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Power Doppler imaging findings in multilocular giant parathyroid adenoma which caused hypercalcaemic crisis

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Abstract
Radiological findings including ultrasonography, computed tomography (CT) and Tc-99m sestamibi scintigraphy of a patient with multilocular giant parathyroid adenoma which caused hypercalcaemic crisis are presented. The location of the tumour by grey scale sonography, CT and Tc-99m sestamibi scintigraphy was not certain because the tumour was uncommon in shape, location, size and internal structure. Whereas, increased flow in the solid portion of the mass was demonstrated on power Doppler sonography, which proved to reflect abundant vessels in the adenoma in pathological findings.

Key words: Parathyroid neoplasms; Adenoma; Ultrasonics; Hypercalcaemia

Introduction

Primary hyperparathyroidism is the most common cause of hypercalcaemia and is caused by an adenoma in 81 per cent of patients, hyperplasia in 16 per cent and carcinoma in three per cent, according to Castleman and Roth (1978). Other rare histopathology includes parathyroid cyst and lipoadenoma.

Hypercalcaemic crisis is a potentially fatal disease and most commonly seen as a complication of a malignancy (Edelson and Kleerekoper, 1995). Primary hyperparathyroidism rarely brings about hypercalcaemic crisis and 1.6 per cent of the 882 cases with surgically confirmed primary hyperparathyroidism developed hypercalcaemic crisis (Wang and Guyton, 1979). This condition is characterized by volume depletion, metabolic encephalopathy, gastrointestinal symptoms, and the marked hypercalcaemia (more than 14 mg/dl in the serum calcium level) (Edelson and Kleerekoper, 1995). Hypercalcaemic crisis caused by primary hyperparathyroidism is curable and the only way of treatment for this type of crisis is surgical removal of the offending parathyroid lesion (Payne and Fichett, 1965; Wang and Guyton, 1979).

Here, we present a case of multilocular giant parathyroid adenoma accompanied by hypercalcaemic crisis in which power Doppler imaging findings were helpful for pre-operative localization of the parathyroid adenoma.

Case report

A 75-year-old woman, who had been affected with biochemical hyperparathyroidism for three months, was admitted to our hospital because of sharply increased serum calcium levels, hypotension, gastrointestinal symptoms, acute renal failure, and coma. Laboratory examinations showed a serum parathyroid hormone level of 99.9 ng/ml (normal; 0.12–0.50) and a calcium level of 17.7 mg/dl (normal; 8.6–10.1). Marked thyrombocytopenia due to disseminated intravascular coagulation was also seen. A diagnosis of primary hyperparathyroidism accompanied with hypercalcaemic crisis was made.

First, nonenhanced CT scan of the neck and the mediastinum was performed for pre-operative localization of the parathyroid lesion. CT examination revealed a mass which surrounded the lateral and posterior aspects of the right lobe of the thyroid gland with contiguous extension into the superior mediastinum. CT attenuation values of the tumour were slightly smaller than those of the muscles (Figure 1). Intravenous administration of contrast material was not performed because of severely impaired renal function.

Next, double-phase technetium-99m (Tc-99m) sestamibi scintigraphy was obtained after intravenous injection of 550 MBq Tc-99m sestamibi. An increased uptake in the middle and lower portions of the right lobe of the thyroid gland was seen on both early and delayed images (Figure 2a/b).

Then, sonography of the neck with a high-resolution real-time scanner (Logiq 500; GE Medical Systems, Milwaukee, WI) was obtained with a 5 MHz and a 7.5 MHz linear-array probe. Grey-scale imaging showed a multilocular cystic mass in the corresponding site (Figure 3a). Based on the findings of CT, scintigraphy, and grey-scale sonography, a parathyroid lesion lying posterior to lateral to the right lobe of the thyroid gland was suspected. However, the localization was not certain because of its uncommon location, shape, size, and internal structure.

Finally, power Doppler imaging with the same unit was performed and showed an increased flow in the solid portions of the mass which surrounded the multiple cysts of various sizes (Figure 3b). This high vascularity of the mass raised the certainty of diagnosis of parathyroid disease. At the same time, fine-needle aspiration (FNA) biopsy under guidance of sonography was performed.

