Letter to the Editor

Pseudoaneurysm of superior thyroid artery following ultrasound-guided radiofrequency ablation of hyperplastic parathyroid gland: a case report and literature review

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Submitted Oct 19, 2019. Accepted for publication Feb 26, 2020.
doi: 10.21037/qims.2020.03.06
View this article at: http://dx.doi.org/10.21037/qims.2020.03.06

Introduction

Dr. Carrafiello and associates reported the successful treatment of secondary hyperparathyroidism by radiofrequency ablation (RFA) in 2006 (1). In recent years, ultrasound-guided percutaneous thermal ablation of hyperplastic parathyroid gland has proven to be an effective method for the treatment of secondary hyperparathyroidism (2-5). Complications of this treatment include cervical nerve injury, neck hematoma (4,5). We report a case of a superior thyroid artery pseudoaneurysm following ultrasound-guided RFA of hyperplastic parathyroid gland for the treatment of secondary hyperparathyroidism.

Case presentation

A 36-year-old man with advanced chronic renal disease had been undergoing hemodialysis treatment three times a week for 11 years. In the past 1 year, his parathyroid hormone continued to rise, reaching ≥2,000 pg/L. This patient had the following symptoms: dry mouth, fatigue, lumbar acid, knee pain, hearing loss, occasional blurred vision. He was given him of Rocaltrol and Cinacalcet for treatment, but the curative effect was poor, and the reduction of parathyroid hormone levels was not obvious after repeated examinations. Ultrasonographic image showed that four parathyroid glands in the bilateral neck were hypertrophic and hypoechoic with calcification. The size of the upper and lower parathyroid glands in the left neck was about 1.1×0.4, 1.9×1.0 cm, and that of the upper and lower parathyroid glands in the right neck was about 1.7×0.6, 1.6×0.8 cm (*Figure 1*).

After communicating with the patient fully, we performed ultrasound-guided RFA. Heparin was not used in hemodialysis the day before RFA. RFA was done with a radiofrequency generator (VIVA; STARmed, Goyang, Korea) along with an 18-gauge-0.7 cm monopolar internally cooled electrode on the left two hyperplastic parathyroid glands on January 21, 2019. For this session of RFA treatment, the RF power was 35 W, and the cumulative ablation time was 90 seconds. After the first ablation, the patient had no complications except for mild neck pain for about 3 days, while his parathyroid hormone levels decreased to about 1,100 pg/L. Then we performed ultrasound-guided RFA using the same RF device as the first time on the right two hyperplastic parathyroid glands on February 24, 2019. For this session of RFA treatment, the RF power was 35 W, and the cumulative ablation time was 110 seconds. One day after this second ablation, a pseudoaneurysm of the superior thyroid artery in the right neck of the patient was found by ultrasonography (US). The size of the pseudoaneurysm was about 0.8×0.7 cm (*Figure 2*). Immediately we took a partial compression treatment on the pseudoaneurysm for 30 minutes under ultrasound monitoring, and then the pseudoaneurysm was found closed and hypoechoic thrombosis formed in the lumen of the

