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● *Original Contribution*

# EFFICACY OF ABLATION THERAPY FOR SECONDARY HYPERPARATHYROIDISM BY ULTRASOUND GUIDED PERCUTANEOUS THERMOABLATION

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**Abstract—The objective of this study was to explore the value of ultrasound-guided percutaneous microwave thermoablation to treat secondary hyperparathyroidism (SHPT). One hundred and thirty-eight parathyroid glands from 56 patients with SHPT were ablated in this study. All the parathyroid glands were evaluated by real-time contrast-enhanced ultrasound before, during and after ablation. Changes in serum parathyroid hormone (sPTH) levels were measured before treatment and at 1 h, 1 wk, 1 mo and 6 mo after thermoablation treatment. All 56 cases had a 1-mo follow-up, and 34 cases had a 6-mo follow-up. The sPTH level of the 54 cases 1 mo after ablation was significantly lower than that before ($p < 0.05$). In the 34 cases that had a 6-mo follow-up, the sPTH levels were also significantly lower at 6 mo after ablation than before ($p < 0.05$). Bone pain in patients improved post-operatively ($p < 0.05$), but itchiness and insomnia did not improve ($p > 0.05$). Ultrasound-guided percutaneous microwave thermoablation is a feasible and effective non-surgical alternative treatment for SHPT patients. (E-mail: qianlinxue2002@163.com) © 2016 Published by Elsevier Inc. on behalf of World Federation for Ultrasound in Medicine & Biology.**

*Key Words:* **Secondary hyperparathyroidism, Serum parathyroid hormone, Thermal ablation, Ultrasound.**

## INTRODUCTION

Chronic kidney disease (CKD) is a major chronic disease with a devastating effect on human health. CKD has a morbidity of 10%, as many patients will progress to chronic renal failure (CRF). About 26.3% of CKD patients have combined secondary hyperparathyroidism (SHPT), which is the most common serious complication of CRF (Douthat et al. 2003; Young et al. 2004). Serum parathyroid hormone (sPTH) is the main hormone that regulates serum calcium and phosphorous levels. Low serum calcium and high serum phosphorus can cause mental abnormalities, muscle spasms and even lead to respiratory or cardiac arrest (Moe et al. 2006; Zhang et al. 2013b). Among the symptoms, bone pain, itching and insomnia are typical, which seriously affect the life quality of patients (Yao et al. 2009). Traditional treatment strategies for SHPT include drug treatment and parathyroid surgery. For refractory SHPT, drug therapy is ineffective, but surgical treatment is invasive and traumatic. Furthermore, many patients do not tolerate surgical treatment. As a result, an effective, minimally invasive therapeutic strategy is needed for the treatment of SHPT.

Current guidelines on refractory SHPT incorporate complicated treatment options that are difficult to use clinically and have very low drug control effect (Bolasco 2011; Morrone et al. 2011; Panichi et al. 2010) and poor treatment efficacy. When patients with SHPT develop hyperplasia that is visible on imaging, but the hyperplastic tissue is small or fewer than four visible hyperplastic parathyroids are found, surgical removal of the parathyroid might not be complete and a secondary surgery might be needed. Because growth control of the parathyroid could be damaged in late nodular hyperplasia of parathyroid with CRF, the parathyroid might result in local invasive growths (Olson and Leight 2002), and this is the cause of recurrent symptoms after treatment of secondary hyperparathyroidism. The 1-y recurrence rate of gland resection can be as high as 30% (Olson and Leight 2002) or patients can be reluctant to undergo surgery.

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Ultrasound-guided interventions are an effective alternative (Lacobone 2006). Recent reports generally indicate ultrasound-guided percutaneous alcohol injection therapies (Chen et al. 2011; Douthat et al. 2011) for clinical applications have gradually been recognized. Ethanol injection therapy is more commonly used as a minimally invasive treatment of SHPT, but incomplete ablation with a 1-y recurrence rate of 80% has limited its clinical application.

