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**Robotic transoral vestibular parathyroidectomy: Two cases report and review of literature**

Ozdenkaya Y *et al.* Robotic transoral vestibular parathyroidectomy

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**Abstract**

Advances in preoperative localization studies and demands for scarless surgery have promoted the researches for remote techniques in parathyroid surgery. Transoral vestibular approach seems to provide the most comfortable and safe access to the neck. In this paper we report our initial experience of robotic transoral vestibular parathyroidectomy (RTVP) in 4 patients with primary hyperparathyroidism. The surgery was performed with Da Vinci system through 3 trocars introduced from lower lip vestibule. The procedure was converted to open in 2 patients due to inappropriate preoperative localization. The mean operative time was 169 min. No postoperative complications were seen. Patients were discharged on postoperative day 1. RTVP is a feasible and safe technique which allows better surgical exposure and manipulation of the instruments. The advantages of transoral vestibular approach can be enhanced by robotics. Further studies are needed to analyze complications and costs.

**Key words:** Robotics; Parathyroidectomy; Transoral vestibular surgery; Natural orifice transendoluminal surgery; Parathyroid adenoma

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**Core tip:** In this paper we present the first national transoral parathyroidectomy cases and in our knowledge, these are the first transoral vestibuler robotic parathyroidectomy cases without thyroidectomy. Our results indicate that correct preoperative localization and experience is essential for success in minimally invasive parathyroidectomy.

Ozdenkaya Y, Ersavas C, Arslan NC. Robotic transoral vestibular parathyroidectomy: Two cases report and review of literature. *World J Clin Cases* 2018; In press

**INTRODUCTION**

Transverse neck incision is the common standard in endocrine neck surgery. Despite satisfactory surgical outcome, surgeons have been searching for alternative approaches to the neck during recent years, as the cosmetic results are disappointing, particularly in young female patients. Open minimally invasive parathyroidectomy was substituted for bilateral neck exploration with less complications and smaller scar[1]. Nevertheless, demands for scarless surgery made the surgeons to be in a quest of remote approaches. Several endoscopic or robotic techniques were described for thyroidectomy and/or parathyroidectomy including trans-axillary, trans-areolar and retroauricular approaches, however none of them has become widespread due to necessity of extensive dissection, limitations in exposure, morbidities and presence of small but visible incisions[2-5]. Transoral approach which allows better exposure to the surgical field, easy identification of recurrent laryngeal nerve (RLN) and comfortable extraction of the specimen has emerged to come over these limitations[6]. Transoral parathyroidectomy was first described through the mouth floor but not widely accepted due to complications and poor patient compliance[7-9]. Endoscopic transoral vestibular parathyroidectomy is a feasible and safe technique which is considered to provide a direct approach to the glands with excellent cosmetic results[10-13].

Robotic endocrine neck surgery has been introduced initially in South Korea[14]. Several reports suggested the safety and comfort of robotic endocrine neck surgery through axilla and/or breasts when compared with conventional laparoscopy[3,15,16]. Robotic transoral vestibular approach to neck may combine the advantages of robotics and natural orifice surgery. There are two studies in the literature reporting robotic transoral vestibular parathyroidectomy (RTVP) including only 4 cases[17,18]. In this paper we present the first national transoral parathyroidectomy cases and in our knowledge, these are the first RTVP parathyroidectomy cases without thyroidectomy.

**CASE REPORT**

All cases underwent RTVP by a single surgeon in our institution between January and February 2018. Based on patients’ demands for scarless surgery, RTVP was discussed with the patients and written informed consent was received. Etiology was primary hypoparathyroidism (PHPT) in all patients. Details of the patient characteristics are given in Table 1.

***Surgical technique***

Patients were placed in supine position and intubated with nerve monitoring endotracheal tube. Intravenous antibiotic prophylaxis of 1 g amoxicillin plus clavulanic acid was administered. Hyperextended neck position was adjusted. Skin and oral antisepsis were provided with chlorhexidine. The lower lip vestibule was incised at the center. Subcutaneous tissue was dissected bluntly until the mandible was reached. One to five hundred thousand epinephrine of 40 cc was injected to create a subplatysmal plane. 12 mm central and two 5 mm lateral trocars were introduced and CO2 insufflation at 6 mmHg was started. Da Vinci Xi system (Intuitive Surgical, Sunnyvale, CA, United States) was docked. Blunt and sharp dissection with hook cautery was performed until reaching sternal notch in the inferior and sternocleidomastoids in the laterals. Strap muscles were lateralized and hanged to the skin with silk sutures. The related thyroid lobe was mobilized and enlarged parathyroid gland was removed using endoscopic dissector (Figure 1). The integrity of RLN was identified visually and by nerve monitoring during the surgery. The specimen was extracted through midline incision (Figure 2). The success of the resection was confirmed with intraoperative quick parathyroid hormone (PTH) level decrease. The surgical site was irrigated, and incisions were closed with polyglactin sutures. A compression dressing was applied.