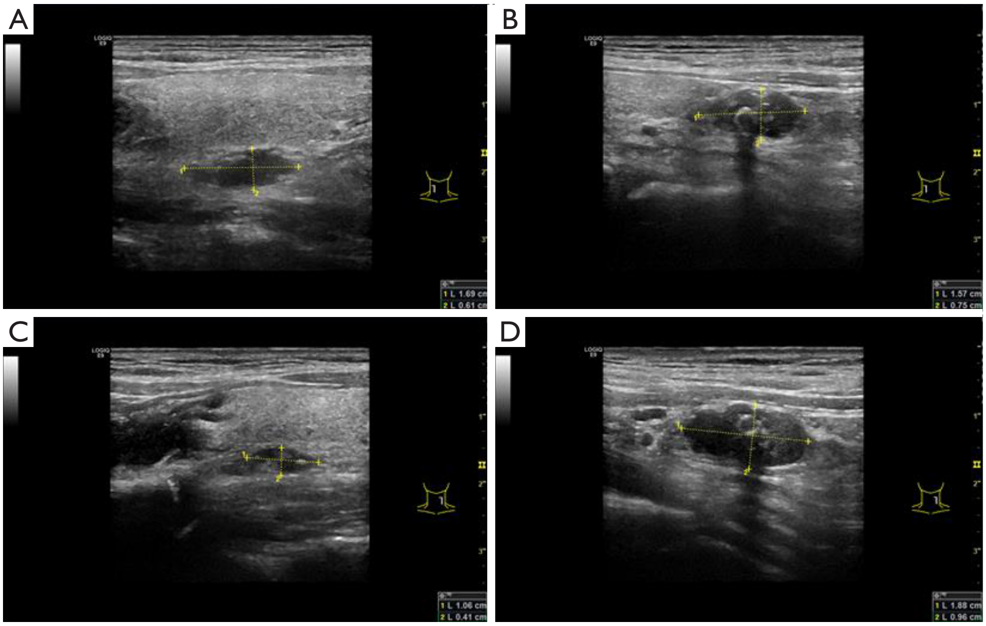

Figure 1 Ultrasound images of parathyroid gland before RFA in this patient. (A) The right upper parathyroid gland is about 1.7×0.6 cm in size; (B) the right lower parathyroid gland is about 1.6×0.8 cm in size; (C) the left upper parathyroid gland is about1.1×0.4 cm in size; (D) the left lower parathyroid gland is about 1.9×1.0 cm in size.

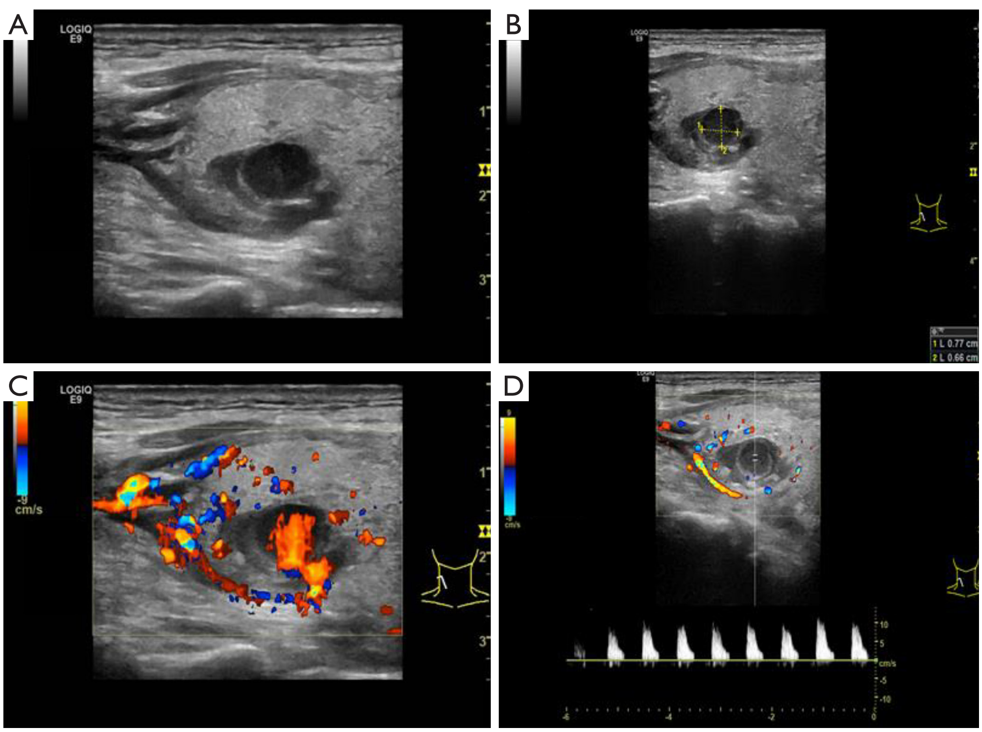

Figure 2 Ultrasound images of pseudoaneurysm in the right neck of the patient, one day after RFA. (A,B) Ultrasound images show the pseudoaneurysm originated from the posterior branch of the right superior thyroid artery. The pseudoaneurysm was 0.8×0.7 cm in size; (C) color Doppler image of the pseudoaneurysm; (D) frequency Doppler image of the pseudoaneurysm.

aneurysm (*Figure 3*). One day after partial compression treatment, the ultrasound imaging indicated that the pseudoaneurysm turned into a hematoma with about 1.8×0.9 cm in size. After 1 month, the hematoma size was further reduced, and the size was about 1.2×0.6 cm (*Figure 4*). In addition, 1 month after two ablation treatments, the parathyroid hormone of the patient decreased to about 120 pg/L, and the volume of four parathyroids also decreased significantly (*Figure 5*).

