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Case Report

Robot-assisted endoscopic mediastinal parathyroidectomy

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ABSTRACT

Ectopic parathyroid glands can be located at any anatomical location from the base of the tongue to the mediastinum. One-third of these glands migrate deep into the mediastinum, which are not accessible with a low cervical incision. In this article, we described the robotic approach to an ectopic mediastinal parathyroid gland. This management method of mediastinal adenomas has significant advantages when compared to conventional surgery.
Keywords: Robotic surgery, thoracoscopic surgery, parathyroid adenoma, parathyroidectomy

INTRODUCTION

The parathyroid glands are generally located in the cervical region, just behind the thyroid gland. These glands are involved in the production of parathyroid hormone (PTH), which is important for the concentration of calcium and phosphate in the blood. In some cases, there is an excess of PTH in the bloodstream due to over activity of one or more parathyroid glands, also called primary hyperparathyroidism. In addition, 15-20 percent of patients with abnormally functioning parathyroid glands have ectopic parathyroid glands due to abnormal migration during embryogenesis (1). These glands can be located at any anatomical location from the base of the tongue to the mediastinum. Removal of these ectopic parathyroid glands depends on their size and location. In most cases, these glands are found in the superior mediastinum which can be successfully removed by a cervical approach (2). Unfortunately, one-third of ectopic parathyroid glands migrate deep into the mediastinum and thus are not accessible with a low cervical incision (3). The ectopic parathyroid glands used to be removed by performing a sternotomy or thoracotomy (4). However, these open procedures were correlated with a higher morbidity risk, high complication rate, longer post-operative recovery, and poor cosmetic results (4). In the past decades, video-assisted thoracoscopic surgery (VATS) was described to be a more safe, less invasive, effective, and feasible procedure for resection of the deep mediastinal parathyroid lesions (5). However, randomized controlled trials should be carried out to support these findings.

Recently, another alternative minimally invasive technique was introduced to the surgical treatment of ectopic mediastinal parathyroid, namely, the da Vinci® robotic system. In a similar context, this technique has already made a significant contribution to, among others, thymectomies (6). This technology revolutionized the field of minimally invasive surgery. In this article, we report a case of robot-assisted endoscopic mediastinal parathyroidectomy, which to our knowledge, is the first case in Turkey.

CASE PRESENTATION

Preoperative Work-Up

A 45-year-old man with a body mass index of 22 presented to a hospital with a history of nephrolithiasis, diffuse joint pain, and problems with walking for 1 year. His serum calcium, PTA and alkaline phosphatase (ALP) levels were increased. A thoracic computed tomography (CT) scan showed a lesion that was interpreted as a lymphadenopathy. Also, a bone scintigraphy was performed and the findings confirmed a metabolic bone disease. The patient was then referred to our institution for further evaluation.

The patient had normal findings on physical examination. However, blood tests revealed an elevated serum calcium (12.9 mg/dL; normal value: 8.5 to 10.2 mg/dL), elevated ALP (2540 U/L; normal value: 20 to 120 IU/L), decreased phosphate (1.7 mg/dL; normal value: 2.4-4.1 mg/dL), and an elevated PTH level (1529.2 pg/mL; normal value: 13 to 54 pg/mL). With regard to these findings, a neck ultrasound showed no evidence of a parathyroid adenoma. Subsequently, a CT scan of the thorax and abdomen showed a 2 cm, hyper-vascular, solitary nodule at the anterior mediastinum, at the level of the anterior aspect of the ascending aorta (Figure 1). This was confirmed by a ^{99m}Tc methoxyisobutylisonitrile

