Langenbeck's Archives of Surgery (2019) 404:693–701
https://doi.org/10.1007/s00423-019-01799-6

ORIGINAL ARTICLE

Impact of drains on nausea and vomiting after thyroid and parathyroid surgery: a randomized controlled trial

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Received: 29 March 2019 / Accepted: 10 June 2019 / Published online: 26 June 2019

Abstract

Objective Nausea and vomiting are common side effects following thyroid and parathyroid surgery. In a prospective controlled randomized trial, postoperative nausea and vomiting (PONV) and the number of episodes of vomiting were defined as two primary endpoints. We analysed whether the placement of drains after thyroid or parathyroid surgery enhances PONV and/or influences vomiting.

Patients and methods From November 2007 to January 2012, 136 consecutive patients were included for thyroid or parathyroid surgery and were randomly assigned to group A (drain, $n = 69$) or group B (no drain, $n = 67$). PONV was assessed with visual analogue scale (VAS; range 0 to 10) measurements. Furthermore, episodes of vomiting as well as analgetic and antiemetic therapies were recorded. Difference in neck circumference was compared pre- and postoperatively.

Results Patients' characteristics did not differ between group A and B. Postoperative VAS values for pain were 2.4 ± 0.3 (group A) and 2.6 ± 0.2 (group B) ($p = 0.62$), and for nausea 1.4 ± 0.2 (group A) and 1.1 ± 0.2 (group B) ($p = 0.57$). The relative occurrences of episodes for postoperative vomiting were equal in both groups 0.3 ± 0.1 ($p = 1.0$). Antiemetic drugs were administered 37 times (group A) and 18 times (group B) ($p = 0.099$). The total number of treatments of patients with antiemetic drugs was 23 (33.3%) in group A vs. 13 (19.4%) in group B ($p = 0.081$). The neck circumference postoperatively was significantly larger in group B ($p = 0.0025$).

Conclusions Drains after surgery do not enhance postoperative pain, nausea and vomiting. The placement of drains in thyroid surgery is recommended to avoid relevant fluid collection. Drains however may influence the amount of antiemetic drug requirements.

Trial registration
ClinicalTrials.gov Identifier: NCT01679418

Keywords Drainage · Nausea · Vomiting · PONV · Thyroid · Thyroidectomy · Surgery

Abbreviations

BW	Body weight
i.v.	Intravenous
POD	Postoperative day
PONV	Postoperative nausea and vomiting
RLN	Recurrent laryngeal nerve
s.c.	Subcutaneously
SLN	Superior laryngeal nerve

Introduction

Postoperative nausea and vomiting (PONV) are regularly encountered after thyroid and parathyroid resections. Together with the risk of postoperative bleeding, nausea and vomiting may be considered limiting factors for outpatient thyroid surgery or early discharge [1–4]. Whether or not postoperative drainage should be recommended in thyroid surgery is still under debate. Mostly, postoperative drainage was used to monitor early postoperative bleeding

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[5–14] but recent studies do show that there is no need for it [15–17]. Nausea, with or without vomiting, occurs commonly after surgery [18–21]. Many patients seem to be more stressed by PONV than pain [19]. Whether the placement of drains is related to PONV remains mostly unknown today. The severity of PONV differs a lot amongst patients [22] and may occur in up to 30% after general surgery and in up to 80% in high-risk patients for PONV undergoing surgery. PONV are especially common after head and neck surgery, and studies reported rates between 60 and 76% when no prophylactic antiemetic drugs are given [23, 24]. Preoperative interviews with patients revealed that they were more afraid of PONV than postoperative pain [19]. The exact pathophysiological mechanisms leading to PONV are not well understood. Significant oedema and inflammation around the neck tissues can evoke parasympathetic impulses through vagal stimulation in the central nervous system [25]. The perception of these impulses can cause nausea and vomiting. Another potential mechanism involves chemical stimuli that are released during surgery. They may activate a zone close to the area postrema [25].

