Letter to the Editor

Microwave ablation of ectopic parathyroid adenoma in the carotid sheath with intraoperative parathyroid hormone monitoring: a case description

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Introduction

Primary hyperparathyroidism (PHPT) is an endocrine disorder typically characterized by elevated serum calcium and parathyroid hormone (PTH) levels (1). In 80–85% of cases, PHPT is caused by a single adenoma, but it may also be caused by multiple adenomas, parathyroid hyperplasia, or, very rarely, parathyroid adenocarcinoma (1). The incidence of ectopic parathyroid glands ranges from 10% to 22% (2).

Recently, microwave ablation (MWA), a minimally invasive approach, has been used as an alternative to parathyroidectomy (3). However, ectopic parathyroid adenomas can be difficult to localize preoperatively. Additionally, it is difficult to discriminate ectopic parathyroid adenomas of the neck from enlarged cervical lymph nodes, making surgical cure challenging on the first attempt. Fortunately, the use of intraoperative parathyroid hormone (ioPTH) monitoring has an increased sensitivity in the preoperative localization. The most important advantage of ioPTH monitoring is that it can be used intraoperatively to confirm the complete removal of hyperfunctioning lesion tissue (4).

In this article, we report a case in which the MWA of an ectopic parathyroid adenoma in the carotid sheath with ioPTH was performed.

Case presentation

A 48-year-old female presented to our Endocrine Outpatient Department for hyperthyroidism. Her serum chemistry values were as follows: serum intact parathyroid hormone (iPTH): 187 pg/mL; serum calcium: 2.75 mmol/L: phosphate: 0.61 mmol/L; and 25-hydroxyvitamin D3: 13.5 ng/mL. The patient was diagnosed with PHPT consistent with hypercalcemia and elevated iPTH levels. The T-score for the lumbar region on dual-energy bone mineral density was –1.1. The patient had a five-year history of kidney stones but had no other symptoms.

A neck ultrasound (US) localized a 0.87-cm lesion in the lower parathyroid glands in the right neck suggestive of a parathyroid adenoma. As the patient was unwilling to undergo traditional surgery, US-guided MWA was selected. Her ioPTH levels decreased from 187 to 112 pg/mL at 10 minutes post ablation, suggesting persistent disease (success was defined as a decrease in PTH levels of > 50% at 10 minutes post excision compared to the baseline) (5). We conducted a radiotracer Tc-sestamibi (^{99m}Tc) scan, but the results were unremarkable (*Figure 1A*). After consultation with superior physicians, a contrast-enhanced ultrasound (CEUS) was performed, and it was suspected that the lesion that had been previously diagnosed as an enlarged cervical lymph node was likely an ectopic parathyroid adenoma in

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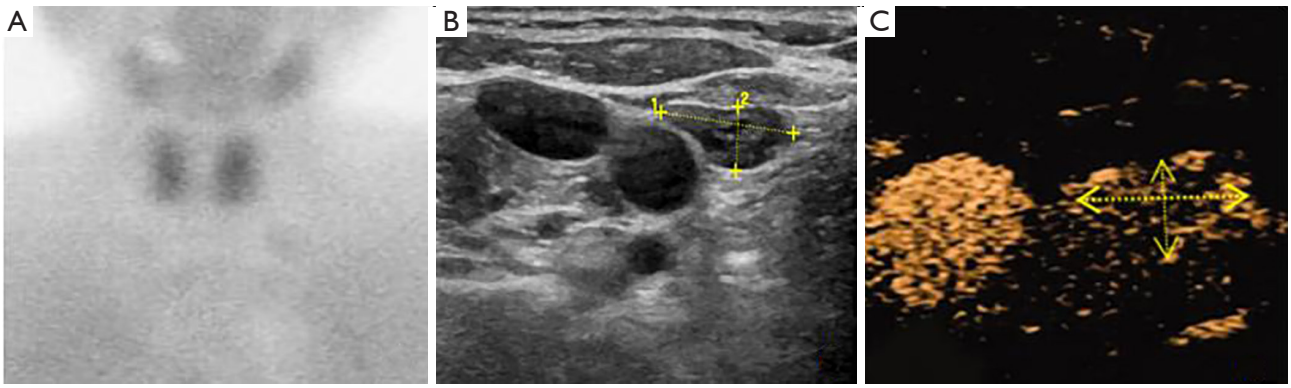


