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Original Research Article

Cutaneous changes in obese patients before and after bariatric surgery

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ABSTRACT

Background: Obesity being a multi-organ disease also affects the skin. Bariatric surgery results in the improvement or remission of many obesity-related comorbid conditions, as well as sustained weight loss and improvement in quality of life. After bariatric surgery, both positive and negative impacts on the skin are seen. Studies have reported improvement in many skin conditions. The present study was conducted with the aim to find cutaneous changes in obese patients before and after bariatric surgery were assessed.
Methods: This prospective, observational study included 61 obese subjects who had undergone bariatric surgery. clinical findings of skin, nails, and hair before and after bariatric surgery at 3 months, 6 months, and 9 months follow-up were also recorded.
Results: Mean age of the subjects was 44.4±13.284 years. Bariatric surgery resulted in a significant decrease in BMI [40.3 (38.25-42.70) vs 32.0 (30-35) kg/m^2]. The median of % effective BMI change was 20.46% (17.12%-24.66%) kg/m^2. Amongst obese subjects, the most frequently seen skin condition was acanthosis nigricans [17 (27.9%)] followed by acrochordon [15 (24.6%)] and intertrigo [10 (16.4%)]. Our study showed no significant difference in the prevalence of various skin conditions/diseases before and after the bariatric surgery except for intertrigo, tinea corporis, and striae rubra.
Conclusions: various skin/hair/nail conditions and/or diseases develop amongst obese individuals, acanthosis nigricans, acrochordon, intertrigo, seborrheic dermatitis, chronic telogen effluvium, onychomycosis, and longitudinal ridges are common. Weight loss after bariatric surgery provided improvement in skin conditions/diseases.

Keywords: Bariatric surgery, Skin, Skin diseases, Obesity, Cutaneous sign

INTRODUCTION

Obesity is a preventable disease yet is a public health problem all across the world.[1] According to an ICMR-INDIAB study in 2015, this modern epidemic has affected approximately 36.3% of Indians.[2] WHO report 2016 says that obesity has nearly increased three times since 1975.[3] Pandemic spread of obesity has led to the evolution of various medications and interventions for its treatment. One of these interventions is Bariatric surgery.[4] Amongst class II and III obese subjects with medical complications such as diabetes mellitus, surgical treatment provides more weight loss than medications. It is usually performed for subjects with a BMI higher than 40 and several complications and subjects with a BMI of 35 to 40 can also be considered for the same.[5] Bariatric surgery results in the improvement or remission of many obesity-related comorbid conditions, as well as sustained weight loss and improvement in quality of life.[6]

Obesity is directly associated with diabetes, nonalcoholic fatty liver, disease (NAFLD), kidney disease, osteoarthritis, cancer, sleep apnea, hypertension, and most importantly cardiovascular disease.[7] Obesity being a multi-organ disease also affects the skin.[4] Nearly 60-70% of subjects suffering from obesity show a variety of skin changes.[4] A patient with obesity has increased subcutaneous fat, larger skin folds, and greater surface roughness.[4] Obesity has an impact on the skin barrier, collagen structure, and wound healing.[8] Non-invasive measurements of skin electrical conductivity have shown profound skin dryness in obese subjects. These subjects also show increased skin erythema owing to inadequate vascular reactivity of the skin capillaries due to decreased skin microcirculation. Skin conditions also develop in obese subjects as a consequence of associated diseases such as insulin resistance, hyperandrogenism, skin infection, and chronic venous insufficiency.[4]

After bariatric surgery, both positive and negative impacts on the skin are seen. Studies have reported improvement in many skin conditions such as psoriasis intertrigo, hidradenitis suppurativa, and ulcerated necrobiosis lipoidica diabeticorum. In contrast, adverse skin conditions have also been reported after bariatric surgery mainly because of nutritional deficiency, for example, of iron, folic acid, vitamins and trace elements.[9] Thus, in the present study cutaneous findings in obese patients before and after bariatric surgery were assessed.

