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Association of suction drain tips culture with postoperative infection in benign thyroid surgeries

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Abstract

Introduction: Wound infection is a rare complication after thyroid surgery. Because of controversy concerning with routine use of the drain by surgeons and its being considered a foreign body material, we aimed to evaluate the clinical significance and relevance of the drain tip culture and wound infection. Materials and methods: From March 2014 to March 2015, 150 consecutive patients undergoing thyroid surgery were studied. Wound infection was defined as occurring within the first 14 days from surgery. While we were suspicious to wound infection, sterile wound sampling was performed and sent to microbiology laboratory. Results: Postoperative infection developed in 4 patients (2.6%) during 2 weeks follow up. The sensitivity and specificity of the drain tip culture were 15% and 82%, respectively with a positive predictive value of 7.6%. Prolonged operative time was an independent risk factor for wound infection. There was no significant relationship between drain tip culture and wound infection. Conclusion: Routine use of the surgical drain can increase the incidence of the wound infection. However, the drain tip culture was not a predictor for wound complications after thyroid surgeries.

Key Words: Thyroid; Wound infection; Drain; Culture;

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Introduction

History of thyroid surgery was first introduced in the 1800s, with poor experience reporting mortality rate up to 40% (1). During twentieth century, due to improved surgical and homeostatic techniques, thyroidectomy became safe and acceptable operation and further studies have been reported to reduce surgery-related mortality (1, 2). There are four major complications associated thyroid surgeries including recurrent laryngeal nerve injury, hypoparathyroidism, neck hematoma, and wound complications (3-5). Complication rates depend on surgeon's experience, thyroid pathology, patient-related factors, and extent of the surgery (2, 6-8). The overall incidence of complications is low (approximately 4-4.5%) (1, 9, 10). Although, neck hematoma in thyroid surgery has been reported to be <1% in experienced hands, it's potentially life-threatening feature has motivated surgeons to use neck drain in order to avoid this dreadful complication (1, 5). Some studies have demonstrated no obvious advantages of using drains after thyroid operation (11, 12, 14). However, most surgeons prefer to use drain sand it seems to depend mostly on surgical school of training and their habit (5,13,1,12).

Drains, as foreign body materials, have been suggested to increase the risk of surgical site infection (SSI) (15, 16). Although incidence of SSI in thyroidectomy is quite low (0.5% to 3%), it's serious consequences lead to higher admission costs, prolonged hospital stay, cosmetic problems and increased mortality (17). Previous studies (have) reported some specific patient and operation related factors such as, obesity, diabetes mellitus, operation type and operation duration, to increase the risk of wound infection (17). Being concerned about wound hematoma and seroma, some surgeons still routinely use drains in thyroid surgery. The aim of the current study was to investigate the association of SSI in thyroid surgeries with the use of drains and patient-related and intraoperative factors.

Materials and Methods

Study population

From March 2014 to March 2015, a prospective multi-central study was carried out in thoracic surgery wards of Imam Reza and Taleghani hospitals, Tabriz, Iran. During this period, 243 patients underwent thyroid surgery including total thyroidectomy, near total thyroidectomy, subtotal thyroidectomy and lobectomy. Our exclusion criteria were as follows: (a) recent thyroid surgery; (b) history of SSIs; (c) cutaneous fistulae at the surgical site; and (e) history of any infection in last 6 months. Among 243 patients, 93 patients were excluded and 150 patients with multinodular goiter or retrosternal goiter were eligible to be enroll in our study. Written informed consent were given to all patients which participated in the study. Demographic data including age, sex, body mass index (BMI) and following parameters were recorded for all patients: patient-related risk factors, history of tobacco use within past years and preoperative complications, length of hospital admission, thyroid hormonal status and final histology.

Procedure

All operations were performed by a single surgeon. Patients underwent general anesthesia with endotracheal intubation and in supine position with their necks extended. Thyroid surgery is considered a clean wound therefore there is no need to administer prophylactic antibiotic. Povidone-iodine was used in all patients to swab the operative field.

Thyroid surgery was performed using a 3-4 cm collar incision immediately 1 cm below cricothyroid cartilage. Platysma muscle was cut and subsequently superior and inferior subplatysmal flaps were raised up to the

Variable		No.	Wound infection (No.)	P-value
Age	< 50	89	1	
	≥ 50	61	3	0.001
Sex	Male	14	2	0.685
	Female	136	11	
Smoking History	(+)	5	1	0.567
	(-)	145	12	
Diabetes Mellitus	(+)	3	1	0.615
	(-)	147	12	
Obesity	BMI ≤ 25Kg/m^2	84	8	0.315
	BMI > 25 Kg/m^2	66	5	
Surgical Procedure	Total thyroidectomy	126	8	0.090
	Subtotal thyroidectomy	24	5	
Intraoperative Blood loss (mL)	<80	150	13	
	>80	0	0	
Operation Time (min)	<97	114	4	0.001
	>97	36	9	
Histopathological results	multinodular goiter	83	8	0.073
	toxic adenomatoid goiter	34	3	
	Retrosternal goiter	33	4	
Drain tip Culture	(+)	26	2	0.078
	(-)	124	11	

