Clinical usefulness of the Valsalva maneuver to improve hemostasis during thyroidectomy

Keywords: Valsalva manoeuvre, hemostasis, Surgical Drains, thyroidectomy

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Abstract

Introduction Bleeding after total thyroidectomy remains a rare event which affects early postoperative morbidity, occurring in 0.3% up to 4.2% of cases. Intraoperative bleeding is an unpleasant complication, and it is often easily manageable though postoperative bleeding may represent a life-threatening condition for the patient. The purpose of our study is to clarify the role of Valsalva manoeuvre, in order to reduce postoperative bleeding.

Methods Between January 2019 to February 2022 , 250 consecutive patients were listed for thyroid surgery at our surgical department. We selected 178 patients and divided them in two groups based on the execution of the Valsalva Manoeuvre.

Results The cohort is made up of one hundred and seventy-eight patients, divided into two groups based on the use of the VM. There is no difference in the duration of surgery between the two groups. In Group B there is a lower number reintervention for bleeding. In Group A there is a significant greater volume of drainage output than in Group B. The Correlation test used, confirms these results.

Conclusion Cervical hematoma can compromise the patient's life, so bleeding control is crucial. The use of a simple, and safe Valsalva Manoeuvre can improve postoperative course, giving a significant reduction of drainage output but does not prevent the risk of reoperation for haemorrhage.

Introduction

Total Thyroidectomy (TT) is one of the most performed operations in the world. In neck surgery, it is among the most important interventions, considering its complexity and diffusion[1].

Despite innovative approaches in surgery and innovations in surgical instruments, bleeding after TT remains a rare event which affects early postoperative morbidity, occurring in 0.3% up to 4.2% of cases [2]. The causes are not to be found only in the complex anatomy of the anterolateral region of the neck, which is richly vascularized, but also in the strategies adopted to achieve perfect haemostasis in an operative field where the nearby anatomical structures must be preserved [3].

Intraoperative bleeding is an unpleasant complication, that most of the time it is easily manageable and resolvable though it engages the surgeon and it might lengthen the operating times; in the other hand postoperative bleeding can instead represent a life-threatening condition for the patient. For this reason, the need to adopt all known methods and strategies to minimize postoperative bleeding. Over time, the use of new instruments, the use of Collagen-Fibrinogen-Thrombin Patch (CFTP), cellulose gauze and other Haemostatic agents have made it possible to reduce the incidence of postoperative bleeding and reintervention but not to cancel it[4].

The purpose of our study is to clarify whether the routine intraoperative execution of a Valsalva manoeuvre (VM) may affect the detection of bleeding that would otherwise remain occult and therefore may manifest in the postoperative period.

Methods

Between January 2019 to February 2022 , 250 consecutive patients were listed for thyroid surgery at our surgical department. In order to evaluate the role of VM, all patients treated with minimally invasive approaches (Mini Invasive Video Assisted Thyroidectomy MIVAT) or with robot-assisted transaxillary thyroid surgery (RATS) were excluded in the cohort. Loboistmectomies were also excluded. Other exclusion criteria were the need for lymph node dissections, patient coagulation disorders and an high anaesthesiologic risk (ASA 3). We chronologically divided our cohort of 178 patients into 2 non-randomized groups: Group A (n = 96 patients) in which no MV was performed, and Group B (n = 82 patients) who had VM performed at the end of the TT.

VM was performed after thyroid excision and after a first revision of haemostasis in the operative field. Thanks to the anaesthesiologist *VM was achieved by applying an incremental PEEP (positive end expiratory pressure) up to 30cm H_2O, and subsequently a new VM by setting the mechanical ventilator in manual mode through the APL (adjustable pressure-limiting) valve.*

All patients were treated by a team with the same surgical approach with extensive experience in neck surgery, therefore all procedures were standardized.

The two groups are comparable in demographics data (Table 1).

	Group A (n=96)	**Group B (n=82)**	**Overall (n=178)**	**p value**
Age (Range) **Mean** **Median (±DS)**	20-74 47.82 49.5 (±14.49)	18-74 45.51 45.5 (±14.28)	18-74 46,75 48 (±14,36)	0.143
M F	37/59	28/54	65/113	0.543
BMI(Range) **Mean** **Median (±DS)**	23-40 31.47 30.5(±4.80)	24-41 32.28 33(±4.77)	23-41 31.84 32(±4.79)	0.130
ASA score **I** **II**	 38/96 58/96	 35/82 47/82	 63/178 115/178	0.675

Table 1 Demographic data. BMI (Body Mass Index), ASA score (American Society of Anesthesiologists). Significance test used are T test in numerical variable, and chi-square tests for categorical variables. A p value of less than 0.05 was considered statistically significant.

