

Radiofrequency Ablation Followed by Percutaneous Ethanol Ablation Leading to Long-Term Remission of Hyperparathyroidism

Mohan T. Shenoy,¹ Arun S. Menon,² P. K. Nazar,³ Srikanth Moorthy,³
Harish Kumar,² Vasantha Nair,² Praveen Valiyaparambil Pavithran,²
Nisha Bhavani,² Vadayath Usha Menon,² Nithya Abraham,²
and R. Vasukutty Jayakumar⁴

¹Department of Endocrinology, Sree Gokulam Medical College and Research Foundation, Venjaramoodu, Trivandrum, Kerala 695607; ²Department of Endocrinology, Amrita Institute of Medical Sciences, Ponekkara, Kochi, Kerala 682041; ³Department of Radiodiagnosis, Amrita Institute of Medical Sciences, Ponekkara, Kochi, Kerala 682041; and ⁴Department of Endocrinology, Aster Medcity, Cheranalloor, Kochi, Kerala 682027

A 30-year-old male with cerebral palsy and motor impairment presented with right femur fracture. He had gradually worsening mobility and contractures of all extremities for the preceding 5 years. Evaluation showed multiple vertebral and femoral fractures, severe osteoporosis, a large parathyroid adenoma, and parathormone (PTH) exceeding 2500 pg/mL. Because of poor general health and high anesthetic risk, parathyroidectomy was deemed impractical. Ultrasound-guided radiofrequency ablation (RFA) helped achieve 50% size reduction and PTH levels with better control of hypercalcemia. Later, as calcium and PTH remained elevated, percutaneous ethanol ablation was performed with resultant normalization of PTH and substantial symptomatic improvement. Two years later, he still remains normocalcaemic with normal PTH levels. We propose that RFA and percutaneous ethanol ablation be considered as effective short-term options for surgically difficult cases, which could even help achieve long-term remission. Although not previously reported, our case illustrates that both RFA and percutaneous ethanol ablation could be safely performed successively achieving long-term remission.

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1. Case

A 30-year-old male presented with a 3-week history of sudden-onset painful swelling on right thigh, followed a few days later by a swelling on the left. His mother had heard a clicking sound from the thigh while moving him from bed to chair. There was no history of trauma or fall. He had cerebral palsy from birth with impaired mobility but used to be active with a stick till the age of 26. However, over the preceding 4 years, his mobility deteriorated because of diffuse body ache and generalized weakness, resulting in him being bed bound for nearly 2 years prior to presentation. His family attributed this to the progression of his cerebral palsy and chose to proceed with alternative and symptomatic therapies. On clinical examination he had generalized flexion deformity of both upper and lower limb with contractures and disuse atrophy of all limb muscles and restriction of movements of neck. He had firm tender bony

Abbreviations: PTH, parathormone; RFA, radiofrequency ablation.

swellings over both thighs and femur, which were confirmed to be fractures of both femurs on X-ray imaging. There were multiple vertebral fractures as well. He had raised serum calcium, alkaline phosphatase, parathormone (PTH) level with low vitamin D, and normal renal function (Table 1).

The biochemistry was in keeping with severe primary hyperparathyroidism with vitamin D deficiency. Bone densitometry confirmed severe osteoporosis (T score 8.1; age-matched Z score of -6.9 at L2–L3 spine). Abdominal sonography identified right renal nonobstructive calculus and left renal medullary calcification. Nuclear and ultrasound imaging confirmed a right inferior parathyroid adenoma. The 99m Tc-MIBI scintigraphy revealed an increased uptake in the right inferior parathyroid region. Ultrasound neck confirmed this as an adenoma (1.36×1.16 cm) in the right inferior parathyroid gland (Fig. 1). He was initially stabilized with hydration and furosemide and later treated with calcitonin therapy, cinacalcet, and zoledronic acid. He had excruciating pain in both thighs that could only be controlled with regular opioid analgesia. Although surgery was the definitive long-term treatment, the high anesthetic risk and poor general condition necessitated a less intensive approach.

Ablative therapy for the parathyroid adenoma was done using 15-cm-long radiofrequency ablation (RFA) needle with 1-cm ablation tip (Cool Tip Covidien) under ultrasound guidance. The lesion was ablated for 5 minutes at 70°C . Prior to the procedure, patient was treated with vitamin D supplementation of 60,000 units \times 2 doses 7 days apart to avoid precipitous fall in calcium postprocedure. Calcium levels were closely monitored after procedure to assess need for calcium infusion. Renal function was also monitored closely in view of nephrocalcinosis. The 5 mL dextrose was injected into the tracheoesophageal groove before ablation to protect the recurrent laryngeal nerve from thermal injury. A complete ablation was not attempted because of concern regarding severe hypocalcemia secondary to hungry bone disease.

