CASE REPORT

DOI: 10.5336/caserep.2024-102419

Giant Parathyroid Adenoma and Non-Recurrent Laryngeal Nerve Association

Sami ACAR[a], Can AYDIN[a], Hadi SASANİ[b]

[a]Tekirdağ Namık Kemal University Faculty of Medicine, Department of General Surgery, Tekirdağ, Türkiye
[b]Tekirdağ Namık Kemal University Faculty of Medicine, Department of Radiology, Tekirdağ, Türkiye

ABSTRACT Primary hyperparathyroidism is an endocrinological condition characterized by clinical hypercalcemia as a result of aberrant parathyroid hormone release by the parathyroid tissue. Parathyroid adenoma accounts for 80-85% of cases. Surgery is the curative treatment for this disease, which can only be performed minimally invasively with proper lateralization and localization. Ultrasonography alone may be sufficient for single and large parathyroid adenomas. Furthermore, its significant advantages include the fact that it can be used intraoperatively, does not contain radiation, and is inexpensive. However, it is advised to use neuromonitoring to lower the incidence of complications brought on by potential nerve abnormalities and intraoperative parathormones and increase success rates. This article presents a case of massive parathyroid adenoma of difficult localization, whose borders were difficult to identify from thyroid tissue and whose concomitant nerve abnormality was identified using neuromonitoring.

Keywords: Hypercalcemia; primary hyperparathyroidism; parathyroid neoplasms; recurrent laryngeal nerve

Primary hyperparathyroidism (PHPT) is the third most prevalent endocrine disorder and the most common cause of hypercalcemia. It is characterized by self-generated, aberrant parathyroid hormone output from one or more parathyroid glands.[1] A solitary parathyroid adenoma (PA) is the most common cause of PHPT (85-90%), followed by multiglandular hyperplasia (6%), double PA (4%), and parathyroid carcinoma (<1%).[2] PAs are generally smaller than 2 cm and weigh less than 1 g. According to the literature, PAs measuring at least 3.5 g are considered "giant", while those weighing between 1-3 g are "large".[3] A small portion of PA is giant adenoma.[4] Surgery is the only way to cure hyperparathyroidism caused by aberrant parathyroid tissue, regardless of the etiology. The accurate localization of parathyroid pathology is critical to the result of surgical treatment. Ultrasonography (US) is the first technique employed for this purpose. It can easily identify enlarged, hypercellular parathyroid glands. The diagnosis is supported by the Doppler examination's findings of hypervascular appearance and polar terminal vascular structure.[5] Furthermore, in comparison to sestamibi imaging, it can offer side and localization identification with a greater accuracy rate, particularly in sub-centimetric adenomas.[6] It can be employed as the only imaging approach in the preoperative period, particularly in larger, single-gland PA, as it reduces costs.[7]

The risk of recurrent laryngeal nerve injury is one of the most feared side effects of thyroid or parathyroid surgery. Large goiter, cancer, and anatomical changes such as extra-laryngeal and particularly non-recurrent laryngeal nerve (NRLN) all

TO CITE THIS ARTICLE:
Acar S, Aydın C, Sasani H. Giant parathyroid adenoma and non-recurrent laryngeal nerve association. Turkiye Klinikleri J Case Rep. 2024;32(4):104-7.

Correspondence: Sami ACAR
Tekirdağ Namık Kemal University Faculty of Medicine, Department of General Surgery, Tekirdağ, Türkiye
E-mail: sacar@nku.edu.tr

Peer review under responsibility of Turkiye Klinikleri Journal of Case Reports.

Received: 26 Feb 2024 ***Accepted:*** 03 Jun 2024 ***Available online:*** 05 Jun 2024

raise this risk.[8] The incidence of NRLN is between 0.1 and 0.7% and is currently classified into three subtypes.[9] In Type 1 variation, NRLN travels along the superior thyroid pedicle. In Type 2A, it is on the outside of the inferior thyroid artery and parallel to it; in Type 2B, it advances towards the cricothyroid muscle and is parallel to the inferior thyroid artery on its inner side.[10] The most common variation in this group is Type 1, which is responsible for the most injuries due to its position and lack of protection.[11] Permanent damage to the recurrent nerve occurs in 0.5-5% of cases following index thyroid surgery, while 1-30% of cases result in acute injury.[12] The incidence of injury is ten times higher in the presence of NRLN.[13]

To contribute to the literature, this study presents a case in which a single large PA was detected using only US as localization imaging in the preoperative period, and the existence of Type 1 NRLN was detected utilizing intraoperative neuromonitoring (IONM).

