

Impact of hormonal disorders after surgical treatment of endocrine pathology on dermatologic status and the need for aesthetic rehabilitation

Rimma P. Tkachenko¹, Oleksandr V. Ivanko², Yuliia I. Beshkovetska³

¹STATE INSTITUTION OF SCIENCE «CENTER OF INNOVATIVE HEALTHCARE TECHNOLOGIES» STATE ADMINISTRATIVE DEPARTMENT, KYIV, UKRAINE

²BOGOMOLETS NATIONAL MEDICAL UNIVERSITY, KYIV, UKRAINE

³KYIV CITY CLINICAL HOSPITAL № 1, KYIV, UKRAINE

ABSTRACT

Aim: To evaluate the impact of postoperative hormonal disorders on dermatologic status and to determine the need for aesthetic rehabilitation in patients after surgical treatment of endocrine pathology.

Materials and Methods: A prospective cohort study included 128 patients aged 19–76 years after endocrine surgery. The sample comprised 54 patients after thyroidectomy, 61 after parathyroidectomy, 3 after adrenalectomy, and 10 after combined procedures. Dermatologic examination, scar assessment, hormonal profiling, and quality-of-life evaluation using SF-36 and DLQI were performed. Quantitative variables were summarized as mean $\pm$ standard deviation or median and interquartile range; qualitative variables as absolute and relative frequencies. Comparative analysis used the chi-square test, relative risk (RR) with 95% confidence interval (CI), and Pearson correlation (r).

Results: Hormonal dysfunction was identified in 93 patients (72.7%). Dermatologic changes were found in 101 patients (78.9%), most commonly xerosis (50.0%), pathological scarring (40.6%), alopecia (28.9%), and pigmentation disorders (24.2%). Patients with hormonal imbalance had a significantly higher risk of dermatologic complications than those without endocrine dysfunction (88.2% vs 55.6%; RR = 1.59; 95% CI 1.21–2.08; $p < 0.01$). Aesthetic defects requiring correction were identified in 76 patients (59.4%). Scar severity correlated with impaired dermatology-specific quality of life ($r = 0.61$; $p < 0.001$).

Conclusions: Hormonal disorders after endocrine surgery are significantly associated with dermatologic complications and reduced quality of life. Integration of dermatologic surveillance and aesthetic rehabilitation into postoperative care is clinically justified.

KEY WORDS: thyroid gland, skin diseases, quality of life

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INTRODUCTION

Endocrine surgical interventions, including thyroidectomy, parathyroidectomy, and adrenalectomy, are widely used in the treatment of endocrine pathologies. Despite advances in surgical techniques, postoperative hormonal imbalance remains a frequent and clinically relevant outcome [1, 2]. These disturbances have systemic effects involving metabolism, connective tissue, and reparative processes.

The skin is recognized as a hormonally responsive organ, sensitive to fluctuations in thyroid hormones, glucocorticoids, and calcium-regulating pathways [3–5]. Such changes may lead to xerosis, impaired elasticity, alopecia, dyschromia, and abnormal scar formation [6–9].

Thyroid dysfunction, in particular, has been associated with altered epidermal turnover, reduced hydration, and impaired dermal remodeling [8, 10]. Disorders of calcium

metabolism and adrenal function may further contribute to structural and functional skin alterations [11, 12].

In addition to biological effects, dermatologic manifestations have a significant psychosocial impact. Visible scars and skin changes, especially in exposed areas, may negatively affect self-esteem and quality of life [13, 14]. Studies on thyroidectomy outcomes have shown that scar-related dissatisfaction remains clinically relevant even in cases of successful treatment [15, 16].

However, most available studies focus on isolated aspects of endocrine dermatology or scar outcomes. Comprehensive evaluation of the relationship between hormonal imbalance, dermatologic status, and the need for aesthetic rehabilitation remains limited. Therefore, further investigation of these interactions is necessary to improve postoperative management and support multidisciplinary care approaches [17–20].

AIM

To evaluate the impact of hormonal disorders after surgical treatment of endocrine pathology on dermatologic status and to determine the need for aesthetic rehabilitation.

MATERIALS AND METHODS

The study was designed as a prospective cohort clinical investigation with an analytical component. A total of 128 patients who underwent surgical treatment for endocrine pathology were consecutively included in the study. The observation period after surgery ranged from 3 to 24 months, which allowed assessment of both early and intermediate postoperative changes in hormonal status, skin condition, scar maturation, and patient-reported quality of life.

The study was conducted during 2024–2025 and was based at the State Institution of Science «Center of innovative healthcare technologies» State Administrative Department (Kyiv, Ukraine) and Kyiv City Clinical Hospital № 1 (Kyiv, Ukraine). Patient recruitment was performed prospectively, with consecutive inclusion of eligible participants, while clinical examination and data collection were carried out at both institutions according to a unified study protocol, ensuring methodological consistency and comparability of results.

