Horner Syndrome as a Complication Following Microwave Ablation of Secondary Hyperparathyroidism (sHPT): A Case Report

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Abstract: Horner's syndrome (HS) has previously been reported in the literature as a complication of parathyroid surgery. It presents clinically with eyelid ptosis, miosis, enophthalmos, anhidrosis, and vascular dilatation, all of which result from a damaged sympathetic chain. Here, we report the case of a 45-year-old female patient who presented with miosis and eyelid ptosis following microwave ablation (MWA) of secondary hyperparathyroidism (SHPT). After 6 months of follow up, the patient's miosis and ptosis was incompletely relieved. We aimed to try to avoid such devastating symptoms in future cases by exploring reasons for the destruction of the cervical sympathetic trunk.

Keywords: cervical sympathetic trunk; Horner syndrome, microwave ablation; secondary hyperparathyroidism

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Horner syndrome (HS) results from a damaged cervical sympathetic trunk, and the condition was first described by Swiss ophthalmologist Johann Friedrich Horner in 1869 [1]. It presents clinically with the following symptoms: eyelid ptosis, miosis, enophthalmos, anhidrosis, and vascular dilatation.

Microwave ablation (MWA) is a minimally invasive technique that has been used to treat benign thyroid nodules and papillary thyroid carcinomas and has achieved promising results [2-3]. Parathyroid nodules have a similar anatomic position and US imaging characteristics to thyroid nodules. Recently, many centers have attempted to apply the technique to treat primary and secondary hyperparathyroidism (pHPT and sHPT) and have achieved effective results. However, several complications have been reported, and they include hypocalcaemia, voice change, skin burns, hematoma formation, and transient hyperthyroidism [4-5].

Currently, MWA of hyperthyroidism (HPT) has been administered to 241 patients (sHPT 201 cases and pHPT 40 cases) in our department, and among these we observed one case of HS in a female patient. As a rare complication of parathyroid surgery, HS has only been reported in a handful of papers, and no previous papers have reported the condition following parathyroid MWA [6-7]. Here, we present HS after MWA treatment in a case of ectopia sHPT, discuss the possible causes and assess technical tips to avoid such devastating symptoms from occurring in future cases.

Case Report

The study protocol was approved by the Human Ethics Review Committee of the China-Japan Friendship Hospital. Written informed consent was obtained before the procedure.

A 45-year-old female patient on regular hemodialysis for 20 years was referred to our department for MWA of recurrent sHPT. Three years ago, she received a total parathyroidectomy (PTX) plus autotransplantation on the left forearm. After surgery, her iPTH was regularly monitored and fluctuated between 100-200 ng/ml. However, five months ago, systemic fatigue appeared again; serum iPTH was elevated to 661.4 ng/ml, and then it increased progressively (from 661.4 ng/ml to 1085.4 ng/ml).

Laboratory tests showed a lack of $25OHD_3$ (29.1 nmol/L); iPTH of the left upper limb was not higher than

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the right upper limb (1356 pg/ml vs 1911 pg/ml). Blood biochemistry displayed kidney failure: Ur 16.36 mmol/L, Cr 902.3 mol/L, UA 536 mol/L.

A MIBI scan (SymbiaT2; Siemens, Munich, Germany) was conducted prior to the ablation procedure. Increased 99 mTc-sestamibi (MIBI) radionuclide concentration in both early and delayed phases were observed in the anterior lateral nodule of the left lobe of the thyroid. Autograft on the left forearm displayed increased radionuclide concentration only in the early phases on the MIBI scan. The diagnosis of ectopic parathyroid hyperplasia was definitive and the enhancement of parathyroid function in the left forearm transplantation was not excluded. (Fig. 1)

