Diyala Journal of Medicine

ORIGINAL RESEARCH
Published: 30 October 2023
Doi: 10.26505/DJM.25017240118

Incidence and Risk Factors of Post-Thyroidectomy Stridor

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Abstract

Background: Thyroidectomy is a common procedure performed by the general surgeons. Stridor is an airway sign caused by a variety of post-thyroidectomy complications.

Objective: To determine the incidence of post-thyroidectomy stridor and the risk factors associated with its occurrence.

Patients and Methods: The study included 280 adult patients who had total or partial thyroidectomy performed by various surgeons. Patients were followed up for 6 months after they were discharged from the hospital. Data collected included demographic information, type of thyroid disease, duration of illness before surgery, type of surgery, number of intubation attempts, and the presence of hoarseness and hematoma post-operatively.

Results: Only eighteen patients (6.43%) who underwent thyroidectomy developed stridor during the follow-up period. They were compared to 25 other patients who were chosen from the original sample based regular visit of patients during the follow up. Higher body mass index (BMI), bilateral thyroidectomy, presence of concomitant hoarseness and hematoma, and more than one attempt at intubation were all associated with an increased risk of post-thyroidectomy stridor.

Conclusion: Stridor affects only a small percentage of patients undergoing thyroidectomy. Increased BMI, bilateral thyroidectomy, presence of concomitant hoarseness and hematoma, and frequent tracheal intubation are the most common risk factors for post-thyroidectomy stridor.

Keywords: Thyroidectomy, stridor, hoarseness of voice.

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Received: 18 January 2023
Accepted: 30 April 2023
Published: 30 October 2023

Introduction

Thyroid diseases are one of the most common endocrine gland disorders worldwide [1]. Thyroid disease management can include both medical and surgical treatment. Thyroidectomy is one of the most common surgical procedures performed worldwide, and it can be partial, subtotal, near-total, or total [2,3].

Thyroidectomy surgery has become more feasible as diagnostic modalities and surgical procedure safety have improved, access to healthcare services has improved, and surgical indications have also been expanded. Thyroidectomy is performed for a variety of reasons, including, toxic goiters, compression symptoms, malignancy, or suspected malignancy [3,4].

Thyroidectomy has become a safe procedure with low postoperative morbidity and mortality rates for experienced surgeons

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with a higher annual thyroidectomy volume due to newer medical developments and increased surgical experience [5]. Recurrent laryngeal nerve injury, permanent hypoparathyroidism, postoperative bleeding, and hypocalcemia are all serious post-thyroidectomy complications [6,7]). Previous studies looked into the risk factors for thyroidectomy complications; age, gender, type of thyroid disease, lymph node dissection, and thyroid gland weight have all been identified as risk factors. Furthermore, thyroid size and the presence of a retrosternal goiter are two of the most important risk factors for transient and permanent vocal cord paralysis [8,9,10].

Thyroidectomy, like any other surgical procedure, carries the risk of complications, including phonation disorders. After thyroid surgery, about 1 in 10 patients experience transient voice disorders, and 1 in 25 experience permanent voice disorders [11]. Because of its proximity to the thyroid gland, injury to the recurrent laryngeal nerve (RLN) is the most common cause of phonation disorders after thyroid surgery. Except for the cricothyroid muscle, this nerve innervates all of the muscles of the larynx [12-13].

The clinical symptoms of RLN damage range from minor changes in voice timbre and hoarseness in the case of unilateral RLN damage to complete silence, dyspnea, and stridor in the case of bilateral RLN injury, which can be a life-threatening condition requiring a tracheostomy [14].

The purpose of this study was to assess the risk of vocal fold paralysis after thyroid surgery and to identify risk factors that have a statistically significant impact on increases in the likelihood of their occurrence.

Patients and Methods

A prospective study was conducted at the department of surgery, Al-Imamain Al-Kadhumain Medical City during the period from 1st January 2016 to 31st September 2018. The study was approved by the Iraqi Council of Medical Specializations.