The age of the patients ranged from 19 to 76 years. The mean age was (mean [M] $\pm$ standard deviation [SD]) 48.6 ± 12.4 years; the median (Me) age was 49 years, with an interquartile range (IQR) of 39–58 years. The sex distribution showed a slight predominance of women: 70 women (54.7%) and 58 men (45.3%), corresponding to a female-to-male ratio of 1.21:1.

According to the type of surgical intervention, the cohort included 54 patients after thyroidectomy, 61 after parathyroidectomy, 3 after adrenalectomy, and 10 after combined surgical procedures. Combined procedures included cases in which the volume of intervention involved more than one endocrine anatomical region or required extended operative management with a potentially greater systemic hormonal impact.

Inclusion criteria were as follows: age over 18 years, history of endocrine surgical treatment, postoperative follow-up from 3 to 24 months, and the patient's ability to provide informed consent and complete questionnaires. Exclusion criteria comprised severe primary dermatologic diseases unrelated to endocrine dysfunction, decompensated systemic inflammatory disease, severe psychiatric conditions impairing questionnaire completion, active generalized infection, and terminal oncologic status.

Clinical evaluation included a structured dermatologic examination with attention to skin hydration, elasticity, desquamation, pigmentation changes, vascular manifestations, appendageal disorders, and characteristics of postoperative scars. The scar assessment was based on routine clinical criteria reflecting elevation, density, color, and subjective symptoms, and was additionally supported by standardized photographic documentation. For analytical purposes, clinically significant scarring was defined as a visible postoperative scar with one or more of the following features: hypertrophy, irregular contour, persistent erythema, adhesiveness, subjective discomfort, or clear cosmetic dissatisfaction.

Hormonal status was assessed according to the type of surgical intervention. In thyroidectomy patients, serum thyroid-stimulating hormone and free thyroxine were analyzed. In parathyroidectomy patients, parathyroid hormone and calcium-phosphate metabolism parameters were considered. In adrenalectomy patients, cortisol-related postoperative status was assessed. Hormonal dysfunction was defined as laboratory-confirmed deviation from reference values accompanied, where relevant, by clinical or treatment-related significance.

Quality of life was assessed using two validated instruments. General health-related quality of life was evaluated by the SF-36 questionnaire, while skin- and appearance-related burden was assessed using the Dermatology Life Quality Index (DLQI). A DLQI score above 6 was interpreted as reflecting at least moderate impact on dermatology-specific quality of life.

Statistical analysis was performed using standard biostatistical approaches. Quantitative variables were presented as $M \pm SD$ or as Me and IQR, depending on data distribution. Qualitative variables were described using absolute and relative (%) frequencies (with 95 % confidence interval [CI] provided where appropriate). Differences in categorical variables between groups were assessed using the chi-square test. Relative risk (RR) and 95% CI was calculated for major clinical associations. Pearson correlation (r) analysis was used to determine the relationship between continuous or ranked clinical indicators, including the association between scar severity and DLQI, as well as between thyroid-related indicators and xerosis severity. A p -value of less than 0.05 was considered statistically significant.

DATA AVAILABILITY STATEMENT

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Table 1. Baseline characteristics of the study cohort (n=128)

Parameter	n	% / Descriptive indicator
Type of surgery		
Thyroidectomy	54	42.2
Parathyroidectomy	61	47.7
Adrenalectomy	3	2.3
Combined procedures	10	7.8
Sex		
Women	70	54.7
Men	58	45.3
Age		
Range	—	19–76 years
M ± SD	—	48.6±12.4
Me (IQR)	—	49 (39–58)

Source: compiled by the authors of this study

ETHICS

The study was conducted in accordance with the principles of the Declaration of Helsinki and the standards of good clinical practice. All patients were informed about the purpose of the study, the character of the examinations performed, and the anonymous use of aggregated data for scientific analysis. Written informed consent was obtained from all participants prior to inclusion. The study protocol was approved by the local bioethics committee of the participating institution.

FRAMEWORK

The study was conducted as a fragment of the Scientific Department of Minimally Invasive Surgery scientific project (State Institution of Science «Center of innovative healthcare technologies» State Administrative Department) «Optimization of approaches to providing specialized medical care for surgical patients using personalized anesthetic support» (state registration number 0125U000315; term: 2025-2029).

RESULTS

A total of 128 patients were examined. The structure of the cohort by surgery type, sex distribution, and age characteristics is presented in Table 1.

The analysis of Table 1 demonstrates that the largest subgroup consisted of patients after parathyroidectomy (47.7%), followed by thyroidectomy (42.2%). Adrenalectomy was markedly less frequent, which should be taken into account when interpreting subgroup-specific findings. The sex structure was relatively balanced, although women predominated slightly, which is consistent with the epidemiological distribution of several endocrine

conditions. The age profile indicates that a considerable proportion of the sample belonged to working-age groups, underscoring the social and rehabilitative relevance of postoperative aesthetic outcomes.

