Preoperative scar perception study comparing ‘scarless’ in the neck endoscopic thyroidectomy with open thyroidectomy: a cross-sectional study

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ABSTRACT

INTRODUCTION Open thyroidectomy is the most common approach to thyroid surgery. However, ‘scarless’ (in the neck) endoscopic thyroidectomy, consisting of endoscopic and robotic surgery, is progressively being adopted for its perceived cosmetic benefits. This study aims to determine the patient’s preferred surgical approach and to identify the factors that influence their decision.

MATERIALS AND METHODS A pilot study consisting of 100 patients with a surgical thyroid disorder were prospectively recruited from a single tertiary centre. An interviewer-administered survey was conducted. Demographic, socioeconomic status, scar perception and an adapted body image scale were evaluated to identify factors that shaped the patient’s perception of the surgical approach.

RESULTS The mean age of participants was 54.5 ± 13.0 years; 72% were women and 87% Chinese. Of the 100 patients, 75 patients considered scarless endoscopic thyroidectomy as their preferred surgical approach while 25 patients opted for open thyroid surgery. Improvement in scar perception score between scarless endoscopic thyroidectomy and open thyroid surgery is associated with an increased willingness to choose scarless endoscopic thyroidectomy. The mean body image scale score was 6.9 ± 2.8 , indicating no statistical difference between the surgical approaches. On multivariate analysis, improvement in scar perception score (odds ratio 3.38, 95% confidence interval 1.11–10.29) and having surgeon recommendation (odds ratio 6.38, 95% confidence interval 1.80–22.63) were independently associated with interest in scarless endoscopic thyroidectomy.

CONCLUSION Patients interest in undergoing scarless endoscopic thyroidectomy is driven by improved scar perception and surgeon’s recommendation compared with open thyroid surgery.

KEYWORDS

Preoperative – Scar perception – Thyroidectomy – Scarless in the neck endoscopic thyroidectomy – Open thyroidectomy

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Introduction

The incidence of thyroid nodules is increasing worldwide and, with time, some of these nodules require surgical intervention.^{1,2} Thyroidectomy is the most common endocrine surgical procedure for surgical thyroid disease. In recent years, there is an increasing variety of approaches available to patients, including remote access and ‘scarless’ in-the-neck surgery to achieve a satisfactory scar appearance post-surgery.^{1,3}

Open thyroid surgery was first described by Billroth and Kocher in the 1800s and is still the most established approach for thyroidectomy.⁴ Despite the good operative outcomes of open thyroid surgery, new approaches are constantly created to overcome the concern of a visible scar

over the neck made by the conventional Kocher incision.^{4,5} Previous studies have demonstrated the psychological effects of poor cosmetic outcomes, which adversely affect a patient’s quality of life.⁷ Thus alternative thyroidectomy approaches have been adopted worldwide in recent decades. These approaches include ‘scarless’ (in the neck) endoscopic thyroidectomy (SET), which includes endoscopic and robotic thyroid surgery via a transaxillary or posterior hairline approach, as well as the transoral approach, which relocates the anterior neck scar to concealed sites.^{7–11}

Despite the trend towards SET because of its superior cosmetic outcomes with equivalent surgical outcomes compared with open thyroidectomy, some controversies

exist over the long-term benefits of SET.^{12–15} The steep initial learning curve for surgeons and the longer operative time raises question over the cost-effectiveness and patient satisfaction of SET.^{16–18} There is currently a lack of research that examines a patient's preoperative perception of different modes of thyroid surgery and their willingness to choose SET over conventional open thyroidectomy. In addition, little is known about how other preoperative factors such as cost, long term complications, post-operative pain and risk of surgery will influence patients' choice of surgery.

The objective of our study was to determine patients' perception of SET compared with conventional open thyroid surgery, and to explore factors that influence their willingness to choose SET in the future. This study also aims to evaluate the patient's body image score and the impact of the surgeon's recommendation on their willingness to choose SET.

Materials and methods

This was a pilot prospective cross-sectional study with a recruitment target of 100 participants over a one-year period. All participants were recruited from the general surgery clinic at a surgical tertiary hospital. Patients included were 21 years of age or older, who were currently on follow-up with a surgeon for a thyroid condition that potentially required surgery. Patients who had undergone previous head and neck surgery were excluded. All patients provided informed consent. The study received ethics board approval. This study has also been reported in line with the STROBE criteria.

