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Management of a Parathyroid Adenoma With Radiofrequency Ablation: A Case Report

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Abstract

Introduction: The standard treatment for symptomatic primary hyperparathyroidism due to parathyroid adenoma is surgery, but in patients who are not good candidates for surgery, other treatment modalities including ethanol ablation, laser ablation, ultrasound wave ablation, and radiofrequency ablation are used. We describe a patient with multiple medical problems and a parathyroid adenoma who was treated with radiofrequency ablation.

Case Presentation: A 47-year-old patient was referred to our hospital (Namazi hospital, Shiraz, Iran) in April, 2015 with intracranial hemorrhage, as well as high serum calcium and PTH (parathyroid hormone) levels (12.1 mg/dL and 1062 pg/mL, respectively), who had a parathyroid adenoma. Radiofrequency ablation was performed for the patient after he was stabilized, and three days later, his serum calcium and PTH levels decreased to 8.9 mg/dL and 38 pg/mL, respectively, and there was abnormal uptake according to the post-ablation parathyroid scan. The patient was followed for 12 months in our endocrine clinic, during which time he was in good general condition, with normal serum calcium, phosphate, and parathyroid hormone levels.

Conclusions: Radiofrequency ablation may be used successfully in the treatment of parathyroid adenoma when a patient cannot tolerate surgery.

Keywords: Parathyroid Adenoma, Radiofrequency Ablation, Hypercalcemia

1. Introduction

Primary hyperparathyroidism is a relatively common disease with a prevalence rate of 1–7 per 1,000 adults (1). The most common cause of primary hyperparathyroidism is parathyroid adenoma (2). The complications of hyperparathyroidism include renal stones, osteoporosis, bone pain, and hypertension (3). The treatment of a parathyroid adenoma that leads to a symptomatic hypercalcemia is primarily surgery (4, 5), but when an operation would be high risk for the patient or when the patient does not consent to undergo surgery, nonsurgical modalities including percutaneous ethanol injection (6), high-intensity focused ultrasound (7), and laser thermal ablation (8) have been used. However, such treatments have transient benefits and many side effects in most circumstances. Recently, radiofrequency ablation has been used in the treatment of a few cases of parathyroid adenoma with great success and few complications (9-11). Here, we describe the treatment of a patient with many medical problems using this modality.

2. Case Presentation

A 47-year-old male presented to our hospital (Namazi hospital, a governmental referral center with general, specialized, and sub-specialized medical and surgical wards in Shiraz, Iran) in April, 2015 with a sudden onset severe headache accompanied by nausea and vomiting. He had experienced a motorcycle accident and head trauma in the preceding two weeks. He had a history of chronic atrial fibrillation and primary hypothyroidism and was on digoxin 0.125 mg P.O. (per os) daily and carvedilol 6.25 mg P.O. two times daily. He was an alcohol user and a heavy cigarette smoker. Upon arrival, his blood pressure was 220/120 mm Hg, his pulse was irregular with a rate of 100 bpm, his temperature was 36.7°C, and his respiratory rate was 12 breaths per minute. He was very anxious, and he suddenly developed a decreased level of consciousness that progressed to coma. His pupils were small and nonreactive. He was immediately intubated and evaluated for blood sugar level and response to naloxone. At this time, his blood sugar level was 138 mg/dl, and he did not show any dramatic response to naloxone. An emergency CT scan was performed that showed subarachnoid and intracerebral hemorrhage. He was transferred to the operating room and underwent ventriculostomy. After surgery and while the patient was

in a deep coma (GCSS = 6), he was transferred to the ICU under mechanical ventilatory support. At that time, a high serum calcium level (12.1 mg/dL) accompanied by a serum phosphate level of 2.3 mg/dL and a serum albumin level of 4.7 g/dl was detected in his lab data. His serum PTH level was also checked and was 1062 pg/mL. The patient was hydrated, and diuretic and calcitonin therapy were started. Serum calcium level was monitored constantly, and medical therapy was performed accordingly. Despite this management, serum calcium level increased; therefore, one 60-mg dosage of intravenous pamidronate was administered. One week later, the ventriculostomy tube was removed, and a VP (ventriculoperitoneal)-shunt was inserted; however, the patient's level of consciousness did not change significantly. Furthermore, he underwent tracheostomy due to prolongation of intubation. The patient's blood and urine cultures tested positive for a strain of acinetobacter that was resistant to every antibiotic of the antibiogram test. He received many antibiotics empirically.

During the patient's stay at the hospital, his BUN (blood urea nitrogen) and serum creatinine levels increased gradually from 15 to 62 and from 1.4 to 7.2 mg/dL, respectively, and he developed uremia manifestations. Therefore, hemodialysis was performed several times.