Haemostasis is reached with monopolar or bipolar coagulators, and LigaSure ™ (LSJ Medtronic, Covidien product, Minneapolis, MN, USA) was also used to achieve better sealing of the vessels. In dangerous areas, vessel's ligation and application of small surgical clips is preferred to avoid recurrent laryngeal nerve injury.

At the end of the operation (after the execution of the VM in Group B), a human fibrinogen and human thrombin (CFTP) patch is always applied and 2 suction surgical drains are placed in the thyroid lodges.

After the surgery, and the anaesthesiologic awakening, the patient waits about 2 hours in the recovery room, with personnel assigned to check the patient and the drainage output. Sometimes a longer observation time is required. If there is a rapid filling of the drains, or symptoms such as dyspnoea, difficulty breathing, suffocation and smoothing of the jugule appear, then the patient quickly undergoes new surgery for revision of the haemostasis.

Primary outcomes considered include drainage volume, reoperation rate in the first 6 hours, and reoperation in the first 24 hours. The duration of the operation and the occurrence of other complications other than bleeding were also evaluated.

Statistic analysis

T test in numerical variable, and chi-square tests for categorical variables was performed for statistical comparison of the groups. Phi Coefficient was calculated for association between dichotomous variables. Point-Biserial Correlation was calculated for correlation between variables dichotomous and continuous. A p value of less than 0.05 was considered statistically significant.

Results

The cohort is made up of one hundred and seventy-eight patients, divided into two groups based on the use of the VM. There are no statistically significant differences in age, sex, BMI (Body Mass Index), and ASA score (American Society of Anesthesiologists) between the two groups (p value> 0.05 for all; Table 1).

In table 2, surgical and postoperative data are shown and analyzed. There is no difference in the duration of surgery between the two groups. On the other hand, it should be emphasized that in Group B there is a lower number of cases of both early (<6h) and late re-intervention within 24h. These results were not statistically significant. The average period of stay under observation in the recovery room was also slightly shorter in Group B, albeit not in a statistically significant manner. The results show that in Group A there is a significant greater volume of drainage output than in Group B, and that more frequently they are kept in place even on the second postoperative day. All patients included in this study underwent double suction drains placement in the right and left thyroid lodges, respectively.

	GROUP A (N=96)	GROUP B (N=82)	P VALUE
OPERATION LENGTH (MIN)	126.11	126.78	0.416
RECOVERY ROOM STAY (MIN)	126.93	123.96	0.083
REOPERATION (<6H)	6/96	1/82	0.085
REOPERATION (<24H)	4/96	0/82	0.125
DRAINAGE VOLUME (ML)	79.38	56.67	**< 0.001**
PERMANENCE OF THE DRAINAGES BEYOND THE FIRST	16/96	5/82	**0.029**

POSTOPERATIVE DAY			
HOSPITAL STAY (DAYS)	2.22	2.15	0.175

Table 2 Surgical and Post surgical data. Significance Test used is Chi-Square. A p value of less than 0.05 was considered statistically significant.

In table 3, we used Correlation tests (Phi Coefficient between dichotomous variables and Point-Biserial was between variables dichotomous and continuous), to evaluate the real contribution of the VM during TT. The results obtained showing there is no significant correlation for early or late reoperation, not even for the length of the drainage beyond the first postoperative day. On the other hand, the correlation with the overall volume of drainage output was statistically significant.

Table 3 Tests of Correlation. Phi Coefficient was calculated for association between dichotomous variables. Point-Biserial Correlation was calculated for correlation between variables dichotomous and continuous. A p value of less than 0.05 was considered statistically significant.

	Φ VALUE	**P VALUE**
REOPERATION (<6H)	-0.129	0.914
REOPERATION (<24H)	-0.140	0.938
PERMANENCE OF THE DRAINAGES ON THE SECOND DAY	-0.163	0.970
	***r* VALUE**	**P VALUE**
DRAINAGE VOLUME (ML)	-0.851	**< 0.001**

Finally, in Table 4, we analyse the incidence of main complications during TT (Postoperative Hypoparathyroidism, recurrent laryngeal nerve palsy, Wound Infection). The two groups were homogeneous, so there are no significant differences between the groups and these complications are not related to the application of VM. All patients included in this study had a 30-day follow-up after surgery. All cases of hypoparathyroidism and cases of recurrent laryngeal nerve palsy resolved during follow-up and were therefore deemed *transient*.

