

Original Article

Risk factors of drainage hole adhesion in patients with thyroidectomy

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Abstract: Objective: Drainage is routinely performed after thyroidectomy. Drainage hole adhesion (DHA) seriously affects the quality of life of patients following thyroidectomy. Our aim was to investigate the factors influencing DHA. Methods: A total of 323 patients who underwent thyroidectomy with postoperative drainage under the same surgical team between January 2007 and October 2011 were enrolled in our study. Multivariate logistic regression was performed to assess the independent associations between DHA and the risk factors that are found to be statistically significant via univariate analysis. Results: Among the 323 patients, 42 were males and 281 were females with a median age of 49 years (range: 17-76 years). The overall DHA incidence rate was 24.5% (79/323), in which mild, moderate, and severe adhesions accounted for 41.8% (33/79), 54.4% (43/79), and 3.8% (3/79), respectively, of the total cases. Drainage material, placement, and quantity, as well as operation extent, were significantly related to DHA ($P < 0.05$). Multivariate analysis results showed a significant association between drainage material, drainage volume and DHA. Conclusions: DHA after thyroidectomy is related to several factors, of which the independent risk factor is the drainage material.

Keywords: Thyroid cancer, thyroidectomy, drainage hole adhesion, risk factor

Introduction

With the improvement in medical technology, patients and doctors are now paying attention to the appearance of thyroidectomy incisions, which are located at the exposed region of the neck [1]. Cosmetic scars are meaningful in patient satisfaction. In the outpatient clinic, the scars of some patients after thyroidectomy are unapparent. However, symptoms such as skin depression, stretching, and distortion, which are observed in the drainage hole position during swallowing and phonation, can cause a negative impact on aesthetic appearance and even trigger swallowing dysfunction. The present study retrospectively reviewed 323 patients who underwent thyroidectomy with postoperative drainage under the same operation team in our department from January 2007 to October 2011. Drainage hole adhesion (DHA) was defined that patients felt unwell of anterior cervical region or dysphagic subjectively and

doctors observed the stretching distance of depressed drainage hole during swallowing based on the drainage hole at rest serving as the baseline. The possible risk factors associated with DHA after thyroidectomy were analyzed to guide the clinical treatment, reduce DHA incidence, and improve the postoperative aesthetic effect on the neck and cosmetic appearance of the scar.

Materials and methods

General information

A total of 4029 patients who underwent thyroidectomy with postoperative drainage under the same senior surgical team in our department from January 2007 to October 2011 were assessed for eligibility. Six hundred patients were randomly selected using a computer based on the admission number. Finally, 323 cases with complete follow-up results were

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Table 1. The results of univariate analysis affecting the drainage hole adhesion after thyroidectomy

Factors	Number of observed patients	Degree of adhesion			Number of adhesion patients (%)	p-value
		Mild (%)	Moderate (%)	Severe (%)		
Age (years)						
<60	284	31 (10.9)	42 (14.8)	1 (0.4)	74 (26.1)	0.071
≥60	39	2 (5.1)	1 (2.6)	2 (5.1)	5 (12.8)	
Gender						
Male	42	1 (2.4)	7 (16.7)	0 (0)	8 (19.0)	0.382
Female	281	32 (11.4)	36 (12.8)	3 (1.1)	71 (25.3)	
Material of the drainage						
Rubber drainage strip	234	25 (10.7)	21 (9.0)	2 (0.9)	48 (20.5)	0.000
Sputum-aspirating tube	49	3 (6.1)	5 (10.2)	0 (0)	8 (16.3)	
T tube	25	4 (16.0)	16 (64.0)	1 (4)	21 (84.0)	
Scalp needle	15	1 (6.7)	1 (6.7)	0 (0)	2 (13.3)	
Drain placement						
Median neck in the incision	230	25 (10.9)	21 (9.1)	2 (0.9)	48 (20.9)	0.001
Laterocervical in the incision	42	3 (7.1)	5 (11.9)	0 (0)	8 (19.0)	
Suprasternal fossa	51	5 (9.8)	17 (33.3)	1 (2.0)	23 (45.1)	
Operation extent						
Unilateral thyroid	174	15 (8.6)	16 (9.2)	1 (0.6)	32 (18.4)	0.022
Bilateral thyroid	112	16 (14.3)	18 (16.1)	2 (1.8)	36 (32.1)	
Containing thyroid isthmus	37	2 (5.4)	9 (24.3)	0 (0)	11 (29.7)	
Classification of diseases						
Unilateral benign	124	14 (11.3)	15 (12.1)	0 (0)	29 (23.4)	0.102
Unilateral malignant	85	10 (11.8)	15 (17.6)	2 (2.4)	27 (31.8)	
Bilateral benign	91	7 (7.7)	6 (6.6)	1 (1.1)	14 (15.4)	
Bilateral malignant	23	2 (8.7)	7 (30.4)	0 (0)	9 (39.1)	
Length of incision (cm)						
≤8	193	25 (13.0)	22 (11.4)	1 (0.5)	48 (24.9)	0.687
8-10	84	6 (7.1)	14 (16.7)	2 (2.4)	22 (26.2)	
>10	46	2 (4.3)	7 (15.2)	0 (0)	9 (19.6)	
Drain time (hours)						
<48	225	28 (12.4)	24 (10.7)	2 (0.9)	54 (24.0)	0.772
≥48	98	5 (5.1)	19 (19.4)	1 (1.0)	25 (25.5)	
Drainage volume (ml)						
≤40	210	17 (8.1)	23 (11.0)	2 (1)	42 (20.0)	0.011
>40	113	16 (14.2)	20 (17.7)	1 (0.9)	37 (32.7)	
Closure of skin incision methods						
Interrupted	220	27 (12.3)	27 (12.3)	2 (0.9)	56 (25.5)	0.543
Continuous	103	6 (5.8)	16 (15.5)	1 (1.0)	23 (22.3)	
Suture size						
5/0	225	28 (12.4)	27 (12.0)	2 (0.9)	57 (25.3)	0.579
4/0	98	5 (5.1)	16 (16.3)	1 (1.0)	22 (22.4)	

