Revision of diagnostic guidelines for parathyroid adenoma based on case reports and a literature review

Rewizja wytycznych diagnostyki gruczolaka przytarczyc na podstawie opisów przypadków i przeglądu literatury

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INTRODUCTION

The parathyroid glands (PGs) are small, nodular endocrine structures located in the neck that produce parathyroid hormone (PTH). The most common cause of adenoma is a mutation in the MEN1 gene. When a person has a parathyroid adenoma, the affected gland produces excess PTH, which can lead to high levels of calcium in the blood (hypercalcemia). Symptoms of hypercalcemia can include fatigue, weakness, bone pain, kidney stones, excessive thirst, and urination. Diagnosis of parathyroid adenoma typically involves blood tests to measure calcium and PTH levels, as well as imaging tests such as ultrasound, CT, or MRI to locate the tumor. Treatment most often involves surgical removal of the adenoma, which effectively cures the hypercalcemia in most cases.

ABSTRACT:

Introduction: Parathyroid adenoma is a benign tumor that affects the parathyroid glands, small organs in the neck that produce parathyroid hormone (PTH). The most common cause of adenoma is a mutation in the MEN1 gene. When a person has a parathyroid adenoma, the affected gland produces excess PTH, which can lead to high levels of calcium in the blood (hypercalcemia). Symptoms of hypercalcemia can include fatigue, weakness, bone pain, kidney stones, excessive thirst, and urination. Diagnosis of parathyroid adenoma typically involves blood tests to measure calcium and PTH levels, as well as imaging tests such as ultrasound, CT, or MRI to locate the tumor. Treatment most often involves surgical removal of the adenoma, which effectively cures the hypercalcemia in most cases.

Case reports: The article presents two cases of patients with parathyroid adenoma, concentrating on the symptomatology, diagnostic workup, and treatment. We searched for and verified the recommendations in the recent literature to revise the diagnostic guidelines for this pathology.

KEYWORDS: parathyroid adenoma, parathyroid hyperactivity, parathyroid neoplasms, primary hyperparathyroidism

ABBREVIATIONS

CT – computed tomography
MRI – magnetic resonance imaging
PGs – parathyroid glands
PHPT – primary hyperthyroidism
PTAs – parathyroid adenomas

PTH – parathyroid hormone
US – ultrasonography

INTRODUCTION

The parathyroid glands (PGs) are small, nodular endocrine struc-
This condition is caused by excessive secretion of parathyroid hormone, which leads to an increased concentration of calcium in the blood serum. Symptoms develop slowly and are non-specific. Initially, there may be weakness, fever, vomiting, and diarrhea. The subsequent manifestations are increased thirst and increased urination, presence of blood in the urine, bone pain, and pathological fractures.

Parathyroid adenomas (PTAs) are the most common cause of PHPT, accounting for around 85% of cases [3]. Most often, the condition is caused by a single adenoma. Much less frequently, the disorder is triggered by the syndrome of adenomas. PTAs are typically benign tumors smaller than 2 cm and weighing less than 1 g on average [4].

In the imaging diagnostics of PTAs, the most important tests are ultrasonography (US), thyroid subtraction scintigraphy, and positron emission tomography with choline labeled with radioactive fluorine.

In the case of a solitary parathyroid adenoma, the treatment of choice is removal of the parathyroid gland from a small incision in the neck, through the nipple or the inguinal fossa.

In order to enhance the comfort of patients, shorten the time needed for convalescence, and improve the cosmetic effect, operators are increasingly using minimally invasive surgical techniques such as radionavigation, endoscopic methods, and videoscope without the use of gas [5].

In this article, we present two cases of parathyroid adenoma and discuss the diagnosis and management of benign lesions of the parathyroid glands.

CASE REPORTS

A 47-year-old patient was referred to our Medical University’s Otorhinolaryngology Department due to a tumor located posteriorly to the left thyroid lobe and medially to the large neck vessels. A lesion of unclear etiology was discovered incidentally in US screening of the thyroid.

On admission, the patient was in good general condition and did not report any complaints. No abnormalities were found upon physical examination and the thyroid was not enlarged or painful on palpation.