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(MIBI) scintigraphy (Figure 2). In addition, the CT-scan identified diffuse heterogeneous density of the bone structures and a well-defined lytic bone lesion of 2.2 cm at the level of the left femoral head, which could be associated with a Brown tumor. With regard to this, a bone scintigraphy was performed that showed diffuse increased bone activity. This finding could be consistent with the ectopic parathyroid adenoma. Primary hyperparathyroidism may occur as a part of Multiple Endocrine Neoplasia (MEN) type 1 or type 2A. Multiple endocrine neoplasia type 2A (MEN-2A) is a hereditary condition associated with three primary types of tumors: medullary thyroid cancer, parathyroid tumors, and pheochromocytoma. Multiple Endocrine Neoplasia (MEN-1) was originally known as Wermer syndrome. The most common tumors seen in MEN-1 involve the parathyroid gland, islet cells of the pancreas, and pituitary gland. Therefore, a magnetic resonance imaging (MRI) of the pituitary gland was performed to exclude this option. The MRI scan showed no abnormalities and therefore MEN-1 was not considered as part of differential diagnosis. During the pre-operative period, serum calcium level was determined daily due to hypercalcemia. The elevated serum calcium level was tried to be lowered with intravenous saline hydration, furosemide, and pamidronate treatment. Nevertheless, the serum calcium level remained high (>15.0 mg/dL). Therefore, hemodialysis was carried out two times prior to surgery.

Figure 1. Mediastinal parathyroid adenoma CT image

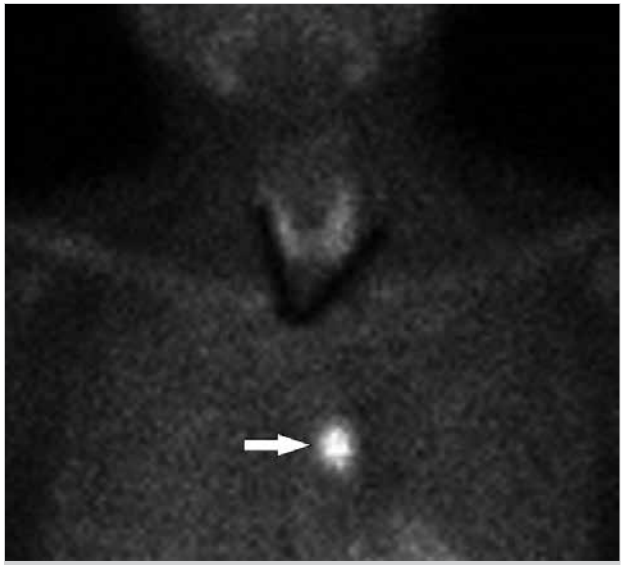

Figure 2. Mediastinal parathyroid adenoma MIBI scintigraphy image

Operative Approach

This patient was evaluated by the Multidisciplinary Endocrine Consultation Team. The team proposed to perform thoracic resection of the MIBI-positive mediastinal solitary nodule using a robotic assisted approach. An informed consent was obtained from the patient, and the operation was performed totally thoracoscopically via the da Vinci Si robot system® (Intuitive Surgical Sarl, Aubonne, Switzerland) with intraoperative intact PTH guidance.

The da Vinci robot consists of a manipulator unit with three arms (two instrument arms and a central arm to guide the endoscope), and a remote master console (optical control with 3-dimensional vision and tele manipulators of the arms). A right-sided approach was chosen due to the location of the solitary ectopic gland. The patient was positioned in a supine position at the edge of the operating table by placing silicone gel behind his right shoulder/upper back. The patient was somewhat tilted to the left side. The right arm was positioned below the table level with flexion at the elbow. The procedure was performed under general anesthesia with double-lumen endotracheal intubation for left single-lung ventilation. The right parietal pleura was incised, and the right chest cavity was entered. A 12-mm port for the 30-degree upward stereo endoscope was placed in the 5th intercostal space at the mid-axillary line, where the incision was made previously for entering the right cavity. Subsequently, two 8-mm robotic operating ports were positioned, both at the anterior axillary line, in the 3rd and 6th intercostal spaces. The three robotic arms of the da Vinci system were attached to these three ports. An accessory additional port was placed in the midclavicular line, just below the nipple (Figure 3). The procedure was performed by two surgeons, one at the console and one surgeon assisting at the operating table using the additional port. The right lung was deflated, and CO2 insufflation was set at 10mm Hg through the camera port with careful hemodynamic monitoring. With this, an improvement of the visualization of the operative field is achieved by washing out diathermy smoke. Fenestrated bipolar forceps and electrocautery hook with EndoWrist® action were used for dissection of the ectopic gland. Dissection was started towards the ectopic gland, skin marking has been previously performed. The mediastinal pleura was opened until the left parietal pleura was visible. Dissection was proceeded towards the ascending aorta and the ectopic gland was identified adjacent to this major blood vessel. The ectopic gland was manipulated and finally removed using the instruments