METHOD

Study design, study population, sample size, sampling technique

This prospective, observational study was conducted in the department of Bariatric surgery, Sri Aurobindo medical college and PG Institute, Indore, India after obtaining approval from the institutional ethics committee. The study included 61 obese subjects who had undergone bariatric surgery over the period of 1 year (from November 2021 to November 2022).[10] Enrollment of subjects in the study was done using a convenience sampling technique.

patients aged more than 18 years, diagnosed with morbid obesity (BMI 40 kg/m^2) who had undergone a bariatric surgery. Exclusion criteria were patients who were not willing to participate or have skin conditions treated 6 months prior to the examination.

Inclusion criteria

Patients aged more than 18 years, diagnosed with morbid obesity (BMI ≥40 kg/m^2) who had undergone a bariatric surgery and presented with cutaneous abnormalities and consenting for the study were included in the study.

Exclusion criteria

Patients who were not willing to participate or have skin conditions treated 6 months prior to the examination were excluded from the study.

Methodology

The information related to age, gender, and BMI was recorded. The clinical findings of skin, nails, and hair before and after bariatric surgery at three months, six months as well as nine months follow-up were also recorded. Bariatric surgery was performed via any of the three procedures viz. Sleeve gastrectomy, slim-pin/ G balloon, or fundoplication according to the appropriateness and suitability of the method for any particular patient.

Post-surgery

All the patients were monitored for nutritional deficiencies and were supplemented according to the requirement.

Ethical considerations

Ethical clearance was obtained from the institutional ethics committee of Sri Aurobindo institute of medical sciences, Indore (M.P.), India (Registration number-ECR/748/Inst/MP2015/18RR). Written informed consent was obtained from the subjects before enrolling in the study. Confidentiality of patient information was maintained.

RESULTS

This study included 61 subjects with a mean age of 44.4±13.284 years (age range-18-73 years). The distribution of study subjects based on age and gender has been presented in Table 1.

Table 1: Distribution of study subjects based on age and gender, (n=61).

Variables		N (%)
Age (years)	18-30	11 (18)
	31-40	15 (24.6)
	41-50	14 (23)
	51-60	17 (27.9)
	61-70	3 (4.9)
	71-80	1 (1.6)
Gender	Male	22 (36.1)
	Female	39 (63.9)

There was a statistically significant difference in the BMI of the subjects before and after surgery shown in the Figure 1 below. The median of the difference in the BMI was 8.0 (7.2-10.0) kg/m^2. The median of percentages

effective BMI change was 20.46% (17.12%-24.66%) kg/m^2.

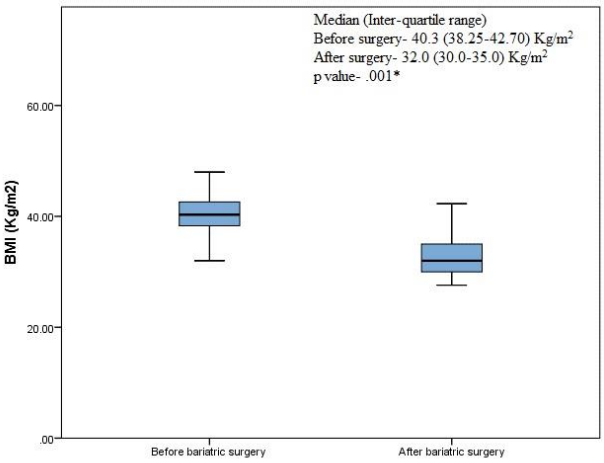

Figure 1: BMI of the study subjects before and after bariatric surge.

*Wilcoxon sign rank test. BMI (Body Mass Index).