Gradually, the patient responded to antibiotic therapy, and his level of consciousness improved. His renal and respiratory functions also improved, and hemodialysis and ventilatory support were discontinued. The tracheostomy was also closed. At this time, his serum calcium level was in the range of 11 - 12 mg/dL, despite adequate hydration and diuresis with furosemide. A color-Doppler sonography of the neck was performed that showed a well-defined hypoechoic nodule (2.7 $\times$ 1.6 cm) in the posteromedial aspect of the right lobe of the thyroid. The patient underwent a 99 mTc-sestamibi parathyroid scan that showed a high uptake region in the lower portion of the right lobe of the thyroid, which was suggestive of a parathyroid adenoma (Figure 1).

A sonography-guided fine needle aspiration was conducted and showed parathyroid adenomatous cells. Due to high serum calcium levels, normal to low serum phosphate levels, the sonography findings, the results of the parathyroid scan, and finally a pathology report on the fine needle aspiration of the lesion, the mass was diagnosed as parathyroid adenoma. Therefore, the patient was a candidate for a parathyroidectomy, but it was not performed because he was considered too high risk for operation due to a history of intracranial hemorrhage and cardiac arrhythmia; therefore, he was started on cinacalcet (30 mg/day). After seven days, although his serum calcium level was still 12 mg/dL, he was scheduled for radiofrequency ablation, which was performed by an interventional radiologist and by a medical electrocautery made in RF Medical CO., Ltd. Korea, model M-2004, with main voltage AC [220 V], main nominal frequency 50HZ, maximum input power 350 VA, output nominal frequency 400KHZ, and maximum RF power 200 w. The patient tolerated the procedure very well without any complications. Three days later, his serum calcium level decreased to 8.9 mg/dL, accompanied by a serum phosphate level of 3 mg/dL and a serum PTH level of 38 pg/mL. A parathyroid scan, which was repeated after seven days, did not show any abnormalities (Figure 2), and he was discharged. The patient remained under close follow-up in our endocrine clinic, and his serum levels of calcium remained in the range of 8.5 - 10 mg/dL, his phosphate levels in the range of 3.5 - 4.5 mg/dL, and his PTH levels in the range of 43 - 49 pg/mL during the last 12 months of the follow-up (Table 1).

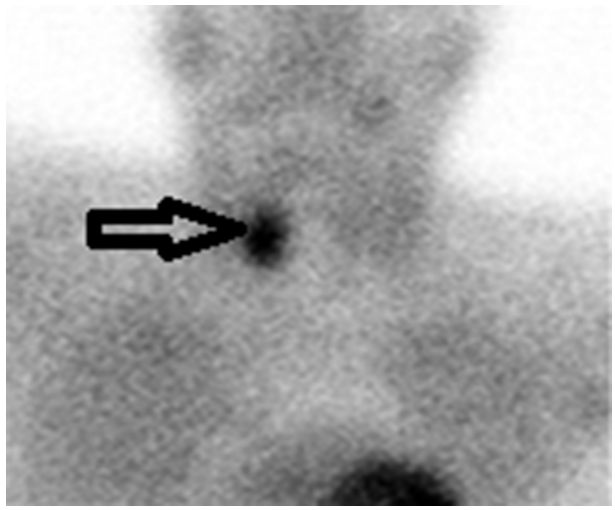

Figure 1. Parathyroid Sestamibi Scan Showing Increased Uptake in Right Parathyroid Gland Before Treatment

3. Discussion

The standard treatment for symptomatic primary hyperparathyroidism due to parathyroid adenoma is surgery; however, in some circumstances, this intervention is not possible, such as when the patient is too high risk for surgery or when the patient does not consent to undergo an operation (4, 5). In these cases, other nonsurgical modalities such as ethanol (6), ultrasound (7), laser (8), and radiofrequency ablations (9-11) are used.

Ethanol ablation has been applied in many cases, but the risk of spreading ethanol to surrounding tissues, vocal cord paralysis, extraparathyroid fibrosis, and the high risk of recurrence have been reported as after effects (6).