Figure 1 Radiologic findings taken at our hospital of the patient's neck. (A) The ^{99m}Technetium sestamibi scan showed no focal radiotracer uptake. (B) The grayscale ultrasound scan showed a hypoechogenic nodule (as indicated by the yellow crosses) beside the carotid artery. (C) The CEUS scan showed a uniform hyperenhanced nodule (as indicated by the yellow arrows) beside the carotid artery. CEUS, contrast-enhanced ultrasound.

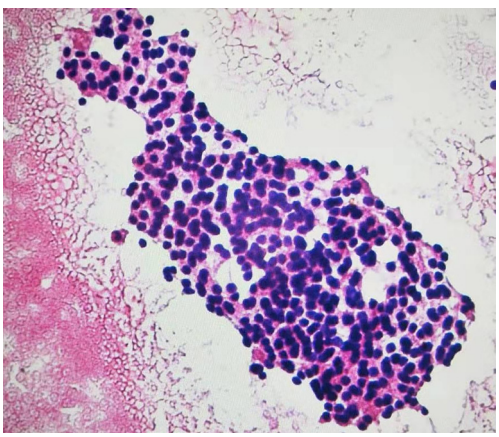


Figure 2 Fine-needle aspiration biopsy of the nodule. The nodule was composed mainly of chief cells with occasional groups of oxyphil cells and water clear cells that corresponded to the appearance of parathyroid adenoma (hematoxylin and eosin stain, ×400).

the carotid sheath (*Figure 1B,1C*). Fine-needle aspiration (FNA) was performed to obtain a definitive diagnosis, and the lesion was confirmed to be a parathyroid adenoma (*Figure 2*). A secondary ablation treatment was immediately performed for the ectopic parathyroid adenoma in the carotid sheath. The patient's ioPTH levels decreased from 187 to 79 pg/mL at 10 minutes post ablation, indicating successful ablation.

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committees and with the Helsinki Declaration (as revised in 2013). The protocol of this study was approved by the Ethics Committee of Gansu Provincial Hospital (No. 2021-243). Written informed consent was obtained from the patient for publication of this article and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

The following key MWA techniques were employed: (I) a liquid-isolating region was formed (*Figure 3A*); (II) under the guidance of real-time US, the ablation began at a power of 35 to 40 W (*Figure 3B*); and (III) after ablation, CEUS was immediately performed to assess the efficacy of the treatment. Complete ablation was achieved when the ablated nodule was covered by non-enhanced areas (*Figure 3C*).

As the follow-up US images show, the echogenic characteristic of the nodule changed from uniform or uneven hypoechogenicity to uneven hypo- or normal echogenicity. The volume reduction rates at three, six, and 12 months after MWA were 58%, 71%, and 97%, respectively (*Figure 3D-3F*).

Prolonged vocal cord mobility impairment after ablation and laryngoscopy showed paralysis of the right vocal cord (*Figure 4*), which improved within two months of the MWA, and no other complications were observed during the 24-month follow-up period. Compared with the patient's pre-MWA results, the serum iPTH, calcium and phosphorus levels improved significantly post MWA (*Figure 5*).