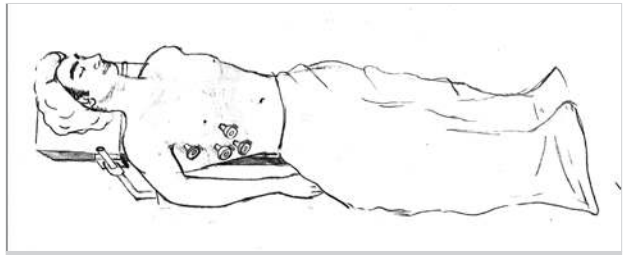

Figure 3. Patient and port positioning

Figure 4. Operative image (Dissection of parathyroid adenoma)

(Figure 4). The right phrenic nerve and the esophagus were identified and preserved. After completion of the dissection, the ectopic gland was removed from the thoracic cavity using an Endo Catch™ bag. At the end of the operation, a chest tube was placed and directed toward the apex of the right hemithorax.

The total operative time was 119 minutes, while the robotic process took 35 minutes and the docking time lasted only 5 minutes. Intraoperative blood loss was minimal and no complications occurred during the operation. There was no bleeding. Serum PTH and calcium levels were determined 20 minutes post-excision. Both PTH and calcium levels showed an appropriate decrease after removal of the ectopic gland (31.6 pg/mL and 9.1 mg/dL, respectively). The patient recovered in the post anesthesia unit and was transferred to the regular nursing unit on the same day. A chest x-ray was performed that did not showed any signs of pneumothorax. The chest tube was removed on postoperative day 1.

With regard to hungry bone syndrome, serum PTH and calcium levels were assessed daily during the postoperative period. During the early postoperative period, calcium levels dropped slightly below normal levels. Hereby, the patient received calcium and vitamin D3 supplements. There were no postoperative complications. The patient was discharged with calcium and vitamin D3 supplements, and the tissue was histopathologically confirmed as a parathyroid adenoma.

DISCUSSION

Parathyroid glands are rarely located in the mediastinum, which are often removed through sternotomy or thoracotomy (<1% - 3%) (3). In this article, we described the robotic approach to the ectopic mediastinal parathyroid gland. This management method of mediastinal adenomas has significant advantages when compared to conventional surgery and maybe even the VATS procedure. Compared with the conventional open approach, the robotic technique seems to have significant benefits in quality of life and morbidity (7). Likewise, in the current literature, multiple case reports have described the robotic technique with similar promising results like the VATS procedure (8, 9). In addition, the da Vinci® robotic system gives the opportunity for a more comfortable approach of the tissue in contrast to the disadvantages of the VATS procedure (e.g. two-dimensional view, unstable camera platform and poor ergonomic position of the surgeon). The robotic technique provides excellent visualization with three-dimensional view, better color resolution, better contrast, precision, and enhanced skills in order to ensure an effective, safe, and accurate operation (8, 9). These potential advantages ensure the possibility for the differentiation of the ectopic parathyroid gland from surrounding tissue (e.g. adipose tissue and thymus). That is why, the technique is very useful to access small and remote surgical fields.

In the current literature, the robotic technique is being increasingly used by other medical specialties. There are promising results in cardiac, gynecologic, urologic, transplantation, and general surgery. As mentioned above, several reports presenting promising outcomes of the robot-assisted mediastinal parathyroidectomy have been published (8, 9). However, to date there is a lack of studies with larger cohorts and randomized control trails to confirm these outcomes. Furthermore, almost all studies that described robot-assisted mediastinal parathyroidectomy have several limitations such as small sample size, being a single-center experience, or mostly being case-reports.