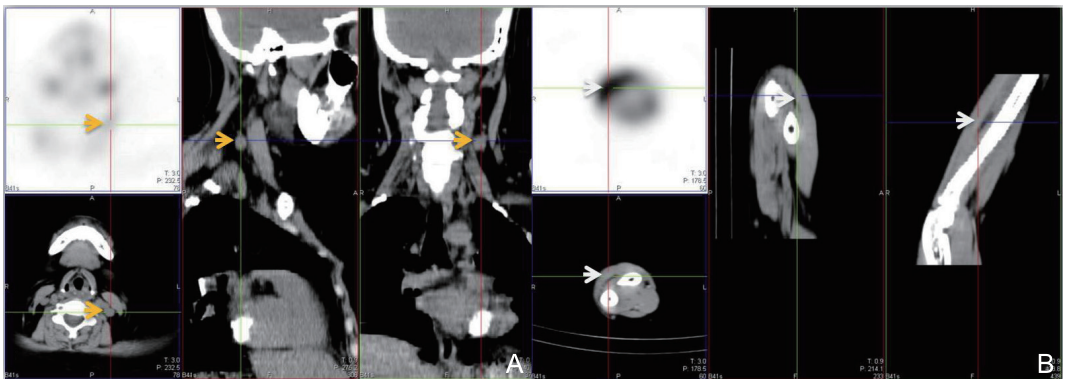

Figure 1 MIBI scan of the nodules. (A) Increased radionuclide concentration in both early and delayed phases of ectopic parathyroid gland (yellow arrows). (B) Auto-graft on left forearm displayed increased radionuclide concentration only in early phases (white arrows).

Ultrasound examination (10.0-MHz linear probe, Aplio 500, Toshiba Medical Systems, Tokyo) revealed a hypoechoic nodule on the lateral side of the left carotid artery, measuring 11x10 mm, with regular contours and well defined limits; the capsule was smooth and complete. The nodule was on the right side of the internal jugular vein (IJV) with greater activity from the outside of the internal jugular vein to the back of the common carotid artery (CCA). A color Doppler map was analyzed afterwards and showed less vascularity. After a bolus injection of 2.4 ml Sonovue (Sonovue, Bracco, Milan, Italy), the mass displayed hyper enhancement in both the arterial and venous phase. A recurrent and ectopic sHPT was diagnosed in combination with the medical history and MIBI scan.

At the same time, no definite parathyroid gland graft nodule was observed in the left forearm under US examination. An iPTH retest was performed on the left upper limb and right upper limb (887.5 pg/ml vs 916 pg/ml). Finally, the diagnosis of hyperparathyroidism was established, the results of an electrocardiogram and laryngoscopy were normal, and the MWA was proposed.

After the ablation site on the neck was sterilized, 40-60 ml normal saline (NS) was first injected into the area around the parathyroid nodule to offer heat insulation and nerve isolation. A liquid-isolating zone was set up between the anterior capsule of the thyroid gland and the cervical anterior muscles, between the lateral capsule of the thyroid gland and the carotid artery, between the posterior capsule of the thyroid gland and the recurrent laryngeal nerve crossing area, and between the esophagus and the parathyroid gland. Next, a lidocaine and NS mixture (1:3, 0.5% lidocaine, 20 ml) was injected closely around the periparathyroid gland and subcutaneous area in order to increase local anesthesia. The cooled MWA antenna (17 G) with a 0.4-cm tip (Intelligent Basic Type Microwave Tumor Ablation System, Nanjing ECO Microwave System, Nanjing, China) was placed by hand in the parathyroid nodule under US guidance. Due to the small size of the parathyroid nodule, the needle tip was steadily held for 15–25 seconds with a power of 30 W. Radiation was repeated two to four times with 5-second intervals to prevent heat injury to surrounding critical structures. After ablation in one unit, the antenna was replaced, and another ablation was performed under US guidance. The therapy was terminated when the entire nodule became transiently hyperechoic. CEUS was performed 5-10 minutes later to assess for a complete ablation (Fig. 2).

Subsequently, we advised the patient to remain in a lying position and to abstain from drinking water for at least 2 hours. One day after MWA, the serum iPTH decreased to 142.7 ng/ml, which meant MWA was effective and successful. However, 3 days after MWA, the patient showed mild miosis and eyelid ptosis in her left eye but no enophthalmos, anhidrosis, or vascular dilatation. The patient underwent examination by a neurological physician. Along with the clinical presentation, the patient was finally diagnosed with HS as a rare complication of MWA. Therefore, routine treatment with mecobalamin was administered immediately.