Furthermore, vomiting increases the risk of postoperative bleeding, with potential airway obstruction [8, 26]. Although postoperative bleeding is rare in thyroid surgery, it remains of clinical impact concerning rapid potential airway obstruction. Therefore, the use of drains (mostly with negative suction) is thought to early detect postoperative bleeding. There is no clear evidence whether placement of drains in patients undergoing thyroidectomy significantly improved postoperative outcomes but did not significantly reduce postoperative re-intervention rates [27]. In terms of pain, the application of drains seemed to correlate with severe pain compared with patients not receiving drains post thyroid surgery [28]. It remains unknown whether drains affect PONV via a mechanical irritation of the vagal nerve only or whether mechanical irritation leads to a kind of inflammation-based cascade that evokes PONV. The primary scope of this study was to evaluate the influence of postoperatively placed drains on PONV using the VAS analogue scale and counted the number of episodes of vomiting postsurgery. Secondly, we aimed to evaluate potential differences in pain perception and the amount and number of antiemetic drug administration to patients due to PONV.

Patients and methods

The study was designed as a two-armed, randomized, controlled trial and was conducted between November 2007 and January 2012 at the Department of Surgery, Kantonsspital Baselland, Liestal, Switzerland.

Protocol

The patient collective consisted of 136 patients (108 females, 28 men) undergoing thyroid or parathyroid surgery with the following exclusion criteria: age < 18 years; pregnancy; missing informed consent; history of severe and/or repeated PONV after previous surgeries, which led to change from standard anaesthetic protocol; and patients with severe life-threatening systemic complications in the past.

A power analysis indicated a total of $n = 132$ patients needed to be included in the study. This calculation based on α at 0.05 and β at 0.2 to detect a 25% reduction in the number of patients with PONV, comparing group A vs. group B.

Ethical approval

The study was approved by the ethical committee of Basel, Switzerland (unique reference number: 156/05), registered at ClinicalTrials.gov NCT01679418 and conducted in accordance with the declaration of Helsinki. Patients were enrolled after written informed consent.

Blinding

Blinding measures were applied only preoperatively for the patient, the involved doctors and data collector according to the recommendations of Probst et al. 2019 [29]. The randomisation envelope was only opened prior to skin closure. From this point onwards, due to the fact of easily visible drain or no drain placement, no further blinding of people was done.

Drainage tubes

The number of tubes was restricted to one per side, i.e. one drain for hemithyroidectomies, two drains for both-sided thyroidectomy. The negative suction of the drain (Redon Suction (Ref. 750 0 09), Charrière 9 (3.0 mm Ø), Medicoplast, Illingen, Germany) was controlled twice daily for proper function. The duration of drainage stay was depending on the daily fluid production rate. At rates of more than 20 ml per 24 h, the drain was left in place for another 24 h. However, the latest after 72 h, every drain was removed.

Randomisation of drainage groups

Randomisation was achieved with a computerized random number table with a repetition cycle of 5. The randomisation code was kept separate and was blinded to the patient and the investigators until the phase of resection, and the operation was finished. Before the wound was closed, the randomisation envelope was opened in the operation theatre and the patient was assigned to study group A (drain) or group B (no drain).

Preoperative assessment

Patients were evaluated preoperatively, and the surgical strategy was assessed based on clinical examination, patients' history and preoperative thyroid sonography to determine thyroid volume and morphology. Postoperatively, the amount of postoperative fluid was measured. Additionally, laboratory function tests including measurement of serum thyroxine, triiodothyroxine, thyrotropin, thyroid antibodies and calcium were conducted. Prior to surgery, every patient's vocal cord motility was tested by laryngoscopy to exclude pre-existing vocal cord dysfunction. Furthermore, the circumference of the patient's neck was measured preoperatively and before hospital discharge.

