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Pitfalls in the follow-up of cervical and mediastinal goitres: role of CT imaging

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Abstract
Four patients with cervical and mediastinal goitres were described. Routine investigation in these patients, including chest X-rays, oesophageal and tracheal X-rays and scintigraphy of the thyroid gland, failed to show significant changes over the years, or underestimated the true extent of the goitres. Three of the goitres caused severe mediastinal compression, evident only on computed tomography (CT) imaging, and requiring urgent surgery. The pros and cons of different diagnostic modalities for imaging cervical and mediastinal gotires are discussed, stressing the importance of CT imaging as exemplified in the cases presented.

Introduction

Computed tomography (CT) and magnetic resonance (MR) imaging are accepted as the most sensitive modalities for evaluating mediastinal pathology (Glazer *et al.*, 1982; Sandler *et al.*, 1984; Arger *et al.*, 1985). These modalities are also excellent for delineating cervical anatomy and pathology. Because of cost considerations, they are not used routinely for the work-up and follow-up of cervical goitres. With respect to mediastinal goitres, the frequency of performance of these examinations has yet to be determined.

We have, until recently, relied on less expensive examinations such as chest X-rays, oesophagograms and scintigraphy. Over the past few years, we have added CT scanning to the accepted radiological imaging work-up of the goitre patient.

TABLE I
CLINICAL DATA AND DIAGNOSTIC PROCEDURES

	Years Follow-up	Clinical	examination	Clinical function	Thyroid X-ray	Scintigraphy	CT	Treatment
F/62 No. 1	16	*MNG, S/P subtotal thyroidect. Recurrence. 12 years later	*MNG. Neck circumference 38 cm	Euthyroid	Large right mediastinal mass deviating trachea minimal narrowing unchanged 16 years. *Esophagogram:* Left deviation (Fig. 1a).	MNG with right lobe descending posterior to manubrium (Fig. 1b)	Large neck mass descending into mediastinum overriding left BCV** marked deviation of trachea and esophagus with tracheal narrowing (Fig. 1c).	Unsuccessful trial with L-thyroxine suppression. Subsequent thoracotomy and thyroidectomy
M/77	7	25 years. post-thyroidectomy SVC*** syndrome.	MNG	Euthyroid	Lg left sup.mediastinal mass, displacing trachea w/o narrowing (Fig. 2a) *Phlebography* occlusion of rt & lt BCV, neck coll. (Fig. 2d)	Retrosternal goitre unchanged over 6 years. (Fig. 2b)	Huge mediastinal mass displacing and narrowing trachea, displacing esophagus to rt and laterally displacing major blood vessels (Fig. 2c)	Unsuccessful trial with L-thyroxine. Refuses surgery.
F/77	14	Goitre, dysphagia, FNA: cystic nodular goitre	MNG, neck circumference 40 cm	Euthyroid.	Calcified sup.mediastinal mass minimal tracheal narrowing (Fig. 3a)	MNG. lt cold nodule. No retrosternal extension. No change over 9 years	Large calcified mass extending into supp. mediastinum, with marked tracheal narrowing (0.5 cm) (Fig. 3c).	Refuses surgery
M/67 No. 4	5	Presented with thyrotoxicosis, 5 years later, SVC syndr.	–	FT4 = 7.6 ng/dl at presentation (nl=0.8–2.4ng/dl)	Sup. mediastinal mass with mild tracheal deviation to rt. (Fig. 4a). *Phlebography:* severe narrowing of both BCV (Fig. 4d)	Rt cervical toxic nodule. No retrosternal extension.	Rt.sup. Mediastinal mass with moderate tracheal narrowing, compression of vessels. (Fig. 4c)	Operation

*MNG = multinodular goitre; **BCV = brachiocephalic vein; w/o = without, FNA = fine needle aspiration; ***SVC = superior vena cava.

