min. DNA that appeared as a single compact crown-shaped band that migrated in parallel with the other samples on the gel was considered to be acceptable. Then isolated DNA digested for 16 h by *Hinf I* and *Rsa I* and separated on 0.8% agarose gels. After transfer to positively charged nylon membrane, samples were hybridized with digoxigenin-labelled probe (TTAGGG) Cat. No. 12 209 136 001 (Roche Applied Science, Mannheim, Germany) for 16 h. Membranes were then exposed to chemiluminescence-sensitive films, detection was done by (ChemiDoc-It® Imager for chemiluminescent blots including Northern, Western and Southern, UVP, England). Modified data analysis methodology was developed through TotalLab analysis software (TotalLab TL120, v2008) [22].

4. Markers of oxidative stress

Thiobarbituric acid reactive substance: Oxiselect™ TBARS Assay Kit (MDA Quantitation) Cell Biolabs, Inc. is designed to provide a standardized, reproducible assay with consistent results using the methods described by Ohkawa et al. Malondialdehyde (MDA); lipid peroxidation product reacts with thiobarbituric acid in ratio 1:2 to give a pink chromophore which was measured spectrophotometrically at 535 nm and expressed as $\mu\text{mol}/\text{mg}$ proteins. MDA concentrations were computed by reference to a standard curve prepared using Malondialdehyde bis(dimethyl acetal) [23,24].

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