Robotic Transaxillary Parathyroidectomy for Upper Mediastinal Parathyroid Adenoma: A Case Report

Luis Fernando Gonzalez-Ciccarelli*, Sofia Esposito, Antonio Bevere, and Pier Cristoforo Giulianotti
Division of General, Department of Surgery, University of Illinois Hospital and Health Sciences System, USA

Abstract

Background: Gold standard treatment for Primary hyperparathyroidism (PHPT) is surgical resection of the adenoma, which in nearly 22-25% of the cases is ectopic. The evolution of preoperative imaging techniques, in association with the intraoperative PTH measurement (IOPTH) have led to the development of minimally invasive targeted approaches for the management of PHPT. We hereby report a case of a mediastinal parathyroid adenoma removed using the robotic-assisted transaxillary approach.

Case presentation: A 46-year-old female presented with PHPT caused by a parathyroid ectopic adenoma located in the upper mediastinum, adjacent to the left sternal notch. We performed a robotic transaxillary parathyroidectomy, with IOPTH measurement. Total operative time was 97 minutes, with no complications. The patient was discharged the next day. At one month follow up total serum calcium was between normal ranges.

Discussion: The Robotic transaxillary approach for parathyroid adenoma has been recently described in literature providing promising results. This procedure completely avoids a scar in a visible area such as the neck and can be performed without the need for gas insufflation. This procedure is particularly recommended in selected patients with history of keloid or hypertrophic scar formation or deeply concerned about the cosmetic outcomes. Robotic-assisted surgery allows fine dissection with better control of the instruments even in narrow spaces.

Conclusion: The role of the transaxillary approach in ectopic mediastinal parathyroid adenoma is still under evaluation, but in our opinion, it represents a valid option in case of a well localized single adenoma in the upper mediastinum.

ABBREVIATIONS

PHPT: Primary Hyperparathyroidism; PTH: Parathormone; IOPTH: Intraoperative parathormone measurement; SPECT: Scintigraphy With Single Photon Emission Computed Tomography

INTRODUCTION

Primary hyperparathyroidism (PHPT) is considered to be the third most frequently diagnosed endocrine disorder in the US and in Europe, after type 2 diabetes and thyroid diseases [1,2]. In 85-90% of the patients it is caused by a single parathyroid adenoma, which in nearly 22-25% of the cases is ectopic [3,4]. The three most common locations of an ectopic parathyroid adenoma are retro/paraesophageal space, intrathyrmic and intrathyroidal [4].

The gold standard treatment for PHPT remains surgical resection of the adenoma. An accurate identification of abnormal parathyroid glands is strictly correlated to a successful operation. Therefore, standard surgical treatment for PHPT was previously considered a cervical incision involving bilateral neck exploration for visualization and localization of all four parathyroid glands with subsequent removal [5]. The evolution of preoperative imaging techniques, such as technetium-99m-sestamibi scintigraphy with single photon emission computed tomography (SPECT), in association with the intraoperative parathormone measurement (IOPTH) have led to the development of minimally invasive targeted approaches for the management of PHPT. These...
techniques have been considered the standard of treatment in many institutions [4,6,7].

Most of the minimally invasive techniques, such as videoscopically assisted parathyroidectomy, minimally invasive radio-guided parathyroidectomy and focused parathyroidectomy, are more appropriately minimal access techniques, in which the parathyroid procedure is performed with a small neck incision (less than 2.5 cm) [8].

On the other hand, pure endoscopic parathyroidectomy can be performed with an anterior or lateral approach, thus resulting in small, distant scars. These techniques are often difficult to reproduce and they could present complications associated to CO2 absorption, such as subcutaneous emphysema, pneumomediastinum and air embolism [9,10].

The introduction of the daVinci robot surgical system has helped enhancing remote access techniques (transaxillary, retroauricolar, transthoracic), overcoming the technical limitations of the endoscopic approaches and avoiding the need for insufflation [11,12].

For ectopic parathyroid adenomas located in the mediastinum, both the robotic thoracoscopic and video assisted techniques have been described to provide a less invasive approach when compared to open cervical incision, sternotomy or thoracotomy [13-15]. We hereby report a case of a mediastinal ectopic parathyroid adenoma removed using the robotic-assisted transaxillary approach.

**CASE PRESENTATION**

A 46-year-old female presented to the emergency department with fatigue, twitching and cramping in her legs and numbness in her fingertips. Calcium and parathormone (PTH) levels were 12.4 mg/dl and 184 pg/ml, respectively. Past medical history was positive for diabetes, vitamin D deficiency, obesity and hyperlipidemia.

She underwent a SPECT/CT study that revealed persistent focal activity within the region inferior to the left thyroid lobe, with a 1 cm soft tissue nodule just adjacent to the left sternal notch, consistent with parathyroid adenoma (Figure 1). The neck ultrasound could not detect the adenoma reported in the SPECT/CT. A chest CT with IV contrast was performed and confirmed the presence of a 12x12 mm mass located just anterior to the left common carotid artery along the inferior margin of the left lobe of the thyroid gland.

