INTRODUCTION

Approximately 2% of hyperfunctioning parathyroid glands will reside in the mediastinum and will not be accessible to neck exploration.1,2 Although a mediastinal location may be defined as a gland completely below the level of the clavicle,3 a more clinically relevant landmark is the brachiocephalic vein as glands below this level are likely to be inaccessible via the neck.1 Indeed, an intrathoracic parathyroid adenoma is one of the commonest scenarios associated with a failed parathyroid neck exploration, accounting for 12 to 38% of reoperative cases.1,2 In such cases, specialized imaging techniques, including CT scanning, sestamibi isotope studies, and parathyroid hormone (PTH) venous sampling may be used to accurately localize an ectopic parathyroid adenoma and, if found to be localized within the mediastinum, the traditional surgical approach needs to undertake a complete median sternotomy.4,5 However, a complete sternotomy can be associated with a significant degree of morbidity including pulmonary complications, delayed wound healing, prolonged pain, and slow return to full recovery.5,6 Other alternative approaches have been described including video-assisted thoracoscopic surgery (VATS),1,7-9 a parasternal approach,10 or an upper partial sternotomy technique.1,11,12 In this report, we describe the technique of upper partial sternotomy or ministernotomy as an appropriate alternative approach to mediastinal sited parathyroid adenomas.

METHODS

It is imperative that localizing studies be undertaken prior to embarking on a mediastinal exploration. When these indicate the presence of hyperfunctioning parathyroid tissue in the superior mediastinum of the chest, its removal can be safely undertaken by upper partial median sternotomy. This technique is performed with the patient under general anesthesia, positioned supine on the operating table with the head extended on a head ring and with a shoulder bag behind the scapula to further extend the neck. Following skin preparation and draping, exposing the anterior neck and the full length of the sternum, in the event that a complete sternotomy might be required, a skin incision is made from the sternal notch in the midline down to the level of the third intercostal space (Fig. 1). The retrosternal space immediately deep to the manubrium is blunt dissected
with the use of the surgeon’s gloved index finger, and the sternum is divided using a pneumatic saw down to the level of the third intercostal space. Particular attention should be paid that this incision is made in the midline of the sternum, as deviation to either side may be problematic for subsequent sternal closure and healing. Using a bone cutter, the remainder of the sternum to the left lateral aspect of the initial cut is divided toward the left third intercostal space resulting in the final configuration of the upper partial sternotomy to be of L-shaped. Care should be taken to avoid the internal thoracic artery in performing this lateral extension. A small sternal (Finochietto) retractor is then used to widen the split sternum for maximal exposure. Bone wax and cautery are used to effect hemostasis. This exposure provides ample access to the superior mediastinal tissues (Fig. 2) and exploration down to and including the region of the aortic arch is able to be performed by dissecting and removing the thymus and adjacent fatty tissue in the exposed region. Following exploration of the thymic and mediastinal fat, and removal of the parathyroid adenoma, underwater sealed drains are placed in the mediastinum and delivered via the thoracic inlet to the skin. The sternum is closed with interrupted sternal wires, the superior of which may be placed through the bone of the manubrium if there is insufficient access to intercostals spaces. One wire may be placed obliquely in order to close the lateral extension of the sternotomy, as indicated in Figure 3. It is important to confine the path of the wires to the medial most aspect of the intercostal spaces in order to avoid damage to the internal thoracic artery, which can result in troublesome bleeding. The sternal wires are ‘knotted’ by a twisting action (using a heavy forcep to snug the ‘twists’ down firmly) to ensure good bone apposition, which is crucial to bone healing. The subcutaneous tissue over the sternum is closed with a continuous absorbable suture and the skin is closed with subcuticular absorbable sutures. In our experience, removal of the offending parathyroid with a mean operating time of 95 minutes, has resulted in successful normalization of hypercalcemia, with a mean hospital stay of 5.5 days and no major complications.