Recently, thermal ablation treatments have changed SHPT treatment. Microbubbles are generated by ablation and detectable by ultrasound imaging. It was reported that using radiofrequency can ablate tumors ≤5 cm and the tumor inactivation rate could be >90% (Lencioni et al. 2003; Lin et al. 2004; Shiina et al. 2005). Furthermore, differences in the efficacy and long-term survival rate after microwave ablation and radiofrequency ablation were not statistically significant (Lu et al. 2005; Shibata et al. 2002). Research on the 3-D ablation thermal field using finite elements has laid a solid theoretic and technical foundation for the clinical application of ablation technology (Liang et al. 2001; Tungjitkusolmun et al. 2002). The use of laser therapy and ultrasound-guided percutaneous radiofrequency tissue ablation of a solitary adenoma of the parathyroid gland have been described (Bennedbaek et al. 2001; Hänsler et al. 2002). Ultrasound-guided percutaneous microwave ablation of benign thyroid nodules was reported as a feasible technique (Feng et al. 2012), and microwave ablation to clinically treat SHPT should be feasible.

This study evaluated the use of ultrasound-guided percutaneous microwave thermoablation to treat SHPT.

## MATERIALS AND METHODS

This study was approved by the Capital Medical University Ethics Committee and written informed consent was obtained from all patients before the study.

### *Participants*

Fifty-six patients presenting with SHPT to the Department of Nephrology at Beijing Friendship Hospital from September 2012 to September 2013 were enrolled in this study. The patients included 26 males and 30 females with an age range of 29–82 y (55.02 ± 10.01). The average period of hemodialysis was 7.89 y with a range of 3.5 to 12 y; the average level of sPTH was 1256.4 pg/mL with a range of 638–2500 pg/mL. The average longitudinal diameter of nodules was 1.35 cm with a range of 0.5–3.5 cm.

### *Inclusion/exclusion criteria*

Patients who were diagnosed with SHPT (sPTH >300 pg/mL) and the presence of parathyroid gland hyperplasia determined by ultrasound (Fig. 1a) and radionuclide imaging were included (Fig. 1b). Patients were

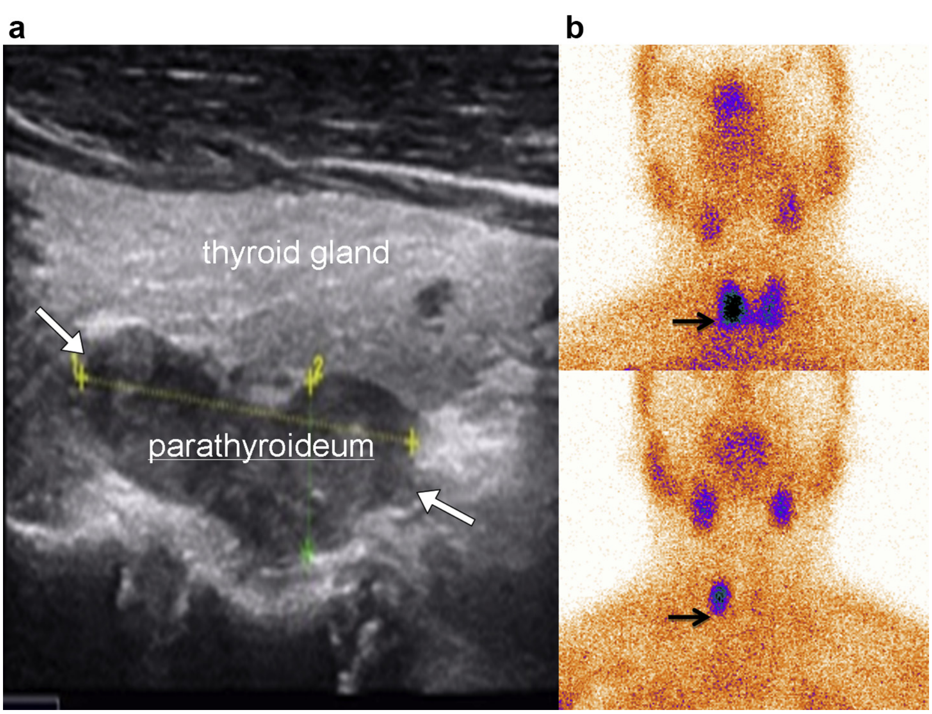


Fig. 1. A 54-y-old male with SHPT and CRF for 10 y. (a) B-mode ultrasound reveals a parathyroid hyperplasia of 28.0 × 8.5 mm (*arrow*). (b) A radionuclide image reveals the same parathyroid hyperplasia. SHPT = secondary hyperparathyroidism; CRF = chronic renal failure.