Short and long-term cosmesis of cervical thyroidectomy scars

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ABSTRACT

INTRODUCTION Multiple surgical approaches to the thyroid gland have been described via cervical or extracervical routes. Improved cosmesis, patient satisfaction, reduced pain (procedure dependent) and early discharge have all been reported for minimally invasive approaches with similar safety profiles and long-term outcomes to conventional surgery. This review summarises the current evidence base for improved cosmesis with minimally invasive cervical approaches to the thyroid gland compared with conventional surgery.

METHODS A systematic review was undertaken. The MEDLINE®, Embase™ and Cochrane databases were searched for relevant articles.

RESULTS A total of 57 papers thyroid papers were identified. Of those, 20 reported some form of cosmetic outcome assessment. There were 6 randomised controlled trials with 412 patients (evidence level 2B), 7 cohort studies with 3,073 patients (level 3B) and 7 non-comparative case series with 1,575 patients (level 4). There was significant heterogeneity between studies in terms of wound closure technique, timing of scar assessment and scar assessment scales (validated and non-validated). Most studies performed early scar assessments, some using non-validated scar assessment tools.

CONCLUSIONS Assessment of cosmesis is complex and requires rigorous methodology. Evidence from healing/remodelling studies suggests scar maturation is a long-term process. This calls into question the value of early scar assessment. Current evidence does not support minimally invasive surgical approaches to the thyroid gland if improved long-term cosmesis is the goal.

KEYWORDS

Thyroidectomy – Minimally invasive video assisted thyroidectomy – Scar – Cosmesis

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Over the past few decades, a plethora of surgical approaches to the thyroid gland have been described via cervical incisions, or remote routes such as the axilla or inframammary fold.¹ Neck scars are in an exposed and prominent position so cosmesis is a priority for many patients.² The role of minimally invasive approaches has been supported by several studies showing improved cosmesis. These studies are open to criticism, however, as the majority assess scars before maturation is complete using non-validated scar assessment tools. Remote access and non-cervical routes to the gland (inframammary, axillary etc) were excluded from this review as these approaches avoid a neck scar at the expense of a minimally invasive technique, longer operative time and higher cost.³

Although uptake of minimally invasive thyroid surgery has been relatively slow in the UK, patients are increasingly aware of this option. We undertook this systematic review to determine the quality of published data assessing short and long-term cervical scar cosmesis in an attempt to draw a conclusion about the overall cosmetic benefits of different cervical approaches. The difficulty of scar assessment is also discussed.

Methods

A systematic review was undertaken, in accordance with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines,⁴ of all published studies of thyroid surgery reporting some form of cosmetic assessment of minimally invasive or conventional cervicotomy. The MEDLINE®, Embase™ and Cochrane databases were searched for relevant articles in the English language using the following terms: minimally invasive thyroidectomy, minimally invasive thyroidectomy cosmesis/scar, video assisted thyroidectomy, video assisted thyroidectomy cosmesis/scar, thyroidectomy cosmesis/scar, endoscopic thyroidectomy and endoscopic thyroidectomy cosmesis/scar.

Any studies describing a cosmetic or scar satisfaction assessment of thyroidectomy cervical neck scars and making use of an assessment scale (validated or non-validated) were included in the review. Papers were reviewed and citations cross-referenced with the search results to reduce the chances of missing relevant research articles (Fig 1). Evidence levels were assessed according to Sackett's classification.⁵

Results

A total of 1,388 articles were returned by the search. There was considerable crossover from all search terms. Fifty-seven relevant thyroidectomy papers were identified, twenty of which reported some form of cosmetic outcome assessment. These included 6 randomised controlled trials (RCTs) with 412 patients (evidence level 2B),^{6–11} 7 cohort studies with 3,073 patients (level 3B)^{12–18} and 7 non-comparative case series with 1,575 patients (level 4).^{19–25} The remaining studies made reference to the issue of cosmesis either by assumption, referencing or general statements unsupported by methodological assessment.