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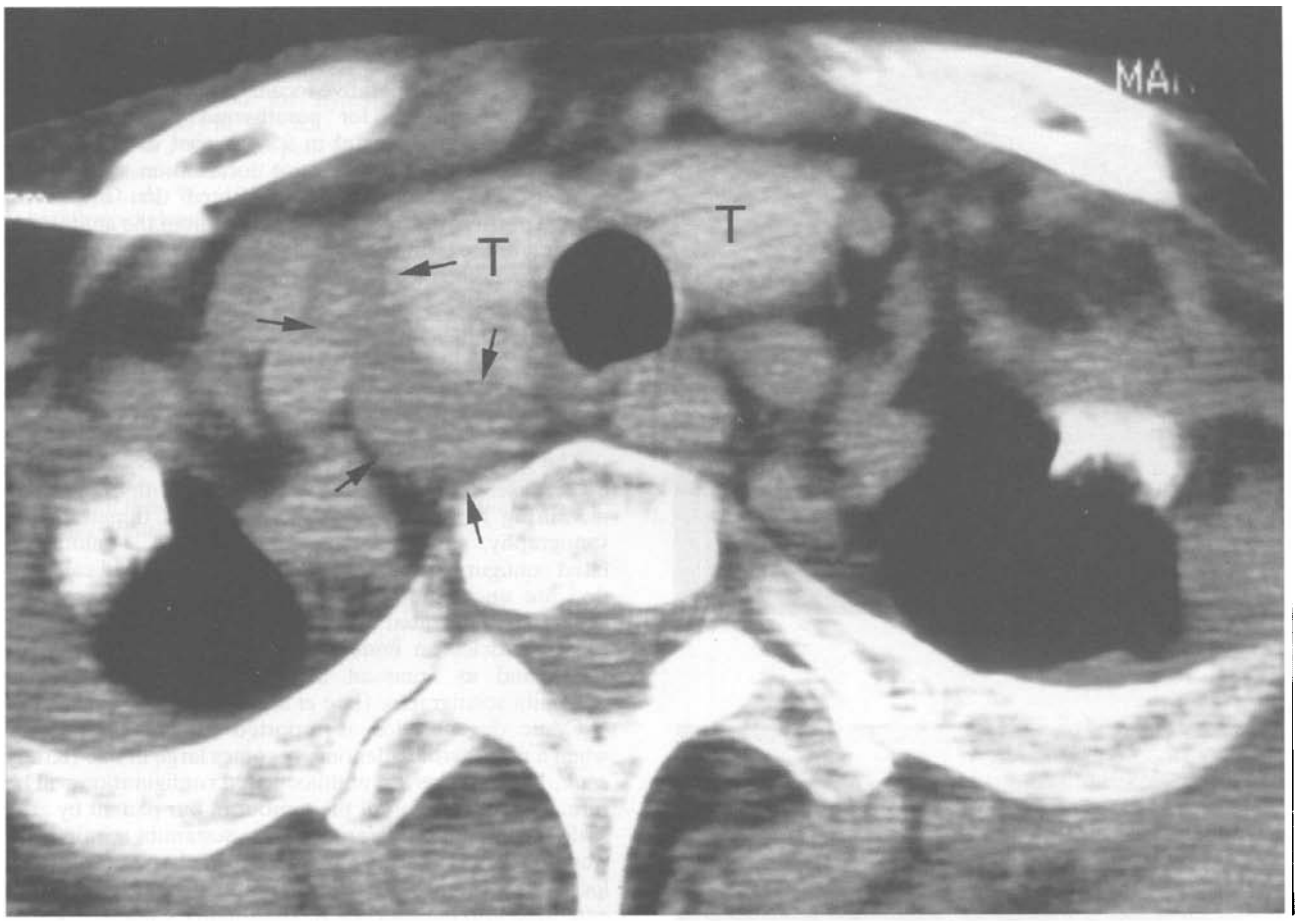
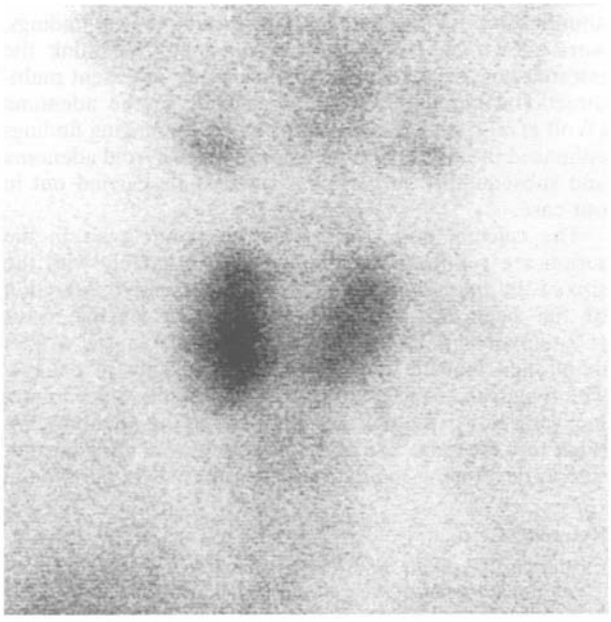


