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Effect of Intraoperative Valsalva Maneuver Application on Bleeding Point Detection and Postoperative Drainage After Thyroidectomy Surgeries

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The purpose of this paper was to analyze the effect of Valsalva maneuver application before finalizing thyroidectomy operations on the identification of bleeding points and postoperational drainage. One hundred patients (age range, 24–76 years) with multinodular goiter, recurrent multinodular goiter, toxic diffuse multinodular goiter, or papillary thyroid cancer were included in the study and were divided into 2 groups of 50 randomly. Both groups underwent thyroidectomy operation, only 1 group received intraoperative Valsalva maneuver application (twice, 30 seconds of 30-cm PEEP). The size of the thyroid gland, the duration of operation, hospital stay, and drain usage were reported. Postoperational occurrences of drainage, hematoma, reoperation, and additional complications were compared between the groups. Valsalva maneuver application helped to identify minor bleeding points in 32% of the cases. There was no significant difference between the study groups regarding the thyroid gland size, operation duration, hospital stay, and the duration of drain usage ($P > 0.05$ for all). The amount of drainage as well as the frequencies of hematoma, reoperation, and further complications was not significantly different between the study groups ($P > 0.05$ for all). Intraoperative application of Valsalva maneuver is only useful to detect minor bleeding points in some patients during thyroidectomy operations, but it had no effect on the duration of postoperative drain usage, the amount of drainage, and risk of hematoma. Therefore,

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intraoperative application of Valsalva maneuver has no beneficial effect on postoperative hemorrhagic complication after thyroidectomy operations.

Key words: Drainage – Hemostasis – Thyroidectomy – Valsalva maneuver

Thyroidectomy is one of the most commonly performed operations worldwide.[1] Though a series of improvements were introduced to the operation process, still several postoperative complications remain to be faced such as seroma, wound infection, skin flap complications, and hematoma.[2,3]

Despite the richness of the blood vessels in the thyroid area,[4] the rate of postoperational bleedings thus hematoma events are low (1–5% of the cases).[5] However, once not controlled, hematoma can result in airway compression and create a life-threatening situation for the patient.[6] Hence, preventive measures have been emphasized and employed to avoid postoperational bleedings after thyroidectomy. These approaches range from exercises to avoid Valsalva maneuver kind of forces such as coughing or straining at opening bowel[7] to the use of drains after the operation. However, recent literature indicates that the drain usage does not have a significant effect on the recovery period or on the duration of the hospital stay.[3,5,8,9] Furthermore, it may cause wound infection and contribute to the discomfort of the patients.[5,8,10,11] Thus a proper hemostasis and an early detection of potential bleeding sites are crucial steps for a successful operation and a steady recovery period.[4] Several techniques have been used to detect and treat bleeding points immediately after the operation to prevent postoperational hematoma. These techniques involve the use of hydrogen peroxide, water in the wound, Valsalva maneuver, and Trendelenburg tilt.[4,7] Recently, the success of Valsalva maneuver and Trendelenburg tilt application on bleeding point detection was demonstrated by Moumoulidis *et al*.[4] However, no further information is provided until now regarding the postoperational evaluation of the patients.

In this paper, we aim to analyze the effect of the Valsalva maneuver application on the identification of bleeding points before finalizing the surgery and its influence on the postoperative drainage, complications, and recovery process.

Methods

Study design and patients

One hundred patients diagnosed with multinodular goiter, recurrent multinodular goiter, toxic diffuse multinodular goiter, or papillary thyroid cancer were included in the study. Patients undergoing lateral neck dissection or unilateral thyroidectomy operation were excluded from the study. Thyroidectomy operations were performed between June 2012 and August 2013 with the approval of the Institutional Ethics Committee of Yildirim Beyazit University Medical School. Patients were informed about the study and signed a written consent before the participation in the study.

Two groups of 50 patients were formed by stratified random sampling. The first group of patients underwent bilateral thyroidectomy. After hemostasis, the operation was completed. The second group of patients underwent bilateral thyroidectomy and after the hemostasis Valsalva maneuver was performed twice for 30 seconds applying 30-cm positive-end expiratory pressure (PEEP). New bleeding points were identified and treated upon the maneuver and the operation was then finalized. Three patients in each group had central lymph node (CLN) dissection in addition to the thyroidectomy operation. In both groups, drains were used, and postoperative observation time was 1 month.

Study parameters

Operative and postoperative values of 2 groups were compared and statistically analyzed. For both study groups demographic and clinical characteristics such as the age, gender, disease diagnosis, thyroid function test, ASA (American Society of Anesthesiologists) score, and the type of operation to be performed were documented prior to the operation. The size of the thyroid gland lobes was measured preoperatively via ultrasonography. After the operation, the duration of operation, the duration of drain usage, and the amount of daily as well as total drainage were recorded. Finally, the number of patients experiencing postoperational complications, hematoma, and reoperation was reported.