The patient was selected to undergo a robotic transaxillary left parathyroidectomy.

**Surgical technique**

The patient was placed in a supine position, with the left arm partially abducted in order to expose the left axilla. A 6 cm incision

---

**Figure 1** SPECT/CT showing the presence of an ectopic upper mediastinal parathyroid adenoma (Red Arrow), located behind the sternal notch.
was made in front of the lateral tendon of the pectoralis muscle. The working space was created dissecting in front of the fascia, reaching the clavicle and entering into the neck space. Dissection continued between the two heads of the sternocleido mastoid muscle, reaching the strap muscles and prethyroid muscles, as shown in (Figure 2). At this point, a self-maintaining retractor was placed and the robotic system was docked, coming from the patient’s right side. We used the robotic 10-mm down-viewing 30° scope. The lower pole of the thyroid was explored and lifted, allowing us to identify an enlarged parathyroid gland, partially behind the sternum. Dissection of the parathyroid gland and vascular bed was performed using the Harmonic Scalpel (Ethicon Endo-Surgery, Cincinnati, OH), and Cadiere forceps (Figure 3).

Intraoperative PTH monitoring was performed before and after parathyroid resection, PTH levels dropped from 364 pg/ml to 20 pg/ml after removal. Frozen pathology confirmed the presence of hyperplastic tissue.

Total operative time was 97 minutes, including docking time. Estimated blood loss was approximately 20 ml with no intraoperative complications. The patient was discharged on postoperative day 1 with no signs and symptoms of hypocalcemia. Total serum calcium at discharge was 9.4 mg/dl. At a 1 month follow up patient presented improvement of symptomatology and serum calcium between normal ranges.

**DISCUSSION**

The robotic transaxillary approach for parathyroid adenoma has been recently described in literature providing promising results [11,16-18]. This procedure completely avoids a scar in a visible area such as the neck and can be performed without the need for gas insufflation, thus being able to overcome the limits of endoscopic parathyroidectomy. A transaxillary approach could be a safe and effective option in selected cases. We believe that patient selection is critical, exclusion criteria should be previous neck surgery, large body habitus and unclear localization of the adenoma on preoperative image studies. This procedure is particularly recommended in patients with history of keloid or hypertrophic scar formation and patients deeply concerned about the cosmetic outcomes.

Karagkounis et al., compared 8 robotic transaxillary cervical parathyroidectomies to 6 transthoracic mediastinal parathyroidectomies concluding that both techniques were safe with all patients treated successfully, no evidence of recurrence and low morbidity. However, transthoracic parathyroidectomies are more traumatic procedures due to the need of one-lung ventilation thus requiring a longer hospital stay [16]. In this case, we were able to successfully resect the retrosternal adenoma with a transaxillary approach.

In confined areas such as the neck and mediastinum, robotic-assisted surgery allows fine dissection with better control of the instruments. The robotic system provides enhanced visualization with the 3-dimensional view of the surgical field, tremor filtering and improved instruments’ range of motion [19]. One of the limits of the robotic approach was considered to be long operative time, but it has been demonstrated to improve with increasing experience [20].

IOPH monitoring is essential in order to confirm an appropriate resection of the adenoma. PTH has a half-life of approximately 4 minutes, allowing the PTH measurements to be tested shortly after the removal of the adenoma. A drop in PTH of 50% is considered to be consistent with a successful resection [16]. In this case the PTH decreased by 93%, suggesting a successful operation.

A parathyroidectomy can lead to many different complications including hypocalcemia, recurrent laryngeal nerve injury, wound infections and hematoma. None of these presented in our patient, even though the incidence of hypocalcemia following parathyroid surgery is higher in patients with history of vitamin D deficiency [21].

**CONCLUSIONS**

Ectopic parathyroid adenomas can be considered a technical challenge. Platform stability, tremor filtering and endorwristed instruments allow precise anatomical dissection, even in narrow surgical spaces. The role of the transaxillary approach in ectopic conditions is promising and deserves further investigation.
mediastinal parathyroid adenoma is still under evaluation, but in our opinion it represents a valid option in cases of a well localized single adenoma in the upper mediastinum. Not only it offers cosmetic benefits due to the single skin incision in a neutral area, but also results in faster return to functional activities, less pain and morbidity, when compared to the transthoracic approach.

CONFLICT OF INTERESTS

Luis Fernando Gonzalez-Ciccarelli1 MD, Sofia Esposito1 MD, Antonio Bevere1 have no conflicts of interest. Pier Cristoforo Giulianotti is a consultant for Covidien LP, and Ethicon, Inc.; he has a proctoring agreement and Grant support as Chief of the Division.

REFERENCES