CASE REPORT

The patient provided informed consent for this case report.

The 68-year-old female patient, who had essential hypertension and had no prior surgery, was referred to the endocrinology outpatient clinic due to excessive calcium levels. She was sent to the clinic after the calcium level was discovered to be 15.6 mg/dL. In addition to the symptoms of fatigue, there were signs of muscle weakness. Calcitonin: less than 2 ng/L; PTH: 926 pg/mL; and vitamin D: 30 ug/L. A hypoechoic, heterogeneous, solid nodular lesion measuring 37x38 mm in diameter and calcification was found on the inferiolateral side of the right lobe of the thyroid gland during neck US imaging. Surgical treatment was decided upon following the endocrinology council meeting with the patient. The parathyroid gland was discovered to be the nodular lesion observed in the preoperative US during the surgery (Figure 1). The right recurrent nerve formed an elliptical ring on the parathyroid tissue after dissection and was non-recurrent (Figure 2). The nerve was located and protected with the use of IONM. Care was taken to preserve the parathyroid gland's integrity during the right lobectomy and parathyroidectomy procedures. Parathyroid tissue was visible macroscopically in the frozen examination (Figure 3). The surgery terminated when the intraoperative PTH dropped to 81.9 pg/mL. Complications such as hypoparathyroidism and phonation deficiency did not prevent the patient from being released. Upon pathological investigation, PA was found to have cystic holes of 35x37x25 mm in diameter (Figure 4).

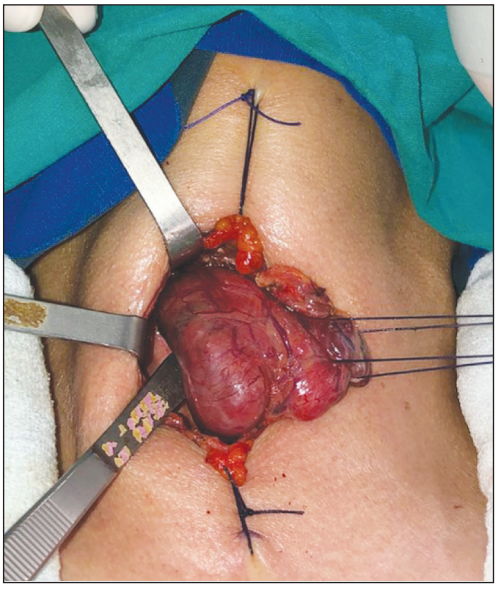

FIGURE 1: Appearance of giant parathyroid neoplasia. It is observed along the lateral aspect of the right lobe of the thyroid.

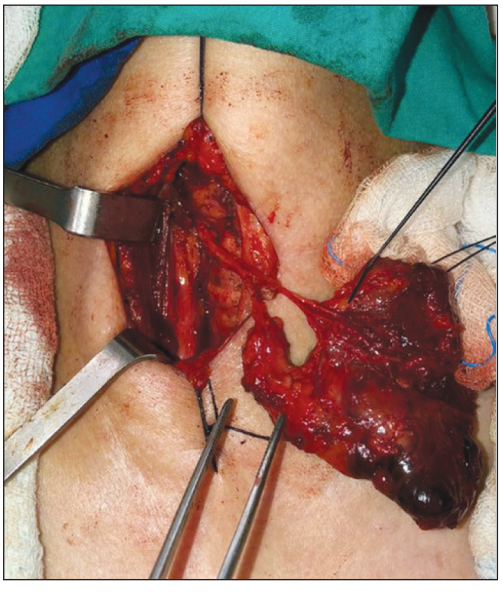

FIGURE 2: Non-recurrent laryngeal nerve located above the parathyroid adenoma.

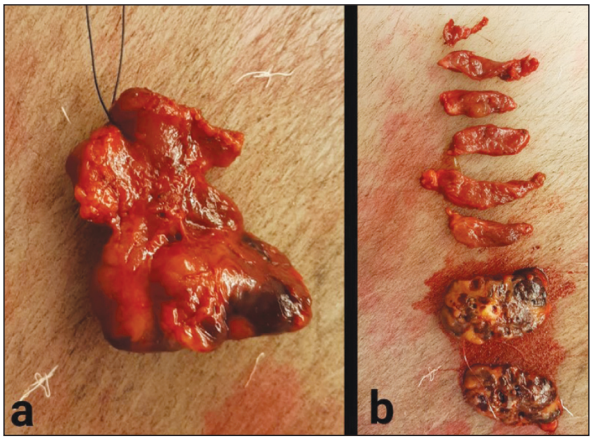

FIGURE 3: Macroscopic appearance of parathyroid neoplasia.