Discussion

The abnormal migration of parathyroid glands in the early

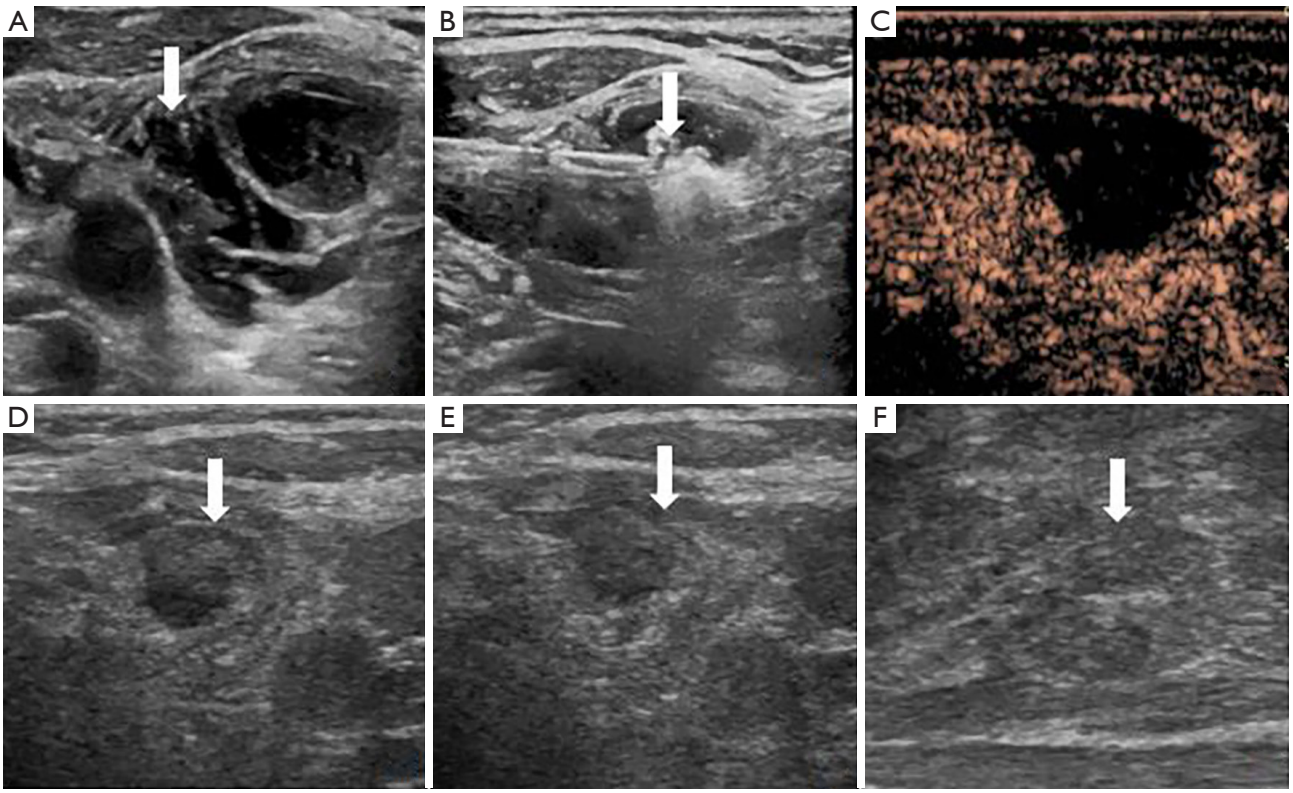
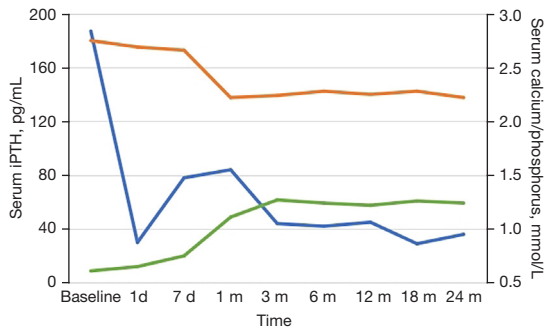


Figure 3 Ultrasound-guided MWA treatment. (A) Establishment of the hydrodissection (as indicated by the arrow) around the nodule; (B) MWA procedure of the nodule (as indicated by the arrow): a hyperechoic area was observed inside the nodule; (C) nonenhancement area covering the nodule on CEUS after ablation; ultrasound examination scans at 3 (D), 6 (E) and 12 months (F); the arrows show the ablation zone. The ultrasounds showed that the VRRs were 92%, 98%, and 100%, respectively. MWA, microwave ablation; CEUS, contrast-enhanced ultrasound; VRR, volume reduction rate.