The interviewer-administered questionnaire composed of three segments: i) patient demographic and socioeconomic status; ii) an adapted body image scale with a scar perception score; and iii) perception towards SET compared with open thyroid surgery and the factors that influence the choice of surgical approach. The body image scale questionnaire was modified from a validated questionnaire from Park *et al.*¹⁹ This study was chosen because it had a similar objective to our study in evaluating scar cosmesis and body image between different types of surgical approaches. The score was adapted to include only the first five questions, which were relevant to our study design on the preoperative assessment of body image and scar perception (Appendix 1, online only). Patients were asked to rate, on a scale of 1 (not at all) to 4 (extremely), how affected they would be if they had a scar post-thyroid surgery. The maximum score on the body image scale is 20, where a higher score indicated that patients were more concerned about their body image.

Scar perception was assessed using a 10-point Likert scale where postoperative photographs were used to help patients visualise the spectrum of scar outcomes (Appendix 2, online only). The 10-point Likert scale ranged from 1 (revolting) to 10 (beautiful) with 5 being in the neutral position (neither revolting nor beautiful). This is similar to the scale used in the Park *et al* study.¹⁹ Images were

randomly selected from publicly available images without copyright to reduce bias related to surgeon-specific treatment outcomes. These images were verified by a senior endocrine surgeon as appropriate representations of expected postoperative scars from SET and open thyroid surgery.

Patients were also tasked with ranking the importance of the following five factors in influencing their choice surgery: scar appearance, postoperative pain, long-term complication, cost of surgery and risk of surgery were ranked in order of importance. The risk of surgery refers to general anaesthetic and surgical risks such as bleeding, wound infection, transient hypocalcaemia and transient hoarseness. Long-term complications refer to permanent injury of the recurrent laryngeal nerve or permanent hypoparathyroidism. These factors were chosen based on the adapted body image score and studies that examined surgical choices.^{14,18,19}

Patients were recruited after they had completed their clinic consultation. They were led to a separate room in the same clinic where they would complete an interviewer-administered questionnaire. There were two interviewers who underwent pre-study training. Both interviewers had to memorise a standardised script of administering the questionnaire and their competency was evaluated by a senior endocrine surgeon. Survey results would then be collected and analysed to determine patients' perception to SET compared with open thyroid surgery and the influence of other factors on their choice of surgery.

The primary outcome was identifying factors that affected a patient's choice of SET compared with conventional open thyroid surgery. Factors included demographic, socioeconomic, patient's scar perception, body image score and recommendation from attending surgeon. This was based on the assumption that the cost of SET and open thyroid surgery were the same. Univariate and multivariate analysis were performed. The secondary outcomes were to identify perioperative surgical factors that would influence a patient's decision for SET compared with open surgery.

All subjects completed the interviewer-administered questionnaire. The demographic, socioeconomic status, scar perception and body image scale score were compared between the group who preferred SET and the group who preferred open thyroid surgery. Continuous variables such as age were analysed using the independent sample T-test. Ordinal data from the survey results between the two groups were analysed using non-parametric analysis (Mann-Whitney U test). Categorical variables were evaluated using the chi-square tests or Fisher's exact tests. Fischer's exact test was used when the two-by-two table consisted of a cell where the number of respondents was fewer than five.

A multivariate binary logistic regression analysis was then used for factors that had a *p*-value ≤ 0.2 in the univariate analysis. The final model consisted of the odds ratio, 95% confidence interval and *p*-value. A *p*-value of 0.05 or less after the multivariate analysis was considered to be an

independent factor that increased the patient's odds for choosing SET over open thyroid surgery. All statistical analysis was performed using SPSS Windows Version 24.0.

Results

The mean age of the patients was 54.5 ± 13.0 years; 72% were women and 87% Chinese. Of the 100 responders, 75 were willing to have SET while 25 preferred open thyroid surgery. Demographics and socioeconomic status of participants were found to be similar between both groups (Table 1).