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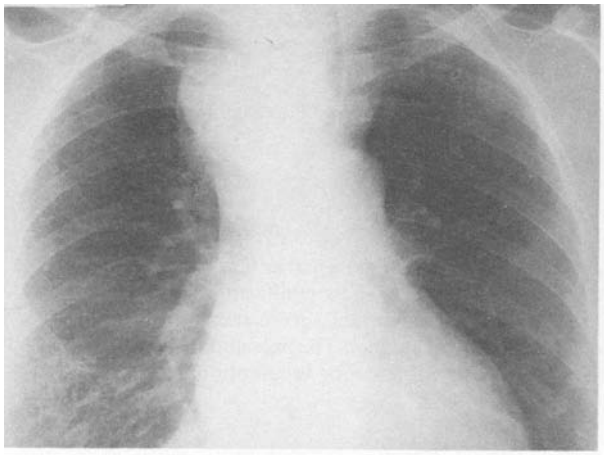

FIG. 1a

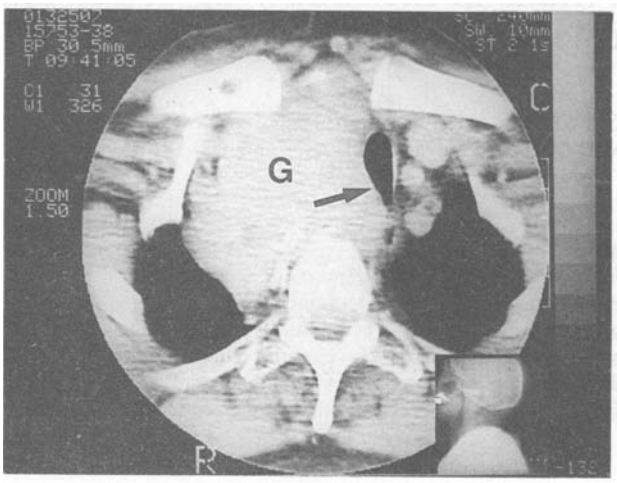

FIG. 1c

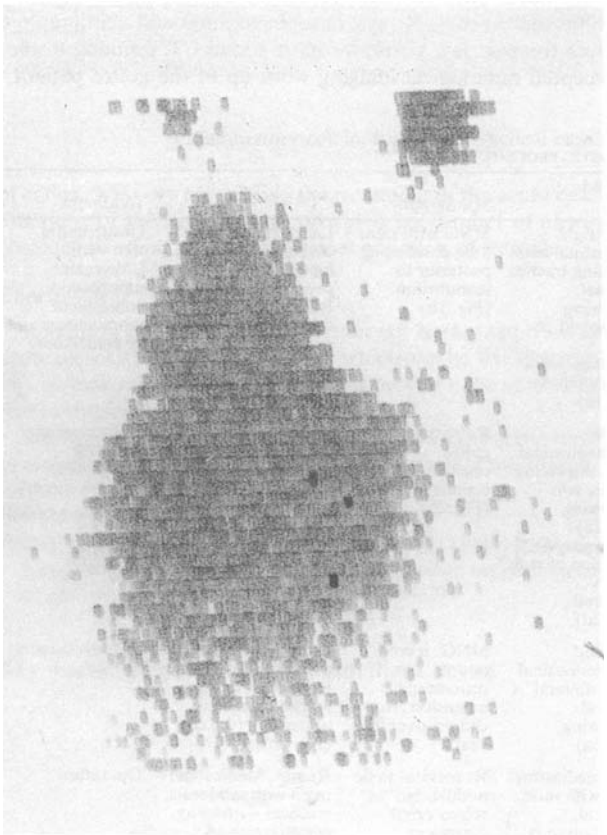

FIG. 1b

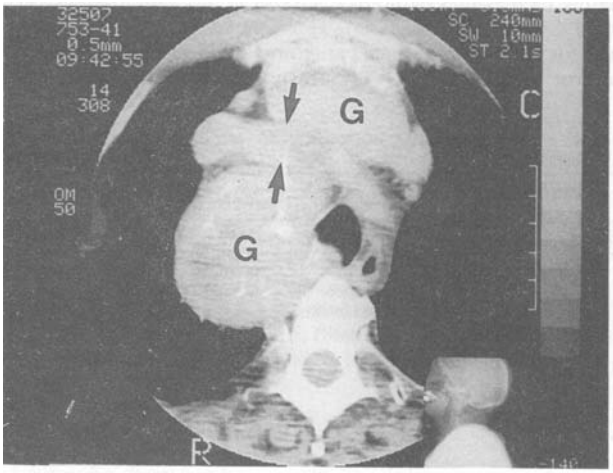

FIG. 1d

FIG. 1

Patient no. 1. Chest X-ray (a) showing a large mediastinal mass. Evidence of retrosternal extension on scintigraphy (b). CT scan (c) demonstrates tracheal narrowing (large arrow) and the true extent of the mediastinal involvement by the goitre (G), as well as its overriding of the left brachiocephalic vein (small arrows) on a lower cut (d).

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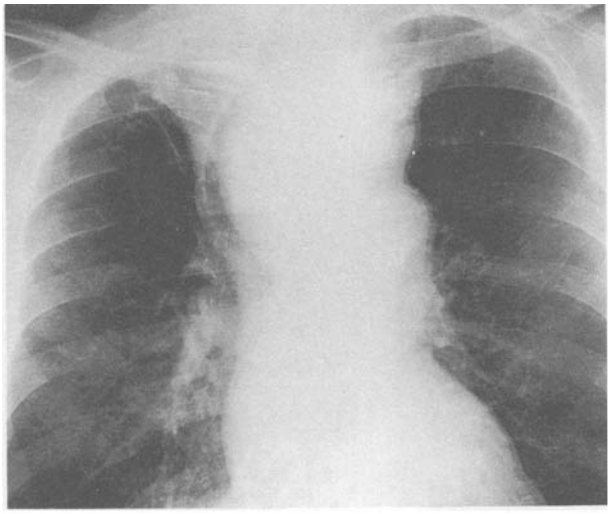