Various skin findings have been presented in Table 2. The three most frequently seen skin conditions were Acanthosis nigricans [17 (27.9%)] followed by acrochordon [15 (24.6%)] and intertrigo [10 (16.4%)] (Table 2). Our study showed no significant difference in the prevalence of various skin conditions/diseases before and after the bariatric surgery except for intertrigo, tinea corporis, and striae rubra. A statistically significant decrease in the number of subjects presenting with intertrigo, tinea corporis, and striae rubra was observed after the surgery ($p<0.05$). Seborrheic dermatitis [9 (14.8%)] was the most prevalent condition affecting the scalp. A significant decrease in the number of subjects presenting with Seborrheic Dermatitis was seen after the surgery ($p<0.05$) (Table 3). This study showed a significant increase in the number of subjects with chronic telogen effluvium at 3rd and the 6th month after surgery compared to their number before surgery, however, at the 9th- month post-surgery, the number of the subjects with the condition was reduced significantly ($p<0.05$) (Table 3).

Table 2: Comparison of skin changes before and after bariatric surgery, (n=61).

Variables	Pre-operatively, n (%)	Post-operatively, n (%)			Chi-square value	Df	P value$^{\Omega}$
		At 3rd month	At 6th month	At 9th month			
Erythema	1 (1.6)	0 (0)	0 (0)	0 (0)	3.012	3	0.390
Intertrigo	10 (16.4)	3 (4.9)	0 (0)	0 (0)	21.694	3	0.001*
Seborrheic keratosis	1 (1.6)	1 (1.6)	0 (0)	0 (0)	2.017	3	0.569
Idiopathic guttate hypo melanosis	3 (4.9)	2 (3.3)	2 (3.3)	2 (3.3)	0.346	3	0.951
Acrochordon	15 (24.6)	11 (18)	8 (13.1)	8 (13.1)	3.796	3	0.284
Acanthosis nigricans	17 (27.9)	17 (27.9)	17 (27.9)	17 (27.9)	0.000	3	1.000
Becker's nevus	1 (1.6)	0 (0)	0 (0)	0 (0)	3.012	3	0.390
Xerosis	6 (9.8)	4 (6.6)	3 (4.9)	1 (1.6)	3.940	3	0.268
Tinea cruris	5 (8.2)	3 (4.9)	1 (1.6)	0 (0)	6.807	3	0.078
Tinea corporis	8 (13.1)	6 (9.8)	1 (1.6)	0 (0)	12.715	3	0.005*
Prurigo simplex	1 (1.6)	4 (6.6)	2 (3.3)	0 (0)	5.148	3	0.161
Striae rubra	3 (4.9)	0 (0)	0 (0)	0 (0)	9.112	3	0.028*
Striae alba	4 (6.6)	5 (8.2)	5 (8.2)	5 (8.2)	0.171	3	0.982
Atopic dermatitis	3 (4.9)	5 (8.2)	4 (6.6)	4 (6.6)	0.535	3	0.911
Keratosis pilaris	1 (1.6)	0 (0)	0 (0)	0 (0)	3.012	3	0.390
Melasma	4 (6.6)	3 (4.9)	3 (4.9)	3 (4.9)	0.244	3	0.970
Hirsutism	5 (8.2)	1 (1.6)	1 (1.6)	1 (1.6)	6.203	3	0.102
Acne vulgaris	1 (1.6)	1 (1.6)	1 (1.6)	1 (1.6)	0.000	3	1.000
Stasis dermatitis	3 (4.9)	3 (4.9)	3 (4.9)	2 (3.3)	0.286	3	0.963
Ulcer	1 (1.6)	0 (0)	0 (0)	0 (0)	3.012	3	0.390
Pityriasis versicolor	1 (1.6)	0 (0)	0 (0)	0 (0)	3.012	3	0.390
Purpura	1 (1.6)	0 (0)	0 (0)	1 (1.6)	2.017	3	0.569
Chronic spontaneous urticaria	2 (3.2)	0 (0)	0 (0)	0 (0)	6.050	3	0.109
Plantar keratoderma	1 (1.6)	1 (1.6)	1 (1.6)	1 (1.6)	0.000	3	1.000

$^{\Omega}$Chi-square value. *$p<0.05$ was considered statistically significant.

Table 3: Comparison of hair changes before and after bariatric surgery, (n=61).