Table 1: Analysis of relationship between preoperative and postoperative risk factors and postoperative wound infection

superior border of thyroid cartilage and sternal notch, respectively. In order to provide enough exposure of thyroid gland, especially in large goiters, strap muscles were divided by monopolar cutter in midline. Then, superior thyroid pedicle was individually divided and ligated. Recurrent laryngeal nerve (RLN) and parathyroid glands were identified separately in each side and preserved if possible. Subsequently, inferior thyroid pedicle was ligated. Inadvertently removed parathyroid glands or glands with disrupted blood flow were immediately autotransplanted in ipsilateral sternocleidomastoid (SCM) muscle. Finally, Hemovac drain was used to provide neck drainage and fixation was performed by 0-2 silk sutures. Vocal cords were checked immediately after extubation in all patients.

All patients received routine postoperative care and no special monitoring was required. Patients' drains were removed if drainage was <10cc during an 8- hour nursing shift or <30cc in a 24-hour record. The removal was performed under sterile conditions as follows:

Variable		Univariate P-value	Multivariate P-value
Age	< 50	0.0001	0.0001
	≥ 50		
Sex	Male	0.685	0.226
	Female		
Diabetes mellitus	+	0.615	0.168
	-		
BMI	≤ 25Kg/m^2	0.315	0.264
	> 25Kg/m^2		
Smoking	+	0.567	0.451
	-		
Operation time	≤ 97	0.001	0.038
	> 97		
Drain tip culture	+	0.078	0.092
	-		
Surgery procedure	Total thyroidectomy	0.090	0.071
	Subtotal thyroidectomy		

Table 2: Univariate and multivariate analysis of relationship between risk factors and wound infection

patient was laid supine and drain scrubbed in a 5-cm circle from wound area using povidone-iodine solution. Surgeon donned sterile gloves subsequently and cut the sutures with autoclaved instruments. Finally, the proximal side of the drain was removed from the neck. The drain tip was sterilely cut and sent for further microbiology laboratory examination. The drains' tips were rinsed by normal saline and resultant solution was cultured and results recorded.

When we were suspicious for wound infection during 2 weeks after surgery, sterile wound sampling was performed immediately and sample was sent to microbiology laboratory. Wound drainage and antibiotic therapy were started if it was needed.

Definitions

Wound infection was defined as infection occurring during14 days after the surgery and having any of the following features: Cellulitis, superficial abscess, and purulent drainage. Further investigation was done when there was signs or symptoms such as pain, tenderness, redness or heat.

Statistical Analysis

All data were analyzed using SPSS version 18. Software (SPSS Inc., Chicago, IL). In order to express quantitative values, we used mean ± SD. Comparison between groups was performed using student t-test and x2 test for paired data and logistic regression analysis and results with p <0.05 were considered as statistically significant.

Results

	Organism	
Patients	**Drain tip culture**	**Wound exudate culture after infection**
1	*Staphylococcus epidermis*	*Staphylococcus epidermis*
2	*Staphylococcus epidermis*	*Staphylococcus epidermis*
3	*Staphylococcus aureus*	No significant organism isolated
4	*Staphylococcus epidermis*	No significant organism isolated

Table 3: Relationship between organisms isolated from drain tip culture and from postoperative wound exudate culture in patients with wound infection

Of 150 consecutive patients, 136 were female (90.7%), and 14 patients (9.3%) were male. Mean age of the patients was 42 years old (mean ± SD, 42±13), ranging from 20 to 83 years. Three patients (2%) had coexisting diabetes mellitus, and 5 patients (3.3%) had positive smoking history. The average BMI of the patients was 23.8 Kg/m2, exceeding 25 Kg/m2in 71 patients (47.3%). Total thyroidectomy was the most frequent procedure which was done in 126 patients (84%) while 24 patients (16%) underwent subtotal thyroidectomy.

The average duration of operation was 121± 57 minutes, ranging from 35 minutes to 180 minutes. The amount of blood loss during surgery was 33 mL ranging from 10 mL to 75 mL; it exceeded 80 mL in none of the patients. The hospital stay was 2 ± 1 days, ranging from 1 day to 5 days.