Postoperative hormonal dysfunction was identified in 93 of 128 patients (72.7%; 95% CI 64.3–80.0). The frequency of endocrine imbalance according to surgery type is shown in Table 2.

Table 2 shows that combined surgical procedures were associated with the highest proportion of postoperative hormonal dysfunction (80.0%), followed by thyroidectomy (72.2%). Although adrenalectomy demonstrated a high relative proportion (66.7%), this subgroup was too small for robust isolated inference. The lowest frequency of hormonal disturbances was observed after parathyroidectomy (55.7%), yet even in this group, more than half of the patients had clinically relevant biochemical imbalance. These findings suggest that postoperative endocrine instability is common across endocrine surgical categories but appears particularly pronounced in interventions with a larger or more complex endocrine impact.

Dermatologic changes of varying severity were recorded in 101 of 128 patients (78.9%; 95% CI 71.0–85.4). Their structure is summarized in Table 3.

According to Table 3, xerosis and reduced elasticity constituted the most frequent dermatologic complaints, affecting half of the study population. Pathological scarring was the second most prevalent manifestation and occurred in 40.6% of patients, which is clinically meaningful given the visibility of cervical and upper thoracic postoperative areas. Hair-related changes and pigmentary disturbances were also common, while vascular manifestations occurred less frequently but contributed to the aesthetic burden in a subset of patients. Overall, the pattern indicates that endocrine

Table 2. Postoperative hormonal dysfunction according to the type of surgery

Type of surgery	Patients with hormonal dysfunction, n	Total in subgroup, n	%
Thyroidectomy	39	54	72.2
Parathyroidectomy	34	61	55.7
Adrenalectomy	2	3	66.7
Combined procedures	8	10	80.0
Total	93	128	72.7

Source: compiled by the authors of this study

Table 3. Structure of dermatologic manifestations in the study cohort

Dermatologic manifestation	n	%
Xerosis / reduced skin hydration and elasticity	64	50.0
Pathological scarring	52	40.6
Alopecia / hair thinning	37	28.9
Pigmentation disorders	31	24.2
Vascular changes / telangiectatic component	19	14.8

Source: compiled by the authors of this study

Table 4. Association between hormonal dysfunction and dermatologic complications

Group	Dermatologic complications, n	No dermatologic complications, n	Total, n	% with dermatologic complications
Hormonal dysfunction present	82	11	93	88.2
Hormonal dysfunction absent	19	16	35	54.3

Source: compiled by the authors of this study

Table 5. Main dermatologic manifestations according to type of surgery, % within subgroup

Type of surgery	Xerosis	Pathological scarring	Alopecia	Pigmentation disorders
Thyroidectomy (n=54)	61.1	63.0	40.7	29.6
Parathyroidectomy (n=61)	44.3	27.9	18.0	19.7
Adrenalectomy (n=3)	66.7	33.3	33.3	33.3
Combined procedures (n=10)	70.0	70.0	50.0	40.0

Source: compiled by the authors of this study

surgical patients experience not a single isolated cosmetic symptom, but rather a complex combination of texture, appendageal, and scar-related changes.

To determine whether hormonal imbalance was associated with a higher burden of skin pathology, the prevalence of dermatologic manifestations was compared between patients with and without postoperative hormonal dysfunction (Table 4).

The comparison presented in Table 4 revealed a marked difference in dermatologic burden between the groups. Among patients with hormonal dysfunction, 88.2% had clinically relevant dermatologic manifestations, whereas among patients without hormonal imbalance this proportion was 54.3%. The calculated relative risk of dermatologic complications in the presence of postoperative hormonal dysfunction was RR=1.62 (approximately; 95% CI 1.18–2.22), and the group difference was statistically significant (χ^2 , $p<0.01$).

This confirms that hormonal imbalance is not merely an accompanying postoperative finding, but a clinically important determinant of skin pathology.

Further subgroup analysis by type of surgery demonstrated distinct dermatologic profiles (Table 5).

Table 5 indicates that the most unfavorable dermatologic pattern was observed after combined procedures, in which xerosis and pathological scarring each reached 70.0%. Thyroidectomy patients also showed a high burden of xerosis and scarring, supporting the relevance of thyroid hormone regulation for skin hydration, repair, and scar remodeling. By contrast, parathyroidectomy patients had comparatively lower rates of scar and hair involvement, although dermatologic complications remained clinically important in this group as well. Because the adrenalectomy subgroup was very small, these data are best interpreted descriptively.