We conducted a systematic review searching database PubMed, Embase and Web of Science from inception to April 2019. The base characteristics of the 14 included cases from 7 articles were shown in *Table 1* (6-12). There were 8 (57.1%) women and 6 (42.9%) men varying in age from 50

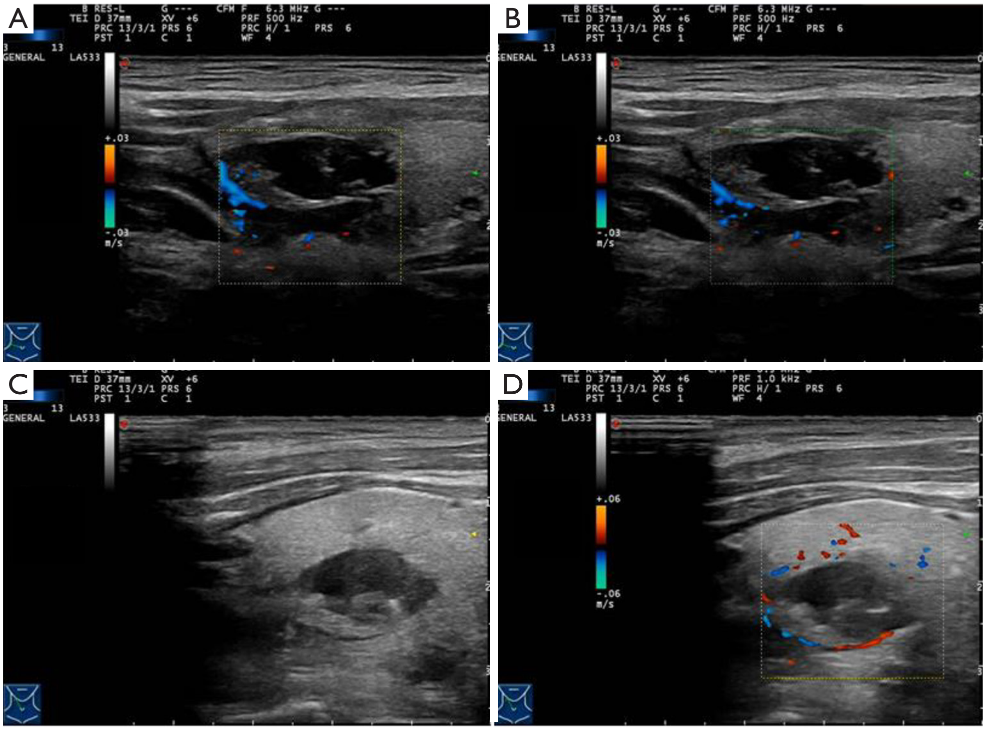

Figure 3 Ultrasound images of pseudoaneurysm during partial compression treatment. (A,B) Partial compression treatment on the pseudoaneurysm under ultrasound monitoring; (C,D) after 30 minutes of compression, the pseudoaneurysm closed and hypoechoic thrombosis formed in the lumen of the aneurysm.

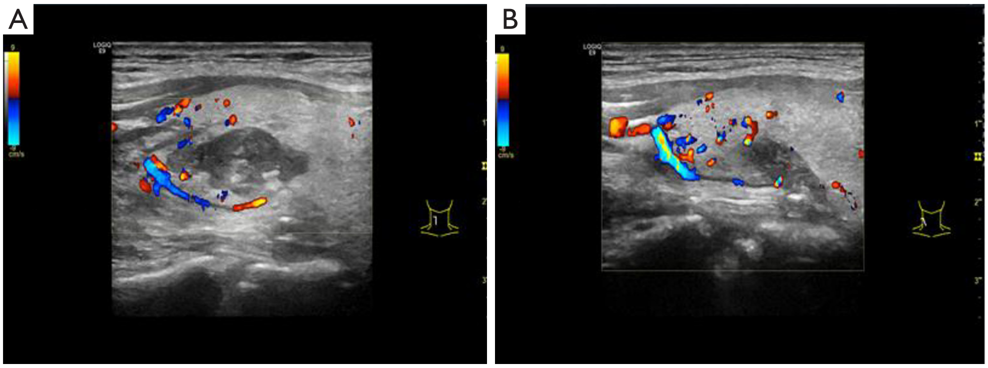

Figure 4 Ultrasound images of pseudoaneurysm after partial compression treatment. (A) One day after partial compression treatment, the ultrasound image indicates that the pseudoaneurysm turned into a hematoma of about 1.8×0.9 cm in size; (B) after 1 month, the hematoma size was further reduced in size to 1.2×0.6 cm.