In patient 1 and patient 2, we converted to open surgery due to inconsistency between preoperative localization studies and intraoperative findings. Preoperative scintigraphy was negative in both patients. In patient 1, ultrasound was indicating an enlarged left superior gland which was completely normal in intraoperative exploration. Alike in patient 2, ultrasound reported an enlarged left superior gland. We kept exploring other glands, but the operative time and tissue dissection had been excessive. These were our first cases and the BMIs were over 30 kg/m2 in both patients. So, we decided to perform open neck exploration. We found a right inferior parathyroid adenoma in patient 1 and a left inferior parathyroid adenoma in patient two both confirmed with quick PTH. Intraoperative bleeding was insignificant (<25 ml) in all cases.

***Postoperative care***

All patients were discharged on postoperative day 1 after calcium and PTH levels were checked. Oral Cephalexine 500 mg twice a day was continued for 5 d. On postoperative day 7, patients were seen in outpatient visit and vocal cords were examined by flexible laryngoscopy. The minimum follow-up was 6 (6-8) mo. No postoperative complications were seen. Cosmetic satisfaction was excellent in 2 patients which the surgery was completed endoscopically.

**DISCUSSION**

Developments in preoperative localization studies have enabled minimally invasive techniques in PHPT treatment. Considering a substantial part of those patients are young women, remote access to the neck without visible scars has been focused by the surgeons during recent years. Several techniques such as transaxillary or inframammary approaches have been described, however it is difficult to qualify those as minimally invasive due to requirement of extensive dissection[2,4]. A good minimally invasive technique should provide not only invisible or short incisions but a short distance between the incision and surgical site which avoids excessive dissection and direct access to the surgical site. Instrumental collision should be minimum with a good operative exposure to safely identify important anatomical structures. For this purpose, transoral neck surgery has been described.

Witzel *et al*[6] and Karakas *et al*[7] reported the first experimental trials on fresh human cadavers and pigs through transoral sublingual approach. Karakas *et al*[7] published the first transoral sublingual parathyroidectomies in human in 2010 and 2014[9]. Of the 7 patients; 2 required conversion to open, 2 had transient hypoglossal nerve palsy and 1 had transient RLN palsy. Since then, sublingual thyroid and/or parathyroid surgery have been studied but have not been popularized due to difficulty and complications[19].

Transoral vestibular approach to the neck was first described by Richmon *et al*[20] in a cadaveric study of 2 robotic thyroidectomies. They concluded that introducing the camera from the oral vestibule was more comfortable than sublingual approach and robotics might overcome the limitations of conventional endoscopic neck surgery. Further studies have been published on endoscopic transoral vestibular thyroidectomy using either gasless technique or CO2 insufflation. The most common complication was persistent paresthesia of the chin skin (mental nerve injury)[21,22]. In 2016, Anuwong[11] published a transoral endoscopic vestibular thyroidectomy series of 60 cases. He reported no mental nerve injury, two had transient hoarseness and a late postoperative hematoma. In another study, 46 patients who underwent transoral endoscopic vestibular thyroidectomy were compared with open thyroidectomy in Graves disease. Operative time was longer and pain was less in endoscopic group, where other results were similar[23].

The conformation of transoral vestibular approach has been evolving parallel with thyroidectomy. In 2016, Udelsman *et al*[12] reported two transoral endoscopic vestibular parathyroidectomies without any complications. In 2017, Sasanakietkul *et al*[10] published the results of 12 transoral endoscopic vestibular parathyroidectomies. This group has a huge endoscopic neck surgery experience. The mean operative time was 107.5 min for PHPT patients in their study. They reported RLN injury in 1 patient which resolved spontaneously in 1 month. No mental nerve injury or infections were seen. Recently, another report from India was published[13]. This study includes 12 patients with PHPT who underwent transoral endoscopic vestibular parathyroidectomy. The mean operative time was 112 min and there were no postoperative complications. In our robotic procedures, the mean operative time was 169 min. The docking of the robot and preliminary learning curve are the reasons for this difference. In our cases we did not have any complications.

