

Investigating the Changes in Respiratory Function Indicators and Intraluminal Airway Pressure in Patients Undergoing Abdominoplasty

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Abstract:

Background and Objective: Abdominoplasty is a cosmetic surgery that aims to improve the appearance of the abdomen by removing excess skin and fat and tightening the underlying muscles. Evidence has shown that it has effects on physiological functions, especially respiratory function parameters and intra-airway pressure. This study aimed to investigate the effect of abdominoplasty on respiratory function parameters, including forced vital capacity (FVC), forced expiratory volume in one second (FEV1), residual volume (RV), and changes in intra-ductal airway pressure.

Materials & Methods: This cross-sectional study was conducted on 36 adult patients who underwent abdominoplasty surgery. Pulmonary function and airway pressure were measured by spirometry before and one week after surgery. The degree of plication was also calculated by measuring abdominal circumference before and after surgery. For statistical analysis and the relationship between respiratory parameters, SPSS version 24 software and paired t-tests and Pearson correlation coefficient were used.

Results: In this study, 36 patients with a mean age of 47.7 ± 8.9 years and a plication rate of 0.8 ± 0.06 were enrolled. FVC and FEV1 decreased significantly after surgery. However, one week after surgery, there was a significant increase in residual capacity, potentially indicating a compensatory response ($P = 0.009$). There was no significant difference in airway pressure before and after surgery, suggesting that abdominoplasty may not directly affect airway compression. A positive and significant correlation was observed between the plication rate and FEV1 and FVC after surgery. In addition, an inverse relationship, although not statistically significant, was observed between plication and residual volume ($r = -0.1$, $P = 0.001$).

Conclusion: The findings of the present study highlight the temporary reduction in lung capacity after abdominoplasty surgery, along with potential compensatory mechanisms and the role of plication in influencing respiratory function parameters. However, further research with larger sample sizes and longer follow-up periods is necessary to fully understand the impact of abdominoplasty on respiratory function and intra-airway pressure.

Keywords: Abdominoplasty, Pulmonary Function, Plication, Airway Pressure, Vital Capacity

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Background and Objective

Abdominoplasty, commonly referred to as a tummy tuck, is a surgical procedure designed to enhance the aesthetic contour of the abdominal region through the excision of excess skin and adipose tissue, along with the progressive tightening of the underlying musculature.¹ While the primary goal of abdominoplasty typically centers on improving cosmetic outcomes, there is a growing interest in investigating its effects on physiological functions, particularly respiratory parameters and airway pressure.^{2,3}

Alterations or restrictions in respiratory function can lead to significant complications, including difficulty in breathing, impaired gas exchange, decreased lung capacity, and potential challenges during the postoperative recovery phase.⁴ Consequently, understanding the impact of abdominoplasty on respiratory function holds paramount clinical significance.

Prior research has explored the effects of abdominoplasty on various respiratory parameters, including Forced Vital Capacity (FVC), Forced Expiratory Volume in One Second (FEV1), and Residual Volume (RV).^{5,6} While some studies have documented improvements in these respiratory metrics following the procedure,^{7,8} others^{9,10} have presented contradictory findings, underscoring the need for further inquiry into this subject.

Additionally, intrapleural pressure emerges as another crucial factor potentially influenced by abdominoplasty.¹¹ An increase in intra-abdominal pressure resulting from abdominal wall laxity or excessive adipose tissue may compress airway structures, thereby contributing to respiratory dysfunction.¹²

Thus, this study aims to conduct a comprehensive evaluation of the impact of abdominoplasty on respiratory function parameters—specifically FVC, FEV1, and RV—while also assessing changes in intra-airway pressure. This investigation seeks to provide a clearer understanding of the interplay between cosmetic surgical interventions and respiratory physiology,

ultimately guiding clinical practice toward optimizing patient outcomes.

Materials and Methods

Study Design and Participants

This cross-sectional study enrolled patients referred to Shahid Tajrish Hospital in Tehran who were candidates for abdominoplasty between 2016 and 2017. Participants were selected through convenience sampling. The study received approval from the Ethics Committee of Shahid Beheshti University of Medical Sciences, and written informed consent was obtained from all participants prior to their inclusion in the study.

Inclusion and Exclusion Criteria

Eligible participants were adults aged 18 years or older seeking abdominoplasty for aesthetic or functional reasons. Exclusion criteria encompassed individuals with a history of respiratory disorders or previous abdominal surgeries to ensure the reliability and validity of the results.

Data Collection

Demographic information, including age and gender, was systematically collected for all participants. A thorough preoperative assessment was conducted to confirm the absence of concurrent respiratory conditions. Respiratory function parameters—specifically Forced Vital Capacity (FVC), Forced Expiratory Volume in One Second (FEV1), and Residual Volume (RV)—were measured using spirometry both preoperatively and one week postoperatively.

Furthermore, waist circumference measurements at the level of the umbilicus were recorded prior to and following the surgical procedure to calculate the percentage reduction in waist circumference (secondary waist circumference divided by initial waist circumference).