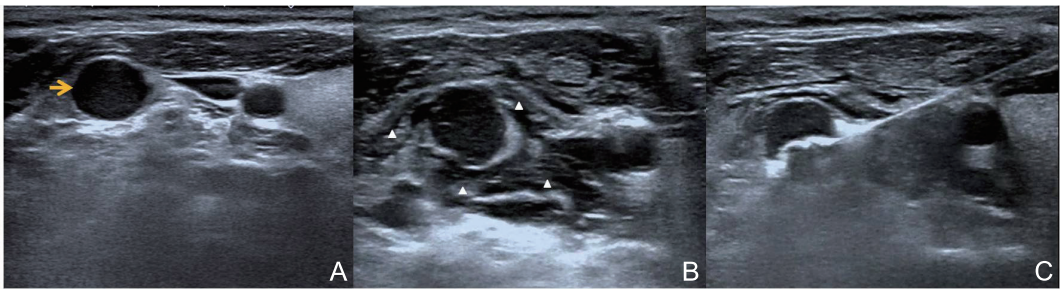

Figure 2 (A) hypoechoic nodule on the lateral side of the left carotid artery, measuring 11x10mm, with regular contours and well defined limits, the capsule was smooth and complete (yellow arrow). (B) A liquid-isolating zone around the nodule (white triangle). (C) The procedure of MWA.

After 1 month of MWA, the nodule showed a reduction in volume with US imaging, the ablation zone was close to the cervical vagus nerve, and the carotid sheath was compressed (Fig 3). The clinical laboratory data was normal (iPTH 78.7 ng/ml, serum calcium 2.55 mmol/L, serum phosphate 1.02 mmol/L, ALP 125 IU/L). However, after 6 months of follow up, the patient's miosis and ptosis had not been completely alleviated.

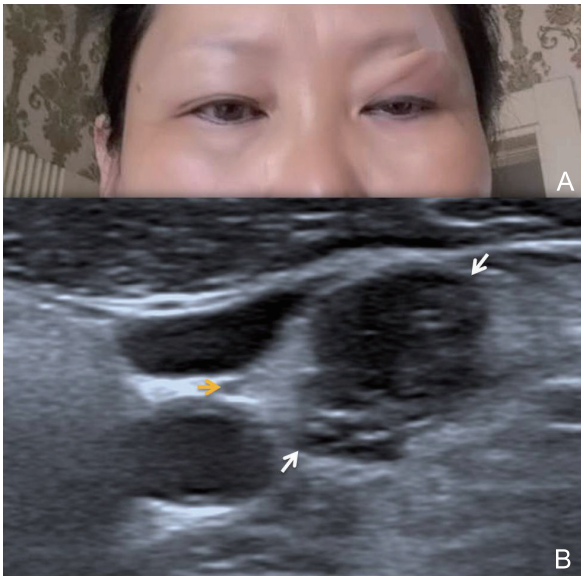

Figure 3 (A) The patient showed mild miosis and eyelid ptosis in her left eye. (B) After 1 month of MWA, the nodule showed a reduction in volume with US and the ablation zone (white arrow) was close to cervical vagus nerve (yellow arrow) and the carotid sheath was compressed.

Discussion

There have been a few reported cases of HS after PTX [6]. HS after MWA has not yet been reported in the literature. Recently, MWA proved to be an effective and safe treatment for sHPT and pHPT. It has been observed to have several benefits such as few risks, low trauma, fast recovery, few side effects, and easy repeatability. Moreover, it is minimally invasive, leaving a good cosmetic appearance without scars.

However, every surgical procedure is associated with risks, and even such a minor procedure is not an exception. The complications of MWA are similar to those of PTX: recurrent laryngeal and superior laryngeal nerve injury, post-MWA hypocalcemia, surgical area hemorrhage, etc.

HS is caused by any compression or destruction of the cervical sympathetic trunk. Depending on the damaged region, it can be classified into 3 types: central, preganglionic, and postganglionic [8]. The cervical sympathetic trunk is located among the CCA, the IJV, the CV, and the anterior fascia of the vertebra, with superior, intermediate, and inferior cervical ganglia. The sympathetic nerve is also distributed throughout the iris sphincter muscle, dilatator iridis, glandula lacrimalis, and cerebrovascular system. Once damaged, it can cause corectasis, increased secretion of the lacrimal gland, and cerebral vasoconstriction.