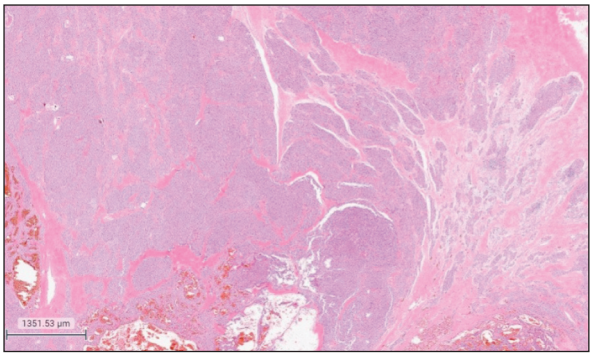

FIGURE 4: Microscopic view of parathyroid neoplasia, H&E, x10.

DISCUSSION

The recurrent laryngeal nerve regulates the motor and sensory innervation of the larynx. Significant problems such as vocal cord paralysis, irreversible phonation abnormalities, and airway blockage can arise as a result of surgery injuries. Anatomical recurrent nerves that are abnormal or variable greatly exacerbate this condition. According to the study by Kowalczyk and Majewski there is a substantial association between a lack of understanding of variable anatomy and the severity of potential surgical difficulties.[13] Important markers to identify the nerve during surgical dissection were highlighted by Zheng et al. in order to minimize the risk of nerve injury.[8] IONM is being used more and more these days, particularly for patients having reoperations or known malignancies. There are differing views regarding its regular application; however, it is recognized as a useful technique for identifying anatomical nerve variations. In fact, the right non-recurrent nerve in our case extends back to the point where it splits from the vagus nerve, covering a sizable portion of the massive parathyroid gland.

About 70-80% of PHPT patients have no evident symptoms, and the diagnosis is made by incidental detection of hypercalcemia.[1] Surgery is the curative method for treating PHPT. Using the right localization techniques is essential to achieving this minimally invasive intervention. For this reason, it was highlighted in the research by Zafereo et al. that the US approach has the lowest cost, the highest levels of specificity (73-95%), and sensitivity (74-91%) at comparable levels to other methods.[6] Particularly when combined with intraoperative PTH monitoring, the success rate rises. According to Fraser's study, 10-15 minutes following adenoma removal, basal PTH levels should drop by 50-60%.[1] Despite this, most surgeons combine sestamibi and US scintigraphy during the preoperative phase.[14] Although four-dimensional computerized tomography (4D-CT) is expensive and has a significant radiation dose, it can be utilized safely when the other two approaches are ineffective. It is able to specifically localize over-functioning glands physically and detect over half of the aberrant parathyroid glands that are missed.[15] In most centers, access to all imaging modalities utilized for parathyroid gland localization is not possible. Furthermore, these operations cannot be completed in time when the calcium level poses a life-threatening risk. The US becomes more significant in these situations. Even though the parathyroid gland could not be found radiologically at a sonography examination, our case was operated on under emergency circumstances. An accurate localization and a clear understanding of the boundary between the parathyroid and thyroid glands were not possible, leading to a thyroid gland right lobectomy. The intraoperative PTH analysis led to the successful termination of the surgery. We think that to avoid these kinds of scenarios, 4D-CT should be employed efficiently. Therefore, we believe that computed tomography, which is almost ubiquitous, will help locate the parathyroid gland. Furthermore, repeated nerve injuries and the development of permanent hypoparathyroidism are well-known consequences that every surgeon worries about in the context of parathyroid and thyroid surgery. When it comes to minimizing recurrent nerve damage, rou-

tine use of IONM is just as critical as localization studies for proper parathyroid surgery.