In addition, airway pressures during the surgical procedure were evaluated to ascertain intra-abdominal pressures using a ventilator device.

Statistical Analysis

Statistical analysis was performed utilizing SPSS software version 24. Descriptive statistics, including means, standard deviations, and percentages, were calculated to summarize the demographic and clinical characteristics of the participants. Paired t-tests and Pearson correlation coefficients were employed to compare respiratory function parameters pre- and post-surgery, as well as to analyze changes in intra-abdominal pressures. A p-value of less than 0.05 was considered statistically significant. This methodology was designed to yield a comprehensive understanding of the impact of abdominoplasty on respiratory function and intra-abdominal pressure, thereby contributing to the existing literature regarding the postoperative outcomes associated with this surgical procedure.

Findings

Participant Characteristics

A total of 36 adult patients who underwent abdominoplasty were included in this study. The mean age of the participants was 47.7 years, with an age range spanning from 21 to 67 years, and a standard deviation of 8.9 years. The majority of the participants were female, comprising 19 individuals.

Respiratory Function Parameters

Table 1 delineates the respiratory function parameters measured preoperatively and one week postoperatively. Notably, a significant decrease was observed in both Forced Vital Capacity (FVC) and Forced Expiratory Volume in One Second (FEV1) among the patients. In contrast, the Residual Volume (RV) demonstrated a significant increase one week post-surgery ($P = 0.009$).

Airway Pressures

The mean airway pressure recorded prior to surgery was 19.3 ± 1.2 cmH₂O. Postoperatively, this mean airway pressure increased slightly to 19.4 ± 1.3 cmH₂O; however, this difference did not achieve statistical significance ($P > 0.05$).

Table 1- Functional indices of patients before and after surgery

Index	Mean	Standard Deviation	Probability Value
Mandatory vital capacity	Previous	87.5	0.021
	Next	83.5	
Forced expiratory volume in one second	Previous	81.6	0.001
	Next	16.2	
Remaining volume	Previous	59.3	0.009
	Next	61.9	

Plication Rate

The average plication rate among the patients was noted to be 0.8 ± 0.06 . To analyze the correlation between the plication rate and respiratory function parameters, Pearson's correlation test was employed. The results revealed a significant positive correlation between the plication rate and FEV1 postoperatively ($P = 0.001$, $r = 0.3$). In a similar vein, a significant positive correlation was observed between the plication rate and FVC ($P = 0.001$, $r = 0.3$). Conversely, Pearson's test indicated an inverse relationship between Residual Volume and the plication rate ($r = -0.1$), which was statistically significant ($P = 0.001$).

Additionally, an examination of the correlation between the plication rate and airway pressure using Pearson's test revealed no significant relationship ($P > 0.05$).

Discussion and Conclusion

The present study was conducted to examine the effects of abdominoplasty on respiratory function parameters and airway pressures. Our cohort comprised 36 adult patients with a mean age of 47.7 years, predominantly female, which reflects a reasonably balanced gender distribution.

The results of our study demonstrated a significant decrease in both Forced Vital Capacity (FVC) and Forced Expiratory Volume in One Second (FEV1) among patients following abdominoplasty. These findings are consistent with previous research^{9,13} that has documented a reduction in lung capacity and overall respiratory function postoperatively. For instance, a study conducted by Park et al.¹⁴ assessed pulmonary function in patients two months after abdominoplasty, reporting significant reductions in mean FVC and mean FEV1 of 11% and 16%, respectively.¹⁴

Notably, our study also identified a considerable increase in Residual Volume (RV) one week after surgery. This increase may signify a compensatory response from the respiratory system during the early postoperative period, potentially attributed to alterations in abdominal wall mechanics and shifts in diaphragmatic positioning.^{2,15}

In terms of airway pressures, our results indicated no statistically significant differences observed between preoperative and postoperative measurements. This suggests that abdominoplasty does not exert a substantial impact on airway pressures. While previous studies have not specifically addressed the relationship between abdominoplasty and airway pressures,¹⁵ our findings corroborate this observed lack of effect.

Furthermore, this study investigated the relationship between the extent of plication and respiratory function parameters. The results indicated a positive and significant correlation between the level of plication and both Forced Expiratory Volume in One Second (FEV1) and Forced Vital Capacity (FVC) following surgery. Consistent with prior

research, these findings suggest that a greater degree of plication may lead to enhanced respiratory function postoperatively.¹⁴

In addition, an inverse relationship was observed between the degree of plication and Residual Volume (RV); however, this finding did not achieve statistical significance. This observation implies that an increase in plication may contribute to a reduction in residual volume, potentially reflecting changes in the distribution of lung volume.¹⁷

Moreover, our study did not establish a significant relationship between the degree of plication and airway pressures, indicating that airway dynamics may not be directly influenced by the level of plication during abdominoplasty.

Despite the noteworthy insights provided by this study, several important limitations must be acknowledged. The small sample size and the absence of a control group constrain the generalizability of our findings. Additionally, the short-term follow-up period of merely one week may not adequately capture the long-term effects of abdominoplasty on respiratory function.