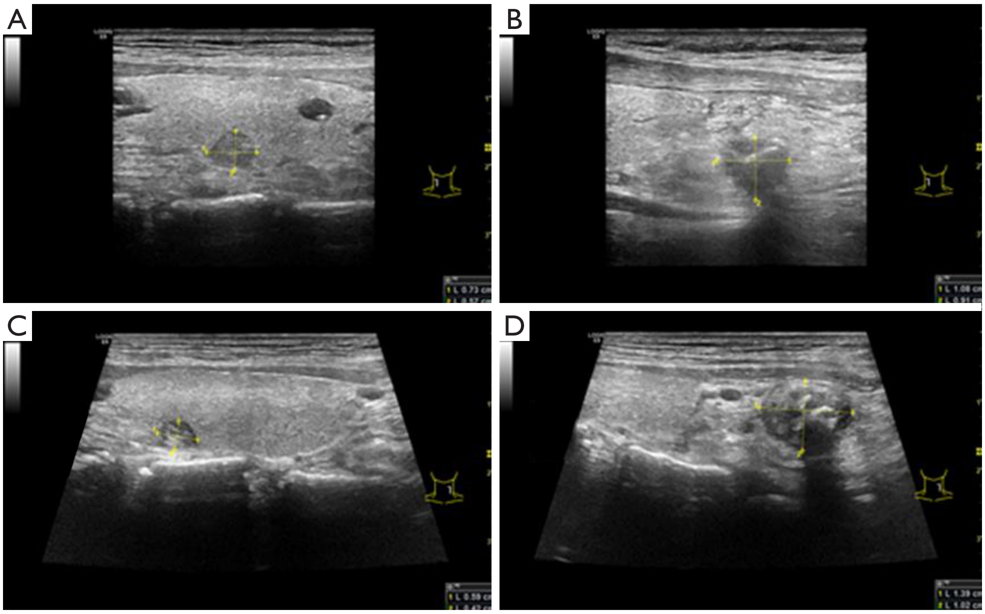

Figure 5 One month after the second ablation. (A) The right upper parathyroid gland was about 0.7×0.6 cm in size; (B) the right lower parathyroid gland was about 1.1×0.9 cm in size; (C) the left upper parathyroid gland was about 0.6×0.4 cm in size; (D) the left lower parathyroid gland was about 1.4×1.0 cm in size.

to 72 years. Of these cases, 10 developed pseudoaneurysm shortly or years after US-guided biopsy of thyroid lesions, who finally were treated by receiving RFA or surgery (6,7,9). Other four cases developing pseudoaneurysm underwent coil embolization and resolved (8,10-12).

Discussion

Ablation of hyperparathyroidism and thyroid nodule has been widely used in clinical practice in recent years, especially in Asian countries such as China. Ablation includes RFA, microwave ablation and laser ablation. There is no significant difference of these methods in the efficacy of thyroid nodule ablation (13-15). However, because RFA electrode is sharper than microwave antenna and laser fiber, and the percutaneous puncture operation is more convenient. RFA was selected in this case. The majority of benign thyroid nodules are asymptomatic, remain stable in size, and do not require treatment. However, a minority of patients with growing nodules may have local symptoms or cosmetic concerns, and thus demand RFA or surgical therapy (16). The main purpose of RFA for hyperparathyroidism caused by primary or secondary hyperparathyroidism is to inactivate parts of the parathyroid tissue, making the parathyroid gland shrink and finally reducing the parathyroid hormone, so to reduce clinical symptoms caused by the increase of parathyroid hormone.

Hyperparathyroidism RFA can be completed under the guidance of ultrasound. It is desirable that four hyperplastic parathyroids can be clearly displayed on ultrasound, or a single-gland adenoma become an indication for RFA treatment. Postsurgical recurrent hyperparathyroidism may be a good indication due to difficulty in reoperation (17). RFA of hyperparathyroidism is usually performed under local anesthesia. Compared with surgery, RFA is more minimally invasive, with lower risk and fewer complications. The main complications reported in the literature include cervical nerve injury, neck hematoma, while no paper reports cervical pseudoaneurysms. Our case of pseudoaneurysm was found 1 day after ultrasound-guided RFA of parathyroid gland. The fundamental cause of the formation of pseudoaneurysms would be vascular injury. The formation of pseudoaneurysm in our case may be related to the following factors: (I) the right upper parathyroid gland is adjacent to the posterior branch of the right superior thyroid artery. During RFA, the posterior branch of the right superior thyroid artery could be injured by puncture of the ablation needle; (II) the posterior branch of the superior thyroid artery was too deep, and the pressure hemostasis of the neck was ineffective after