Subjects

The study included 280 patients aged 16 years and up who underwent total or partial thyroidectomy for any reason. Any patient who received regional anesthesia for the procedure and/or those with known airway pathology (tracheal stenosis, tracheomalacia) were excluded from the study.

Statistical Analysis

Data analysis was performed using IBM SPSS Statistics Program Version 20. Quantitative variables were summarized as mean and standard deviation, while qualitative variables were tabulated as frequency and percentage. Factors associated with post-thyroidectomy stridor were determined using multiple logistic regression analysis for the calculation of odds ratio (OR) with the correspondent 95% confidence interval (CI). The level of significance was set at 5%.

Results

Demographic data of the patients

The majority of patients (84.29%) are between the ages of 20 and 39, with the 40-60 age group coming next with 11.07%, and patients over 60 years make up the minority (1.43%). The majority of patients (92.2%) were females, while the minority (7.5%) were males. Almost half of the patients (51.07%) had a normal BMI, 27.5% were

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overweight, 15% were obese, and 6.43% were underweight Table (1).

Table (1): Demographic data of the patients

Variables	Frequency	Percentage
Age (years)		
<20	9	3.21%
20-39	236	84.29%
40-60	31	11.07%
>60	4	1.43%
Gender		
Male	21	7.5%
Female	259	92.5%
BMI (Kg/m^2)		
<18.5	18	6.43%
18.5-24.9	143	51.07%
25-29.9	77	27.5%
≥30	42	15%

Clinical data of the patients

The clinical characteristics of the patients are shown in Table (2). Out of the total number of cases, 68.57% had non-toxic goiter, 28.93% toxic goiter, 1.43% malignant thyroid, and the smallest (1.07%) had thyroiditis. The majority of patients (61.76%) had been ill for one year before surgery, while the minority (12.86%) had been ill for more than three years.

Table (2): Clinical characteristics of the patients

Variables	Frequency	Percentage
Thyroid disease		
Toxic goiter	81	28.93%
Non-toxic goiter	192	68.57%
Thyroiditis	3	1.07%
Malignant thyroid	4	1.43%
Duration of illness, years		
< 1	173	61.76%
2-3	71	25.36%
>3	36	12.86%

Operative and post-operative patients' data

Two hundred and sixty (92.29%) patients underwent bilateral thyroidectomy, of them 225 (86.54%) underwent near-total thyroidectomy, 25 (9.61%) underwent total thyroidectomy, and the remaining 10 (3.85%) underwent subtotal thyroidectomy. Only 22 (7.86%) of patients have both hoarseness and hematoma. Only 2 (0.71%) patients required extended neck dissection. Furthermore, 190 (67.86%) patients had operations that lasted more than 2 hours. The majority of patients (76.77%) require only one attempt at intubation, while none require a deliberate intraoperative sacrifice of RLN Table (3).

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Table (3): Operative and post-operative patients' data

Variables	Frequency	Percentage
Type of thyroidectomy		
Unilateral	20	7.14%
Bilateral	260	92.29%
Extend of thyroidectomy*		
Total	25	9.61%
Sub-total	10	3.85%
Near total	225	86.54%
Concomitant hoarseness and hematoma		
Yes	22	7.86%
No	258	92.14%
Neck dissection		
Yes	2	0.71%
No	278	99.29%
Duration of surgery (hours)		
≤ 2	190	67.86%
>2	90	32.14%
Attempt at intubation		
Once	215	76.77%
More than once	65	23.21%
Deliberate intraoperative sacrifice of RLN		
Yes	0	0%
No	280	100%

*for bilateral thyroidectomy only, RLN = recurrent laryngeal nerve

Incidence of stridor

During the follow-up period, 18 patients developed stridor, accounting for 6.43% of the total patients who underwent thyroidectomy. For the prediction of stridor risk factors, 25 patients who did not develop stridor were chosen from the original sample based on the their availability during follow up period, and compared to the 18 patients who did.