The in-office diagnostic workup prior to admission included magnetic resonance imaging of the neck with contrast that confirmed the presence of an enhancing, well-limited lesion lateral to the esophagus and medial to the left common carotid artery (Fig. 1A–B.).

The in-ward diagnosis was extended with scintigraphy, which revealed an increased accumulation of the radiotracer in a typical location of the upper-left PG. After administering 99mTc-MIBI, it was observed that the tracer remained in the imaged tissue for longer than in the surrounding thyroid parenchyma and was still visible after 2 h (Fig. 2.).

Fig. 1. Neck magnetic resonance image of the first case report, identifying an enhancing tumor 10 × 13 × 18 mm in size (yellow arrow) located posteriorly to the left thyroid lobe and laterally to the esophagus (ES, blue arrow) and the common carotid artery (CCA, red arrow). (A) T1 transverse scan with contrast; (B) Coronal scan with contrast.
Due to the 8-mm nodule in the left thyroid lobe synchronously visualized in US, with the morphological characteristics of a benign lesion, the decision was made to perform fine-needle aspiration of the thyroid lesion to exclude well-differentiated papillary cancer before planning the extension of the operation. The biopsy confirmed a benign thyroid lesion of category 2 according to the Bethesda classification and an adenoma of one of the PGs. The patient was qualified for surgical resection of parathyroid adenoma.

On the day of the operation, just before the procedure, a sample of the patient’s blood was collected in order to determine the PTH level. The preoperative PTH concentration was 95.7 pg/mL, with the normal range being 10–60 pg/mL. During the operation, a lesion resembling a parathyroid adenoma was identified on the posterior surface of the left thyroid lobe, in its upper part. This was dissected and completely removed. Before the wound was closed, a blood sample was collected again. The postoperative PTH concentration was 14.6 pg/mL. The procedure and perioperative period were uneventful and the patient did not complain of neck pain, dysphagia, or shortness of breath. Control laboratory tests, such as calcium, phosphate, and PTH levels, were normal. A follow-up US scan of the thyroid gland showed no abnormalities apart from the previously diagnosed class 2 lesion in the left thyroid lobe.

The second patient was a 51-year-old woman who was admitted to the emergency department of our hospital due to the most severe headache of her life, located in the frontotemporal region. After normalizing the pressure, the headache subsided, but there was discomfort in the right occipital region, radiating to the shoulder blade and elbow. The pain worsened with swallowing and trunk movements.

Fig. 2. Scintigraphy of the parathyroid glands after administration of [99mTc]Tc-MIBI (biphasic and subtraction [99mTc]Tc / [99mTc]Tc-MIBI and SPECT/CT [early and late]). The subtraction examination revealed a small spot of moderately increased accumulation of the radiotracer in the projection of the upper pole of the left thyroid lobe, which remained visible in the biphasic examination 2 h after the administration of [99mTc]Tc-MIBI. The accumulation seems prolonged in view of the decreasing accumulation of the radiotracer in the thyroid parenchyma. A similar dynamic was also observed in SPECT examinations performed 20 min and 2 h after [99mTc]Tc-MIBI administration. In the SPECT/CT examination posterior to the left lobe of the thyroid, between the esophagus and the common carotid, a hypodense, oval, well-defined tissue lesion 9 × 18 × 18 mm in size was visible. Accumulation in the lesion at the same level as in the thyroid parenchyma cannot be clearly separated from the high uptake of the radiotracer in the thyroid parenchyma, which makes assessment difficult. Due to the location of the lesion—which is typical of the upper-left parathyroid gland—the positive result of the subtraction test and the accumulation of the radiotracer visible in SPECT in the lesion, the picture supports the presence of a hyperactive upper-left parathyroid gland.
The physical examination showed palpable tenderness and increased tissue resistance in the lower part of the sternocleidomastoid muscle on the right side, without lymphadenopathy and features of fluttering. US revealed a well-defined hypoechogenic, heterogenous lesion 27 × 17 mm in size, located posteriorly and inferiorly to the right thyroid lobe, with increased vascularization on power Doppler (Fig. 3.).

A 5.5-mm-thick edema was also visualized, spread around the lesion and progressing to the retropharyngeal space, in the area of the cervical vessels, and to the mediastinum (Fig. 4.).