Perioperative medication, anaesthesia, postoperative vomiting and risk factors for PONV

General anaesthesia was performed with routine medications including midazolam 10 mg 60 min before surgery. Anaesthesia was induced with propofol bolus (1.2–1.5 mg/kg/BW) followed by sufentanyl (0.2–0.3 μg/kg/BW) and endotracheal intubation of the patient as well as propofol maintenance dose of 5–8 mg/kg/h during the operation. For muscle relaxation, the non-depolarizing atracurium (0.2–0.3 mg/kg/BW) was administered at a lower dosage (0.2–0.3 mg/kg/BW) compared with 0.3–0.6 mg/kg/BW in major visceral surgeries at our institution. No gas was used for general anaesthesia, due to a potential influence of volatile anaesthetics on PONV [21, 30].

Postoperative pain and nausea were assessed at 12, 24 and 48 h after surgery and determined using a standardized visual analogue scale (VAS) ranging from 0 (no pain) to 10 (worst pain imaginable). For further, more detailed analysis of the extent of vomiting, we divided the total number of vomiting episodes into three subgroups (zero episode of vomiting, one to three times of vomiting and more than three times of vomiting). Postoperative analgesia consisted of a baseline medication with oral acetaminophen (not more than 4 g/day). Additionally five patients in group A and six patients in group B received pethidine (1 mg/kg/BW s.c.) during intermittent pain exacerbation. Treatment of postoperative nausea was approached by tropisetron (1 mg/ml i.v. up to 5 mg a day), metoclopramide (5 mg/ml iv, up to 4 times a day) and/or haloperidol (2.5–5.0 mg p.o. per day). The administration of postoperative analgesia and antiemetic treatment was monitored and recorded closely.

Apart from female gender, we investigated the smoking status of patients that could influence PONV. In group A, we had 14 patients (3 men and 11 women) and in group B 13 patients (2 men and 11 women) that were exposed to smoking on a daily basis (p value not significant).

Surgical procedure

The surgical procedures consisted of hemithyroidectomy, total thyroidectomy or parathyroidectomy (removal of 1 to 4 parathyroid glands). Intraoperative neuromonitoring (monitoring of the recurrent laryngeal nerve (RLN)) was performed routinely. Surgical dissection of the thyroid gland was performed after identification and preservation of both RLN in total thyroidectomies and identification of the corresponding RLN during hemithyroidectomy. The tissues removed were weighed and sent to pathology.

Statistics

Data in this study are presented as mean ± standard error of the mean (SEM) or as median and range. Statistical analysis of data was performed using the GraphPad PRISM6 software (GraphPad Software Inc., La Jolla, CA, USA). Contingency table analyses were performed using the Fisher exact test or χ^2 test. For single comparison, the Mann-Whitney U test or Student's t test was used as well as 2-way ANOVA analysis for multiple comparisons. Values of $p < 0.05$ were considered statistically significant.

Results

Between November 2007 and January 2012, 136 patients (108 women and 28 men) were included for thyroid or parathyroid resection. The patients' characteristics and number of surgical interventions are listed in Table 1.

There were no significant differences between group A (drain) and group B (no drain) regarding postoperative pain, nausea and vomiting assessed by VAS (Table 2). Also, the subgroup analyses of postoperative pain and nausea after 12 h, 24 h and 48 h did not reveal differences in analysed VAS data concerning pain and nausea (Table 2). Postoperative vomiting was counted as total episodes in relation to the study group within 48 h (Table 2). Five patients in group A and six patients in group B received, each, once pethidine within the first 24 h. The total amount of pethidine was calculated in morphine equivalent, as defined as 1 mg morphine equals 10 mg pethidine. There was no statistical difference in the amount of morphine equivalent administered, and postoperative morphine administration and perioperative parameters are displayed in Table 3. Sonographically detected amount of fluid in study group A (drain) was significantly less as in group B ($p = 0.0009$) (Table 3). Neck circumferences of patients in both groups were comparable in the preoperative ($p = 0.86$) and postoperative course ($p = 0.25$) whereas the delta values showed significance ($p = 0.0025$) (Table 3).