Variables	Pre-operatively, n (%)	Post-operatively, n (%)			Chi - square value	Df	P value
		At 3rd month	At 6th month	At 9th month			
Acute telogen effluvium	2 (3.3)	6 (9.8)	3 (4.9)	0 (0)	7.140	3	0.068
Chronic telogen effluvium	1 (1.6)	9 (14.8)	8 (13.1)	2 (3.3)	10.893	3	0.012*
Seborrheic dermatitis	9 (14.8)	5 (8.2)	0 (0)	1 (1.6)	14.420	3	0.002*

ΩChi-square value. *p<0.05 was considered statistically significant.

Table 4: Comparison of nail changes before and after bariatric surgery, (n=61).

Variables	Pre-operatively, n (%)	Post-operatively, n (%)			Chi - square value	Df	P value
		At 3rd month	At 6th month	At 9th month			
Ingrown nail	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	-	-	-
Onychomycosis	5 (8.2)	5 (8.2)	7 (11.5)	3 (4.9)	1.743	3	0.627
Onycholysis	2 (3.3)	2 (3.3)	1 (1.6)	1 (1.6)	0.683	3	0.877
Leukonychia	2 (3.3)	2 (3.3)	2 (3.3)	1 (1.6)	1.034	3	0.793
Brittle nail	2 (3.3)	5 (8.2)	2 (3.3)	0 (0.0)	5.884	3	0.117
Longitudinal ridges	3 (4.9)	3 (4.9)	3 (4.9)	1 (1.6)	1.251	3	0.741

Figure 2: Acne vulgaris grade 3 with hirsutism before surgery.

Figure 3: Hirsutism before surgery.

Figure 4: Pre surgery tinea.

Figure 5: Pre surgery striae rubra with axillary intertrigo.

Figure 6: Pre surgery striae rubra.

Figure 7: Pre surgery onychomycosis.

Figure 8: Pre surgery acrochordon with acanthosis nigricans.

Figure 9: Post surgery premature canities.

Figure 10: Post surgery chronic telogen effluvium.

Onychomycosis [5 (8.2%)] and longitudinal ridges [3 (4.9%)] were the most common conditions existing amongst the obese subjects before the surgery. No significant changes were noticed in the frequency of their occurrence after the surgery (Table 4).

DISCUSSION

Bariatric surgery has been proven to be an effective treatment strategy for obesity after the non-success of behavioral and pharmacologic approaches for weight loss. Bariatric surgery can result in nutritional deficiency, for example, of iron, folic acid, vitamin, and trace elements manifesting as skin diseases. In the present study, an effort has been made to study the various skin diseases associated with obesity and bariatric surgery. This study included subjects with a mean age of 44.4±13.284 years such that 75.5% of subjects belonged to the age group of 30-60 years and a majority of the subjects were females [39 (63.9%)] (Table 1). The

subjects undergoing bariatric surgery were having median (Inter-quartile range) BMI of 40.3 (38.25-42.70) kg/m^2. Itthipanichpong et al also reported female preponderance among patients undergoing bariatric surgery.[9] Greater body image dissatisfaction and psychological disturbances in women have been considered the reason behind the sexual disparity in the use of weight loss procedures.[11]

In this study, the bariatric study was found to be effective in reducing BMI. BMI of the patients was found to reduce significantly after the surgery [From 40.3 (38.25-42.70) kg/m^2 to 32 (30.0-35.0) kg/m^2] with a median reduction in BMI of 8.0 (7.2-10.0) kg/m^2 (Figure 1). Similar to our study, many previous researches have shown the effectiveness of bariatric surgery in reducing BMI of the patients.[12-14]