Statistical analysis

The data is presented as mean ± standard deviation for continuous variables and as percentage for

Table 1 Demographic and clinical characteristics of patients in study groups

	Thyroidectomy (n = 50)	Thyroidectomy + Valsalva (n = 50)	*P* value
Age (years)	49.30 ± 12.06	45.82 ± 11.98	0.151
Gender			0.096
Male	42 (84%)	35 (70%)	
Female	8 (16%)	15 (30%)	
Diagnosis			0.726
MNG	41 (82%)	44 (88%)	
Recurrent MNG	2 (4%)	1 (2%)	
Toxic diffuse MNG	1 (2%)	0 (0%)	
Papillary thyroid cancer	6 (12%)	5 (10%)	
Thyroid function test			1.000
Hypothyroid	1 (2%)	2 (4%)	
Euthyroid	39 (78%)	39 (78%)	
Hyperthyroid	10 (20%)	9 (18%)	
ASA			0.220
1	25 (50%)	28 (56%)	
2	16 (32%)	19 (38%)	
3	9 (18%)	3 (6%)	
Type of operation			1.000
Thyroidectomy	47 (94%)	47 (94%)	
Thyroidectomy + CLN dissection	3 (6%)	3 (6%)	

Data are represented as n (%). The significance is calculated using the Mann-Whitney *U* test.

MNG, multinodular goiter; ASA, American Society of Anesthesiologists; CLN, central lymph node.

categorized variables. The normality of data distribution was determined with Kolmogorov-Smirnov test. Data fitting to normal distribution was analyzed with the parametric Student *t*-test and the comparison of categorized variables was done with the nonparametric Mann-Whitney *U* test. For statistical analysis, Statistical Package for Social Sciences, Version 17.0 (SPSS Inc, Chicago, Illinois) software was used, and the statistical significance level was set as $P < 0.05$.

Results

One hundred patients, 77 females and 23 males, were included in this study (mean age: thyroidectomy group, 49.30 ± 12.06 years; thyroidectomy + Valsalva group, 45.82 ± 11.98 years; Table 1). Two groups of 50 patients were formed to test the effect of Valsalva maneuver on the identification of bleeding points after the bilateral thyroidectomy operation. There was no significant difference between the groups regarding the disease diagnosis, thyroid function test, ASA, and the type of operation applied ($P > 0.05$ for all; Table 1).

Table 2 Thyroid lobe size, operative and postoperative parameters of patients in study groups

	Thyroidectomy (n = 50)	Thyroidectomy + Valsalva (n = 50)	*P* value
Right lobe (mL)	21.06 ± 16.14	19.78 ± 13.78	0.871
Left lobe (mL)	21.56 ± 21.87	18.34 ± 15.88	0.964
Total volume (mL)	43.16 ± 38.42	32.31 ± 23.17	0.896
Duration of operation (min)	84.10 ± 13.32	81.70 ± 14.13	0.372
Hospital stay (days)	1.08 ± 0.45	1.12 ± 0.53	0.648
Duration of drain usage (days)	2.78 ± 0.65	2.84 ± 0.72	0.659
Postoperative drainage Day 1 (mL)	94.00 ± 42.59	88.50 ± 35.71	0.651
Postoperative drainage Day 2 (mL)	44 ± 31.07	44.90 ± 31.31	0.978
Total drainage (mL)	152.9 ± 84.11	148.3 ± 74.18	0.915

Data are represented as mean ± standard deviation. The significance is calculated using the Student *t*-test.

Operative and postoperative evaluation of patients

The average size of the left and right lobes, as well as the total volume of the thyroid gland, was not significantly different between the 2 study groups ($P > 0.05$ for all; Table 2). Similarly, the average duration of the operation and the postoperative hospital stay were not significantly different between the groups with and without the application of Valsalva maneuver ($P > 0.05$ for all; Table 2).

Upon Valsalva maneuver, 68% of the patients showed no bleeding, whereas 26% of the patients had 1 and 6% of the patients had 2 minor bleeding points identified.

Application of the Valsalva maneuver did not have any significant effect on the duration of the drain usage ($P > 0.05$; Table 2). There was only a slight but nonsignificant decrease in the total amount of drainage in the study group receiving Valsalva maneuver application (Table 2). There was no significant difference regarding the postoperative complications between the 2 study groups ($P > 0.05$; Table 3). Only 1 patient in the group without the Valsalva maneuver application experienced postoperative hematoma and was operated on again under emergency circumstances, whereas none of the patients had hematoma or reoperation incident in the Valsalva maneuver group. Nonetheless, these parameters were not significantly different between the study groups (Table 3).