**DISCUSSION**

Up to 20% of abnormal parathyroid glands causing primary or secondary hyperparathyroidism will be located ectopically. In approximately 3 to 5% of cases, parathyroid neck exploration will be unsuccessful, predominantly due to these anatomical aberrations, and approximately 1 to 2% will be associated with hyperfunctioning parathyroid tissue residing in the mediastinum, which will not be accessible through a traditional cervical approach.1,2

Following a failed neck exploration, sophisticated localizing investigations are usually undertaken, including CT and/or MRI examination of the chest, sestamibi scanning and in some cases PTH venous sampling. If these investigations convincing localize the presence of hyperfunctioning parathyroid tissue to the mediastinum, then the traditional surgical approach needs to undertake a complete median sternotomy or a thoracotomy.4,5 However, the complication rates and morbidity associated with these procedures is high. Russell et al, in their series of 38 patients reported a morbidity rate of 29% (11 of 38 patients), due to pulmonary and wound complications, including sternal dehiscence and mediastinitis.6 Conn et al reported a complication rate of 19% (4 of 21 patients), which included two pleural effusions, a left subclavian vein thrombosis and chondritis of the xiphisternal junction.4 Recurrent laryngeal nerve (RLN) palsy rates following any reoperative parathyroid surgery are high. This complication has been reported at 4 to 6.6% overall,2 and at 2 to 20% following median sternotomy.1,13,14 Complete median sternotomy is also associated with a high mean length of hospital stay ranging 9 to 15 days.1,15 Success rates, when defined as mediastinal explorations yielding mediastinal parathyroids and leading to a normalisation of hypercalcemia, vary between 64 and 100% in series of full sternotomies and are largely dependent on the presence of accurate preoperative localization studies.1,4,6,12-14

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**Fig. 2:** The partial sternotomy incision with exposure of the superior mediastinum as viewed from the patient’s head

**Fig. 3:** Drains and sternal wires are laid in place in preparation for closure. Note the cervical scar from a previous cervical exploration
The partial sternotomy technique involves a sternal split from the sternal notch to the second or third intercostal space. While this technique is well-recognized in cardiothoracic publications, we believe it has not received sufficient exposure in the literature of general and endocrine surgery. Conversion rates to full sternotomy were reported as 30% in one series only. Major complication rates are few, the highest being the isolated 25% (2 of 8 patients) recurrent laryngeal nerve palsy rate reported by Cupisti. Reported success rates after partial sternotomy series, 63 to 100%, are similar to those of complete sternotomy series. In cardiothoracic surgery, operative time, blood loss and postoperative pain is reduced and cosmesis, lung function and upper limb function is improved. The experience in general/endocrine surgical or otorhinolaryngological series is too limited to be able to make such comparisons, but similar advantages may be inferred. Certainly the length of stay in the recent series from Gold et al (mean 2.6 days) was low.

Another alternative is a parasternal approach, which involves an anterior mediastinotomy via the bed of an excised costal cartilage, but this has not been widely taken up and has the disadvantage of limiting exposure to favor one side of the chest. VATS and video-assisted mediastinoscopic surgery (VAMS) have been proposed as alternative advantageous approaches to mediastinal parathyroid adenomas. However, as parathyroid disease is in fact usually managed by endocrine surgeons, the VATS technique would not be an approach with which the average endocrine surgeon would be familiar. Furthermore, other than improved cosmesis, the VATS approach would appear to have no greater advantage over the partial sternotomy technique, given that a recent review reported mean operating time to be 112 minutes and mean length of stay as four days.

CONCLUSION

We believe that a full sternotomy is unnecessary for the resection of mediastinal ectopic parathyroid glands and that an upper partial sternotomy provides just as good direct visualization and access into the upper thorax for the purposes of localizing and resecting ectopic parathyroid tissue. It is a technique which endocrine surgeons with general surgery training can easily adopt and is associated with low patient morbidity and success rates which parallel other techniques.

REFERENCES