Surgical procedures

The terminology employed reflects that cited in the literature. Four thyroid procedures are described: conventional thyroidectomy (CT), open minimally invasive thyroidectomy (OMIT), minimally invasive video assisted thyroidectomy (MIVAT) and endoscopic thyroidectomy (ET). OMIT is an open thyroidectomy performed through a short 'collar' incision and does not necessitate special equipment although

two assistants are desirable.^{14,17,18} Indications for OMIT are defined as thyroid volume >30ml but <70–80ml and a dominant nodule between 3cm and 5cm. MIVAT refers to the video assisted gasless thyroidectomy as described by Miccoli *et al.*⁶ Indications for MIVAT are defined as thyroid volume <20–30ml and a dominant thyroid nodule <3–3.5cm in diameter. ET is a totally endoscopic thyroidectomy with CO₂ insufflation as described by Gagner and Inabnet.¹² Indications for ET are defined as a dominant thyroid nodule of <3cm in diameter.

Incision length

A variety of incisions are described in the literature; mean postoperative measurements are given below and summarised in Table 1. The classic collar incision for CT ranges from 3.5cm to 8.2cm.^{7,8,10,15,16} The OMIT scar had a mean length of 3.5cm.¹⁴ MIVAT scars ranged from 1.7cm to 3.2cm.^{7,10,15,19,20} ET with CO₂ insufflation is described in one study.¹²

Randomised controlled trials

Six RCTs (level 2B) compared CT with MIVAT.^{6–11} None discussed a power calculation. Two of the studies measured postoperative wound length.^{9,11} There was variation in wound closure technique (between arms of trials), timing of cosmesis assessment (all ≤6 months) and scar assessment tools used. Five of the RCTs made no reference to the validity of the scar assessment tools used.^{6–10} Table 2 summarises the main findings.

All six RCTs found that MIVAT scars were cosmetically superior to CT scars; this reached statistical significance in five studies.^{6–8,10,11} Previous meta-analyses based on these RCTs have reiterated the cosmetic advantage of MIVAT over CT^{26–29} but the abovementioned heterogeneity in wound closure, timing of scar assessment, variety and lack of validation of assessment tools should be borne in mind when interpreting these results. One review article³⁰ acknowledged this, limiting its meta-analysis of 3/5 RCTs.^{6–8} The difference for cosmetic outcome (measured at 1–3 months using non-validated scar assessment tools) was statistically significant with MIVAT being superior to CT.³⁰ However, it is important to be mindful of the heterogeneity observed.

Cohort studies

Seven cohort studies (level 3B) compared cosmetic outcomes between CT and minimally invasive approaches to the thyroid gland: four prospective studies,^{14–17} two retrospective

Table 1 Variation in postoperative length of cervicotomy scars

Operation	Mean reported scar lengths	Symmetry
Conventional thyroidectomy	3.5cm, ¹⁶ 4.1cm, ⁴⁹ 4.9cm, ⁹ 5.4cm, ¹¹ 6.96cm, ³² 8.2cm ¹⁴	Yes
Open minimally invasive thyroidectomy	3.3cm ¹⁴	Yes
Minimally invasive video assisted thyroidectomy	1.7cm, ¹⁴ 1.9cm, ²³ 2.2cm, ⁹ 2.8cm, ¹⁶ 3.2cm ¹¹	Yes

