The Effect of Hypothyroidism on Surgical Outcomes Postabdominoplasty: A Case-control Study

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Background: Hypothyroidism is common in surgical patients. The objective of this study is to determine the rate of short- and long-term complications after abdominoplasty for patients treated for hypothyroidism.

Methods: This is a retrospective chart review that enrolled consecutive patients undergoing abdominoplasty across a 5-year period. Cases had a preoperative diagnosis of overt hypothyroidism requiring thyroid replacement therapy, whereas controls are without thyroid disease. Groups were matched by age, gender, comorbidity status (hypertension and diabetes), smoking, and center of surgery in a 3:1 ratio.

Results: There was a total of 61 cases and 183 matched controls followed up for 18 months; most were women (n = 240, 98%) and between the ages of 31 and 45 years (n = 142, 58%). There were no significant differences between cases and controls in any of the sociodemographic and comorbidity status except for current BMI, which was higher for cases than the control (P < 0.05). The proportions of all other infections (4.5% versus 1.6%), wound dehiscence (4.7% versus 0.8%), dermatitis (4.7% versus 1.6%), and necrosis (2.3% versus 0%), hematoma (4.7% versus 2.5%) and seroma (2.3% versus 1.6%) formation were higher in cases but not significant (P > 0.05). LTCs were not statistically different across groups (P > 0.05).

Conclusion: This study did not find a significantly different higher risk of complications after abdominoplasty for patients treated for hypothyroidism. (Plast Reconstr Surg Glob Open 2022;10:e4127; doi: 10.1097/GOX.0000000000004127; Published online 17 February 2022.)

INTRODUCTION

Hypothyroidism is a common comorbidity that affects between 1% and 7% of the population. This condition can result in surgical complications, especially those related to surgical wounds, due to the role of thyroid hormones in wound healing. Specifically, experimental studies have shown that a state of hypothyroidism decreases the level of type-IV collagen and hydroxyproline in rat serum, which leads to delayed wound healing. Treated hypothyroidism, however, was not found to increase postoperative complications, including wound complications, mortality, or cardiovascular outcomes. Nowadays, widespread thyroid function testing results in most patients receiving thyroid replacement therapy. For example, it was reported that levothyroxine prescription has increased by 1.74 fold from 2001 to 2009 in the UK. Thus, many patients are now classified under “treated hypothyroidism.” Because hypothyroidism is 10 times more likely to affect women than men, and women are more likely to opt for abdominoplasty, studies that investigate the effects of hypothyroidism on surgical outcomes for this patient population are vital. The objectives of this case-control study are to determine and compare the rate of short- and long-term complications for cases treated for hypothyroidism when compared with control patients with no thyroid disease after undergoing abdominoplasty.

METHODS

Study Design and Participants
This is a retrospective chart review that enrolled consecutive patients undergoing abdominoplasty in a tertiary care center over 5 years. Inclusion criteria were patients who are above the age of 18 opting for abdominoplasty...
with cases being those who had a preoperative diagnosis of overt hypothyroidism requiring thyroid replacement therapy whereas controls are without thyroid disease. Patients undergoing surgery would undergo preoperative testing of their thyroid-stimulating hormone levels to ensure good control before surgery. All preoperative values were within normal levels. Primary outcomes were the rate of short- and long-term complications, and the need of operative revisions for cases when compared with control after undergoing abdominoplasty. Secondary outcomes include assessing the effect of hypothyroidism on weight loss dynamics for those who underwent bariatric surgery. To control for confounding and address potential sources of bias, cases and controls were matched by age, gender, comorbidity status (hypertension and diabetes), smoking, and center of surgery in a 3:1 ratio. Missing data were matched on the next available variable.

