On-line Case Report

Thoracoscopic excision of mediastinal parathyroid adenomas: a report of two cases

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ABSTRACT

Two patients with primary hyperparathyroidism caused by solitary ectopic mediastinal parathyroid adenomas have been successfully treated by thoracoscopic excision. The patients were not suitable for open thoracic surgery. Both had right-sided adenomas confirmed by sestamibi and computerised tomography – one adjacent to the oesophagus at the level of D3, the other anterolateral to the ascending aorta. Both procedures were performed through one 12-mm camera port and two 5-mm operating ports, and were uncomplicated, with 30–45 minutes skin-to-skin operating time. Both patients were well enough to be discharged the next day, and both rapidly became normocalcaemic. At follow-up, neither had developed any complications. In selected cases, where an ectopic adenoma lies immediately deep to the mediastinal pleura, thoracoscopic excision offers considerable advantage over open thoracic surgery.

Keywords: Thoracoscopic excision – Mediastinal parathyroid adenoma – Hyperparathyroidism

Excision of ectopic parathyroid adenomas located within the mediastinum has traditionally relied on open techniques such as full median sternotomy, manubrial split or thoracotomy.^{1,2} Thoracoscopy is a well-established thoracic surgical technique used to biopsy pleural or pulmonary lesions, drain pleural effusions, and to perform pleurodesis for recurrent pneumothorax and effusions.³ The application of thoracoscopy to the excision of mediastinal ectopic parathyroid adenomas represents a novel treatment with the potential for greatly reduced complication rates and length of stay compared to conventional open thoracic surgery,⁴ and represents a technique that has not yet been reported in British medical literature.

Case 1

A 70-year-old man with a history of hypertension, repair of a ruptured abdominal aortic aneurysm and transient

ischaemic attacks, was referred by his GP for renal investigation because of a raised creatinine of 255 mmol/l. Blood tests revealed corrected calcium of 2.97 mmol/l (range, 2.15–2.6) and parathyroid hormone (PTH) level of 25.8 pmol/l (range, 0.5–4.4). Glomerular filtration rate (GFR) was estimated at 22 ml/min. An ultrasound showed no renal tract abnormality. Tertiary hyperparathyroidism was suspected. A technetium-labelled sestamibi scan was reported as showing no increased uptake in the neck or upper mediastinum. The patient's calcium had risen to 2.99 with a PTH of 45.6, and he was symptomatic with profound lethargy, bone and abdominal pains. He had required two pamidronate infusions, with only minimal improvement. A neck exploration was performed despite the negative sestamibi: this revealed three normal glands, which were left *in situ*.

A computerised tomography (CT) scan subsequently revealed a 1.5-cm enhancing mass adjacent to the

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Figure 1 CT scan showing the ectopic parathyroid adenoma in Case 1 adjacent to the oesophagus, behind the trachea, at the level of the body of D3.

Figure 2 Intra-operative photograph demonstrating the excision of the adenoma in Case 1.

oesophagus, at the level of the third thoracic vertebra in the right upper posterior mediastinum (Fig. 1). To investigate this further, a sestamibi scan with multiplanar reconstruction (single photon emission computerised tomography [SPECT] scan) was performed. This demonstrated a focus of intense isotope activity persisting on the 2-h and 4-h washout images, thus confirming an ectopic parathyroid adenoma, and a diagnosis of primary hyperparathyroidism.

Access to the gland through a cervical approach, manubrial split or sternotomy would have been impossible, and conventional right thoracotomy represented the best open surgical option. However, the patient's significant cardiovascular history conferred considerable

risk, with an American Society of Anesthesiologists (ASA) grade of 3. Minimally invasive approaches such as mediastinoscopy or thoracoscopy were contemplated in order to reduce the risks associated with open surgery; thoracoscopic excision was considered to be the optimal solution – providing the best possible access to the posteriorly placed adenoma as well as facilitating manipulation intra-operatively. Under a general anaesthetic, and ventilation through a double lumen endotracheal tube, with the patient supine, 500 ml of CO₂ was insufflated through a Verres needle to collapse the right lung, which was selectively non-ventilated. A 12-mm camera port was introduced in the fourth intercostal space in the mid-axillary line. Two 5-mm working ports were inserted under direct vision. The adenoma was seen as a bulge immediately deep to the pleura anterior to the vertebral column, with the lung suitably retracted. The pleura was incised, and the adenoma obligingly bulged further into the chest cavity. The adenoma was further dissected using the diathermy hook (Fig. 2) and removed intact using a specimen retrieval bag. As a precaution, a 24-G chest drain was inserted after the lung was re-inflated under direct vision through the camera port.

The patient was observed on the high dependency unit overnight, and was mobilising freely the following day. He was discharged home on the fourth postoperative day, through over caution rather than the development of any complication. Reviews after 1 month and 6 months revealed no complications, with improvements in the symptoms of lethargy and generalised pains. The calcium rapidly fell to within normal limits (corrected calcium 2.2). The histology confirmed complete excision of a parathyroid adenoma weighing 4 g.

Case 2

A 66-year-old woman with hypertension, gastro-oesophageal reflux and morbid obesity (body mass index of 32 kg/m²) was diagnosed with primary hyperparathyroidism, her calcium high at 3.3 mmol/l, and a PTH of 63.5. She had been complaining of tiredness, low mood, abdominal pains and thirst. Localisation scans included a cervical ultrasound, which failed to demonstrate a parathyroid adenoma, and a sestamibi SPECT scan, which revealed a sizeable focus of activity persisting on the washout phase of the study, within the right hemithorax (Fig. 3). 3-D CT reconstructions confirmed the location of a 3-cm diameter ectopic parathyroid adenoma in front of the ascending aorta (Fig. 4).