Acknowledgements

Thanks to Dr Gülşah ELBÜKEN. for his support in the treatment process of the patient. Thanks to Meltem ÖZNUR, for preparing the microscopic and macroscopic images.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Sami Acar;* ***Design:*** *Sami Acar;* ***Control/Supervision:*** *Sami Acar, Hadi Sasani;* ***Data Collection and/or Processing:*** *Sami Acar, Can Aydın;* ***Analysis and/or Interpretation:*** *Sami Acar;* ***Literature Review:*** *Hadi Sasani;* ***Writing the Article:*** *Sami Acar;* ***Critical Review:*** *Hadi Sasani;* ***References and Fundings:*** *Sami Acar;* ***Materials:*** *Sami Acar.*

REFERENCES

1. Fraser WD. Hyperparathyroidism. Lancet. 2009;374(9684):145-58. [Crossref] [PubMed]
2. Yeh MW, Ituarte PH, Zhou HC, Nishimoto S, Liu IL, Harari A, et al. Incidence and prevalence of primary hyperparathyroidism in a racially mixed population. J Clin Endocrinol Metab. 2013;98(3):1122-9. [Crossref] [PubMed] [PMC]
3. Spanheimer PM, Stoltze AJ, Howe JR, Sugg SL, Lal G, Weigel RJ. Do giant parathyroid adenomas represent a distinct clinical entity? Surgery. 2013;154(4):714-8; discussion 718-9. [Crossref] [PubMed] [PMC]
4. Garas G, Poulasouchidou M, Dimoulas A, Hytiroglou P, Kita M, Zacharakis E. Radiological considerations and surgical planning in the treatment of giant parathyroid adenomas. Ann R Coll Surg Engl. 2015;97(4):e64-6. [Crossref] [PubMed] [PMC]
5. Shindo ML. Parathyroid ultrasonography. In: Orloff LA, ed. Head & Neck Ultrasonography. 2nd ed. San Diego, CA: Plural Publishing; 2016. p.137-54.
6. Zafereo M, Yu J, Angelos P, Brumund K, Chuang HH, Goldenberg D, et al. American Head and Neck Society Endocrine Surgery Section update on parathyroid imaging for surgical candidates with primary hyperparathyroidism. Head Neck. 2019;41(7):2398-409. [Crossref] [PubMed]
7. Deutmeyer C, Weingarten M, Doyle M, Carneiro-Pla D. Case series of targeted parathyroidectomy with surgeon-performed ultrasonography as the only preoperative imaging study. Surgery. 2011;150(6):1153-60. [Crossref] [PubMed]
8. Zheng V, Rajeev R, Pinto D, de Jong MC, Sreenivasan DK, Parameswaran R. Variant anatomy of non-recurrent laryngeal nerve: when and how should it be taught in surgical residency? Langenbecks Arch Surg. 2023;408(1):185. [Crossref] [PubMed]
9. Toniato A, Mazzarotto R, Piotto A, Bernante P, Pagetta C, Pelizzo MR. Identification of the nonrecurrent laryngeal nerve during thyroid surgery: 20-year experience. World J Surg. 2004;28(7):659-61. [Crossref] [PubMed]
10. Wang T, Dionigi G, Zhang D, Bian X, Zhou L, Fu Y, et al. Diagnosis, anatomy, and electromyography profiles of 73 nonrecurrent laryngeal nerves. Head Neck. 2018;40(12):2657-63. [Crossref] [PubMed]
11. Lynch J, Parameswaran R. Management of unilateral recurrent laryngeal nerve injury after thyroid surgery: a review. Head Neck. 2017;39(7):1470-8. [Crossref] [PubMed]
12. Iacobone M, Citton M, Pagura G, Viel G, Nitti D. Increased and safer detection of nonrecurrent inferior laryngeal nerve after preoperative ultrasonography. Laryngoscope. 2015;125(7):1743-7. [Crossref] [PubMed]
13. Kowalczyk KA, Majewski A. Analysis of surgical errors associated with anatomical variations clinically relevant in general surgery. Review of the literature. Transl Res Anat. 2021;23:100107. [Crossref]
14. Wilhelm SM, Wang TS, Ruan DT, Lee JA, Asa SL, Duh QY, et al. The American Association of Endocrine Surgeons Guidelines for Definitive Management of Primary Hyperparathyroidism. JAMA Surg. 2016;151(10):959-68. [Crossref] [PubMed]
15. Bunch PM, Randolph GW, Brooks JA, George V, Cannon J, Kelly HR. Parathyroid 4D CT: what the surgeon wants to know. Radiographics. 2020;40(5):1383-94. [Crossref] [PubMed]