Table 3 Postoperative complications in the study groups

	Thyroidectomy (n = 50)	Thyroidectomy + Valsalva (n = 50)	*P* value
Postoperative transient hypocalcemia	2 (4%)	3 (6%)	1.000
Postoperative hematoma	1 (2%)	0 (0%)	1.000
Reoperation	1 (2%)	0 (0%)	1.000

Data are represented as n (%). The significance is calculated using the Mann-Whitney *U* test.

Discussion

This is the first study evaluating the effect of intraoperative Valsalva maneuver on bleeding point detection and postoperative drainage after thyroidectomy surgeries. We found that although intraoperative Valsalva maneuver provides identification of bleeding points in 32% of the cases, it had no effect on the duration of postoperative drain usage, the amount of drainage and risk of hematoma.

When performed correctly and followed by a proper hemostasis, thyroidectomy surgeries are routinely performed and result in successful operations with a fast recovery. However, any uncontrolled postoperative bleeding resulting in hematoma represents a severe danger to patient's health causing respiratory problem and cardiac arrest.[12,13] Thus, the precise detection of bleeding points following the operation is highly critical. Few trivial methods have been used to identify the bleeding points before finalizing thyroidectomy surgeries, such as the use of water or hydrogen peroxide in the operation area.[7]

Recently, the application of another intraoperative technique, Valsalva maneuver, was emphasized as an alternative to these methods.[4] Valsalva maneuver is widely used to test cardiac and baroreflex functions in addition to adrenergic system responses.[14–16] Besides being used for these purposes, Moumuolidis *et al* recently demonstrated that the application of Valsalva maneuver helps to identify potential bleeding sites after head and neck surgeries.[4] Additionally, a precise control over potential bleeding points was unceasingly brought into attention as a crucial step to the recovery process by preventing hematoma and excessive drainage.[4,6,11,12] Therefore, in this study we aimed to evaluate the effect of Valsalva maneuver application on the detection of bleeding sites and more importantly on postoperative parameters, such as the drainage and complications particularly after thyroidectomy operations.

We observed that the application of Valsalva maneuver did not prolong the operation time between the groups, but allowed the operation team to detect potential bleeding points in 32% of the cases (26% with one bleeding point and 6% with 2 minor bleeding points). The percentages of patients identified with 1 or 2 bleeding points were consistent with the data presented by Moumoulidis *et al*.[4]

However, identification of bleeding points did not have a favorable effect on the duration of postoperative drain usage, the amount of drainage and risk of hematoma. The values for these parameters were similar to the previously described data.[17] The amount of drainage in both groups was also comparable with the rates defined in former studies.[9,17] Only a slight but nonsignificant decrease was observed in the amount of total drainage with the study group receiving the Valsalva maneuver application. The lack of clinical effect of Valsalva maneuver can be explained by 2 possibilities. First, Valsalva maneuver application may trigger minor bleedings due to the excessive pressure applied, which under normal conditions do not take place. Secondly, even if minor bleedings occur in patients for whom Valsalva maneuver was not applied, these bleedings can be overcome by the natural hemostasis mechanisms of the body before reaching a critical state.

It should also be noted that the Valsalva maneuver is temporally limited to 1 minute to avoid the consequences of barotrauma.[4] To overcome this limitation, Trendelenburg tilt was suggested as a supplementary approach to be used during head and neck operations following Valsalva maneuver.[4,18] This approach showed an increased sensitivity for the detection of bleeding points.[4]

Lastly, the use of drains after thyroidectomy operations has been highly debated in the literature. It was shown that there is no beneficial effect of drain use with respect to recovery time and hospital stay.[3,5,8,9] Furthermore, it may trigger infection and prolong hospital stay if not changed frequently.[5,19] Only in certain cases where the patients use anticoagulants or undergo lymphatic dissection, the use of drains is recommended.[17] Optional tools are also suggested to replace drains for hematoma treatment, such as needle aspiration.[20] Thus, a future step would be to test the application of Valsalva maneuver and the Trendelenburg tilt on the

recovery and postoperative complications of patients without the use of drains.

In clinical practice, surgeons generally believe that intraoperative approaches such as Valsalva maneuver can detect bleeding points and potentially prevent the occurrence of postoperational bleedings. However, our finding showed that although intraoperative Valsalva maneuver provides identification of minor bleeding points in some patients, it had no beneficial effect on postoperative parameters. On the other hand, it should also be noted that there were no hematoma or reoperation cases observed for the group with Valsalva maneuver application and the percentage of patients experiencing postoperative complications was similar for both groups. But since the rates of hematoma, postoperative complications, and reoperation were very low, further large-scale studies are needed to accurately conclude whether intraoperative Valsalva maneuver has clinical advantages in terms of these parameters or not.

In conclusion, we suggest that intraoperative application of Valsalva maneuver has no beneficial effect on postoperative hemorrhagic complication after thyroidectomy operations. Surgeons should consider giving up intraoperative Valsalva maneuver in thyroid operations without causing any postoperative disadvantage.

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