included. The follow-up duration was ≤6 months in 92 patients, 6-12 months in 121 patients, and >12 months in 110 patients. Among the 323 patients, 42 were males and 281 were females with a median age of 49 years (range: 17-76 years). The pathological examination revealed 166 nodular goiters, 30 adenomas, 108 differentiated thyroid cancers, and 19

other diseases. Forty-four (41%) microcarcinomas were observed among the 108 cases of confirmed differentiated thyroid cancers, which is higher compared with those of the previous literature [2-4]. The inclusion standards were patients (1) with incision healing by first intention, (2) with drainage after operation, and (3) without anterior cervical muscle group tran-

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section. The exclusion criteria include patients (1) who underwent L-shaped incision neck dissection surgery, (2) who had blood-clotting disorders, (3) who had accompanied chronic diseases (e.g., diabetes mellitus or hypertension), (4) who had adhesion on the whole incision, (5) who had postoperative infection or fever, (6) who had postoperative hematoma or bleeding, and (7) with a history of previous neck surgery or personal or family history of scar diathesis or hypertrophic scar formation.

The research protocol used in this study was approved by the Ethics Committee of the First Affiliated Hospital of Wenzhou Medical University, and informed consent was obtained from each patient.

Postoperative follow-up

All 323 patients were followed up through outpatient clinic. The DHA criteria are composed of subjective and objective specifications as well as the degree of adhesion. (1) The subjective criteria are as follows: 1 point when no discomfort is felt on the anterior cervical region, 2 points when discomfort is felt on the anterior cervical region, 3 points when dysphagia is present. (2) For the objective criteria, the doctors observed and measured the drainage hole condition (the stretching distance of drainage hole was measured during swallowing, with the drainage hole at rest serving as the baseline), and the following point systems are assigned: 1 point for drainage openings without depression, 2 points for depressed drainage holes, 3 points for depressed drainage holes with stretching distance >0.5 cm, and 4 points for depressed drainage holes with stretching distance >1 cm. (3) The DHA degree was judged based on the total subjective and objective criteria score: 2 points as normal, 3 points as mild, 4-5 points as moderate, and ≥ 6 points as severe adhesion.

Statistical analysis

Data on normal distribution were expressed as mean \pm standard deviation (SD) and compared with those of the t-test. Categorical variables were expressed as percentage and compared with those of the chi-square or Fisher's exact test, as appropriate. Univariate analysis of individual factor affecting DHA was conducted using standard χ^2 test or Fisher's exact test.

Multivariate logistic regression was performed to assess independent associations between DHA and the risk factors found to be statistically significant through univariate analysis. All p -values were two sided, and a p -value of <0.05 was considered statistically significant. Statistical analysis was performed with SPSS software version 18.0 (SPSS, Chicago, IL, USA).

Results

Characteristics of included patients

Among the 323 consecutive patients, DHA was observed in 79 (24.5%) patients. Of those, 41.8% (33/79), 54.4% (43/79), and 3.8% (3/79) have mild, moderate, and severe adhesions, respectively.

