A large intrathoracic parathyroid adenoma

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Daggett, P., Johnston, I. D. A., and Lowe, D. (1976). Thorax, 31, 782–785. A large intrathoracic parathyroid adenoma. A case is described in which an unusually large parathyroid adenoma was visible on the plain chest radiograph taken during the investigation of hypercalcaemia. This was diagnosed preoperatively and a scheme is suggested whereby such a diagnosis can now readily be made. The differential diagnosis is discussed and the literature is reviewed.

Intrathoracic masses associated with hypercalcaemia are most commonly due either to sarcoidosis or to tumours, primary or secondary. The hypercalcaemia associated with bronchial carcinoma may be due to bone metastases or caused by the secretion of hypercalcaemic substances, which may include parathyroid hormone (PTH), by the primary tumour. It is most uncommon for primary tumours of the parathyroid glands to be visible on a plain chest radiograph, but in the case presented here such a tumour was clearly seen and correctly diagnosed preoperatively.

CASE REPORT

A 76-year-old woman from the Andaman Islands had lived in the United Kingdom for many years. She was referred to the Middlesex Hospital on account of hypercalcaemia associated with an abnormal chest radiograph. At the time of her admission her principal symptoms were back pain and progressive loss of height. In addition, she had become very breathless, even at rest. Examination showed gross kyphoscoliosis and dyspnoea at rest, without cyanosis. Thoracic movement was very poor, particularly on the right, and over the right upper zone there was dullness to percussion and absent breath sounds. Investigation showed all haematological indices to be normal. The plasma calcium, corrected for an albumin of 41 g/litre, was 3.13 mmol/litre (12.5 mg/100 ml) with a phosphate of 0.66 mmol/litre (2.0 mg/100 ml) and alkaline phosphatase of 29 KA units. Plasma urea was 9.5 mmol/litre (57 mg/100 ml) with a creatinine clearance of 16.9 ml/min and the urinary calcium was low at 5 mmol/24 h (10 mg/24 h).

There was no evidence of myelomatosis. The peripheral venous parathyroid hormone level was raised at 3.8 ng/ml (normal 0.1–1.0 ng/ml). The chest radiograph confirmed the large mass in the upper part of the right hemithorax, continuous with the superior mediastinum, and there was elevation of the right hemidiaphragm (Fig. 1a, b).

Radiographic changes had been present three years previously, during investigation of the patient's original illness, but were thought to be caused by soft tissue deformity associated with the kyphoscoliosis. At that time her symptoms and signs had been the same as on the present admission. Investigations had shown an alkaline phosphatase of 17 KA units but with normal calcium and phosphate. A normochromic normocytic anaemia of 7.8 g/dl had also been noted. A skeletal survey showed Looser's zones in one rib and in the pelvis, and a diagnosis of osteomalacia was made. This was possibly secondary to malabsorption as faecal fat excretion and D-xylose absorption were abnormal. Calciferol was started at a dose of 50 000 units on alternate days, but within two weeks her plasma calcium had risen to 3.4 mmol/litre (13.6 mg/100 ml). After withdrawal of calciferol the plasma calcium returned to normal, and as radiographs showed healing of the Looser's zones, no further treatment was given.

In 1975 a routine blood test showed the plasma calcium to be elevated at 3.35 mmol/litre (13.4 mg/100 ml) but on this occasion she was receiving no vitamin D. A skeletal survey showed phalangeal erosions of hyperparathyroidism, but these were thought to be healed (Dr. M. Chapman). At this stage the differential diagnosis of

(a)

(b)

FIG. 1(a). PA chest radiograph showing a mass in the right upper zone. (b) Lateral chest radiograph showing kyphosis, elevation of the right diaphragm, and a mass in the superior mediastinum.

FIG. 2. Arch aortogram showing a relatively avascular tumour displacing the subclavian artery downwards.

the mass seen on the chest radiograph included bronchial carcinoma, retrosternal goitre, aneurysm of the subclavian artery, and a tumour of the parathyroid gland. An arch aortogram showed the mass to be relatively avascular and displacing the subclavian artery downwards (Fig. 2). Percutaneous needle biopsy of the mass

yielded tissue with the histological appearances of parathyroid adenoma (Fig. 3). Since the patient had symptoms from the mass itself, in addition to marked hypercalcaemia, thoracotomy was undertaken despite her advanced years. At operation (Mr. M. Sturridge) a large cystic swelling was found displacing the right innominate vein downwards very considerably. The superior vena cava was compressed and displaced medially, while the other structures at the root of the neck were closely applied to the tumour. Thus the mass appeared to have originated in the neck, but owing to the kyphoscoliosis the neck structures were located within the thorax. The tumour was easily separated from its false capsule, and during this procedure 400 ml of brown opalescent fluid were aspirated. The wall of the cystic structure (Fig. 4) had the same histological appearances as the needle biopsy. Postoperatively the patient made a good recovery and her dyspnoea improved considerably. Three months after the procedure she is well and normocalcaemic, receiving no medication.