A reduction in size of $>50\%$ was noted on ultrasound after RFA (Fig. 2). There was an appreciable decline in PTH levels to 356 pg/mL, but it rose to 920 pg/mL within 1 week. A second RFA as planned initially could not be completed because of technical difficulties (subcentrimetric residue and inability to fix the probe to a bony landmark because of the superficial location of the residue). Hence, we proceeded with percutaneous ethanol injection with 2 mL 95% ethanol under ultrasound guidance using a 22G lumbar puncture needle. This small quantity was injected using a 2-mL syringe and under direct ultrasonographic visualization. Alcohol is very bright (echogenic), and hence it was possible to ensure that the injection did not overflow from the tumor (Fig. 2).

Appreciable reduction of adenoma size was achieved in the repeat sonography after 5 days. Substantial reduction of calcium, alkaline phosphatase, and PTH levels was noted at the end of these procedures. Follow-up levels over a 12-month period showed normalization of calcium, phosphorus, PTH, and alkaline phosphatase (Table 1). There was appreciable reduction of calcium, alkaline phosphatase, and PTH levels were noted at the end of these procedures. The resultant complete normalization of calcium and PTH levels was

Table 1. Biochemical and Hormonal Profile at Admission and Discharge

Parameter With Normal Range	Initial Value	After RFA and Ethanol Ablation Completion	After 1-Year Follow-Up
Calcium (8.8–10.6 mg/dL)	14.1	7.9	9.2
Albumin (3.5–5.2 g/dL)	3.87	3.55	4.25
Corrected calcium (9–11 mg/dL)	10.2	8.26	9.2
Phosphorous (2.5–4.5 mg/dL)	1.63	1.75	3.43
Alkaline phosphatase (13–120 IU/L)	3549	1241	117.8
Creatinine (0.6–1.4 mg/dL)	0.45	0.33	0.66
25-OH vitamin D (30–70 ng/mL)	<3	<3	64.63
PTH (5–68 pg/mL)	>2500	17.4	29.3
Urine calcium:creatinine ratio (0.1–0.2)	0.6	0.4	0.2

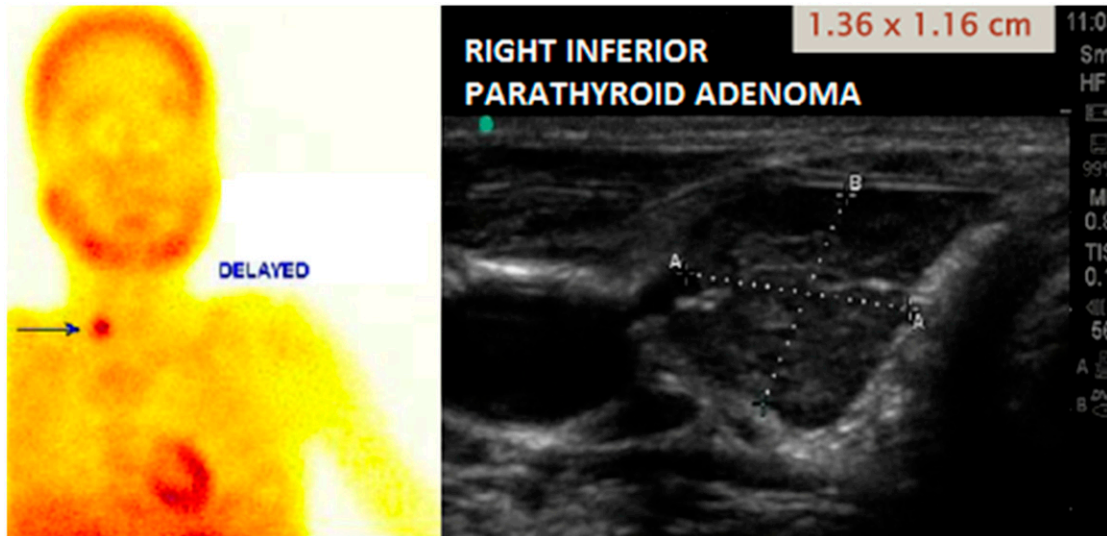


Figure 1. Structural localization of the parathyroid adenoma in the technetium sestamibi scintigraphy (left) and ultrasound scan of neck region (right).

accompanied by symptomatic improvement in pain and no further fractures after completion of 2-year follow-up.