Regarding the administration of antiemetic drugs postoperatively (Table 4), a trend towards a higher consumption in

Table 1 Patients' characteristics and surgical procedures

	Group A (drain) ($n = 69$)	Group B (no drain) ($n = 67$)	p values
Demographics			
Age (years)*	58 (19–82)	56 (24–83)	0.90[†]
Gender (male/female)**	11/58 (15.9%/84.1%)	17/50 (25.4%/74.6%)	0.21[¶]
Preoperative risk evaluation[◊]			
ASA score 1/2/3/4	8/57/4/0 12%/83%/6%/0%	15/46/6/0 22%/69%/9%/0%	0.16[§]
Surgery (n)			
Hemithyroidectomy	28 (40.6%)	24 (35.8%)	0.76[¶]
Total thyroidectomy	34 (49.3%)	33 (49.3%)	
Near total thyroidectomy	0	4 (6.0%)	
Hemithyroidectomy with parathyroid resection	1 (1.4%)	2 (3.0%)	
Total thyroidectomy with parathyroid resection	2 (2.9%)	0 (0%)	
Enucleation	3 (4.3%)	1 (1.5%)	
Isthmus resection	0 (0%)	2 (3.0%)	
Parathyroid resection alone	1 (1.4%)	1 (1.5%)	
Percentage of malign lesions	10/69 (14.5%)	6/67 (9%)	0.43[¶]

*Continuous variables are expressed as median (range). **Values are total number of patients (percentage). [◊] Total number of patients and percentage. [¶] p values of categorical variables calculated by Fisher's exact test, except [§] chi-quadrat test. [†] Unpaired t test was used to compare the variable of interest between the different groups. p value < 0.05 is considered statistically significant

group A (23 out of 69 patients (33.3%)) compared with group B (13 out of 67 patients, (19.4%)) was recorded, however, not matching the level of significance ($p = 0.081$). Also, subgroup analysis in splitting the particular drug use in one-time, two-time and three-time drug administration revealed a close level of significance (0.0554) when comparing group A and B (Table 4).

The mean units of drugs (Table 4) administered related to all patients in the group 2.65 units for group A vs. 1.7 units for group B showed no significant level (0.681) (Table 4).

In terms of postoperative complications, we had transient hypocalcaemia ($n = 4$, 2 men and 2 women) and transient palsy of recurrent laryngeal nerve ($n = 2$, 2 women). One acute

Table 2 Postoperative assessment of pain, nausea and vomiting (PONV)

	Group A (drain) ($n = 69$)	Group B (no drain) ($n = 67$)	p values
Postoperative pain VAS*			
At 12 h	3.3 ± 0.3	3.9 ± 0.4	0.25[§]
At 24 h	2.4 ± 0.2	2.4 ± 0.3	0.82[§]
At 48 h	1.3 ± 0.2	1.3 ± 0.2	0.41[§]
Postoperative nausea VAS*			
At 12 h	3.1 ± 0.4	2.1 ± 0.4	0.64[§]
At 24 h	0.8 ± 0.2	0.7 ± 0.2	0.23[§]
At 48 h	0.3 ± 0.2	0.4 ± 0.2	0.75[§]
Overall comparison of data			
Postoperative pain	2.4 ± 0.3	2.6 ± 0.2	0.62[§]
Postoperative nausea	1.4 ± 0.2	1.1 ± 0.2	0.57[§]
Postoperative vomiting**	0.3 ± 0.1	0.3 ± 0.1	1.00[¶]

*VAS value is expressed in units (range 1 to 10) and results as mean ± SEM. **Relative occurrence of postoperative vomiting episodes

[¶] p values of categorical variables calculated by Fisher's exact test, except [§] chi-quadrat test. p value < 0.05 is considered statistically significant