Measurement of Risk Factors
Factors of demographic characteristics, past medical and surgical history, operative details, and postoperative complications were collected from patient charts using a predetermined data collection excel sheet. A past smoker was one who quit smoking more than 6 weeks preoperatively, whereas those who quit less than 6 weeks preoperatively or currently smoke were classified as active smokers. Comorbidity status was determined according to medical history as documented in the patient’s chart, including preoperative consultations and prior medical visits.

Measurement of Outcomes
Outcomes were classified into three major groups. Short-term outcomes are those that occurred during a patient’s hospital stay, whereas long-term complications required re-admission or were detected during follow-up. Delayed wound infection occurred after 30 days postoperatively; deep vein thrombosis and pulmonary embolism were defined by radiologic evidence, whereas an infection was defined by a positive culture. Redness around incision site was classified as cellulitis, whereas overt dead tissue was diagnostic of wound necrosis.

Statistical Analysis
Means were calculated to summarize continuous variables and compared using t-tests or nonparametric tests as indicated. Categorical data were tested using $\chi^2$ test. A $P$ value of less than 0.05 was considered significant. IBM SPSS (v 23) was used for the analysis of data.

Ethical Approval
The study was approved by the ethical committee of the Kuwait Ministry of Health.

RESULTS
A total of 61 cases and 183 matched controls were included in this study. All patients were followed for 18 months. Patients were mostly women ($n = 240$, 98%) and between the ages of 31 and 45 years ($n = 142$, 58%) as in Table 1. All patients were followed up for 18 months after the abdominoplasty procedure. There were no significant differences between cases and controls in any of the sociodemographic and comorbidities except for current BMI, which was higher for cases ($31.5 \pm 6.41$) than control ($29.5 \pm 5.09$) with a $P$ value of 0.041 (Table 2). Interestingly, both cases and controls presented for abdominoplasty had similar complaint distribution, as seen in Figure 1, where the majority were mainly disturbed by their skin laxity (75% cases versus 80% control) followed by abdominal bulge (53% cases versus 51% control), and the least contributing factor was functional disturbance (10% cases and 12% control).

| Table 2 | Measurement of Outcomes | Statistical Analysis |
|---------|-------------------------|----------------------|

### Takeaways

**Question:** Does a diagnosis of hypothyroidism per se increase the risk of complications after abdominoplasty?

**Findings:** This case-control study on 244 patients found no significant difference in the occurrence of the following short- and long-term complications after abdominoplasty between patients treated for hypothyroidism and normal controls: infection, wound dehiscence, wound dermatitis, wound necrosis, hematoma or seroma formation, thromboembolic events, delayed wound infection, delayed or abnormal wound healing, and umbilical deformity.

**Meaning:** This study found that patients treated for hypothyroidism do not carry a significantly higher risk of complications after abdominoplasty.
Table 1. Categorical Sociodemographic Characteristics (n = 244)