One patient had HS in our study. A possible reason is that the middle cervical sympathetic ganglion (MCSG), which usually is located lateral/medial to the CCA, was damaged during thermal ablation and was compressed by the ablation zone after MWA. The MCSG is small and only 41% can be visualized on US. Sometimes it could be misinterpreted as lymph nodes, the longus capitis muscle, or the thyroid incidentaloma [9-10]. Sympathetic anatomical variations may occasionally occur due to individual differences. Therefore, an unexpected injury could occur in some person and cause HS during MWA. In addition, ectopic parathyroid gland was adjacent to the carotid sheath. It extends from the cervical fascia to both sides, loosening and moving, which might influence the location of the HPT nodule. Another contributing factor is the compression of post-MWA hematoma and inflammation. With the absorption of water, the ablation zone expresses a shrinkage strain. In addition, inadequate isolation due to postoperative adhesion may also be the cause.

First, in minimizing the complications, careful US examination of the adjacent structures around the sHPT nodule plays an important role in distinguishing the MCSG. Second, hydrodissection is an effective method

for separating the HPT nodule and the surrounding important structures. Third, US-guided cautious tracing of the antenna and the active tip never advanced beyond the HPT nodule capsule and are mandatory during the MWA procedure. Fourth, adjusting the needle direction to prevent heat diffusing directly to the nerve and measuring the temperature should be considered.

Conclusion

MWA can be accepted as a relatively safe procedure for the treatment of sHPT and pHPT. However, even though the incidence of HS complication is rare, attention should be given to this possible outcome. Careful study of the anatomic relationship of the cervical sympathetic trunk and parathyroid gland with adjacent structures will help surgeons take precautionary measures to minimize the possibility of damage.

Conflicts of Interest

The authors declare that there is no conflict of interest.

References

[1] Y Kong YX, Wright G, Pesudovs K, O'Day J, Wainer Z, Weisinger HS. Horner syndrome. *Clin Exp Optom* 2007;5:336–44.

[2] Cheng Z, Che Y, Yu S, Wang S, Teng D, Xu H, et al. US-Guided Percutaneous Radiofrequency versus Microwave Ablation for Benign Thyroid Nodules: A Prospective Multicenter Study. *Sci Rep* 2017; 1:9554

[3] Yue W, Chen L, Wang S, Yu S. Locoregional control of recurrent papillary thyroid carcinoma by ultrasound-guided percutaneous microwave ablation: aprospective study. *Int J Hyperthermia* 2015;4: 403–408.

[4] Zhuo L, Peng LL, Zhang YM, Xu ZH, Zou GM, Wang X, et.al. US-guided Microwave Ablation of Hyperplastic Parathyroid Glands: Safety and Efficacy in Patients with End-Stage Renal Disease-A Pilot Study. *Radiology* 2017; 2:576-584.

[5] Liu C, Wu B, Huang P, Ding Q, Xiao L, Zhang M, et al. US-Guided Percutaneous Microwave Ablation for Primary Hyperparathyroidism with Parathyroid Nodules: Feasibility and Safety Study. *J Vasc Interv Radiol* 2016;6:867-75.

[6] Harding JL, Sywak MS, Sidhu S, Delbridge LW. Horner's syndromein association with thyroid and parathyroid disease. *ANZ J Surg* 2004;6:442-5.

[7] Zhang X, Ge Y, Ren P, Liu J, Chen G. Horner syndrome as a complication after thyroid microwave ablation: Case report and brief literature review. *Medicine (Baltimore)* 2018;34:e11884.

[8] Kanagalingam S, Miller NR. Horner syndrome: clinical perspectives. *Eye Brain* 2015;7:35–46.

[9] Ha EJ, Baek JH, Lee JH. Ultrasonography-Based Thyroidal and Perithyroidal Anatomy and Its Clinical Significance. *Korean J Radiol* 2015;4:749-766

[10] Shin JE, Baek JH, Ha EJ, Choi YJ, Choi WJ, Lee JH. Ultrasound features of middle cervical sympathetic ganglion. *Clin J Pain* 2015;10:909-13.