FIG. 1

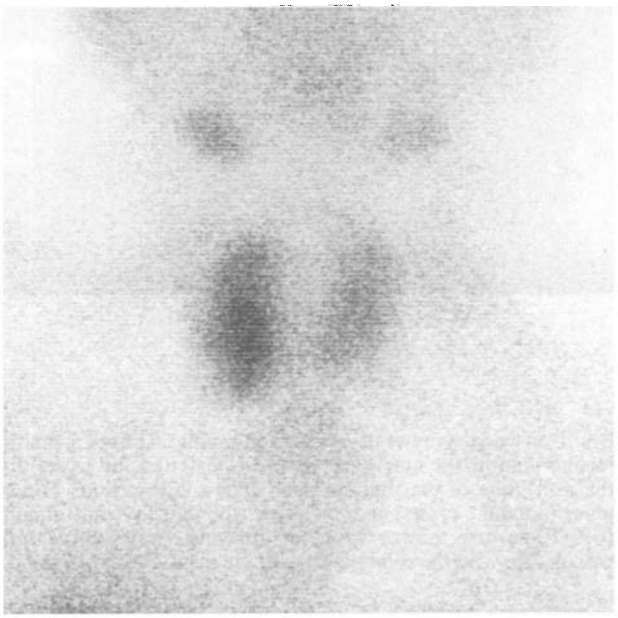
Non-enhanced CT scans show a mass (arrows) of homogeneous density posterior and lateral to the right lobe of the thyroid gland. CT attenuation of the mass is slightly smaller than that of the muscles. T; thyroid gland.

However, a haematoma around the thyroid gland which was formed immediately after the first pass of FNA precluded this examination.

Surgery was performed, and a 4.5 × 3.5 × 1 cm tumour behind and lateral to the right lobe of the thyroid gland was removed. A diagnosis of parathyroid adenoma with multiple cyst formation was made on the pathological



(a)



(b)

FIG. 2

Tc-99m sestamibi scintigraphies obtained at early (a) and late phases (b) demonstrate a swelling of the right lobe of the thyroid. A slightly increased uptake in the middle and lower portions of the right lobe of the thyroid gland was seen on both images.

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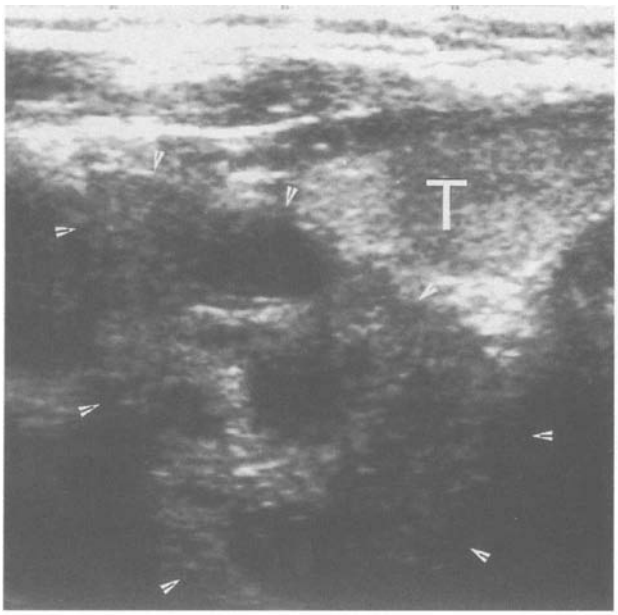
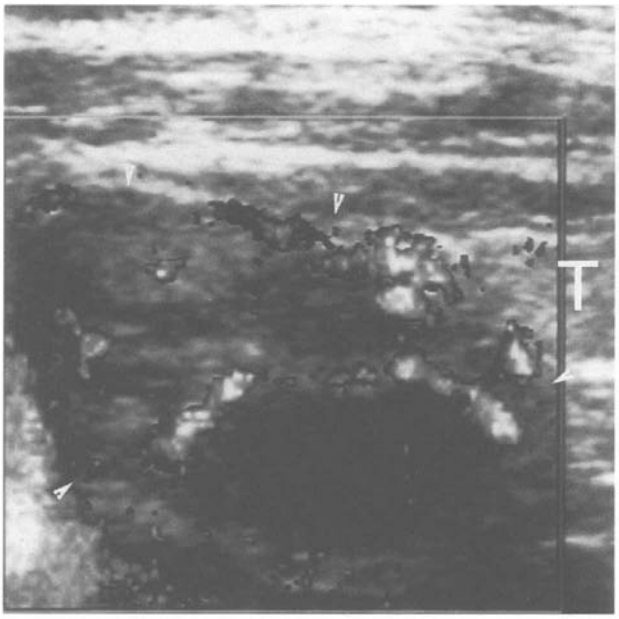