Demographic risk factors for stridor

Although older patients were more common in patients with stridor than in those without (38.89% versus 24%), the difference was not statistically significant, (p 0.289). Similarly, the gender distribution between the two groups was comparable, with no significant difference (p 0.953). Subjects with a high BMI (25 Kg/m^2 or higher) were more common among patients with stridor (83.33%) than those without stridor (24%), with a highly significant difference (OR=2.02, 95%CI=0.54-7.54, p<0.001) Table (4).

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Table (4): Demographic risk factors for stridor

Variables	Patients		P-value	OR (95%CI)
	With stridor (n=18)	Without stridor (n=25)		
Age (years)				
16-30	11(61.11%)	19(76%)	0.289	1.0
31-60	7(38.89%)	6(24%)		2.02(0.54-7.54)
Gender				
Male	3(16.67%)	4(16%)	0.953	1.0
Female	15(83.33%)	21(84%)		0.95(0.19-4.89)
BMI				
(Kg/m^2)	3(16.67%)	19(76%)	**<0.001**	1.0
<18.5-24.9	15(83.33%)	6(24%)		15.8(3.38-74.03)
25 and above				

Clinical risk factors for stridor

There was no difference in the type of thyroid disease or the duration of illness before surgery between those with and without stridor Table (5).

Table (5): Clinical risk factors for stridor

Variables	Patients		P-value	OR (95%CI)
	With stridor (n=18)	without stridor (n=25)		
Thyroid disease				
Toxic goiter	6(3.33%)	8(32%)	0.995	1.0
Non-toxic goiter	9(50%)	13(52%)	0.908	0.92(0.24-3.59)
Thyroiditis	2(11.11%)	3(12%)	0.912	0.89(0.11-7.12)
Malignant thyroid	1(5.56%)	1(4%)	0.849	1.33(0.7-25.91)
Duration of illness				
< 1 year	8(44.44%)	13(52%)	0.625	1.0
≥ 1 year	10(55.56%)	12(48%)		1.35(0.4-4.57)

Operative and postoperative risk factors for stridor (Table 6)

Only three of the seven operative and post-operative risk factors were significantly associated with the occurrence of stridor. Sixteen patients (88.89%) with stridor had a bilateral thyroidectomy, compared to six patients/25 (24%) without stridor (OR= 3.96,95%CI=1.07-14.62, p=0.039). Similarly, 77.78% of patients with stridor had concomitant hoarseness and hematoma, compared to 24% of patients without stridor (OR= 25.3, 95%CI=4.48-43.32, p<0.001). Furthermore, 10 patients (55.56%) with stridor had multiple intubation attempts compared to 5 patients (20%) without stridor (OR=5.0, 95%CI=1.29-19.3, p= 0.20).

Even though a higher proportion of patients with stridor (38.89%) had more than two hours of surgery than patients without stridor (28%), the difference was not statistically significant.

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Table (6): Operative and postoperative risk factors for stridor

Variables	Patients		P-value	OR (95%CI)
	With stridor (n=18)	Without stridor (n=25)		
Type of thyroidectomy				
Unilateral	2(11.11%)	19(76%)	**0.039**	1.0
Bilateral	16(88.89%)	6 (24%)		3.96(1.07-14.62)
Type of surgery				
Total	8(44.44%)	6(24%)	0.188	1.0
Sub-total	8(44.44%)	11(44%)	0.228	0.41(0.1-1.75)
Near total	2(11.11%)	8(32%)	0.08	0.19(0.03-1.23)
Concomitant hoarseness & hematoma				
No	4(22.22%)	19(76%)	**<0.001**	1.0
Yes	14(77.78%)	6(24%)		25.3(4.48-43.32)
Neck dissection				
No	17(94.44%)	25(100%)	0.892	1.0
Yes	1(5.55%)	0(0%)		1.04(0.61-14.21)
Duration of surgery, hrs				
≤ 2	11(61.11%)	18(72%)	0.454	1.0
>2	7(38.89%)	7(28%)		1.64(0.45-5.940
Attempt at intubation				
One	8(44.44%)	20(80%)	**0.020**	1.0
More than one	10(55.56%)	5(20%)		5.0(1.29-19.3)