Paper	Study design	Power calculation	Number of patients	Timing of cosmesis assessment	Scar assessment tool	Scar score / scar satisfaction / cosmetic satisfaction	p-value
Miccoli, 2001, Italy ⁶	RCT	No	49 (CT 25, MIVAT 25)	1 month	4-point VRS 10-point NS	MIVAT > CT	<0.05
Bellantone, 2002, Italy ⁷	RCT	No	62 (CT 31, MIVAT 31)	3 and 6 months	10-point NS (cosmesis and satisfaction)	MIVAT > CT	<0.05
Lombardi, 2005, Italy ⁸	RCT	No	20 (CT 10, MIVAT 10)	3 months	4-point VRS 10-point NS (cosmesis and satisfaction)	MIVAT > CT	<0.05
Hegazy, 2007, Egypt ⁹	RCT	No	68 (CT 33, MIVAT 35)	1 month	4-point VRS 10-point NS	MIVAT > CT	>0.05
Gal, 2008, Hungary ¹⁰	RCT	No	30 (CT 15, MIVAT 15)	1 month	4-point VRS 10-point NS	MIVAT > CT	<0.05
El-Labban, 2010, Egypt ¹¹	RCT	No	72 (CT 38, MIVAT 38)	3 months	10-point VAS	MIVAT > CT	<0.05
Gagner, 2001, US ¹²	Retrospective cohort	No	34 (CT 18, ET 16)	3 weeks	10-point NS	ET > CT	<0.05
O'Connell, 2008, Canada ¹³	Prospective / retrospective paired cohort	Yes: 0.8 power	22 (CT&BNE 11, OMIP 11)	15 months (minimum 8 months)	POSAS VSS 10-point VAS	OMIP > CT&BNE	>0.05
Perigli, 2008, Italy ¹⁴	Prospective cohort	No	957 (CT 687, OMIT 214, MIVAT 56)	1 month	10-point NS	OMIT&MIVAT > CT	<0.05
Dobrinja, 2009, Italy ¹⁵	Prospective cohort	No	137 (CT 69, MIVAT 68)	1 month	4-point VRS	MIVAT > CT	<0.05
Bokor, 2012, Germany ¹⁶	Prospective cohort	Yes: MIVAT sample too small to fulfil 0.8 power	250 (CT 200, MIVAT 50)	Preoperatively and 6 months	Body image questionnaire	MIVAT > CT	>0.05
Docimo, 2013, Italy ¹⁷	Prospective cohort	No	982 (CT 211, OMIT 592, MIVAT 179)	1–6 months	10-point NS	OMIT&MIVAT > CT	<0.05
Linos, 2013, Greece ¹⁸	Retrospective cohort	Yes: 0.9 power	691 (CT&BNE 383, OMIT&OMIP 308)	55 months	PSAQ	OMIT&OMIP > CT&BNE	>0.05

BNE = bilateral neck exploration; CT = conventional thyroidectomy; ET = endoscopic thyroidectomy; MIVAT = minimally invasive video assisted thyroidectomy; NS = numeric scale; OMIP = open minimally invasive parathyroidectomy; OMIT = open minimally invasive thyroidectomy; POSAS = patient and observer scar assessment scale; PSAQ = patient scar assessment questionnaire; RCT = randomised controlled trial; VAS = visual analogue scale; VRS = verbal response scale; VSS = Vancouver scar scale

studies^{12,18} and one prospective/retrospective paired cohort study¹³ (Table 2). Two of the studies compared CT vs OMIT vs MIVAT,^{14,17} two compared CT vs MIVAT,^{15,16} one compared CT or bilateral neck exploration (BNE) vs OMIT or open minimally invasive parathyroidectomy (OMIP),¹⁸ one compared CT or BNE vs OMIP¹⁵ and one compared ET with CO₂ insufflation vs CT.¹² Three papers discussed a power calculation for the cosmetic assessment^{13,16,18} and three papers discussed the validity of the scar assessment tools used.^{13,16,18}

All four cohort studies containing MIVAT in one arm found this to be cosmetically superior to CT but this only reached statistical significance in three of the studies,^{14,15,17} none of which used a validated assessment tool at >6 months postoperatively. The single study that used a validated assessment tool (body image questionnaire) at six months found no significant cosmetic advantage to MIVAT.¹⁶ Likewise, two studies that looked at OMIT found this to be cosmetically superior to a collar incision, using a