| Sociodemographic Characteristics | Frequency | Controls* | Cases | P       |
|----------------------------------|-----------|-----------|-------|---------|
| All cases                        | 244 100.0 | 183 75.0  | 61 25.0 | >0.05   |
| Age (y) ≤30                      | 23 9.4    | 16 8.7    | 7 11.5 | >0.05   |
| Age (y) 31–45                    | 142 58.2  | 107 58.5  | 35 57.4 | >0.05   |
| Age (y) ≥46                      | 79 32.4   | 60 32.8   | 19 31.1 | >0.05   |
| Gender                           |           |           |       | >0.05   |
| Men                              | 4 1.6     | 3 1.6     | 1 1.6  | >0.05   |
| Women                            | 240 98.4  | 180 98.4  | 60 98.4 | >0.05   |
| Smoking status                   |           |           |       | >0.05   |
| Current smokers                  | 17 7.0    | 13 7.1    | 4 6.6  | >0.05   |
| Pack years (10)                  | 5.80 4.4  | 6.11 4.5  | 3.00 0.0 | >0.05   |
| Past smokers                     | 2 0.8     | 2 1.1     | 0 0.0  | >0.05   |
| Nonsmokers                       | 225 92.2  | 168 91.8  | 57 93.4 | >0.05   |
| Comorbidities                    |           |           |       | >0.05   |
| Diabetic                         | 60 24.6   | 42 23.0   | 18 29.5 | >0.05   |
| Hypertensive                     | 45 18.4   | 34 18.6   | 11 18.0 | >0.05   |
| Asthma                           | 42 17.2   | 29 15.8   | 13 21.3 | >0.05   |
| Anemia                           | 7 2.9     | 5 2.7     | 2 3.3  | >0.05   |
| DVT                              | 3 1.2     | 3 1.6     | 0 0.0  | >0.05   |
| CAD                              | 3 1.2     | 1 0.5     | 2 3.3  | >0.05   |
| Renal disease                    | 3 1.2     | 1 0.5     | 2 3.3  | >0.05   |
| Rheumathological disorder(s)     | 3 1.2     | 3 30.0    | 0 0.0  | >0.05   |
| Cancer                           | 2 0.8     | 1 0.5     | 1 1.6  | >0.05   |
| H/O pulmonary embolism           | 1 0.4     | 1 10.0    | 0 0.0  | >0.05   |
| Oral contraceptive use           | 21 8.60   | 18 9.8    | 3 4.9  | >0.05   |

*Controlled for center, gender, age, HTN, diabetes, and smoking in 3:1 ratio.

Table 2. Continuous Sociodemographic and Operative Factors (n = 244; Control: 183, Cases: 61)

| Sociodemographic Characteristics | All | Controls* | Cases | P       |
|----------------------------------|-----|-----------|-------|---------|
| Age                              | 42.1 8.23 | 42.0 8.21 | 42.2 8.37 | >0.05 |
| Current BMI†                     | 29.89 5.42 | 29.5 5.09 | 31.5 6.41 | 0.041† |
| Hospital stay (d)                | 7.28 4.21 | 7.27 4.49 | 7.30 3.25 | >0.05 |
| Output (ml/drain/day)            | 66.2 56.14 | 67.4 60.04 | 62.5 42.60 | >0.05 |
| Average ASA score                | 1.55 0.58 | 1.45 0.57 | 1.84 0.49 | <0.000 |
| Operative time (min)             | 179.3 60.13 | 183.2 61.18 | 167.4 55.65 | >0.05 |

*Controlled for center, gender, age, HTN, diabetes, and smoking in 3:1 ratio.
†Statistically Significant.

Fig. 1. Distribution of complaints of patients presenting for abdominoplasty.
DISCUSSION

Abdominoplasty procedures are being performed increasingly and experienced a growth of 382% during the last decade. This is largely mirroring the increase in bariatric surgery procedures in recent years. The majority of complications post abdominoplasty are attributed to wound healing. The mechanism by which hypothyroidism is thought to increase complications is through its effect on proliferating fibroblasts, which are essential for wound healing. In vivo studies in animals have found thyroxine hormone (T3) to have beneficial effects on wound healing. Topical application of supraphysiologic T3 doses resulted in 58% greater wound closure as well as increased wound healing-associated keratin 6 protein expression in a dose-dependent manner. In addition, a prospective controlled trial on guinea pigs found that topical T3 application was associated with a significant and dose-dependent reduction in wound surface area through contraction, which enhanced wound healing. On the other hand, a randomized control trial in 12 mice investigated the effects of T3 cream on wound healing and found that healing was better for the treated group when compared with control, but a significant difference could not be detected.