In conclusion, the findings of this study reveal that abdominoplasty is associated with a significant decrease in both FVC and FEV1, indicative of a temporary reduction in lung capacity. However, the observed increase in residual volume one week post-surgery may reflect a compensatory respiratory response. While the degree of plication exhibited a positive correlation with FEV1 and FVC, it showed an inverse relationship with residual volume. Notably, there were no significant changes in airway pressures postoperatively. Future research encompassing larger sample sizes and extended follow-up periods is essential to enhance our understanding of the impact of abdominoplasty on respiratory function and airway dynamics.

References:

1. Pereira N, Sciaraffia C, Danilla S, Parada F, Asfora C, Moral C. Effects of abdominoplasty on intra-abdominal pressure and pulmonary function. *Aesthetic Surgery Journal*. 2016 Jun 1; 36(6): 697-702.
2. Rodrigues MA, Nahas FX, Gomes HC, Ferreira LM. Ventilatory function and intra-abdominal pressure in patients who underwent abdominoplasty with plication of the external oblique aponeurosis. *Aesthetic plastic surgery*. 2013 Oct; 37: 993-9.
3. Abdali H, Yousefvand M. Assessment of the effects of plication abdominoplasty on respiratory function. *Journal of Isfahan Medical School*. 2018 Jan 21; 35(459): 1762-6.
4. Messeha MM. Effect of switching between pressure-controlled and volume-controlled ventilation on respiratory mechanics and hemodynamics in obese patients during abdominoplasty. *Anesthesia, essays and researches*. 2017 Jan; 11(1): 88.
5. Tercan M, Bekerecioglu M, Dikensoy O, Kocoglu H, Atik B, Isik D, Tercan A. Effects of abdominoplasty on respiratory functions: a prospective study. *Annals of plastic surgery*. 2002 Dec 1; 49(6): 617-20.
6. Wilhelmsson S, Fagevik Olsén M, Staalesen T, Elander A, Nygren-Bonnier M. Abdominal plasty with and without plication-effects on trunk muscles, lung function, and self-rated physical function. *Journal of Plastic Surgery and Hand Surgery*. 2017 May 4; 51(3): 199-204.
7. Libby DM. Ventilatory function in patients who underwent abdominoplasty with plication of the aponeurosis of the external oblique. *Aesthetic plastic surgery*. 2013 Oct; 37: 1000-2.
8. Kosloski FR, Barbosa MV, Rodrigues MA, Martins MR, Ferreira LM, Nahas FX. Effect of compression garments on the ventilatory function after abdominoplasty. *Aesthetic Surgery Journal*. 2023 Jul 21: sjad231.
9. Soto-Hopkins S, Milla H, Espino-Gaucin I. Effect of Rectus Plication during Abdominoplasty on the Mechanical Power and Airway Pressures: Comparison of Two Ventilatory Strategies. *Surgical Science*. 2022 Jul 19; 13(7): 335-42.
10. Staalesen T, Elander A, Strandell A, Bergh C. A systematic review of outcomes of abdominoplasty. *Journal of plastic surgery and hand surgery*. 2012 Sep 1; 46(3-4): 139-44.
11. Kadry HM, Balbaa FY, Ismail M, Elsharkawy O. A Novel Formula to Predict Intra-Abdominal Pressure Changes in Abdominoplasty. *The Egyptian Journal of Plastic and Reconstructive Surgery*. 2022 Apr 1; 46(2): 129-35.
12. Pillai RT, Joseph V, Marar K. Intra abdominal pressure changes in meshplasty and abdominal wall plication techniques in abdominoplasty: a comparative study. *International Surgery Journal*. 2021 Oct 28; 8(11): 3370-4.
13. Helene Junior A, Saad Junior R, Stirbulov R. Respiratory evaluation in patients submitted to abdominoplasty. *Revista do Colégio Brasileiro de Cirurgiões*. 2006; 33: 45-50.
14. Park JM, Ha SU, Lee KC, Kim SK, Son CH. The effect on pulmonary function after abdominoplasty. *Archives of Plastic Surgery*. 2005; 32(6): 733-8.
15. Netscher DT, Coveler LA. Intraabdominal Pressure after Full Abdominoplasty in Obese Multiparous Patients. *Plastic and Reconstructive Surgery*. 2004 Jun 1; 113(7): 2151-5.
16. Rodrigues MA, Ferreira LM, de Carvalho Calvi EN, Nahas FX. Preoperative respiratory physiotherapy in abdominoplasty patients. *Aesthetic Surgery Journal*. 2018 Feb 15; 38(3): 291-9.
17. Morales-Olivera M, Hanson-Viana E, Rodríguez-Segura A, Rendón-Medina MA. Abdominal Hypertension after Abdominal Plication in Postbariatric Patients: The Consequence in the Postoperative Recovery. *Archives of Plastic Surgery*. 2023 Nov 30; 50(06): 535-40.