Univariate analysis

Table 1 presents the univariate analysis results. The drainage material ($P < 0.001$), placement ($P = 0.001$), and volume ($P = 0.011$) as well as operation extent ($P = 0.022$) were significantly related to DHA.

Multivariate logistic regression

All the above risk factors found to be statistically significant through univariate analysis were analyzed to assess independent associations with DHA using multivariate logistic regression. The association of DHA with operation extent and drainage material was highly significant. The drainage material is a highly influential factor in DHA ($P < 0.001$). Further analysis revealed that drainage material (odds ratio (OR) = 2.309, 95% CI, 1.524-3.499, $P < 0.001$) and drainage volume (OR = 1.908, 95% CI, 1.028-3.543, $P = 0.041$) were the independent high-risk factors for DHA after thyroidectomy (**Table 3**).

Comparison between "T" tube and sputum-aspirating tube

Considering that all "T" tubes in our study were drawn out from the suprasternal fossa, we only selected 26 patients whose drainage tubes exited in the same site as those in the sputum-aspirating tube group for analysis to exclude the interference of different drainage placements. **Table 2** shows the clinical data of the two groups. No significant differences were observed in the disease classification, opera-

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Table 2. The clinical data of “T” tube group and sputum-aspirating tube group

Group	Classification of diseases			Types of operation				Drain time (day)		Amount of drainage (ml)	
	Nodular goiter (%)	Thyroid carcinoma (%)	Others (%)	LE (%)	TT (%)	BST (%)	Dunhill procedure (%)	2-3 (%)	4-6 (%)	≤50 (%)	>50 (%)
Sputum-aspirating tube	7 (26.9)	16 (61.5)	3 (11.5)	11 (42.3)	5 (19.2)	3 (11.5)	7 (26.9)	9 (34.6)	17 (65.4)	5 (19.2)	21 (80.8)
T tube	8 (32.0)	14 (56.0)	3 (12.0)	4 (16.0)	7 (28.0)	6 (24.0)	8 (32.0)	7 (28.0)	18 (72.0)	3 (12.0)	22 (88.0)
<i>p</i> -value		0.914				0.199			0.611		0.708

LE: lobectomy, TT: total thyroidectomy, BST: bilateral subtotal thyroidectomy, Dunhill procedure: total LE plus contralateral subtotal LE.

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Table 3. The results of multivariate logistic regression analysis affecting the drainage hole adhesion after thyroidectomy

Characteristics	OR	95% CI	P-value
Drain placement	1.218	0.664-2.235	0.525
Drainage material	2.309	1.524-3.499	<0.001
Operation extent	1.503	0.979-2.309	0.063
Drainage volume	1.908	1.028-3.543	0.041

tion method, drainage tube standing time, and drainage amount ($P>0.05$) between the “T” tube and sputum-aspirating tube groups. However, the adhesion rate between the “T” tube and sputum-aspirating tube groups was significantly different ($P<0.01$), with adhesion rates of 84.0% and 16.3%, respectively.

Discussion and conclusions

Thyroid disease and surgery incidence rates have increased over time. Surgical scars have always been a source of worry for patients, especially in the visible region of the neck [5]. The aesthetic appearance of the neck after thyroidectomy is the patients’ greatest concern, primarily in young females [6]. Endoscopic thyroidectomy is a new operation method that has been increasingly used in recent years to achieve a maximum postoperative aesthetic effect on the neck. However, at present, endoscopic thyroidectomy still cannot take the place of traditional thyroidectomy [7]. Up to now, traditional thyroidectomy is the primary surgical management because the safety and feasibility of endoscopic thyroidectomy depend on strict and accurate case selection [8]. Moreover, the incision length has been notably reduced, and a 2-6 cm-long incision has become the standard for open conventional thyroidectomy during the past decades [9-11]. The thyroid gland is located in the soft tissues of the neck and attached to the trachea and moves up and down with breathing, swallowing, and phonation; thus, maintaining the thyroid gland in a completely still position is difficult. In addition, postoperative exudation is inevitable due to the fairly rich blood and lymph circulation of the thyroid [12-14], even for the simplest adenoma excision. Furthermore, as the space of the neck is relatively small, a small amount of hematocele or dropsy can compress the trachea and lead to suffocation. Therefore, drainage is used routinely after thyroidectomy

[15]. In the present study, the DHA rate reached 24.5%, which seriously affected the life quality of patients following thyroidectomy.