Table 3 Summary of scar assessment tools

Tool	Scoring system	Attributes	Deficiencies	Advantages
Stony Brook scar evaluation scale ⁴⁵	0 (worst) to 5 (best) Visual analogue scale	4 physical scar characteristics Overall visual analogue scale for scar appearance	Photo-based scale Does not include patient assessment Not designed for long-term scar assessment	Designed for short-term appearance of repaired lacerations
Vancouver scar scale ⁵⁰	0 (best) to 13 (worst)	4 physical scar characteristics	Lacks patient perception, no symptom assessment, operator dependent	Used widely in burn scar assessment
Modified Hollander scale ⁵¹	0 (worst) to 6 (best) Visual analogue scale	5 physical scar characteristics Overall visual analogue scale for scar appearance	Limited number of scar characterisations No patient reported outcomes Initially designed for short-term appearance of repaired lacerations Not used extensively in research or clinical studies	Simple to use Designed for repaired lacerations or surgical scars
Manchester scar scale ⁵²	5 (best) to 18 (worst) Visual analogue scale	6 physical scar characteristics Overall visual analogue scale for scar appearance	Arbitrary assessment and weighting of items Designed to be filled in by clinician	Suitable for postoperative scars
Patient and observer scar assessment scale ⁵³	Observer score: 5 (best) to 50 (worst) Patient score: 6 (best) to 60 (worst)	5 physical scar characteristics 6 patient reported scar symptoms (colour, pliability, thickness, relief, itching, pain) Overall 10-point visual analogue scale for scar appearance	Patient items represented may not represent patient's own perceptions and concerns	Suitable for linear and non-linear scar assessment Includes patient's opinion
Patient scar assessment questionnaire ⁵⁴	Appearance: 9 (worst) to 36 (best) Consciousness: 6–24 Satisfaction with appearance: 8–32 Satisfaction with symptoms: 5–20	9 physical scar characteristics 6 consciousness attributes 8 satisfaction attributes	Symptoms subscale has been omitted owing to reliability issues related to format and application in scar groups with minimal symptoms	Developed specifically for linear scars Includes patient's opinion Completed by the patient Subscales can be used independently
Visual analogue scale ⁵⁵	0 (worst) to 100 (best)	5 physical scar characteristics and summing up of results for a final score	Photo-based scale Does not include patient assessment Reduced reliability and consistency if used by lay panel	Suitable for linear scars Simple to use

non-validated scar assessment tool at 1–6 months.^{14,17} Two adequately powered studies employing validated scar assessment tools at >6 months found no cosmetic advantage of OMIT or OMIP approaches when compared with conventional collar incisions.^{15,18}

Non-comparative case series

Seven case series (level 4) report a cosmetic assessment: three for CT^{25,31,32} and four for MIVAT.^{20,22–24} Wounds were closed with a variety of materials, and timing and method of scar assessment varied. All studies reported

excellent/high cosmetic and satisfaction scores with their respective approaches regardless of timing of assessment or scar assessment tools employed.

Discussion

Wound healing studies demonstrate that scars usually develop after 6–8 weeks following re-epithelisation and a period of 6–18 months is required for scar maturation.^{35,34} Healing and remodelling is largely completed by 8–12 months³⁵ so scar evaluation should be delayed until

1 year.⁵⁶ Scar aesthetics improve with time.^{56,57} The validity of scar assessment is open to criticism in the majority of the studies reviewed here as thyroidectomy scars were assessed at 1–6 months and only 4 of the 20 studies performed cosmetic assessment at >6 months postoperatively.

Scar assessment tools

Surgical wound healing is influenced by patient factors such as skin type, surgeon factors such as surgical technique, postoperative wound care (wound dressings, sun exposure) and postoperative complications such as infection or dehiscence.⁵⁵ Tissue repair can result in a variety of scars ranging from a fine line to pathological scars.⁵⁵ Patient satisfaction depends on scar appearance, symptoms and any functional limitations.^{55,58} Appearance alone is not necessarily the predominant factor.⁵⁸

Scar assessment is discussed in detail in the plastic and reconstructive surgery literature.^{56,59–41} A scar assessment tool is considered suitable for evaluation (ie validated) if it has been shown to be consistent (low intraobserver variability), reliable (low interobserver variability), feasible and appropriate in the field it is designed to assess (ie a scar scale for burns may not be adequate for linear surgical scars). Scar assessment tools should include ‘objective’ physical characteristics of the scar, scar aesthetics and scar symptoms as well as the patient’s consciousness of and satisfaction with scar aesthetics and symptoms (Table 5).^{59–41}

The patient and observer scar assessment scale (POSAS) and the patient scar assessment questionnaire (PSAQ) are comprehensive scar assessment tools, and they are the only scales that record patients’ symptoms and opinions of their scar.^{40,42,45} The PSAQ has also been validated for thyroid and parathyroid neck scars.⁴⁵ Visual analogue scales are used for a range of assessments⁴⁴ and have also been shown to correlate well with validated multidimensional scar assessment tool scores.^{15,45,46} Numeric and verbal response scales are tools that are used to assess a wide variety of clinical outcomes. Neither has been validated for cosmetic assessment.