FIG. 3. Biopsy specimen showing tissue with the histological appearance of parathyroid adenoma.

DISCUSSION

The differential diagnosis of a mass originating at the apex of the chest includes pulmonary and extrapulmonary lesions. Bronchial carcinoma accounts for many such masses, and in this position adenocarcinoma is as likely as squamous carcinoma (Crofton and Douglas, 1969). Extrapulmonary lesions include retrosternal thyroid, various lymphomata, ectopic thymoma, and rare mesenchymal tumours (Lyons, Calvy, and Sammons, 1959). In addition, aneurysms of the subclavian artery, bone tumours, and neurofibromata should be considered. Parathyroid adenomata have been detected on a plain chest radiograph (Hardy, Snively, and Langford, 1964; Judd, Heimburger, and Johnston, 1966; Becker and Tausk, 1970; Lee and Hutcheson, 1974) and despite their rarity they should perhaps be added to the list. Hyperfunctioning parathyroid tissue occurs in reported series of parathyroid adenomata with a variable frequency, estimated at 1.4% (Scholz *et al.*, 1973), 4% (Krementz *et al.*,

FIG. 4. The wall of the cystic tumour showing histological changes similar to the needle biopsy specimen.

1971), and 21% (Nathaniels, Nathaniels, and Wang, 1970). Pyrah, Hodgkinson, and Anderson (1966), in their extensive review, found eight mediastinal tumours in a series of 363 patients collected from the literature. The glands which are the seat of tumours usually lie in the superior mediastinum, and Cope (1960) reported that up to 10% of normal adults have one or both of the inferior parathyroid glands in this position. They may be either free or embedded in the thymus gland (Nathaniels *et al.*, 1970). It has been suggested that, once enlarged, the parathyroid may migrate downwards under the influence of the negative intrathoracic pressure (Cope, 1941; Walton, 1931). Lateral spread occurs when further downward movement is made impossible by the other mediastinal structures, and this is particularly likely if the gland is cystic (Greer, 1967). The majority of mediastinal parathyroid adenomata are considerably larger than their counterparts in the neck. Their average weight is 6 grams, but tumours containing up to 35 grams of solid material have been recorded (Scholz *et al.*, 1973). They are almost always benign, but two cases of mediastinal parathyroid carcinoma

have been described, one weighing 27 grams (Lee and Hutcheson, 1974; Scholz *et al.*, 1973). Cystic degeneration of the benign tumours is common, and it is these whose dimensions become most impressive (Lee and Hutcheson, 1974; Greer, 1967).

When confronted with the clinical problem of hypercalcaemia and a mass on the chest radiograph preoperative diagnosis of these rare tumours is possible now that serum levels of parathyroid hormone can be measured. In the presence of the hypercalcaemia associated with bone metastases or sarcoidosis, the peripheral venous levels of immunoreactive parathyroid hormone will be low. The presence of hypercalcaemia with a normal or high level of parathyroid hormone should lead to further parathyroid function studies. A number of methods have been used for the preoperative localization of parathyroid tumours. Radio-isotope scanning with selenomethionine is generally unhelpful (Krementz *et al.*, 1971), and selective arteriography (Kuntz and Goldsmith, 1972) can be dangerous. Venous sampling of the upper thoracic and neck veins with analysis for parathyroid hormone is extremely useful where available (O'Riordan, Kendall, and Woodhead, 1971). It was not carried out in this case, as the position of the tumour was already known, but, in general, mediastinal parathyroid tumours show a high level of parathyroid hormone in the left innominate vein and superior vena cava.

Arch aortography was used in this case to demonstrate the arterial anatomy in relation to the mass, which appeared relatively avascular and therefore safe to biopsy. Percutaneous needle biopsy of the mass was diagnostic in this case, and it is likely that this is the first occasion on which the diagnosis of parathyroid adenoma has been established by this technique. Despite the extreme rarity of this condition, the radiographic appearances over three years, together with the biochemical changes, enabled a correct preoperative diagnosis to be reached. It is suggested that the distinction between a bronchial neoplasm and a parathyroid adenoma can be made by using the investigatory scheme outlined above. Also, that the latter condition should now be considered when a problem of hypercalcaemia with an abnormal chest radiograph presents.

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