Table 3 Postoperative morphine administration and perioperative parameters

	Group A (drain) ($n = 69$)	Group B (no drain) ($n = 67$)	p values
Number of postoperative morphine administration*	5 (7.2%)	6 (9.0%)	0.76[¶]
Operating time (min)**	140 (40–320)	140 (60–340)	0.74[†]
Total specimen weight (g)**	35 (1–444)	34 (1–699)	0.95[†]
Perioperative measurements			
Preoperative neck circumference (cm)	37.0 (30.0–56.0)	38.0 (31.0–44.0)	0.86[§]
Postoperative neck circumference (cm)	37.0 (30.0–52.0)	38.0 (32.0–47.0)	0.25[§]
Difference in neck circumference (cm)***	0 (0 to 4) − 0.24 ± 0.04	− 1 (− 6 to 4) − 1.2 ± 0.21	0.0025[§#]
Total drainage fluid until removal (ml):			
Right side	30 (0–185)	–	–
Left side	30 (0–240)	–	–
Sonographically detected fluid			
No. of patients with seroma or haematoma	20 (29.0%)	32 (47.8%)	0.03[¶#]
ml fluid (mean ± SEM)	1.1 ± 0.2	4.3 ± 0.8	0.0009[†#]

*Values are total numbers of patients (percentage). **Continuous variables are expressed as median (range). ***Delta value is expressed as mean ± SEM. [¶] p values of categorical variables calculated by Fisher's exact test. [†] Mann-Whitney U test was used to compare the variable of interest between the different groups, except [§] unpaired t test. [#] Statistical significance between the groups was found. p value < 0.05 is considered statistically significant

postoperative bleeding in group A needed emergency surgery. Other complications included one contact dermatitis (group A) due to allergy to plaster and one urinary tract infection (group B). No wound infections occurred in our patients.

Discussion

The incidence of PONV is considered high after thyroid or parathyroid surgery; occurrence reaches up to 63% or even

Table 4 Antiemetic therapy

	Group A (drain) ($n = 69$)	Group B (no drain) ($n = 67$)	p values
Antiemetic drug usage			
Units administered per group	51	28	0.0638[¶]
Mean units of antiemetics administered per patient with PONV	2.2 ± 0.2*	2.2 ± 0.4*	0.6665[†]
Mean units of drug administration related to all patients in the group	2.65 (100%)	1.70 (100%)	0.6807[¶]
Particular drug use (total no. of patient)	23 (33.3%)	13 (19.4%)	0.0810[¶]
One-time drug administration	9	9	
Two-time drug administration	14	3	0.0554[◊]
Three-time drug administration	0	1	
Total units (mean) between groups			0.6850[◊]
Metoclopramide	1.3 (32%)	1.4 (29%)	
Tropisetron	1.3 (32%)	1.4 (29%)	
Haloperidol	1.5 (36%)	2.0 (42%)	
Times of drug[§] administration to patients (n)	37 (53.6%)	18 (26.9%)	0.0993[◊]
Metoclopramide	10 (27%)	5 (28%)	
Tropisetron	14 (38%)	9 (50%)	
Haloperidol	13 (35%)	4 (22%)	

*Delta value is expressed as mean ± SEM. [¶] p values of categorical variables calculated by Fisher's exact test, except [◊] calculated by ^{2} -test. [†] Mann-Whitney U test was used to compare the variable of interest in between the different groups. p value < 0.05 is considered statistically significant

[§] Basic information about used drugs: metoclopramide is a dopamine antagonist and acts as a prokinetic agent with antiemetic properties

Tropisetron is a serotonin 5-HT_3 receptor antagonist and α_7-nicotinic receptor agonist

Haloperidol is a typical antipsychotic medication but also used to treat PONV

84% [31, 32]. Prolonged hospital stay, triggered postoperative pain and increased need for antiemetic therapy are described to be the most common ancillary effects of PONV [33, 34].

The impact of postoperative drainage placement in influencing PONV remains still unknown. The placement of drains is performed routinely because of concerns regarding seroma or haematoma formation and its related morbidity such as airway obstruction. In contrast, no drainage [33–37] or selective drainage [38, 39] is recommended by many surgeons because of the possible negative side effects of drains. In 2018, Li et al. [40] published a systematic review and meta-analysis (13 studies were analysed) to the efficacy and safety of negative pressure vs. natural drainage after thyroid surgery. They found that the difference between negative and natural pressure drainage remains uncertain, due to sparse data on that particular subject and risk of bias for the studies.