Table 4 Most important complications during TT.

	GROUP A (N=96)	**GROUP B (N=82)**	**P VALUE**
WOUND INFECTION	2/96	1/82	0.655

TRANSIENT POSTOPERATIVE HYPOPARATHYROIDISM, n (%)	14/96	9/82	0.474
TRANSIENT RECURRENT LARYNGEAL NERVE PALSY, n (%)	2/96	2/82	0.873

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Discussion

Total thyroidectomy and lymph node dissections of the neck are among the most common surgery performed at the cervical level and had low rates of morbidity and mortality. Bleeding after thyroidectomy is well known complication, but with improved surgical technique e meticulous hemostasis has become a rare occurrence. However, although it is a rare occurrence if it is not diagnosed early and managed correctly, it becomes potentially life-threatening.

Indeed, patients with postoperative cervical hematoma they required a new surgery and longer hospital monitoring [5]. Symptoms that arise are: respiratory distress, choking, difficulty swallowing and a feeling of constriction in the neck. In 72% of cases, postoperative hematoma occurs within 6 hours after surgery and 89% of the time within 12 hours [6 7]. The risk of bleeding is affected not only by the patient's factors, but also by the underlying thyroid disease and the haemostatic techniques used.

The use of drains in thyroid surgery is still widespread. In our unit, all patients undergoing TT are routinely subjected to placement of a drain for the right thyroid lodge, and one for the left thyroid lodge and placed on suction. They are then removed in the first postoperative day or remain longer in case of too high an output.

Traditionally, the main purpose for the use of drains is to prevent postoperative complications evacuating postoperative hematoma or lymphatic fluid and to notify the surgeon as soon as possible. However, the use of drains may be omitted in uncomplicated cases because often the drained volume is very low and it may not be necessary, or why haemostasis was remarkably adequate during surgery [8 9]. In light of improvements in hemostasis techniques and increasing surgical skills, the value of drainage in thyroid surgery may again be questioned, but to date, numerous randomized trials have failed to solve this question [10 11]. However we believe that life-

143 threatening complications, such as postoperative bleeding, hematoma, compression of air
144 passages or suffocation, can be more promptly signaled by the presence of drains, and guarantee
145 the surgeon a more timely diagnosis and the patient a less rapid onset of symptoms associated
146 with hematoma.

147 The VM is a fairly common procedure for detecting bleeding points during thyroidectomy
148 procedures [12]. During VM, increased intrathoracic and intraabdominal pressures causing internal
149 jugular vein distension and increasing internal jugular venous pressure. The venous hipertension
150 that involves the large veins causes a involves also the vessels of the thyroid lodge, increasing
151 blood flow and forcing any bleeding, which can be detected.

152 Tokaç et al suggest that intraoperative application of VM has no positive effects on postoperative
153 hemorrhagic complication[13], Beyoglu in 2020 recommends to keep airway pressure at 50 cm H2O
154 for 22.5 s in order to a more efficacious intraoperative detection of bleeding points in patients
155 undergoing total thyroidectomies [14]. Ozdemir affirms that The Valsalva maneuver helps to detect
156 any bleeding point after Trendelenburg positioning[15].

157 In our study, we considered how VM can help surgeons practicing TT. In order to reduce
158 postoperative bleeding at the end of haemostasis phase we perform a double VM by applying an
159 incremental PEEP up to 30cm H_2O, and afterwards a new VM setting the mechanical ventilator in
160 manual mode. The second shot, often show a new bleeding point so the surgeons can reach a
161 clean and dry surgical field.

162 This procedure allowed us to have fewer re-operations both in the first 6 postoperative hours and
163 in the following 24 hours. These data were not statistically significant in our study, while a
164 significant difference was in the reduction of the total volume of drains and in a lower incidence of

permanence of the drains beyond the first postoperative day. VM did not affect any of the other complications examined.

Conclusion

The manifestation of a hematoma can be life-threatening causing a compression of the airway therefore severe bleeding control is crucial. Technological progress and the use of new hemostatic agents have contributed to reducing the incidence of this phenomenon. However, the use of a simple, economical and safe maneuver such as the VM can improve postoperative course, giving a significant reduction of drainage output but does not prevent the risk of reoperation for haemorrhage.

178 **References**

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