Histopathological results showed that the most frequent pathology was multinodular goiter in 83 patients (55.3%), followed by toxic adenomatoid goiter in 34 patients (22.6%), and retrosternal goiter in 33 patients (22%). There was no significant relationship between the pathology results and wound infection (p = 0.073)

Univariate analysis was performed in order to identify the relationship between preoperative factors age, DM, smoking history and BMI and wound infection. None of these variables were significantly associated with wound complications and drain tip culture results (Table1). Additionally, among intraoperative factors such as blood loss amount and operation duration, operation time less than 97 minutes was significantly associated with negative drain tip culture and absence of wound infection in patients (p = 0.001). Multivariate analysis showed that, among preoperative and intraoperative factors, operation time and age more than 50 years were significantly associated with wound infection (Table. 2).Surgical site infection developed in 4 patients (2.6%) during 2 weeks follow up after operation. All patients were presented with local cervical erythema and discharge were received respective treatments and interventions. Of 4 patients, 3 patients (2%) had negative drain tip culture, and only 1 patient (0.6%) had positive drain tip culture. The drain tip culture demonstrated a sensitivity of 15% and a specificity of 82%, with a positive predictive value of 7.6%, and a negative predictive value of 91.12%. Analysis using chi-square test revealed that there was no significant relationship between drain tip culture and wound infection in thyroid surgeries. However by considering patients over 50 years old, 3 patients had positive drain tip culture and presented with subsequent wound infection. Our analysis showed that positive drain tip culture would significantly predict the wound complications in patients older than 50 years (p = 0.01).

Of 26 positive drain tip cultures, Staphylococcus epidermidis was the most prevalent isolated bacteria from 7 cultures (26.9%). However, the organisms isolated from wound exudate were similar to the organisms isolated from wound in 2 patients with positive drain tip cultures, which was not statistically significant (p = 0.486) (Table. 3).

Discussion

Thyroid surgery has evolved into a safe and routine procedure due to significant reduction in postoperative complications, but even recent advances might still not be capable of eradicating them. Some major complications of thyroid surgery including, recurrent laryngeal nerve injury, hypocalcaemia, hematoma, and wound infections are still fearful for surgeons (3, 4). Some surgeons still prefer the routine use of the surgical drains to reduce the risk, despite the studies that do not suggest any protective benefit for it (18, 19). In addition, the routine use of surgical drain has been suggested to be in association with prolonged admission, cosmetic discomforts and increased risk of surgical site infection (11, 13). Nonetheless, although postoperative complications incidence is quite low, the consequences can be expensive and life-threatening for victims (20). In current prospective study, according to its low positive predictive value (PPV), we demonstrated that a positive drain tip culture was not a strong predictive factor for postoperative infections. According to the literature, our study is the first to investigate the relationship of the drain tip culture to postoperative infection.

Elfenbin et al. suggested that, risk factors for postoperative infection in other procedures may not be applicable for patients undergoing thyroid surgeries (17). However, obesity, prolonged operative duration, and operations including neck dissection are the most frequent suggested risk factors for postoperative infection in thyroid surgeries (17, 21, 22). We investigated the relationship between the mentioned risk factors and postoperative infection after thyroidectomy. Additionally, sex, tobacco usage, diabetes mellitus, body mass index, blood loss volume, hospital stay length, operation type and drain tip culture were also studied. We divided the risk factors into two subgroups of preoperative risk factors that cannot be altered e.g. tobacco usage and intraoperative and postoperative risk factors that can be altered e.g. operation time. During univariate and multivariate analysis, age more than 50 was the only preoperative risk factor, which was significantly associated with wound infection incidence.

Our study demonstrated that prolonged operation time is the only independent intraoperative risk factor for postoperative infection in thyroid surgery same as the other operations. Our results wereconsistent with the previous reports (17,23). Therefore, operating time reduction seems to be helpful in preventing surgical site infection. We found an incidence rate of 2.6% for postoperative infection in thyroid surgeries that is similar to previous studies (10, 21, 24). In addition, our analysis revealed that drain tip culture was not a predictive factor for postoperative infection, considering its low odds ratio (OR). However, Yamauchi et al. showed that chest tube tip culture is strongly associated with postoperative infections in lung cancer patients. On the other hand, the drain tip culture sensitivity and PPV was too low to be considered as a risk factor. To our knowledge, it was the first study comparing the organisms of the drain tip culture with the wound culture in thyroid surgery. The most frequent organism cultured from drain tip was coagulase negative Staphylococcus. However, in previous studies the same organism was found to be the most common bacterium responsible for postoperative infections (25,27). It has been suggested that contamination in the surgical

field is a strong predictor of postoperative infection (27, 28, 29). We think that similar mechanisms including contamination of surgical field and routine use of the surgical drain may be the underlying reason of the higher incidence of postoperative infections in our population.

Elfenbin et al. suggested that bleeding may be in association with higher incidence of SSI(17). We investigated that there was not significant statistical association between postoperative infection and operative blood loss. Additionally we were not able to evaluate the bleeding complications in patients with postoperative infection because none of the patients had postoperative bleeding or hematoma.

The present study had some limitations. First, since it was a prospective study, we were not able to study a large population. Second, in order to reduce biases due to different types of surgeries including neck dissection or other pathologies such as thyroid cancers, in this study we evaluated only the patients with goiter diagnosis that were eligible for thyroid surgeries. In future studies, patients underlying disease including cancer type or other involvements can be discussed as factors associated with postoperative wound complications.

Conclusion

Prolonged operative time is an independent risk factor of postoperative infection in thyroid surgeries. Although drain tip culture is not a predictor for postoperative infection in thyroid surgeries, coexisting of age 50 years or older and positive drain tip culture could be associated with wound infection.

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