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Original research

## Comparing transaxillary robotic thyroidectomy with conventional surgery in a UK population: A case control study

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## HIGHLIGHTS

- The uptake of transaxillary robotic thyroid surgery in the UK is low.
- Robotic thyroidectomy has not been previously evaluated in the UK.
- We prospectively evaluated robotic thyroidectomy and compared this with open thyroidectomy.
- Transaxillary robotic thyroidectomy is feasible and safe in a selected UK population.
- Transaxillary robotic thyroidectomy gives superior cosmesis over open thyroidectomy at the expense of time and cost.

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## ABSTRACT

**Introduction:** Transaxillary robotic thyroid surgery was pioneered in South Korea where cultural factors, anthropometry and remuneration favour this. Small thyroid nodules account for the majority of cases due to a national thyroid cancer screening programme. However, the technique has not been evaluated in the United Kingdom where larger thyroid nodules tend to undergo surgery in a patient population with a higher body mass index (BMI).

**Methods:** Long term prospective non-randomised study. Sixteen consecutive robotic hemithyroidectomy patients were compared to 16 open controls.

**Results:** There were no robotic conversions to open and no significant difference regarding pain, voice, or quality of life (QoL). In the robotic group, long term, scar cosmesis at 3 years was superior ( $p = 0.02$ ) although the operative time was significantly longer (228 min vs. 85 min,  $p = 0.01$ ). One patient had a transient recurrent laryngeal nerve paresis and another had temporary shoulder dysfunction. Both resolved in 4 weeks.

**Discussion:** This study highlights the considerable difference between a Western patient population compared to South East Asia. Despite this robotic thyroidectomy is feasible and safe in a UK population. **Conclusions:** Despite a low uptake in the UK compared to the Far East, robotic thyroidectomy represents a viable option for selected patients, achieving superior cosmesis compared with conventional thyroidectomy at the expense of time and cost. The key is careful patient selection. A randomised study is needed to establish the clinical efficacy compared to conventional surgery in this population.

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## 1. Introduction

Following the first publication of transaxillary robotic surgery (TARS) for thyroidectomy using the da Vinci<sup>®</sup> surgical robot (Intuitive Surgical, Inc., Sunnyvale, CA) in 2009 by a group in South Korea led by Chung [1], TARS thyroidectomy has been gaining increasing popularity. However, this popularity seems to be confined to South

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Korea and the Far East with the majority of publications on the subject originating from South Korean institutions. A possible explanation for this could be the negative connotation associated with having a horizontal neck scar which, in the Far East, is thought to denote death [2]. Although this cultural factor could be the main driver towards the development of “scarless” thyroidectomy, it cannot, in isolation, fully account for the disproportionate proliferation of TARS thyroidectomy in South Korea compared with Europe and North America.

Another important factor is that in South Korea, a national thyroid cancer screening program has been in place for years. Consequently, a substantial, increase in the incidence of thyroid cancer has been observed (15 times that of the UK and 5.6 times that of the USA [3], with an equivalent associated increase in the number of patients undergoing thyroid surgery). The majority of incidentally identified thyroid tumours are papillary microcarcinomas making them ideal for a robotic resection because the thyroid gland remains macroscopically normal in size. [4].

Other reasons for disparity in TARS thyroidectomy uptake include remuneration differences for the procedure. In the UK and US, thyroid surgery is remunerated according to the extent of surgery performed and not the type of approach used. On the contrary, in the Korean healthcare system, TARS thyroidectomy is reimbursed at four times the rate for conventional thyroid surgery and twice the rate for endoscopic thyroidectomy [5,6].

Both in the US and the UK, TARS thyroidectomy accounts for less than 1% of total thyroid surgical volume. In a recent study evaluating TARS thyroidectomy trends across the US, despite initial interest, numbers have declined since 2011. Several factors have been implicated including retraction of support for TARS thyroidectomy from the robot manufacturer due to complications reported with the approach and associated concerns over the validity of its Food and Drug Administration (FDA) approval [7].