FIG. 2a

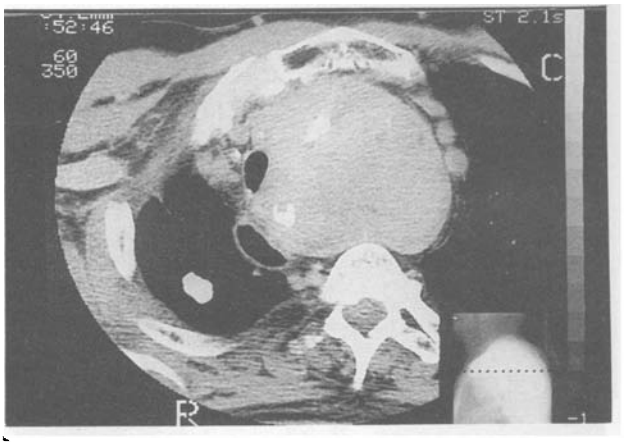

FIG. 2c

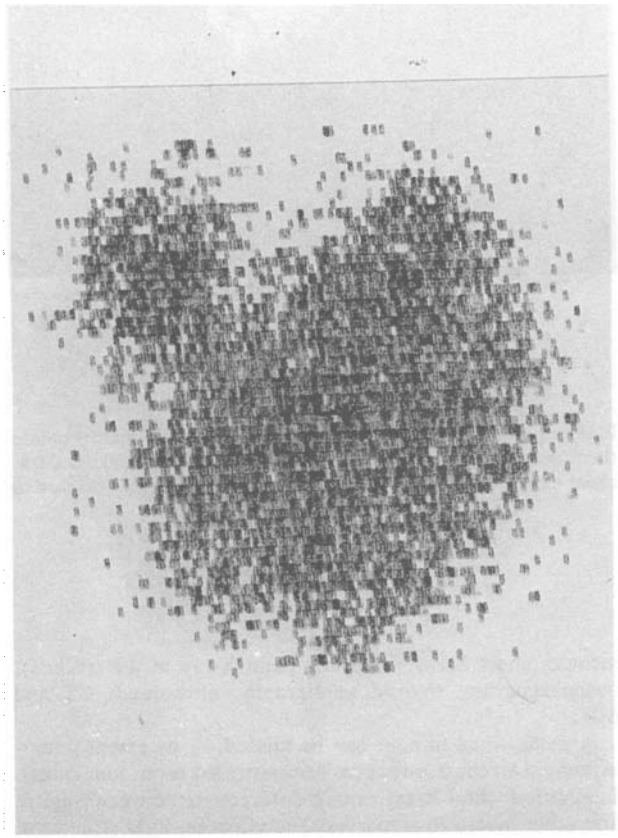

FIG. 2b

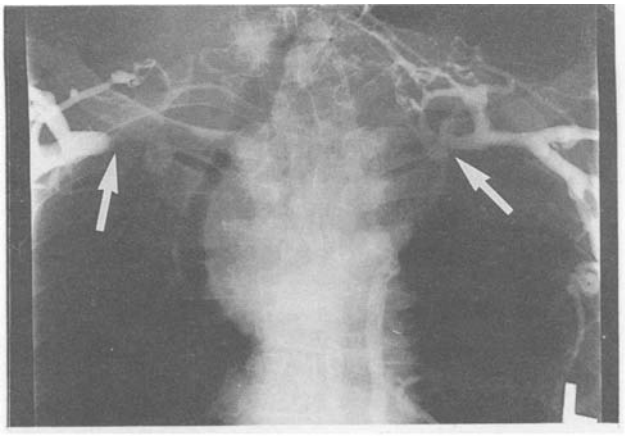

FIG. 2d

FIG. 2

Patient no. 2. Chest X-ray (a) and scintigraphy (b) fail to show the extent of the large mediastinal mass evident on CT scan (c), which caused displacement and occlusion of both brachiocephalic veins and occlusion of the superior vena cava demonstrated more clearly on phlebography (d).

We wish to discuss four representative cases with mediastinal goitre, in which the CT scan played a significant role in the decision-making process.

Patient material

The clinical data and diagnostic procedures of the four patients are summarized in Table I.