Figure 4 The laryngoscopy results showed paralysis of the right vocal cord.



iPTH	187	30	78	84	44	42	45	29	36
Calcium	2.75	2.69	2.66	2.22	2.24	2.28	2.25	2.28	2.22
Phosphorus	0.61	0.65	0.75	1.11	1.27	1.24	1.22	1.26	1.24

Figure 5 Characteristics of the changes in the iPTH calcium and phosphorus levels after MWA treatment. iPTH, intact parathyroid hormone; MWA, microwave ablation.

stages of development may stimulate the formation of ectopic parathyroid glands. A recent meta-analysis reported that ~12% of ectopic parathyroid adenomas occur in the neck and ~4% occur in the mediastinum, but that ectopic parathyroid adenomas rarely occur in the carotid sheath (6).

Preoperative accurate localization is a key factor in the success of parathyroid adenoma operations. Due to the variety of possible anatomical sites, some patients may undergo one unsuccessful surgical procedure and have to undergo a second operation. Routine US and ^{99m}Tc-sestamibi scans are first-line imaging modalities. However, sestamibi scans can produce false-negative results. The evaluation of ectopic parathyroid glands is difficult, especially for patients with Hashimoto thyroiditis, and it is also very challenging to differentiate between ectopic parathyroid adenomas of the neck and enlarged cervical lymph nodes. CEUS could be used to improve the US discrimination of parathyroid lesions from lymph nodes, as PHPT nodules are generally hyperenhanced in the arterial phase (7). The FNA of suspicious lesions can also assist in the successful preoperative localization of ectopic glands (8).

The use of both ioPTH monitoring and CEUS appear to be effective in improving PHPT control after ablation. The results of ioPTH monitoring, which relies on the real-time assessment of gland function, help to determine the success of ablation (9). In this case, the ablation area was evaluated by CEUS immediately after ablation, and the results accurately reflected the perfusion of the lesion and showed complete ablation.

In this case, the patient's ectopic parathyroid adenoma was misdiagnosed as a lymph node, resulting in the first unsuccessful ablation. The diagnosis was missed in the first US for a number of reasons. First, ectopic parathyroid adenoma in the carotid sheath is a rare cause of PHPT. Second, preoperative and intraoperative localization is difficult, which poses challenges for diagnosis and treatment. Third, the patient had Hashimoto thyroiditis, which also added to the difficulty in distinguishing the ectopic parathyroid adenoma of the neck from an enlarged cervical lymph node. Based on this case study, ectopic parathyroid adenoma should be considered in clinical practice when parathyroid surgery fails due to persistent PHPT, even if the initial preoperative imaging fails to identify a target adenoma (10). This is the first article to report a case in which persistent PHPT was successfully treated by MWA with ioPTH monitoring.

In conclusion, the preoperative localization of ectopic parathyroid adenomas is crucial in determining the surgical approach to be adopted and improving cure rates. IoPTH monitoring can effectively reduce the incidence of persistent PHPT. Further investigations need to be conducted to determine whether future guidelines on the management of PHPT should recommend the routine use of ioPTH monitoring.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://qims.amegroups.com/article/view/10.21037/qims-23-1506/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committees and with the Helsinki Declaration (as revised in 2013). The protocol of this study was approved by the Ethics Committee of Gansu Provincial Hospital (No. 2021-243). Written informed consent was obtained from the patient for publication of this article and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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