Patient's perception of scar appearance and their body image scale scores are presented in Table 2. In our study, improvement in scar perception score between SET and open thyroid surgery is associated with a patient's willingness to choose SET as their preferred surgical approach. This was calculated based on the difference in scar perception scores for SET and open thyroid surgery

(Appendix 2). The mean perception score for a SET wound was 6.3 ± 1.2 whereas it was 4.6 ± 0.8 for an open wound. Patients' willingness to choose SET was also influenced by the surgeon's recommendation of surgical approach (3.29 ± 0.97 compared with 2.84 ± 0.80 , $p = 0.01$).

The mean score on the body image scale was 6.89 ± 2.8 from a total of 20. There was no statistical difference between patients who opted for SET compared with those who chose open surgery. Although 24% of patients had a scar from a previous operation in other parts of the body and 22% felt that scar appearance was important, both factors were not significantly associated with patients' willingness to choose SET over open thyroid surgery (Table 2).

On multivariate analysis, improvement in scar perception (odds ratio, OR, 3.38, 95% confidence interval, CI, 1.11–10.29) and surgeon's recommendation (OR 6.38, 95% CI 1.80–22.63) were independent factors that predicted the patient's choice of surgical approach (Table 3).

Table 1 Demographics and socioeconomic status of the study participants				
	Total (n = 100)	Group 1 SET surgery (n = 75)	Group 2 Open thyroid surgery (n = 25)	p-value ^a
Age (years), mean ($\pm$ SD)	54.5 $\pm$ 13.0	53.5 $\pm$ 13.6	57.5 $\pm$ 11.0	0.180
Sex, n (%):				
Male	28 (28.0)	22 (29.3)	6 (24.0)	0.607
Female	72 (72.0)	53 (70.7)	19 (76.0)	
Ethnicity, n (%):				
Chinese	87 (87.0)	63 (84.0)	24 (96.0)	0.176
Non-Chinese	13 (13.0)	12 (16.0)	1 (4.0)	
Marital status, n (%):				
Single/widowed/separated or divorced	15 (15)	14 (18.7)	1 (4.0)	0.107
Married	85 (85)	61 (81.3)	24 (96.0)	
Working status, n (%):				
Employed	37 (37)	29 (38.7)	8 (32.0)	0.637
Unemployed/homemaker	63 (63)	46 (61.3)	17 (68.0)	
Highest education, n (%):				
Secondary education and below	57 (57)	39 (52.0)	18 (72.0)	0.104
Tertiary education, (A levels/diploma/degree)	43 (43)	36 (48.0)	7 (28.0)	
Housing type, n (%):				
$\leq$ 4 room HDB flat	66 (66.0)	51 (68.0)	15 (60.0)	0.465
5 room HDB flat/condominium/private	34 (34.0)	24 (32.0)	10 (40.0)	
Payment for healthcare, n (%): ^b				
Subsidised	87 (87.9)	64 (86.5)	23 (92.0)	0.725
Non-subsidised	12 (12.1)	10 (13.5)	2 (8.0)	

^a For comparing mean (for age) the independent sample T-test was used and for comparing proportions in 2×2 contingency tables, the chi-square test and Fisher's exact test were used.

^b 1 invalid result.

HDB, Housing and Development Board; SD, standard deviation; SET, scarless endoscopic thyroidectomy.

Factors that influenced patients' choice of surgery, from the most important to least important, were risk of surgery, long-term complications, cost of treatment, postoperative pain and scar appearance (Figure 1). Compared with other perioperative risk factors, scar appearance was ranked as the least important factor in influencing the choice of surgery.

Discussion

There remains a gap in the literature regarding the patient's preoperative perception of different modes of thyroid surgery. In this study, patient perception of having a visible neck scar versus a hidden scar at the axilla or hairline was studied. This pilot study demonstrated key factors that influence a patient's willingness to choose SET over conventional open thyroidectomy. There were three key findings from our study. First, patient demographics

and socioeconomic status do not influence a patient's decision on the type of surgical approach. Second, improvement in scar perception score and recommendation from surgeons were found to be independently associated with an increased willingness to opt for SET over open thyroid surgery. Third, patients place greater value on risk of surgery, long-term complications, cost and postoperative pain than scar appearance when choosing between SET and open thyroid surgery.