Our study revealed a myriad of skin conditions and diseases prevailing among subjects with obesity. We found acanthosis nigricans [17 (27.9%)], acrochordon [15 (24.6%)], intertrigo [10 (16.4%)], xerosis [6 (9.8%)], tinea corporis [8 (13.1%)], tinea cruris [5 (8.2%)], hirsutism [5 (8.2%)], melasma [4 (6.6%)], striae alba [4 (6.6%)], stasis dermatitis [3 (4.9%)], atopic dermatitis [3 (4.9%)], striae rubra [3 (4.9%)] and chronic spontaneous urticaria [2 (3.2%)] amongst multiple subjects. Brown et al reported skin-related problems amongst 75% of obese patients.[15] Almost similar skin-related findings were reported by Itthipanichpong et al and Babu et al in their study of obese subjects.[9,16] It is known that cutaneous manifestations amongst obese patients are the result of metabolic effects of obesity, such as causing hyperandrogenism and gout. Moreover, there is an association between obesity and bacterial and Candida skin infections, as well as onychomycosis, inflammatory skin diseases, and chronic dermatoses.[8]

The three most frequently seen skin conditions were acanthosis nigricans [17 (27.9%)] followed by acrochordon [15 (24.6%)] and intertrigo [10 (16.4%)]. Acanthosis nigricans is a consequence of hyperinsulinemia which is associated with obesity.[17]

Obese individuals commonly develop intertrigo as a result of increased friction, occlusion, as well as maceration.

In our study, subjects showed improvement in Intertrigo after the bariatric surgery. Itthipanichpong et al also reported improvement in intertrigo.[9] Improvement in Intertrigo could be the result of a reduction in body weight and consequently in a reduction in friction, occlusion, and maceration. In this study, no improvement was seen in other conditions and diseases. This can be explained by the fact that obesity is one of the risk factors for these conditions. The persistence of etiological factors and other risk factors could have led to the existence of various skin diseases even after bariatric surgery. Many studies have shown improvement in the etiology of skin diseases such as metabolic, and hyperandrogenic disorders after bariatric surgery, although it was seen after a long up period compared to our study.[18]

We have found a significant increase in cases of chronic telogen effluvium after the surgery (1.6% vs 14.8% 3 months after surgery). Chronic telogen effluvium is a condition characterized by diffuse hair loss affecting the entire scalp for which no obvious cause can be found.[19] Itthipanichpong et al reported alopecia in 41.67% of post-bariatric surgery women.[9] Ruiz-Tovar et al also reported an incidence of alopecia in 41% of women after bariatric surgery.[20] Alopecia in these subjects can be associated with nutritional deficiency and sudden and great weight loss.[9] However, in our study, after 9 months the number of subjects reporting chronic telogen effluvium was reduced to 2 (3.2%). This can be attributed to the fact that nutritional supplements could have re-established the normal levels of various important nutrients and have helped in recovery from diseases occurring due to nutritional deficiency as a consequence of bariatric surgery. Another hair related condition seen amongst subjects in present study was seborrheic dermatitis which was seen in 14.8% subjects before the surgery. In the study done by Babu et al the prevalence of seborrheic dermatitis amongst 10% obese subjects.[16]

A significant improvement in subjects with seborrheic dermatitis was observed after the surgery in this study.

In addition to the skin and hair changes, subjects had also shown changes in nails which included onychomycosis (8.2%), longitudinal ridges (4.9%), onycholysis (3.3%), leukonychia (3.3%) and brittle nail (3.3%). Although results of the study revealed no significant improvement or worsening of nail changes after bariatric surgery.

Limitations

A major drawback of the study was that the manifestation of skin, nail, and hair diseases were not correlated with their underlying cause such as insulin resistance, diabetes, metabolic disorder, infection, etc., seen in obese patients. Also, changes in the frequency of occurrence of skin, nail, and hair diseases after bariatric surgery were not correlated with the nutritional status. The study was designed with a short follow-up period of 9 months. Also, as the study was done in COVID era the sample size was small.

CONCLUSION

Our findings led to the conclusion that amongst the various skin/ hair/ nail conditions and/or diseases developing amongst obese individuals, acanthosis nigricans, acrochordon, intertrigo, seborrheic dermatitis, chronic telogen effluvium, onychomycosis, and longitudinal ridges are common. Weight loss after bariatric surgery provided improvement in skin conditions/diseases.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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