The patient was reluctant to have open surgery; furthermore, with an ASA grade of 2–3 she was considered a high-risk candidate. She experienced increasing

Figure 3 Sestamibi SPECT scan clearly demonstrating a hot spot of isotope activity in the anterior mediastinum in front of the ascending aorta.

symptoms from hypercalcaemia, requiring repeated admissions for pamidronate infusions, with limited success. With the prospect of a minimally invasive

Figure 4 CT reconstruction clearly showing ectopic parathyroid adenoma in front of the ascending aorta (arrowed).

approach to excise her parathyroid adenoma, the patient consented to surgery. In view of the large size and position of the adenoma within the mediastinum, thoracoscopy was regarded as the most suitable technique for optimal views and ease of manipulation. Thoracoscopic excision was performed, again using one 12-mm and two 5-mm ports,

Figure 5 Intra-operative photograph of mediastinal parathyroid adenoma in Case 2 being dissected free of the ascending aorta, with epicardial fat visible beneath it.

in the same manner as in Case 1. The large adenoma was easily identified, the pleura incised over it longitudinally to avoid the phrenic nerve (which could not be identified because of the patient's size) and the adenoma was freed using hook diathermy (Fig. 5). There were no intra-operative difficulties, and intercostal drainage was deemed to be unnecessary.

The patient was observed in the high dependency unit overnight as a prophylactic measure, and discharged home on the second day postoperatively having made an unremarkable recovery. On review 4 weeks' post-operatively, and again after 3 months (the most recent follow-up at the time of writing), there had been no complications, and she was symptomatically much improved with calcium levels down to 2.39. Histology confirmed an intact parathyroid adenoma weighing 12 g.

Discussion

The embryological origin and subsequent migration of the parathyroid glands explains their tendency to lie in ectopic positions. The superior parathyroid glands are derived from the 4th branchial pouches, and are relatively more constant in their position with the majority close to the intersection of the recurrent laryngeal nerve and inferior thyroid artery. A small proportion of superior parathyroids are related to the upper pole of the thyroid or lie in a para-oesophageal location. The inferior parathyroids, derived from the 3rd branchial pouch along with the thymus, have a more variable position. Less than two-thirds are found close to the lower pole of the thyroid, but the remainder are usually found within the thyrothymic ligament or in the mediastinum.^{5,6}

Parathyroid localising investigations have advanced parathyroid surgery considerably. Accurate pre-operative localisation permits minimally invasive day case adenoma excision, which may be performed under local anaesthetic, and facilitates the excision of difficult ectopic glands, and residual or missed glands in cases of recurrent hyperparathyroidism.⁷ High-resolution ultrasound can reliably identify cervical adenomas, but it is of little use in the localisation of mediastinal glands. CT and MRI scans provide excellent spatial resolution and facilitate 3-D reconstructive techniques. Sestamibi scans utilise a technetium-99m labelled protein taken up diffusely but retained in overactive parathyroid tissue: 'washout' studies accurately reveal a hot spot of isotope activity. An advance in radionuclide studies is the SPECT scan, equating to a 3-D reconstruction of a sestamibi scan, further increasing the sensitivity for adenoma localisation.⁸

Mediastinal parathyroid adenomas have usually been removed through a manubrial split, median sternotomy

or thoracotomy. However, we feel that thoracoscopy confers two major advantages: some ectopic adenomas might be better accessed thoracoscopically than through conventional open approaches (as in Case 1); second, a minimally invasive approach carries considerably less risk than conventional open thoracic surgery. In our experience, thoracoscopy permits optimal views and ease of dissection, particularly within the posterior mediastinum, when compared with mediastinoscopy. The reported cases illustrate significant co-morbidities in both patients, who would have had substantial risk of morbidity and mortality had they required thoracotomy. In utilising a thoracoscopic technique, these risks were reduced and the number of high-dependency bed-days and total hospital stay also reduced. It should be emphasised that these cases involved high-risk patients and potentially complicated thoracic surgery: the procedures were performed in a unit familiar with performing upper sternal splits for complex thyroid and parathyroid surgery, thoracotomy for trauma, and with many years of thoracoscopic and open thoracic experience. Intensive care facilities were readily available, as well as input from experienced anaesthetic colleagues throughout.

The excision of both these adenomas was straightforward; we believe the dissection was facilitated by the relative higher contralateral intrathoracic pressure (from the ventilated side) pushing the adenoma into the thoracic cavity after the pleura had been divided. Moreover, the sub-pleural location of both these adenomas aided the visualisation of the glands on insertion of the thoracoscope. Other authors have had to rely on either intra-operative parathyroid hormone assay^{4,7} or intra-operative γ -probe localisation following administration of radiolabelled sestamibi⁷ to locate glands situated deeper within the mediastinum.

These cases illustrate advantages of thoracoscopic excision over open excision of ectopic mediastinal parathyroid adenomas, centring around reduced length of stay, less morbidity and mortality, reduced post-operative pain and improved cosmesis. From the healthcare providers viewpoint, the reduced length of stay and complication rate should represent significant cost savings (albeit in a small number of patients), as well as improving quality of care under the auspices of clinical governance. In addition, this represents new training opportunities and the chance to develop skills in minimally invasive surgery. The authors believe that, in the hands of appropriately experienced surgeons, thoracoscopic excision of mediastinal parathyroid adenomas represents a safe, effective, and innovative technique that can safely be undertaken in a district general hospital offering endocrine surgery.

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