In two cases (nos. 1 & 3) the scans and radiographs were constant during the years of follow-up. The chest CT was the only modality which demonstrated the severe degree of tracheal narrowing, and the true dimensions of the mediastinal mass.

A large mediastinal mass was demonstrated in case 2 by radiographs and scans. CT was superior in demonstrating the extent of the mass and demonstrated neck collaterals, secondary to superior vena cava occlusion, which was subsequently confirmed by phlebography and the clinical appearance of superior vena cava syndrome.

Patient no. 4 suffered from thyrotoxicosis; no retrosternal goitre was demonstrated by I^{131}. Superior vena cava syndrome appeared after a year of follow-up. Although a mass was seen on chest X-ray, only the CT diagnosed it as a mediastinal goitre by its continuity with the cervical gland.

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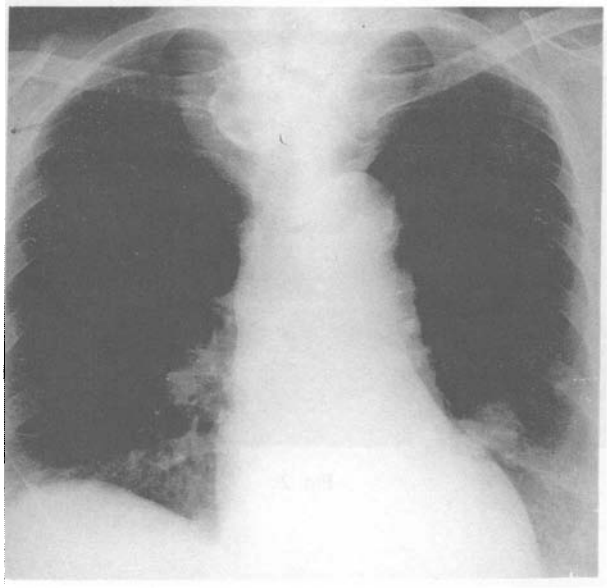