DHA after thyroidectomy is related to many risk factors, such as surgical procedure and suture techniques. All patients included in our study were treated by the same operation team without anterior cervical muscle group transection. Moreover, the risk factors associated with DHA after thyroidectomy were evaluated under similar operative procedure conditions. Patients with postoperative hematoma were excluded because the accumulated blood volume cannot be determined in this retrospective analysis.

Drainage material

The results of univariate analysis on the drainage material showed that the “T” tube had the highest adhesion rate (84.0%), followed by rubber drainage strip (20.5%), sputum-aspirating tube (16.3%), and scalp needle (13.3%), with a significant statistical difference observed between them ($P<0.001$). Logistic regression analysis results revealed that drainage material (OR = 2.309, 95% CI, 1.524-3.499, $P<0.001$) and drainage volume (OR = 1.908, 95% CI, 1.028-3.543, $P = 0.041$) were the high-risk factor for DHA. A comparison between the “T” tube and sputum-aspirating tube groups can explain more clearly the major role of the “T” tube in adhesion formation. Under the same drainage site conditions, no significant difference existed in the clinical data of both groups ($P>0.05$). However, the adhesion rate of the “T” tube group (84.0%) was obviously higher than that of the sputum-aspirating tube group (16.3%) ($P<0.01$). Clinically, the “T” tube was often applied to the drainage after biliary tract surgery to form a fistula. Subsequently, bile could be drained from the fistula tract after removing the “T” tube instead of flowing into the abdominal cavity to form biliary peritonitis. The “T” tube has a rough wall that was made of latex, resulting in a strong stimulus to the body tissues and a significant potential for fistula formation. By contrast, silicone tube was less irritating to the surrounding tissues with a small chance of fistula formation. Hence, it was generally not used unless special needs arise. This study confirmed that the two drains with the highest adhesion rates were both made of latex. The adhesion rate of silicone was evi-

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dently lower than that of latex. As a foreign body, latex caused strong irritation to the surrounding tissues and produces a large amount of inflammatory exudates, which predominantly consist of cellulose. After latex drainage removal, an adhesion forms around the drain. The drain was often placed around the trachea after thyroidectomy. Adhesion between the superficial tissues and the trachea exerted an adverse effect on the appearance of the operative site of the neck surgery.

Drainage placement

As previously noted, with the movement of trachea, skin depression, stretching, or distortion in the drainage hole position is inevitable owing to the adhesions between the trachea and superficial tissues together with drainage fluid outflow alongside the drain in front of the neck. If the fluid discharges from the front of the sternocleidomastoid muscle next to the neck, functional and physical changes in the drainage hole do not necessarily occur, even if an adhesion appears around the drainage. Even slight adhesion affects the appearance because the anterior cervical region has the maximum shift amplitude of the larynx and trachea during swallowing and phonation [16]. Statistical analyses showed that the suprasternal fossa has the highest adhesion rate (45.1%), followed by the middle of the neck intraincision (20.9%) and laterocervical region intraincision (19.0%), with a significant difference between them ($P = 0.001$). We also drew the conclusion that the anterior cervical region has a higher adhesion rate than the laterocervical region.

Other factors

In terms of operation extent, thyroidectomy plus isthmus resection (29.7%) and bilateral thyroidectomy (32.1%) have a higher DHA rate than simple unilateral thyroidectomy. This finding is related to the lack of isthmus covering in front of the trachea after isthmus resection [17], which facilitates a much easier adhesion formation between the superficial tissues and the trachea. Although drainage volume was found to be a statistically significant risk factor in the univariate analysis, the same finding was not reflected in the nonconditional logistic regression. Patients with drainage time ≥ 48 h (25.5%) do not have significantly higher adhesion rate than those with drainage time < 48 h (24.0%). For the disease classification, the

adhesion rate of malignant diseases after bilateral thyroidectomy (39.1%) is higher compared with that of other diseases. This finding is probably associated with the need to perform bilateral disease surgery and lymph node exploration or dissection [18], which generates a large wound surface and significant trauma. The incision length exerts a slight effect on DHA.

Our studied group was retrospectively analyzed, and the number of cases was small. For these reasons, several limitations exist in our study. On the basis of the results of multivariate logistic regression analysis, the drainage material is an independent risk factor for DHA. The results indicated that patients with silicone drainage material had better cosmetic appearances, higher satisfaction levels, and lower anxiety degree than those with latex drainage material. The "T" tube is a high-risk factor for DHA after thyroidectomy; thus, its use should be avoided during the drainage process following thyroidectomy. Further research is needed for effusion, which may be associated with DHA. We recommend silicone as the first choice for drainage material after thyroidectomy.

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Disclosure of conflict of interest

None.

Abbreviations

DHA, drainage hole adhesion.

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