Vagal stimulation during surgical manipulation of the neck and other implications from the area postrema are not considered to induce PONV [41]. Direct stimulation of the vagal nerve is regularly used to ensure the integrity of the RLN. In our series, the detection and direct stimulation of the RLN is a standard procedure in all patients, whereas the direct stimulation of the vagal nerve is not a routine. The occurrence of PONV in our series is comparable to the literature [23, 31], even though we routinely stimulate the RLN directly.

Our results indicate that the mechanical irritation of the postoperatively inserted drainage is not a leading factor for postoperative pain, nausea or vomiting. In contrast to our results, other studies reported an increased need for analgetic drugs on the day of surgery and postoperative day one after drain insertion following thyroid surgery [33, 39]. Mechanical irritation might be of less significance compared with other factors like the biochemical release of transmitters and potentially also chemokines that influence PONV on a neurochemical basis. Therefore, intraoperative administered analgetics are leading factors in reducing postoperative pain and PONV [31, 32, 42]. Nevertheless, opioids can increase PONV, and additional sedation, dizziness or urinary retention. Opioids are not considered first-line treatment of pain after thyroid surgery, and only 11 patients received once opioids (pethidine) within 24 h in our study with exacerbated pain episodes postoperatively (five patients in group A vs. six patients in group B). As previously shown, the use of NSAIDs as first-line pain treatment may contribute to less PONV and also to a decrease in postoperative dizziness [42]. In our study, patients received acetaminophen as basic pain management.

In an additional step, we tested the amount and need for postoperatively administered antiemetic drugs. Three common regimens were used for antiemetic therapy: first metoclopramide, second tropisetron and third haloperidol. Interestingly, patients in group A (drain) ordered more frequently and more often repeatedly antiemetic drugs than patients in group B (no drains), but the level of statistical significance could not be reached. Taking these nevertheless weak and non-statistically significant findings into account, it shows that, even though vomiting might be differently sensed by individual patients, the need for antiemetic drugs might be higher ($p = 0.081$) in patients that receive drains after thyroid and parathyroid surgery. On one hand, it might be the mechanical irritation and bulkiness of the tubes themselves, or biochemical responses related to irritation of the vagal nerve come into play. However, the VAS score is still similar in both groups concerning nausea, it shows that a rudimentary score, as the VAS measured in units (from 1 to 10), might not be ideally suitable to measure the fragile senses of postoperative nausea in postsurgical patients.

Vomiting was not a concern in our patients postoperatively. In terms of frequency, total occurrence and timely distribution of vomiting in group A and B were not different in our collective.

Although drains cannot prevent bleeding, they are thought to play a role as a sentinel to early detect severe bleeding. Further, it was always postulated that postoperative drainage after surgery would be necessary due to the presence of dead spaces [43]. No significant decrease in fluid collection in surgical bed was detected when pressure dressings were used combined with suction drains [44]. In further prospective randomized studies, no significant difference in fluid amounts detected by ultrasonography between drain and no drain insertion was detected [38, 45]. In contrast, our study results indicate a higher amount of collected fluid in the surgical bed in group B (no drain) ($p = 0.0009$). Interestingly, it underlines the fact that smaller amounts of fluid accumulation (situation in group B) may not be of significant pressure momentum to influence the origin of PONV.

For drains, a possible advantage is under debate. Possibly, that negative pressure created by the drain will seal off the lymphatics [46]. Consequently, the risk of seroma formation might be triggered by placement of drains. Furthermore, the duration till retaining the drain is an important parameter. Hence, newer studies demonstrated that monitoring of drainage rate in 8-hourly intervals and removal criteria of ≤ 1 ml/h have contributed to earlier discharge of patients [35]. Thus, Amir et al. [35] postulated that the widely accepted criterion for drain removal (≤ 25 ml over a 24-h period) is not sensible enough to reflect the development of drainage rate during the first postoperative hours. Williams et al. [47] indicated that collected fluid amount in the drain reservoir during the first 24 h is at its maximum and declines afterwards. Generally, drain output is detected on morning after surgery and often drain is left for another 24 h. Thus, discharge of patients is delayed. In studies, it was noticed that the length of hospital stay of patients with drainage is increased [33, 37, 38, 45].