Table 1. Serial Serum Levels of Calcium, Phosphate, PTH, BUN, and Creatinine of the Patient During Hospitalization and Follow Up

Laboratory Tests	On Admission	10 Days Later	2 Months Later	3 days After Ablation	6 Months Later	1 Year Later	Normal Range	Method of Measurement
Calcium, mg/dL	12.1	11.5	12.4	8.9	8.5	9.8	(8.6 - 10.3)	MTB, End point
Phosphate, mg/dL	2.3	4.7	3.1	3	4	4.2	(2.7 - 4.5)	Colourimetric
Albumin, g/dL	4.7	2.7	4	3.9	4	4.1	(3.5 - 5.2)	BCG
PTH, pg/mL	1,062	-	666	38	43	49	(10 - 65)	Immunochemiluminescence assay
BUN, mg/dL	15	62	14	23	25	18	(17 - 43)	Urease-GLDH
Creatinine, mg/dL	1.4	7.2	2	1.8	1.9	2.1	(0.7 - 1.4)	Jaffe

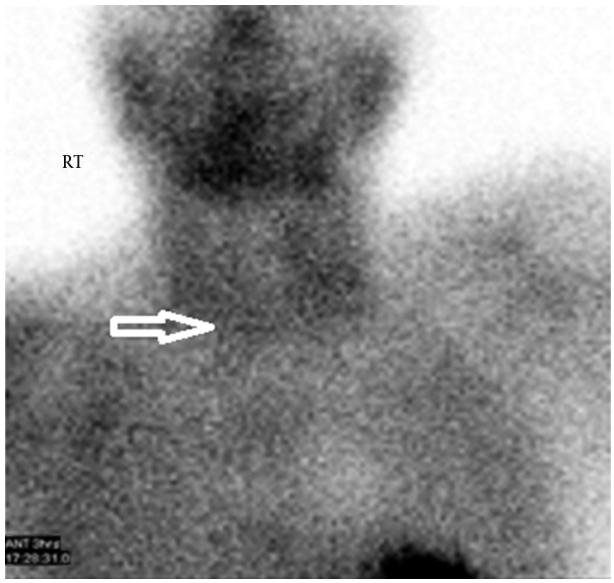

Figure 2. Parathyroid Sestamibi Scan Showing no Uptake by the Parathyroid Adenoma After Treatment

High-intensity focused ultrasound has been used in some cases of primary hyperparathyroidism. Complete remission has been observed in a few patients, and partial response or unsuccessful procedures have been seen in others. Transient vocal cord paralysis and subcutaneous edema have been reported in some of them (7). Laser ablation has been used in the treatment of parathyroid adenoma in some cases that resulted in improvement of hyperparathyroidism, but in most cases, the benefits are transient, and the procedure needs to be repeated (8).

Radiofrequency refers to oscillatory elastic currents with a frequency between 200 and 1200 KHZ. When it is applied to tumor tissue through a catheter, it oscillates tissue ions due to changes in the direction of the alternating current. The rapid movement of these ions produces heat around the catheter. Tissues further away from the catheter are heated through thermal conduction. Irreversible tissue damage is produced when the temperature is increased to 50–52°C for 4 - 6 minutes; this causes coagulative necrosis of the tissue. The necrotic tissue is then engulfed by macrophages (12). Radiofrequency ablation has been used successfully for treatment of secondary hyperparathyroidism (13) and a few cases of primary hyperparathyroidism (9-11), as well as liver and other solid malignant tumors (14). Because of the small number of case reports, there are no long-term studies evaluating the outcome of this nonsurgical procedure.

In our patient, because of severe hypercalcemia, renal failure, and decrease in level of consciousness, the treatment of hypercalcemia was necessary; therefore, therapy, including hydration, diuretic therapy, calcitonin, and intravenous pamidronate with adjusted dose was applied during his hospital stay. When necessary and after the progression of his renal failure, he underwent hemodialysis as well. Gradually, after resolving sepsis and improvement in his level of consciousness, a renal failure diagnostic work up for the etiology of his hypercalcemia was performed and showed a high focus of uptake in the parathyroid scan in favor of adenoma. The plan was surgery, but as mentioned, he was considered too high risk for operation.

Due to the transient effects of other nonsurgical modalities, we decided to use radiofrequency ablation for this patient because of the high success rate reported in previous cases (9-11). It was performed by an experienced interventional radiologist, and there were no complications. The patient was followed-up for 12 months after the operation, during which time he had normal calcium, phosphate, and PTH levels.

The most important finding in this case study was the performance of the procedure without any complications in a patient with central nervous system hemorrhage and hemiparalysis, cardiac arrhythmia, and some degree of renal impairment without any recurrence during a one-year follow-up. However, this case study has some limitations. First, a more prolonged follow-up period is needed to evaluate recurrence versus cure in our patient. In addition, an experienced interventional radiologist and is so expensive that is not possible to provide one to all patients.

Overall, the results of our study supported the results

of previous studies about the use of radiofrequency ablation in the treatment of parathyroid adenoma (9-11). In conclusion, radiofrequency ablation can be used safely in the treatment of parathyroid adenoma.

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Footnote

Authors' Contribution: Mahmood Soveid, initial idea, drafting the manuscript, care of the patient; Azar Sattarinezhad, data collection, drafting the manuscript, care of the patient; Alireza Rasekhi, performance of radiofrequency ablation.

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