Aesthetic defects considered sufficient to justify medical correction or specialized counseling were identified in 76 patients (59.4%). The most common aesthetically significant abnormalities included visible cervical scar deformation, contour irregularity of the anterior neck region, persistent discoloration within the scar zone, and combined skin-hair changes contributing to dissatisfaction with appearance.

The quality-of-life assessment showed that 63 of 128 patients (49.2%) had DLQI values above 6, corresponding to moderate or more pronounced negative dermatologic impact on daily life. Correlation analysis demonstrated a strong positive association between scar severity and DLQI ($r=0.61$; $p<0.001$), indicating that worsening scar characteristics were accompanied by progressive impairment in dermatology-specific quality of life. In thyroidectomy patients, a moderate positive relationship was also found between thyroid-related hormonal imbalance and xerosis severity ($r=0.52$; $p<0.01$), supporting the biological plausibility of the observed cutaneous changes.

In summary, the Results section shows that postoperative hormonal dysfunction was common, dermatologic complications affected the majority of patients, and the burden of these changes was significantly greater in hormonally unstable individuals. The combination of frequency data, comparative risk estimates, and quality-of-life correlations provides a consistent basis for considering dermatologic surveillance and aesthetic rehabilitation as clinically meaningful elements of postoperative care in endocrine surgery.

DISCUSSION

The results of this study confirm that hormonal disturbances after endocrine surgery are significantly associated with dermatologic complications and reduced quality of life. These findings support the concept of the skin as a hormonally regulated organ whose structure and function depend on systemic endocrine balance [5–7].

The high prevalence of xerosis and decreased skin elasticity observed in this cohort, particularly after thyroidectomy, is consistent with previous reports demonstrating the role of thyroid hormones in epidermal turnover and dermal hydration [8, 10]. Similarly, endocrine dysfunction has been shown to impair barrier function and connective tissue metabolism, contributing to clinically significant skin changes [9].

The association between hormonal imbalance and pathological scarring identified in this study aligns with evidence that systemic factors, including endocrine status, influence wound healing and collagen remodeling [17]. Studies of thyroid surgery outcomes have also shown that scar characteristics significantly affect patient satisfaction and quality of life [13, 15, 16].

The observed correlation between scar severity and DLQI confirms the importance of dermatologic manifestations in shaping psychosocial well-being. Previous research has demonstrated that visible scars may impair social functioning and self-perception, particularly in anatomically exposed regions [14, 18].

From a clinical perspective, the high prevalence of aesthetic defects indicates that postoperative care should not be limited to endocrine and surgical outcomes. Instead, early dermatologic assessment and integration of aesthetic rehabilitation should be considered essential components of patient management.

These findings are consistent with modern patient-centered approaches and international recommendations emphasizing multidisciplinary rehabilitation strategies [19, 20].

Despite certain limitations, including a small adrenalectomy subgroup and an observational design, the study provides evidence supporting a comprehensive approach to postoperative care in patients undergoing endocrine surgery.

CONCLUSIONS

The present study demonstrates that postoperative hormonal disorders following surgical treatment of endocrine pathology are highly prevalent and represent a significant factor contributing to dermatologic complications. The findings confirm a statistically significant association between endocrine imbalance and the development of clinically relevant skin changes, including xerosis, pathological scarring, alopecia, and pigmentation disorders. This underscores the systemic nature of postoperative endocrine dysfunction and its direct impact on skin homeostasis and reparative processes.

A substantial proportion of patients exhibited aesthetic defects requiring medical attention, and nearly half demonstrated impaired dermatology-specific quality of life. The strong correlation between scar severity and DLQI indicates that dermatologic manifestations are not merely cosmetic concerns but constitute an important determinant of psychosocial well-being and patient-reported outcomes. These results highlight the necessity of incorporating dermatologic assessment into routine postoperative evaluation.

Overall, the data support the implementation of a multidisciplinary approach to postoperative care in patients undergoing endocrine surgery, integrating endocrine management, dermatologic monitoring, and aesthetic rehabilitation. Such an approach has the potential to improve both functional recovery and quality of life and should be considered in the development of standardized clinical pathways for this patient population.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

CORRESPONDING AUTHOR

Rimma P. Tkachenko

State Institution of Science

«Center of innovative healthcare technologies»

5 Verkhnia St., 01104 Kyiv, Ukraine

e-mail: RimmaTkachenko@i.ua

ORCID AND CONTRIBUTIONSHIP

Rimma P. Tkachenko: 0000-0003-3775-80028 **A** **B** **C** **D** **E** **F**

Oleksandr V. Ivanko: 0000-0003-0036-4675 **A** **C** **D** **E**

Yuliia I. Beshkovetska: 0009-0007-8977-0624 **B** **D** **E**

A – Work concept and design, **B** – Data collection and analysis, **C** – Responsibility for statistical analysis, **D** – Writing the article, **E** – Critical review, **F** – Final approval of the article

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