A less apparent but equally important factor contributing to this disparity may be the anthropometric differences between Far Eastern and Western populations. As an example, the mean BMI in the UK is 25.4 kg m<sup>-2</sup>, which is considerably higher to that in South Korea at 22.7 kg m<sup>-2</sup> [8,9]. An increased body habitus has been shown to make TARS thyroidectomy more technically challenging [10–12].

Hence, the anthropometric differences between the South Korean (smaller, slimmer patients facilitating transaxillary access) and Western populations combined with the fact that in the Western World patients generally present with larger thyroid nodules make TARS thyroidectomy practice potentially more challenging in the West. These pose questions with regards to the applicability of the results from publications on TARS thyroidectomy from South Korea to Western populations. This study, the first to assess the applicability of TARS thyroidectomy in a selected UK population, prospectively compares TARS thyroidectomy performed by an experienced group in TARS thyroidectomy (more than 50 cases to date) to the time-honoured open thyroidectomy approach with the longest follow-up of any published study on TARS thyroidectomy to date [13].

## 2. Materials and methods

### 2.1. Ethical approval

The study received favourable approval from the National Health Service (NHS) Health Research Authority (National Research Ethics Service Committee London, Protocol Reference Number: 08/H0721/97).

### 2.2. Study design

A prospective comparative ethically approved pilot study was conducted, as randomisation was ultimately not feasible. Patients were recruited between March 2009 and June 2012 from the Departments of Otorhinolaryngology and Head & Neck Surgery, St. Mary's Hospital and Endocrine and Thyroid Surgery, Hammersmith Hospital, both part of Imperial College Healthcare NHS Trust, London, UK. Sixteen consecutive patients with unilateral thyroid disease who underwent TARS thyroidectomy and 16 consecutive patients with unilateral thyroid disease who underwent conventional thyroidectomy were compared. The selection criteria were the same for the 2 groups as described below. Both approaches were offered to all patients that met those criteria and the first 16 patients that opted for the robotic approach were compared with the first 16 that opted for conventional surgery.

### 2.3. Selection criteria

Patients with a solitary thyroid nodule less than 6 cm (by ultrasound dimensions) confined to one thyroid lobe were eligible. Patients with evidence of thyroiditis, previous neck surgery or irradiation and Thy5 (Bethesda system VI) cytology were excluded from the study. Indications for surgery followed the British and American Thyroid Association guidelines [14,15]. The majority of patients had either Thy 3 (Bethesda system IV) cytology or Thy 2 (Bethesda II) cytology with other suspicious features on history, clinical examination and/or ultrasonography mandating a thyroid lobectomy. All cases had been discussed at the Imperial Thyroid Multidisciplinary Team (MDT) Meeting and only cases where the consensus of the Tumor Board was to proceed with a thyroid lobectomy were eligible for inclusion in the study.

### 2.4. Subjects

Thirty two (n = 32) patients were recruited. The patient demographics, BMI, nodule size, biometric measures and histology are summarized in Tables 1 and 2.

### 2.5. Treatment allocation

The selection of a robotic (n = 16) versus a conventional approach (n = 16) was based upon patient preference. Both approaches were offered to all patients. TARS thyroidectomy was performed by the same console and bedside surgeons (NST and AA respectively). This team also performed all the conventional thyroidectomies. The senior surgeon (NST) had significant experience in thyroid surgery in excess of 100 cases per annum.

### 2.6. Surgical technique

The surgical approach for TARS thyroidectomy has been extensively described in the literature [16]. A modification to the original technique described by Chung was used which relates to ipsilateral arm positioning. The arm is positioned whilst the patient is awake in order to ensure comfort and thus minimize the intraoperative risk of traction on the brachial plexus with subsequent neurapraxia. The position involves the back of the patient's hand touching the central portion of the forehead, in an “extended salute” position (Fig. 1) [17]. A transoral endotracheal tube with electrodes (NIM EMG Endotracheal Tube, Medtronic, Inc., Jacksonville, FL) was used in all 32 cases. For the robotic cases, an extended tip of the NIM was used due to the long distance between the axillary incision and neck.

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