Table 1 Summary of treatment of pseudoaneurysm in 7 published literatures

Author, country	Year	Prior procedure	Gender (M/F)	Age	Number of pseudoaneurysm	Size of pseudoaneurysm (mm)	Site	Time of detection	Initial treatment	Final treatment	Time to recovery
Ha *et al.*, Korea	2017	US-guided CNB of thyroid lesions	NA	NA	1	NA	Superior thyroidal artery	16 h	US-guided compression for 3 h	RFA	Immediately
Jun *et al.*, Korea	2016	US-guided CNB of thyroid lesions	3/5	54.1±16.0	8	US: 7.2 (4 to 12)	7 anterior middle portions; 1 anterior lower portion	7 immediate, 1 detected 3 days later	4 ITPAs succeeded with US-guided compression, and their mean size of 5.4 (4 to 7.5) mm while 4 ITPAs failed with US-guided compression, and their mean size of 9.0 (6 to 12) mm	4 ITPAs resolved with RFA	57.5±57.0 min
Khera *et al.*, India	2015	Insertion of the left IJV dialysis catheter	1 F	50	1	NA	Sternocleidomastoid branch of the right superior thyroid artery	1 day later	US-guided compression for 15 min	Coil embolization	1 week
Ruan *et al.*, China	2015	Internal jugular vein puncture	1 F	51	1	NA	Inferior thyroid artery	NA	NA	Coil embolization	No more hemorrhage immediately
Lin *et al.*, United States	2012	Tracheostomy	1 M	56	1	NA	Left superior thyroid artery	NA	NA	Coil embolization	NA
Petrocheilou *et al.*, Greece	2010	Inferior thyroid artery pseudoaneurysm caused by blunt trauma	1 M	72	1	CTA: 25 mm	Inferior thyroid artery	NA	NA	Coil embolization	NA
Kim *et al.*, Korea	2009	FNAB of the right thyroid lesion	1 F	63	1	US: 4.9×5.9 cm	Right inferior thyroid artery	5 years later	NA	Surgical repair	NA

CNB, core needle biopsy; FNAB, fine needle aspiration biopsy; US, ultrasonography; RFA, radiofrequency ablation; CTA, computed tomographic angiography; ITPA, iatrogenic thyroid pseudoaneurysm; NA, not available.

ablation; (III) the arterial wall of the patient could be fragile due to chronic kidney disease for 11 years. In addition, the patient underwent hemodialysis treatment with heparin intermittently.

In our case, the pseudoaneurysm of the posterior branch of the superior thyroid artery in the right neck was successfully treated with ultrasound-guided local compression. The steps of treatment in this case were: (I) hemodialysis without heparin before treatment; (II) full-range monitoring with color Doppler ultrasound; (III) local compression with high frequency linear array probe, which was placed on the center of the pseudoaneurysm passage in the right neck of the patient, and moderately compressed to flatten the aneurysm chamber to stope blood flow signal; (IV) after 30 minutes of continuous compression, the hypoechoic thrombosis was observed in the lumen of the tumor after slow decompression, and then gauze and bandage were used for moderate pressure dressing for additional 24 hours.

In 1991, Fellmeth *et al.* (18) first reported the compression therapy of pseudoaneurysm under the guidance of ultrasound. Four iatrogenic thyroid pseudoaneurysms (ITPAs) were treated with US-guided compression and their mean size was 5.4 (4 to 7.5) mm; while 4 ITPAs failed with US-guided compression and their mean size was 9.0 (6 to 12) mm (7).

In conclusion, we report a case of pseudoaneurysm of the superior thyroid artery due to ultrasound-guided RFA of hyperplastic parathyroid gland in a patient with chronic kidney disease. We used a partial compression therapy under ultrasound monitoring to treat this pseudoaneurysm successfully.

Acknowledgments

Funding: None.

Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/qims.2020.03.06). The authors have no conflicts of interest to declare.

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Cite this article as: Tian S, Tian G, Jiang T. Pseudoaneurysm of superior thyroid artery following ultrasound-guided radiofrequency ablation of hyperplastic parathyroid gland: a case report and literature review. Quant Imaging Med Surg 2020;10(5):1162-1168. doi: 10.21037/qims.2020.03.06