The main incentive for undergoing SET is its perceived favourable cosmesis outcomes when compared with open surgery.¹⁵ The general belief is that women and younger patients place a greater value on thyroidectomy scar perception.²⁰ Our study challenges this assumption, suggesting that the thyroid neck scar appearance may not matter in terms of sex, ethnicity, marital status or education level (Table 1). Among patients who were willing to have SET and those who were unwilling, there were no statistical differences in demographics and socioeconomic status.

Table 2 Participants' perception of scar appearances and their body image scale

	Total (n = 100)	Group 1 SET surgery (n = 75)	Group 2 Open thyroid surgery (n = 25)	p-value ^a
Has scar from previous operation, n (%):				
Yes	24 (24.0)	16 (21.3)	8 (32.0)	0.279
No	76 (76.0)	59 (78.7)	17 (68.0)	
Feels that scar appearance is important, n (%):				
Important (score ≥ 3/5)	40 (40.0)	28 (37.3)	12 (48.0)	0.005
Unimportant (score < 3/5)	60 (60.0)	47 (62.7)	13 (52.0)	
Improvement in scar perception score between open vs SET, n (%):				
No difference	33 (33.0)	19 (25.3)	14 (56.0)	0.005
Improvement	67 (67.0)	56 (74.7)	11 (44.0)	
Feels that scar appearance is important, mean (± SD)	2.47 ± 1.03	2.51 ± 1.02	2.36 ± 1.08	0.614
Surgeon's recommendation (for SET), mean (± SD)	3.18 ± 0.95	3.29 ± 0.97	2.84 ± 0.80	0.01
Would you be less satisfied with your body after the operation? mean (± SD)	1.39 ± 0.58	1.44 ± 0.60	1.24 ± 0.53	0.102
Would you feel that the operation damaged your body? mean (± SD)	1.44 ± 0.64	1.48 ± 0.60	1.32 ± 0.75	0.077
Would you feel less attractive after the operation? mean (± SD)	1.38 ± 0.60	1.43 ± 0.62	1.24 ± 0.52	0.147
Would you feel less feminine/masculine after the operation? mean (± SD)	1.35 ± 0.56	1.39 ± 0.57	1.24 ± 0.52	0.193
Would you find it difficult to look at yourself after the operation? mean (± SD)	1.33 ± 0.55	1.37 ± 0.56	1.20 ± 0.50	0.117

^a For comparing mean (ordinal data) Mann-Whitney U test was used, and for comparing proportions in 2 × 2 contingency tables, the chi-square test and Fisher's exact test were used.
SD, standard deviation; SET, scarless endoscopic thyroidectomy.

Studies have consistently shown that SET achieves better patient cosmetic satisfaction compared with conventional thyroid surgery.^{13,14,21,22} This study demonstrates that the majority of patients (67%) perceive that SET provides better scar appearance compared with open surgery. This perceived improvement in scar appearance is also predictive for patients to choose SET over open thyroid surgery when all other factors are equal. Patients are also more inclined to opt for SET when the procedure is advocated for by their attending surgeon.

This is the first study that examines a patient's preoperative perception of different thyroidectomy approaches and their willingness to undergo endoscopic/robotic thyroid surgery in Singapore. We decided to evaluate preoperative perception to avoid treatment bias because patients' retrospective evaluation of their scars may overestimate

satisfaction levels; they may be more inclined towards their own treatment choice, whether the outcome was desirable or otherwise.²³

Ironically, while SET is often credited for its improved cosmetic outcomes, patient's decision on the type of surgery is least influenced by the scar appearance.²⁴ Instead, patients rank the risk of surgery as the most important determining factor. The issue of safety is ultimately most important to patients. Robotic thyroidectomy is associated with longer operative time, which could place patients at higher general risks of anaesthesia. On average, the operating time is prolonged by 55.8–69.8 minutes.^{14,15} The risk of temporary injury to the recurrent laryngeal nerve also needs to be explored. A meta-analysis by Hung *et al* found that robotic thyroidectomy was associated with higher rates of temporary recurrent

Table 3 Univariate and multivariate analyses for possible factors affecting the choice of surgery