2. Discussion

Surgical removal of parathyroid adenoma is recommended as standard treatment [1] of patients with primary hyperparathyroidism and having one or more adenomas. However, in a surgically risky case, there are very few proven modalities that will give remission of disease in the long-term. Our case had a successful outcome following staged procedure with RFA, followed by ethanol injection of parathyroid adenoma, and thus highlights the usefulness of these methods in carefully selected cases. There have been a few reports of ultrasound-guided RFA of parathyroid adenomas from South Korea and Japan [2–5]. Recent reports of three cases from Korea [3] and two cases in China [2] have suggested RFA as an effective procedure with a relevant decreasing trend in serum calcium and PTH immediately after RFA. Similar reports of RFA for palliative treatment of hyperparathyroidism due to parathyroid adenoma have been reported from India [6]. RFA for parathyroid glands is a difficult procedure due to the risk of burn injury to the recurrent laryngeal nerve. This can be minimized to a large extent by dextrose injection into the neck recess between the gland and the nerve. RFA for parathyroid hyperplasia using contrast-enhanced ultrasound scan to identify necrotic tissue has been advised [5]. Percutaneous treatment of a parathyroid adenoma by absolute ethanol injection may represent an alternative therapeutic approach [7]. This procedure was first described by Solbiati *et al.* in 1985 [8] and has been mainly used in the treatment of secondary or tertiary hyperparathyroidism [9, 10]. Few studies suggest that parathyroid adenoma by absolute ethanol injection may also be used for the treatment of selected cases of primary hyperparathyroidism, although there are reports of incomplete inactivation of the PTH secretion. RFA ensures consistent and predictable ablation zone as compared with percutaneous ethanol injection. The diffusion of ethanol into the injected tissue and its spread to surrounding normal areas is unpredictable, thereby resulting in incomplete treatment with potential complications. Long-term monitoring of serum calcium and PTH levels is important to establish the effectiveness of RFA as a therapeutic option for the management of parathyroid adenoma. Local expertise coupled with a multidisciplinary team is needed to have a safe and minimally invasive RFA by localizing the lesion in color Doppler ultrasonography.

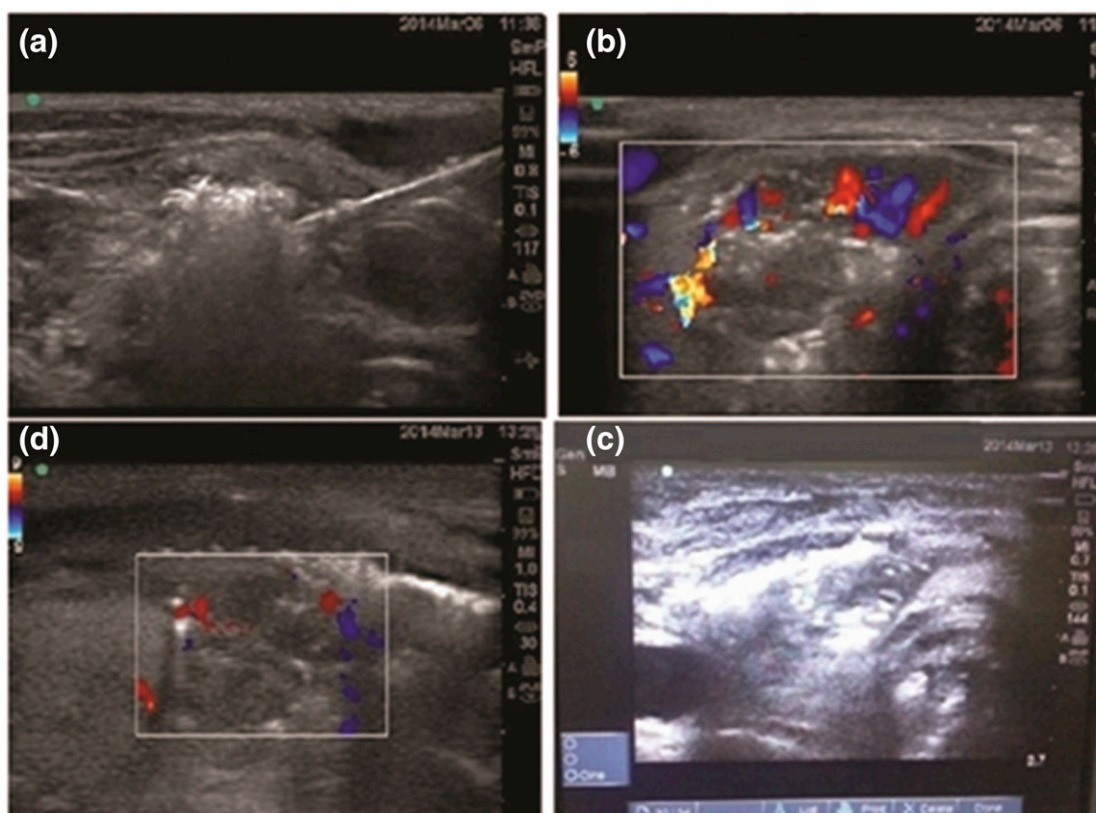


Figure 2. Ultrasound-guided intervention in parathyroid adenoma. (a) Entry of RFA needle. (b) Substantial reduction in adenoma size. (c) Percutaneous ethanol injection into lesion. (d) Appreciable resolution of the remnant adenoma.

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Address all correspondence to: Mohan T. Shenoy, DM, Sree Gokulam Medical College and Research Foundation, India, TC 2/3397 (2), KRA-11, Trivandrum, Kerala 695004, India. E-mail: drmts@outlook.com.

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