Four studies undertook the scar assessment at >6 months using validated scar assessment tools.^{15,18,25,52} Two cohort studies, by Linos *et al*¹⁸ and O’Connell *et al*,¹⁵ demonstrated no statistically significant differences between open minimally invasive (OMIT, OMIP) and conventional approaches (CT, BNE) in terms of cosmetic outcome scores (POSAS, PSAQ). Both grouped thyroid and parathyroid scars together for analysis and O’Connell *et al*¹⁵ did not have thyroid surgery in both arms so the results of these studies may be of limited relevance to this review.

Criticisms of the study by O’Connell *et al* (CT/BNE vs OMIP)¹⁵ include the low number of patients ($n=22$, study was adequately powered), the older age of patients and the fact that it compared symmetric collar incisions (CT/BNE) with an asymmetric targeted parathyroidectomy incision (OMIP).⁴⁷ The study by Linos *et al* (CT/BNE vs OMIT/OMIP) compared outcomes in 691 patients, was adequately powered for cosmesis and used the PSAQ score.¹⁸ No statistically significant benefit was found for minimally invasive scars.

Two case series reported scar assessment at >6 months using a validated tool.^{25,52} Both demonstrated high patient satisfaction with either CT or MIVAT.

Incision length and cosmesis

The indications restrict MIVAT to only 10–20% of patients undergoing thyroid surgery.²⁶ An open incision for a small gland/thyroid nodule need not be 6–8cm although this is commonly cited by advocates of MIVAT.²⁰ Table 1 shows the postoperative length of minimally invasive and conventional cervicotomy scars. The variation in the length of cervicotomy scars may influence cosmesis independently of the approach employed. Some authors clearly adapt their incision length to thyroid size, some actively seek a short open incision and others do not. Thyroid volume has been shown to be an independent predictor of incision length⁴⁸ and in suitable patients, it is possible to perform an open thyroidectomy with an incision of 3.3–4.2cm. Other factors such as high body mass index and neck circumference will also increase scar length.⁴⁸

The question of whether shorter cervical scars are associated with improved cosmesis and patient satisfaction was addressed by Toll *et al*.⁵² In their case series of 80 CT patients, no association was found between incision length and patient satisfaction measured at 12.2 months postoperatively using a visual analogue scale.

Surgical technique and impact of cultural sensitivities

The effect of surgical technique on scar cosmesis is not easy to assess in the literature. Billmann *et al* presented the results of an adequately powered study comparing the cosmetic outcome of a conventional and ‘enhanced’ CT.⁴⁹ In the ‘enhanced’ group, patients were marked in supine and sitting position, care was taken to perform a symmetrical incision in a skin crease, wound edges were protected, traumatised skin was excised, the skin was closed with 5/0 absorbable monofilament sutures, silicone wound dressings were used postoperatively and specific wound instructions were given to the patients. The mean scar lengths were comparable in both groups. The results showed statistically significant body image and cosmetic scores favouring the enhanced treatment algorithm although the authors questioned the clinical significance as overall satisfaction was very high with both approaches.

All cited studies bar two^{9,11} were undertaken in North American and European populations. Only two studies disclosed a breakdown of ethnicity and skin types.^{15,18} The assumptions made in this review of the studied population cover physical patient characteristics (Fitzpatrick skin types) as well as cultural scar perceptions that may not be generalisable to other parts of the world.

Conclusions

Satisfaction with any cervical approach was high in all studies reviewed. All RCTs and some cohort studies assessed cervical scars using non-validated scar assessment tools before scar maturation had taken place. Only a few well designed cohort studies assessed mature scars

using validated scar assessment tools. These showed no cosmetic benefit for minimally invasive approaches. All case series demonstrated high satisfaction irrespective of the procedure or closure methods employed.

Adapting incision length, using careful surgical technique and postoperative wound care may ensure the best possible cosmetic outcome in all cases regardless of the surgical approach. Current evidence does not, however, support minimally invasive surgical approaches to the thyroid gland if improved long-term cosmesis is the goal.

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