FIG. 3a

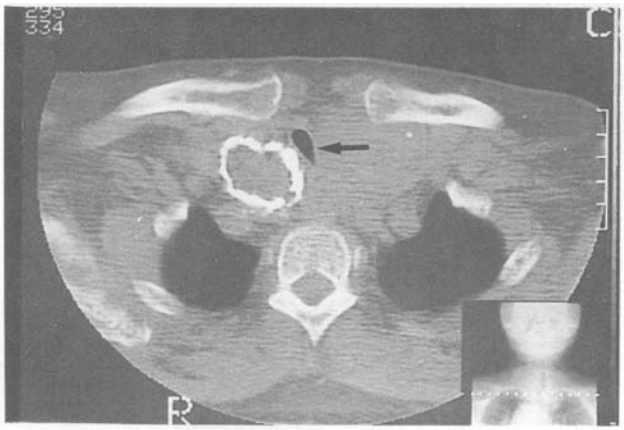

FIG. 3c

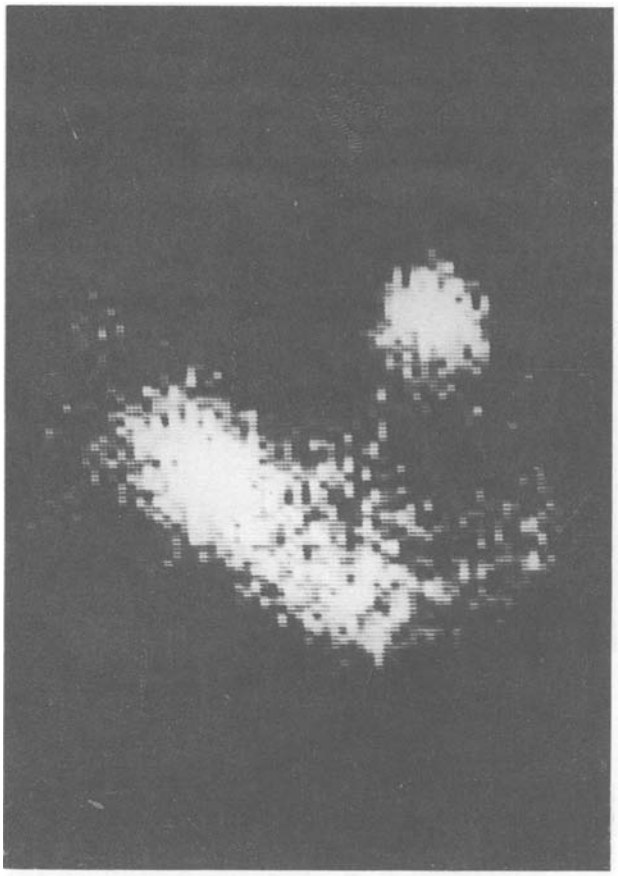

FIG. 3b

FIG. 3

Patient no. 3. Chest X-ray (a) and scintigraphy (b) underestimate the retrosternal extension of the goitre, which caused marked tracheal narrowing (arrow) seen on CT (c). Note ring calcification in the right lobe.

Of the four mediastinal goitres, three were not confined to the retrostenal region alone. Two were located in the middle mediastinum as well, and one extended into the posterior mediastinum.

Discussion

The mediastinal goitre is one of the most common mediastinal tumours. In 2 to 14 per cent of patients operated on for a cervical goitre, a mediastinal component is found (Sabiston, 1986). The origin of the mediastinal goitre is usually due to inferior extension of a cervical goitre, or rarely, from aberrant mediastinal thyroid tissue. The average age of patients is 50 years and there is a 4:1 female-to-male ratio (Katlic *et al.*, 1988). In one surgical series, 16 per cent of operated mediastinal goitres had malignant change (Allo and Thompson, 1983).