Due to the symptoms and slightly elevated white blood cell count, empiric treatment of amoxicillin with clavulanic acid was administered along with intravenous steroids. Improved swallowing and subsiding pain was reported within 3 days.

Magnetic resonance imaging confirmed the presence of a lesion posteriorly and beneath the right thyroid lobe and adhered to the esophagus while modeling it. The lesion did not restrict diffusion, which would suggest an abscess. The images were not unambiguous, but according the radiologist suggested that the first thing to consider in the differentiation was the bleeding to a focal lesion in the parathyroid gland, or other bleeding into the esophageal diverticulum.

The laboratory tests revealed a high concentration of PTH (225 pg/mL) and elevated concentration of calcium (3.31 mmol/L).

The diagnosis was suspicion of hyperparathyroidism caused by an adenoma and it was decided to treat the tumor surgically. Both the operation and the postoperative period were uneventful and the patient was discharged home in good general condition on the 5th day with a recommendation to report for a follow-up. The final histopathological result confirmed the presence of a parathyroid adenoma. In the follow-up US scan, no focal lesions were found on the neck.

### DISCUSSION

A parathyroid adenoma is a benign tumor of the parathyroid gland that results in the overproduction of PTH and subsequently leads to hyperparathyroidism [6]. The main goal of the treatment is to decrease the level of PTH and calcium in the blood, which can be achieved by surgical removal of the adenoma.

An algorithm presenting a diagram of action in the event of characteristic symptoms may be helpful in the diagnosis of parathyroid adenomas (Fig. 6.).
Locating the parathyroid adenoma can be challenging, especially in patients with mild or non-specific symptoms. If a parathyroid adenoma is detected, we can choose one of the following therapeutic options. In some cases, observation may be recommended for patients who have mild or asymptomatic hyperparathyroidism and no complications. In those patients, regular monitoring of calcium and PTH levels, as well as bone density tests, are necessary.

The most common and effective treatment for parathyroid adenoma is surgery, also known as parathyroidectomy [7]. During the procedure, the surgeon removes the adenoma along with the involved parathyroid gland. The surgery can be done through a small incision in the neck or using minimally invasive techniques, such as endoscopic or robotic surgery. Relatively often, after a successful resection of the parathyroid gland, a decrease in blood PTH concentration of more than 50% from the baseline value is observed [8]. This puts patients at risk of a rapid drop in calcium levels and related symptoms. It is very important to monitor calcium and parathyroid hormone (PTH) levels after resection of the parathyroid adenoma in order to prevent complications related to disorders of calcium metabolism. This enables the optimal levels of calcium and PTH to be determined after surgery and calcium metabolism to be normalized.

Control of calcium and PTH levels is especially important in patients with hyperparathyroidism, overstimulation of the parathyroid glands, increased secretion of PTH, and an imbalance of calcium and phosphate. Medications can be used to manage hyperparathyroidism in patients who are not candidates for surgery or who choose not to undergo surgery. Drugs such as cinacalcet can reduce PTH levels and decrease blood calcium levels.

Radiation therapy may be used in rare cases when surgery is not possible and medications are ineffective. Radiation therapy may help to diminish the size of the adenoma and reduce PTH levels.

The differential diagnosis of a neck lesion located posteriorly to the thyroid lobe depends on the patient’s age, medical history, symptoms, blood test results, and imaging diagnosis. In any case, it should include thyroid pathologies, parathyroid lesions, lymph node enlargement or metastatic involvement, cysts, neuroendocrine tumors, neuromas, and hematomas.

The use of adequate diagnostic tools such as ultrasound, CT, MRI, biopsy, tests for tumor markers, and specific laboratory blood tests are essential for the differential diagnosis.
The case reports presented herein show that parathyroid adenomas have a high propensity to be diagnosed accidentally. Monitoring of intraoperative PTH levels may be useful to confirm the sufficiency of the surgery. The treatment of parathyroid adenoma depends on the severity of the condition and the individual patient’s health status. Surgery is the most effective treatment and can result in a complete recovery, but medications and radiation therapy can also be used as an alternative therapy or for patients who are not eligible for surgery.

REFERENCES