Follow-up and management

The onset of stridor, the number of patients, and the management of those who developed stridor were all shown in Table (7). Those who had postoperative stridor were all scheduled for a repeat laryngoscopy within 2 to 3 months. Those who still had vocal cord dysfunction were given repeat laryngoscopies every 2 to 4 months until normal vocal cord mobility returned. Vocal cord dysfunction lasted more than six months was considered permanent.

Table (7): Shows the number of patients, onset of stridor, and management

Number	Onset	Management and follow up
12	Immediately (post-extubation)	Three patients underwent tracheostomy; the tube was removed 5 days later after the vocal cords retain their mobility. In nine patients (the vocal cords did not regain their mobility during the first check-up after 5 days); the tube was removed within 6 months post-operatively in 7 patients when the vocal cords retained their mobility, and the other 2 patients were kept on tracheostomy for more than 6 months, however, we lost the contact with them
4	Within the first post-operative 6 hours	Two patients underwent tracheostomy; the tube was removed within the first 6 months when the vocal cords retained their mobility. Two patients develops hematoma and immediate evacuation was done and the patients' symptoms were relieved.
2	Within 6-12 hours post-operatively	One patient underwent tracheostomy; the tube was removed within the first 6 months when the vocal cords retained their mobility.

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		One patient developed a hematoma and immediate evacuation was done and the patients' symptoms were relieved.

Discussion

Demographic and clinical data

Females make up 92.5% of the population in this study. This finding is consistent with previous studies [15,16] that show females outnumber males in various thyroid disorders. The female-to-male ratio has been reported to be as high as 6:1. Females are more vulnerable because of hormonal and reproductive characteristics that distinguish them.

Furthermore, this study found a higher proportion of non-toxic goiter than other types of thyroid disorders. This finding is consistent with the findings of numerous previous studies [17,18]. This high proportion of non-toxic goiter may be due to a lack of adequately iodized salt, age, socioeconomic status, and a goiter family history.

Thyroidectomy is the most common endocrine surgical procedure performed worldwide [19]. Thyroid disorders can be treated using a variety of surgical procedures. Because more than two-thirds of patients in the current study had non-toxic goiter, it is expected that most surgeries will be directed toward treating this condition. There are several surgical procedures available in this regard, including subtotal thyroidectomy, near-total thyroidectomy, and total thyroidectomy. The assessment of the balance between these types is based on postoperative complications and recurrences.

Preoperative concomitant hoarseness and hematoma were reported in 22 (7.86%) of the patients in the current study. This result is very close to that obtained by Fernando and colleagues [20] (6.86%), but it is significantly higher than the 0.8% reported by Ayandipo and colleagues [21]), 1.3% reported by Shaha and Jaffe [22], 2.5% reported by Agrawal and Mishra [23], and 0.4% reported by Lacoste and colleagues (24).

Aside from surgical experience, many demographic and clinical factors can influence the occurrence of postoperative hoarseness and hematoma. In one study, older patients, male gender, smokers, patients on antiplatelet/anticoagulant therapy, Graves' disease patients, patients who underwent bilateral thyroidectomy, and patients who underwent simultaneous parathyroidectomy had a higher risk of hematoma formation [25]. When it comes to thyroid surgery, opinions differ; some studies show that the incidence of hematoma is higher after total or near-total thyroidectomy, while other studies do not support these findings [26].