The association between hypothyroidism (decreased serum thyroxine levels) and surgical complications has been studied by Landenson et al., who reported it to be associated with intraoperative hypotension in noncardiac surgery and an increased risk of gastrointestinal and neuropsychiatric complications. They, however, found no association with hypothyroidism and perioperative blood loss, duration of hospitalization, delayed anesthesia recovery, impaired wound healing, abnormal tissue integrity, or death. Similar findings were also reported by Komatsu et al., who carried out a retrospective cohort study on patients who have hypothyroidism (n = 800), treated hypothyroidism (n = 1805), and are euthyroid (n= 5612) and reported that hypothyroidism was not associated with worse postoperative mortality and wound or cardiovascular outcomes in noncardiac patients. Our study, which included hypothyroid patients with normal plasma thyroid function, had similar findings in that both our patient groups were hospitalized for a week, had similar blood loss data, anesthesia recovery times, and wound complications. Specifically, we did not find significantly higher rates of short- and long-term complications in hypothyroid patients as opposed to control. A state of hypothyroidism, treated or not, seems to have no clinical implication on wound complications despite the theoretical risk discussed above.

### Table 3. Categorical Operative Factors

| Operative Factors                      | Frequency | Controls | Cases |
|----------------------------------------|-----------|----------|-------|
| All                                    | 244       | 183      | 61    |
| Divarication of recti                  | 179       | 132      | 47    |
| Abdominoplasty technique               | 240       | 179      | 61    |
| Classical                              | 4         | 4        | 2     |
| Mini-abdominoplasty                    | 72        | 53       | 19    |
| Concurrent procedures                  | 65        | 48       | 17    |
| Liposuction                            | 5         | 3        | 2     |
| Belt lipectomy                         | 2         | 2        | 0     |

*Controlled for center, gender, age, HTN, diabetes and smoking in 3:1 ratio.

### Table 4. Postoperative Complications (n = 244)

| Complication                  | All | Controls | Cases |
|-------------------------------|-----|----------|-------|
| All                           | 244 | 183      | 61    |
| Short-term complications      | 27  | 16       | 11    |
| Deep vein thrombosis          | 2   | 1        | 1     |
| Pulmonary embolism            | 3   | 3        | 0     |
| Surgical site infections      | 2   | 2        | 0     |
| Other infections              | 4   | 2        | 2     |
| Wound dehiscence              | 3   | 1        | 2     |
| Wound dermatitis              | 4   | 2        | 2     |
| Wound necrosis                | 1   | 0        | 1     |
| Seroma                        | 5   | 3        | 2     |
| Hematoma                      | 3   | 2        | 1     |
| Blood loss†                   | 34  | 24       | 10    |
| Long-term complications       | 16  | 11       | 5     |
| Delayed wound infection       | 4   | 3        | 1     |
| Delayed wound healing         | 6   | 3        | 3     |
| Abnormal wound healing        | 5   | 4        | 1     |
| Umbilical deformity           | 1   | 0        | 0     |

*Controlled for center, gender, age, HTN, diabetes and smoking in 3:1 ratio.
†Blood loss requiring transfusion.
With regard to the complication profile of abdominoplasty, Winocour et al.9 carried out a multivariate analysis on 25,478 patients and reported that the most common complications post abdominoplasty were hematomas, infections, and thromboembolism. Our analysis showed similar findings as thromboembolism affected 2% of all our patients while infection rates and hematoma or seroma formation reached 2.4% and 3.2%, respectively. Winocour et al.9 moreover, indicated that the significant risk factors for complications post abdominoplasty were male gender, age, BMI of 30 or greater, and performing combined procedures. The differential analysis we conducted across hypothyroid cases versus control showed similar prevalence of these factors in both groups; thus, they could not have been potential confounders of our results.

Strengths and Limitations

This study is the first to address the effect of controlled hypothyroidism on complications postabdominoplasty. We investigated a large range of complications that are properly defined and adjusted for multiple confounding variables. We followed all patients for 18 months, which is sufficient time for the purpose of this study. However, this study is not without limitations. The sample size of the case arm is limited; thus, this study is underpowered.

CONCLUSION

Taking the findings of this study into consideration, a state of controlled hypothyroidism is not associated with increased short- or long-term complications after abdominoplasty.

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