Transient hypocalcaemia does not seem to be influenced by the placement of postoperative drains after thyroid or parathyroid surgery. In our series, only four patients suffered from

transient hypocalcaemia. In the literature, we could not find evidence that hypocalcaemia is related to PONV.

PONV however are related to the type of anaesthesia. Specht et al. [48] reported a trend towards a decreased rate of PONV in patients with local anaesthesia for thyroid surgery. Propofol is regularly used in place of volatile anaesthetics that are known to be emetogenic. Matsuura et al. [21] demonstrated that propofol could decrease the incidence of PONV compared with sevoflurane. Propofol presumably depresses the chemoreceptor trigger zone and central areas which are involved in development of nausea [32]. In comparison with inhalational anaesthetics, the use of propofol has been demonstrated to reduce PONV [32]. However, propofol is only reducing the risk of PONV by about 20% [49]. An option in the first-line treatment of PONV are 5-HT3-receptor antagonists, e.g. odansetron [50]. Further antiemetics such as metoclopramide are used. Extrapyramidal symptoms can occur by dopaminergic acting agents. Adverse effects such as excessive sedation and hallucinations are more common for D2 receptor antagonists such as haloperidol [51]. None of these side effects was monitored in our patients' collective.

The potency of serotonin receptor antagonists is much more pronounced than traditional antiemetic drugs. The combination of above mentioned drugs or with dexamethasone is highly effective [31]. We demonstrated that patients with drains ordered more antiemetic drugs than patients without drainage.

Also, the single-dose administration of dexamethasone given preoperatively was reported to reduce the incidence and severity of nausea and the need for antiemetic therapy after thyroid surgery [52–54]. The exact mechanism is unknown; but inhibition of central synthesis of prostaglandin and reduction of inflammation in the neck area seem to be crucial. In our series, we did not apply dexamethason. Lee et al. [55] demonstrated that the combination ramosetron and dexamethasone significantly reduced not only the incidence of nausea and need for antiemetics but amongst others also reduced the VRS one hour pain value. Furthermore, Zhang et al. [56] reported that one perioperative small dose of dexamethasone reduced wound drainage volume and inflammatory content after thyroid surgery.

Further Asian studies corroborated these findings, and a prophylactic steroid effect on PONV was postulated [57–59]. Worni et al. [53] focussed on both sexes, knowing that gender is an important risk factor for PONV.

The present clinical trial demonstrates no distinct advantage for or against routine use of drainage in thyroid surgery in relation to influence PONV. Limitations of the trial might be that VAS assessment of pain and PONV is not a sensitive-enough tool for detection of these parameters because of the conscious perception of patients. Furthermore, the close to significance ranging results of antiemetic drug usage demonstrate that the total number of patients in our study might not be sufficient to filter significant differences, but in terms of clinical significance, we have seen a tremendous difference. Many patients were affected by PONV, more as they were suffering from pain. That is in accordance with what has been stated earlier: PONV is in many patients of more fear than pain [19].

Conclusion

We conclude that the placement of drains after thyroid and parathyroid surgery does not influence the occurrence of PONV in general. A (non-significant) trend however was noted for a higher demand for antiemetic drugs by patients with placement of drains. How the connection of this circumstance can be explained remains unsolved. Nevertheless, recommendation of postoperative drain placement in thyroid and parathyroid surgery as a standard application is not deemed medically sensible.

Authors' contributions BMK participated in the study concept and design, analysis and interpretation of data, and drafting manuscript. JW, CB, and TB participated in the acquisition of data and analysis and interpretation of data. MW and CK participated in the critical revision of the manuscript. AZ participated in the critical revision of manuscript and statistics. CAM participated in the study conception and design, and critical revision of the manuscript.

Compliance with ethical standards

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

Conflict of interest The authors declare that they have no conflict of interest.

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