	Patients (n = 100)	Univariate odds ratio (95% CI)	p-value	Multivariate odds ratio (95% CI)	p-value
Age (years):			0.907		
≤ 50	41	1.00			
> 50	59	0.95 (0.38–2.38)			
Sex:			0.608		
Male	28	1.00			
Female	72	0.76 (0.27–2.16)			
Ethnicity:			0.155		0.353
Chinese	87	1.00			
Non-Chinese	13	4.57 (0.56–37.09)		2.97 (0.30–29.61)	
Marital status:			0.108		0.139
Single/widowed/separated or divorced	85	1.00			
Married	15	5.51 (0.69–44.2)		5.61 (0.57–55.09)	
Working status:			0.551		
Employed	37	1.00			
Unemployed/homemaker	63	0.75 (0.29–1.95)			
Highest education:			0.085		0.449
Secondary education and below	57	1.00			
Tertiary education, (A levels/diploma/degree)	43	2.37 (0.89–6.35)		1.58 (0.48–5.18)	
Improvement in scar perception:			0.006		0.006
No difference	13	1.00			
Improvement	67	3.75 (1.46–9.66)		3.38 (1.11–10.29)	
Total body image scale score:			0.144		0.978
≤ 7	68	1.00			
> 7	32	2.25 (0.76–6.68)		1.02 (0.27–3.79)	
Surgeon recommended:			0.001		0.004
Concerned	52	1.00			
Interested	48	7.45 (2.33–23.86)		6.38 (1.80–22.63)	

laryngeal nerve injury, which was attributed to traction injury.¹⁴ However, this may be associated with the initial learning experience with robotic thyroidectomy as a recent 2016 meta-analysis showed that robotic thyroidectomy is as safe as conventional thyroid surgery.¹⁵ Importantly, these factors have to be carefully discussed with patients prior to a decision on the surgical approach.

While the cost of open and endoscopic thyroidectomy is similar, robotic surgery is significantly more expensive by up to 70%.^{14,15} Cost mitigation of SET is another area to be further explored since it is ranked as more important than scar appearance in affecting a patient's willingness to choose endoscopic/robotic thyroidectomy surgery over conventional open thyroidectomy.

The strength of this study is the quality assurance measures such as pre-implementation training of the study investigators as well as an interviewer-administered survey in both English and Mandarin. This ensured consistency and minimised selection bias of only choosing English-speaking patients. There is also no social desirability bias in selecting SET over conventional thyroidectomy as the survey was conducted after clinic consultation with the attending surgeon. This eliminated the possibility of the survey influencing the patient's choice of a particular surgical approach. Equally, the survey did not determine the

treatment and/or surgical approaches the participants would be offered. Our study examined preoperative scar perception, thus negating the treatment response biases that are common to all postoperative cosmesis perception studies on robotic thyroid surgery versus open thyroidectomy.²⁵⁻²⁷ Hence, our study offers a realistic examination of the factors that influence a patient's decision making in their choice of surgical approach and also their scar perceptions prior to surgery.

Studies by Chaung *et al* and Rajakumar *et al* evaluated patient's perception on the length, thickness or neck position of the thyroid scar.^{5,28} This current study adds value by evaluating the patient's perception when presented with a neck scar versus a hidden scar at the axilla or hairline. This gives a direct comparison between SET versus conventional open thyroid surgery.

The limitations of this study include the relatively small sample size and the absence of younger, fee-paying private patients, which constitute a fair population of patients who present to the thyroid clinic.²⁹ It may also be hard to extrapolate the body image score worldwide, owing to the role of other multiple factors such as sociocultural factors and level of self-awareness that shape one's body image.³⁰

In our study, 75% of patients opted for SET over open thyroidectomy. This would have affected the statistical power when comparing between both groups. This could have accounted for the lack of association in demographic and socioeconomic between the SET and open thyroid surgery groups. The patient's desire for SET could be based upon their preconceived perception or from the surgeon's recommendation during the surgical consultation. Both SET and open thyroidectomy are routinely offered to patients. While the surgeon's recommendation might have swayed the patient's decision for SET approach, we are of the opinion that our findings are representative of clinical practice. The factors that influence the patient's choice of surgical approach can only determine after patients have been informed of both surgical treatments.

Conclusion

In conclusion, 'scarless' endoscopic thyroid surgery would probably be acceptable for patients if other factors, namely risk of surgery, long-term complication, cost of treatment and postoperative pain, were kept to be similar to conventional open thyroidectomy. Patients who opt for SET are likely to have improved scar appearance scores. A larger multicentre prospective study is needed to determine whether our results can be extrapolated to the other centres in the world.

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