With the introduction of high sensitive radiographic modalities (e.g. MIBI scan, CT, MRI, and venous blood sampling), more ectopic parathyroid glands can be detected in patients with hyperparathyroidism symptoms (10). The advances in preoperative screening enable accurate localization of the ectopic parathyroid gland(s). This is one of the key concepts of endocrine and robotic surgery, which makes targeted minimally invasive approaches feasible. Inadequate diagnostic imaging could lead to waste of time and a failed surgical procedure for an hyperactive ectopic parathyroid gland (9). At our center, localization studies begin with ultrasound and a MIBI scan, involving the chest along with the neck.

Despite the potential advantages and promising results of the robotic technique, there are some obstacles. First of all, there is a need for a specially trained surgical team to perform the robotic technique. All participants are closely involved with the operation, including the surgeon(s), assistants, anesthesiologist, and other personnel. The surgeons also have to undergo training to achieve the robotic surgery skills. These aspects are very important for a successful robotic procedure. Besides, the robotic technique has a high cost due to the additional expenditure of the da Vinci® robotic system and the robotic instruments.

CONCLUSION

Based on our results, we concluded that resection of anterior mediastinal parathyroid gland with the da Vinci® robotic system is feasible. Accurate localization of the ectopic parathyroid gland(s) via preoperative screening is essential for the robotic approach. This technique has already been described in several reports with promising results. This report validates previous results and is another contribution to the literature. Therefore, the robotic approach is our preferred method for mediastinal located parathyroid glands.

Informed Consent: Written informed consent was obtained from patient who participated in this study.

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Conflict of Interest: The authors have no conflicts of interest to declare.

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REFERENCES

1. Kaplan EL, Yashiro T, Salti G. Primary hyperparathyroidism in the 1990s. Choice of surgical procedures for this disease. Ann Surg 1992; 215: 300-317. [CrossRef]
2. Freeman JB, Sherman BM, Mason EE. Transcervical thymectomy: an integral part of neck exploration for hyperparathyroidism. Arch Surg 1976; 111: 359-364. [CrossRef]
3. Alesina PF, Moka D, Mahlstedt J, Walz MK. Thoracoscopic removal of mediastinal hyperfunctioning parathyroid glands: personal experience and review of the literature. World J Surg 2008; 32: 224-231. [CrossRef]
4. Russell CF, Edis AJ, Scholz DA, Sheedy PF, van Heerden JA. Mediastinal parathyroid tumors: experience with 38 tumors requiring mediastinotomy for removal. Ann Surg 1981; 193: 805-809.[CrossRef]
5. Iihara M, Suzuki R, Kawamata A, Horiuchi K, Okamoto T. Thoracoscopic removal of mediastinal parathyroid lesions: selection of surgical approach and pitfalls of preoperative and intraoperative localization. World J Surg 2012; 36: 1327-1334. [CrossRef]
6. Rea F, Schiavon M, Di Chiara F, Marulli G. Single-institution experience on robot-assisted thoracoscopic operations for mediastinal diseases. Innovations (Phila) 2011; 6: 316-322. [CrossRef]
7. Balduyck B, Hendriks JM, Lauwers P, Mercelis R, Ten Broecke P, Van Schil P. Quality of life after anterior mediastinal mass resection: a prospective study comparing open with robotic-assisted thoracoscopic resection. Eur J Cardiothorac Surg 2011; 39: 543-548. [CrossRef]
8. Ismail M, Maza S, Swierzy M, Tsilimparis N, Rogalla P, Sandrock D, et al. Resection of ectopic mediastinal parathyroid glands with the da Vinci robotic system. Br J Surg 2010; 97: 337-343. [CrossRef]
9. Chan AP, Wan IY, Wong RH, Hsin MK, Underwood MJ. Robot-assisted excision of ectopic mediastinal parathyroid adenoma. Asian Cardiovasc Thorac Ann 2010; 18: 65-67. [CrossRef]
10. Johnson NA, Tublin ME, Ogilvie JB. Parathyroid imaging: technique and role in the preoperative evaluation of primary hyperparathyroidism. AJR Am J Roentgenol 2007; 188: 1706-1715. [CrossRef]