The treatment of choice is surgical. Goitrous patients, suffering from cervical or mediastinal goitres, who are not operated on, are followed up relative to their thyroid function and the dimensions of the mass. Signs and symptoms of mediastinal compression are usually indications for urgent operation (Katlic *et al.*, 1985).

The imaging techniques available for the evaluation of goitre include: chest X-ray (including plain X-ray of the trachea), oesophagogram, thyroid scintigraphy, ultrasound, CT and MR.

A mediastinal tumour can be missed, or its extent underestimated on chest X-rays (as demonstrated in our four cases). In addition, chest X-ray cannot differentiate between a goitre and other mediastinal masses. The effect on local structures, such as blood vessels, is not demonstrated to advantage.

Oesophagogram and X-rays of the trachea, although capable of demonstrating the degree of pressure on these organs (Alfonso *et al.*, 1981), are not sufficiently accurate.

Scintigraphy is usually thought to be highly efficient for the diagnosis of intrathoracic goitres (Irwin *et al.*, 1978; Park *et al.*, 1987). However, some authors (Glazer *et al.*, 1982; Bashist *et al.*, 1983) have found scanning to be less useful because more than 50 per cent of the patients have less, or no intrathoracic uptake. The decreased avidity of the intrathoracic goitre for the radioisotope is not fully understood; possible explanations are: 1) low energy photons are preferentially absorbed by the sternum and bony thoracic cage (Morris *et al.*, 1982; Shih *et al.*, 1984); 2) Tc^{99m} images are less clear because of high background interference form the great vessels (Shih *et al.*, 1984); 3) parallax error (McKitrick *et al.*, 1985).

Ultrasound is excellent in the delineation of cervical goitres,

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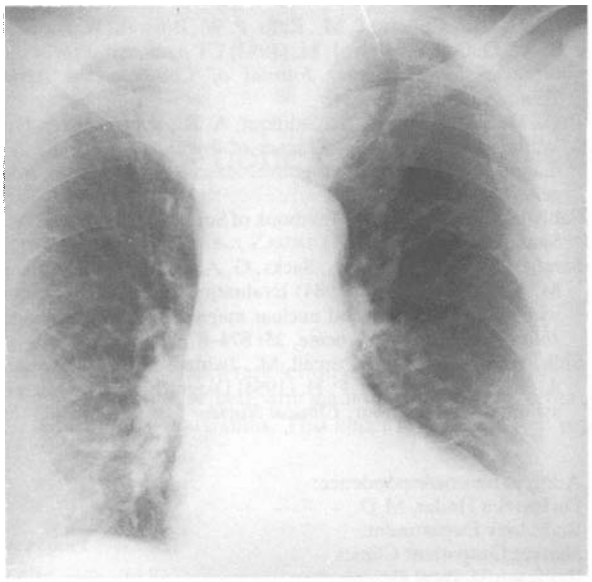