(a)



(b)

FIG. 3

(a): Transverse grey-scale sonography demonstrates a multilocular giant cystic mass (arrowheads) posterior and lateral to the right lobe of the thyroid gland. The solid portions of the mass appear hypoechoic relative to the thyroid gland. (b): Transverse power Doppler imaging shows increased vascular flows in the solid portions of the mass. T; thyroid gland.

findings. Infarct foci were not found in the tumour. The cysts contained a clear, yellowish, watery fluid. Abundant vessels interspersed within enlarged chief cells, which formed the cyst walls, were identified. After surgery, the serum calcium dropped to the normal level and all of the symptoms disappeared.

Discussion

There is some debate regarding the necessity of imaging modalities for pre-operative localizing tests in patients who have initial surgery for parathyroid disease, because surgery will be successful in 95 per cent of the patients without need for pre-operative localization (Payne and Fichett, 1965). Gooding (1993) noted that of the 55 patients with hypercalcaemic crisis in whom the anatomical location of the lesion was specified, seven (13 per cent) had the lesion in the mediastinum. In addition, all patients with hypercalcaemic crisis are critically ill at the time of diagnosis. Therefore, we think accurate pre-operative localization will be justified for these patients, because this may reduce the post-operative complications by reducing the surgical time and by minimizing tissue dissection.

The typical parathyroid lesions appear as oval hypoechoic discrete masses posterior to the thyroid gland measuring less than 3 cm in the greatest dimension on sonography, and cystic changes, giant size, a multilobulated configuration, inhomogeneous content, and calcification are uncommon (Gooding, 1993). These lesions are usually demonstrated as masses of CT attenuation similar to the muscles on nonenhanced CT scans (Clark *et al.*, 1984) and as areas of increased uptake on Tc-99m sestamibi scintigraphy (Lee *et al.*, 1995).

Cystic degeneration is reported to frequently occur when a parathyroid adenoma becomes large in size (Krudy *et al.*, 1984). However, multiloculated configuration will be rare. The localization of the tumour in our patient by grey scale sonography, CT, and Tc-99m sestamibi scintigraphy was not certain, because of its bizarre shape, uncommon location (posterior to lateral to the thyroid gland with extension into the superior mediastinum), giant size (larger than 3 cm in one dimension), and rare internal structure (multilocular cystic mass). Differential diagnosis included a thyroid nodule and a parathyroid lesion. Although aspiration biopsy is a useful procedure for definitive diagnosis, this procedure was precluded by haemorrhage in our case.

Wolf *et al.* (1994) reported that colour Doppler imaging demonstrated blood flows in the peripheral portions of the adenomas in 63 per cent of the 32 parathyroid adenomas and that this finding was a useful adjunct for diagnosing parathyroid adenoma. In our case, internal flows in addition to peripheral flows, which proved to reflect abundant vessels in the adenoma in pathological findings, were shown on power Doppler imaging. We think the internal flow depicted with this technique represent multidirectional blood flow of slow velocity in the adenoma (Wolf *et al.*, 1994). These power Doppler imaging findings enhanced the certainty of diagnosing parathyroid adenoma and subsequently surgery was successfully carried out in our case.

The calcium and parathyroid hormone levels in the serum are reported to be associated intimately with the size of the parathyroid adenoma and a massive infarction of the adenoma can lead to a hypercalcaemic crisis (Castleman and Roth, 1978). Wang and Guyton (1979) mentioned that all of the parathyroid lesions in patients with hypercalcaemic crisis were of a giant size. Since infarct foci were not pathologically identified in the adenoma, we think that the giant size of the tumour played an important role in developing the hypercalcaemic crisis in our case.

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