Transoral vestibular approach seems to be the best option for remote access neck surgery. The feasibility and safety of the procedure have been shown in numerous studies. We believe that the superiority of this technique can be enhanced by robotics. Conventional endoscopy has well known limitations including interposition of the instruments, inadequate 2-dimensional exposure, unfavorable surgical comfort and long learning curve. Robotic transoral vestibular surgery provides 3-dimentional magnified view through a direct access to the neck which enables superior identification of important anatomical structures. Robotics also minimize the collision with articulated instruments and a stable platform. There are scarce data in the literature focused on robotic transoral vestibular approach. Russel *et al*[18] performed 6 robotic thyroid lobectomy, one with parathyroidectomy, through transoral vestibular access. Another case report of RTVP by Bearelly *et al*[17] described excision of an ectopic retropharyngeal parathyroid but the approach was through posterior pharynx. In our knowledge, our report presents the first pure RTVP cases[24]. Transoral vestibular approach can also provide convenience in neck dissection and surgery of thyroid malignancies, however there is no data about parathyroid malignancies in the literature[24,25]. The steps of the surgery should be well defined for patient safety before adoption of this technique[26]. A recent study comparing robotic and laparoscopic transoral vestibular approach revealed similar safety and feasibility but longer operative time for robotic surgery which indicates the role of learning curve[27].

In our institution we perform robotic surgery more than 5 years including bariatric and adrenal procedures. The application of robotics to endocrine neck surgery has just started in 2018. Out of 4 cases, we converted to open surgery in 2, due to wrong preoperative localization of the glands. The limited experience and extended operative time drove us to convert to open. Relatively high BMI of those patients might be another point. We did not perform a cost analysis. Despite these limitations, we did not see any postoperative complications. Cosmetic results were excellent even in early postoperative period.

The transoral vestibular approach seems to be the future of minimally invasive parathyroidectomy. Robotic approach through transoral vestibular access may overcome the limitations of initially described endoscopic transoral vestibular technique. The potential benefits of RTVP may theoretically decrease the incidence of postoperative complications. Further studies including wide series and cost analysis are needed.

**ARTICLE HIGHLIGHTS**

***Case characteristics***

The patients presented with asymptomatic hypercalcemia.

***Clinical diagnosis***

All the patients were diagnosed with parathyroid adenoma.

***Differential diagnosis***

Neck ultrasound and parathyroid scintigraphy were performed to identify the etiology of primary hyperparathyroidism.

***Laboratory diagnosis***

Calcium and parathormone levels were elevated and intraoperative decrease of parathormone was observed in all cases.

***Imaging diagnosis***

Single parathyroid adenoma was detected in all cases.

***Pathological diagnosis***

Diagnose of parathyroid adenoma was confirmed by postoperative histopathologic examination.

***Treatment***

Robotic transoral vestibular parathyroidectomy was performed.

***Related reports***

**Udelsman R**, Anuwong A, Oprea AD, Rhodes A, Prasad M, Sansone M, Brooks C, Donovan PI, Jannitto C, Carling T. Trans-oral Vestibular Endocrine Surgery: A New Technique in the United States. *Ann Surg* 2016; **264**: e13-e16 [PMID: 27649533]

***Experiences and lessons***

Robotic transoral vestibular approach is a safe and feasible method for well-located parathyroid adenomas.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | Age | Sex | BMI  (kg/m2) | Etiology | Preop. PTH (pq/mL) | Intraop. PTH  (pq/mL) | Blood loss (mL) | Op. time (min) | Conversion to open | Hospital stay (d) | Final diagnose |
| 1 | 37 | F | 35.3 | PHPT | 161 | 6.9 | 50 | 205 | Yes | 1 | Right inferior parathyroid adenoma (15 mm × 10 mm × 8 mm) |
| 2 | 38 | M | 32.4 | PHPT | 97 | 21 | 40 | 196 | Yes | 1 | Left inferior parathyroid adenoma (18 mm × 12 mm × 10 mm) |
| 3 | 43 | F | 26.6 | PHPT | 815 | 33 | 20 | 162 | None | 1 | Left inferior parathyroid adenoma (32 mm × 13 mm × 7 mm) |
| 4 | 66 | F | 27.5 | PHPT | 281 | 70 | 20 | 176 | None | 1 | Left inferior parathyroid adenoma (18 mm × 12 mm × 10 mm) |

**Table 1 Characteristics and surgical results of the patients**

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**Figure 1 Intraoperative view of case 3.** A: Left inferior parathyroid adenoma located under inferior thyroid artery; B: Resection of the gland. ITA: Inferior thyroid artery; PTA: Parathyroid adenoma.

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**Figure 2 View of the surgical site after the specimen extraction.**