FIG. 4a

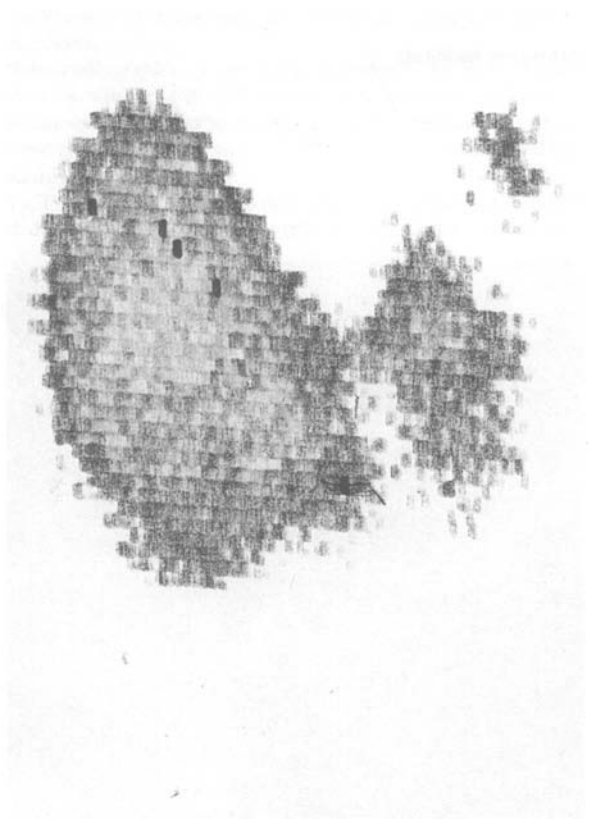

FIG. 4b

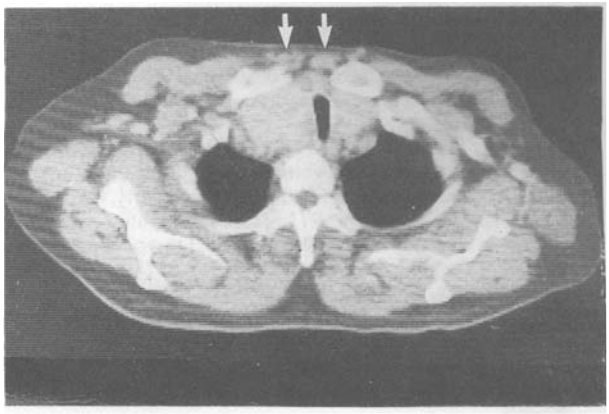

FIG. 4c

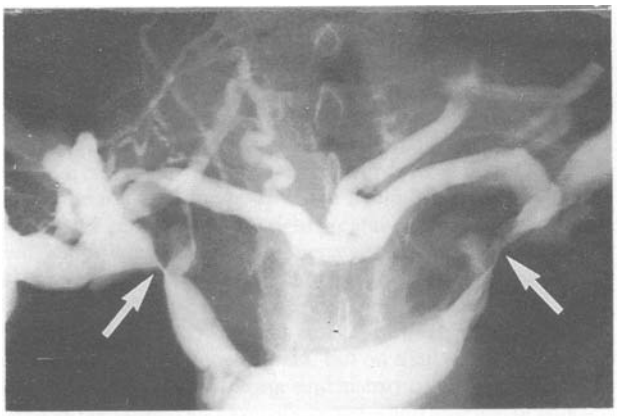

FIG. 4d

FIG. 4

Patient no. 4. CT scan (c) demonstrates tracheal narrowing, cervical collaterals (small arrows), and compression of brachiocephalic veins, better seen on phlebography (large arrows, d). Chest X-ray (a) is presented for comparison. No retrosternal uptake is noted on scintigraphy (b).

but its use in the mediastinum is limited (by air in the lungs, and by the ribs) (Shih *et al.*, 1984).

Computed tomography has several advantages. It easily demonstrates the continuation of the cervical goitre into the mediastinum. The axial plane facilitates demonstration of the borders of the enlarged gland and of its effect on the neighbouring vascular structures. Tracheal narrowing is clearly demonstrated (Arger *et al.*, 1980; Glazer *et al.*, 1982; Bashist *et al.*, 1983).

MR imaging has all the advantages of CT, and in addition, of not being dependent on the use of iodinated contrast media to demonstrate the relationship to blood vessels. However, because of the high cost, it should be reserved for specific indications, (*e.g.* the allergic patient, in equivocal examinations).

We therefore recommend performing a CT examination at least once in all patients with a known mediastinal goitre. In addition, CT should be considered in all patients with a large cervical goitre, or when the patient's complaints are severe and disproportionate to the size of the gland. CT should be performed as a follow-up examination every few years and urgently, if symptoms worsen.

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