Tracheal intubation is a well-documented risk factor for airway complications and stridor. In the current study, 65 patients (23.21%) required more than one intubation attempt. In comparison to other studies, this is considered a low percentage. Ayandipo and colleagues [21] studied 507 Nigerian patients who underwent thyroidectomy and had various thyroid disorders. The majority of patients (80%) were successfully intubated after three attempts, while the remaining 20% were successfully intubated after the third attempt. This variation may be related to the anesthetist's experience, the age and gender of the patients, their BMI, and the presence of comorbidities at the time of intubation.

Endotracheal intubation is a common procedure used for respiratory support, and it

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Doi: 10.26505/DJM.25017240118

can have several side effects and complications. The literature is contradictory regarding the duration of intubation and the risk of developing complications [27]. In the adult literature, analyzing specifically the presence of post-extubation stridor, a duration of more than 3 days was associated with an increased risk of stridor [28].

Nonetheless, other authors fail to demonstrate this connection, keeping the subject in dispute (29).

The current study found a 6.43% overall incidence of stridor after thyroidectomy. There are no studies that directly target the incidence of stridor worldwide. Rather, the majority of studies looked into the associated complications, such as vocal cord dysfunction and airway complications. Lacoste and colleagues [24] investigated the postoperative mortality and morbidity of 3008 French thyroidectomies. Respiratory compression symptoms were reported in 330 of the cases (11%). Airway complications, including stridor, were found in 12.8% of Nigerian patients [21]. Rahman [30] identified 10% of patients who had respiratory complications as a result of RLN palsy. Sancho and colleagues [31] discovered 10.9% postoperative vocal cord dysfunction in 188 Spanish patients in a prospective study.

The only demographic risk factor that was significantly associated with the incidence of stridor was BMI (OR= 15.8,95%CI=3.38-74.03, p<0.001), implying that patients with BMI 25 kg/m2 are 15.8-times more likely than those with BMI 25 kg/m^2. This finding contradicts the findings of Eminov and colleagues [32]) who investigated the impact of obesity on post-thyroidectomy complications in Turkish patients. The authors discovered no statistically significant difference in the occurrence of vocal cord paralysis between normal and overweight patients. This variation in results could be attributed to the type of surgery used in each study.

Buerba and colleagues [33] reported operational results after thyroidectomy in patients with a high BMI, stating that longer operation periods are required in such patients and that they are more prone to complications when compared to patients with a normal BMI. Short neck, obesity, round back, limited neck extension, tracheal deviation, and tracheal compression may all contribute to intubation technical difficulties in thyroidectomy patients [34]. Obese patients are also more likely to have comorbidities, which may increase the risk of airway complications.

In the current study, neither the type of thyroid disease nor the duration of illness before surgery had a significant association with the development of post-thyroidectomy stridor. These findings are consistent with previous research [35].

In the current study, three operative and postoperative risk factors were found to be significantly associated with the incidence of stridor. These included bilateral thyroidectomy, concurrent hoarseness and hematoma, and multiple intubation attempts.

The OR for bilateral thyroidectomy was 3.96, 95%CI=1.07-14.62, p=0.39. This means that patients undergoing bilateral thyroidectomy are four times more likely to experience stridor than those undergoing unilateral thyroidectomy. This finding is supported by the findings of Zakaria and

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colleagues [36], who examined 340 Egyptian patients for complications after thyroidectomy. Total bilateral thyroidectomy was associated with a significant increase in RLN injuries. Such a result is reasonable given that performing bilateral thyroidectomy involves more tissue injuries and complications, including those associated with stridor.

The OR for the presence of concurrent hoarseness and the hematoma was 25.3, 95%CI=4.48-43.32, p<0.001, the highest significant risk factor. Lee and colleagues [37] reviewed 10 Korean patients with post-thyroidectomy hemorrhage in a retrospective study. One of the most common complaints in those patients was airway discomfort caused by the presence of a deep hematoma.

When compared to a single attempt at intubation, more than one attempt increases the risk of post-thyroidectomy stridor by a factor of five. It is widely accepted that airway intubation damages the glottis, subglottis, and trachea. It is also associated with cuff stenosis or malacia, as well as ulceration and granulation at the tube's tip. The clinical manifestations of recurrent intubation-induced laryngeal injury range from a mild change in voice quality to severe stridor, hoarseness, and dyspnea. Exertional dyspnea is the most common presenting symptom, and it usually does not appear until the airway diameter is less than 10 mm. At rest, dyspnea and stridor appear only when the airway is narrowed to 5 mm or less [38]. As a result, repeated intubation attempts are expected to further influence the airways and increase the incidence of stridor.

Conclusions

Increased BMI, bilateral thyroidectomy, presence of concomitant hoarseness and/or hematoma, and frequent tracheal intubation are the most common risk factors for post-thyroidectomy stridor.

Recommendations

The study recommends to pay a special attention and frequent postoperative inspection for overweighed and obese patients and those with concomitant hoarseness and/or hematoma.

Source of funding: The current study was funded by our charges with no any other funding sources elsewhere.

Ethical clearance: The study was approved by Iraqi Council of Medical Specializations.

Conflict of interest: Nil

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Diyala Journal of Medicine

ORIGINAL RESEARCH
Published: 30 October 2023
Doi: 10.26505/DJM.25017240118

معدل حدوث الصرير وعوامل الخطر المرتبطه بحدوثه بعد استئصال الغدة الدرقية

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الملخص

خلفية الدراسة: استئصال الغدة الدرقية هو إجراء شائع يقوم به الجراحون العامون. الصرير هو علامة مرضية لـتأثر مجرى هوائي ناتجة عن مجموعة من مضاعفات ما بعد استئصال الغدة الدرقية.

اهداف الدراسة: لتحديد نسبة حدوث الصرير بعد استئصال الغدة الدرقية وعوامل الخطر المرتبطة بحدوثه.

المرضى والطرائق: شملت الدراسة 280 مريضاً بالغاً خضعوا لعملية استئصال الغدة الدرقية الكلي أو الجزئي بواسطة جراحين مختلفين. تمت متابعة المرضى لمدة 6 أشهر بعد خروجهم من المستشفى. تضمنت البيانات التي تم جمعها المعلومات الديموغرافية ، ونوع مرض الغدة الدرقية ، ومدة المرض قبل الجراحة ، ونوع الجراحة ، وعدد محاولات تنبيب الرغامي، ووجود بحة في الصوت وورم دموي بعد الجراحة.

النتائج: أظهر ثمانية عشر مريضا فقط (6.43٪) ممن خضعوا لعملية استئصال الغدة الدرقية صريرا خلال فترة المتابعة. تمت مقارنتهم بـ 25 مريضًا آخر تم اختيارهم من العينة الأصلية بناءً على الزيارة المنتظمة للمرضى أثناء المتابعة. ارتبط ارتفاع مؤشر كتلة الجسم ، واستئصال الغدة الدرقية الثنائي ، ووجود بحة مسبقة في الصوت، وجود ورم دموي ، وأكثر من محاولة لتنبيب الرغامي بزيادة خطر الإصابة بالصرير بعد استئصال الغدة الدرقية.

الاستنتاجات: يحصل الصرير في نسبة صغيرة فقط من المرضى الذين يخضعون لاستئصال الغدة الدرقية. تعد زيادة مؤشر كتلة الجسم ، واستئصال الغدة الدرقية الثنائي ، ووجود بحة مسبقة في الصوت والورم الدموي ، وتنبيب الرغامي المتكرر أكثر عوامل الخطر شيوعًا لحدوث الصرير بعد استئصال الغدة الدرقية.

الكلمات المفتاحية: استئصال الغدة الدرقية ، صرير ، بحة في الصوت

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تاريخ استلام البحث: 18 كانون الثاني 2023

تاريخ قبول البحث: 30 نيسان 2023

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