

Scan-directed unilateral neck exploration for primary hyperparathyroidism: eight-year results from a regional hospital

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Objective To determine the results of scan-directed unilateral neck exploration for primary hyperparathyroidism.

Design Retrospective study.

Setting Regional hospital, Hong Kong.

Patients Patients who underwent parathyroid surgery for primary hyperparathyroidism between January 2000 and December 2007 were included.

Main outcome measures The demographic, imaging, biochemical, and pathological data, as well as surgical outcomes were analysed according to the treatment received.

Results A total of 78 patients were included in this study; 65 underwent unilateral neck exploration with image guidance by ultrasonography or technetium Tc99m sestamibi scan. The scan sensitivity for localising the side of the lesion was 66% for ultrasound scans, 71% for technetium Tc99m sestamibi scans, and 85% for both scans used in combination. Pathological analysis showed that 95% (74/78) of the patients had a single parathyroid adenoma, two had hyperplasia of four glands, one had a double adenoma, and one a parathyroid carcinoma. Among the patients undergoing scan-directed unilateral neck exploration, one defaulted follow-up, while the remaining 64 patients achieved normal calcium levels at a median follow-up of 6 months.

Conclusion Scan-directed unilateral neck exploration is a safe alternative form of treatment for patients with primary hyperparathyroidism, with a cure rate similar to conventional therapy.

Introduction

The traditional treatment for primary hyperparathyroidism (PHP) is bilateral neck exploration, which achieves cure rates of about 95% with an experienced surgeon.¹ With advancements in imaging, scan-directed unilateral neck exploration becomes an alternative treatment of choice. According to the literature, scan-directed minimally invasive parathyroid surgery carries a similar cure rate as does conventional surgery, while entailing less operating time and potential operative morbidity. This study set out to evaluate the results of scan-directed unilateral neck dissection for PHP in a regional hospital in Hong Kong.

Key words

Hyperparathyroidism; Parathyroidectomy;
Sensitivity and specificity; Technetium
Tc99m sestamibi

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Methods

A total of 78 patients with PHP underwent the operation in our unit between January 2000 and December 2007. The diagnosis of PHP was established by baseline calcium and parathyroid hormone (PTH) levels. For preoperative localisation, all patients underwent either a dual-phase sestamibi scan and/or an ultrasound scan. Unilateral neck exploration was performed in patients with a localised single parathyroid adenoma on imaging. Both parathyroid glands on the targeted side were explored during the operation. Frozen section was routinely obtained to confirm that the tissue was a diseased parathyroid gland. Intra-operative PTH was not measured, as it is expensive and not available in our unit. In patients with an equivocal scan, bilateral neck exploration was performed. Bilateral neck exploration was also performed if there was failure to identify a parathyroid adenoma

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during unilateral exploration. All procedures were performed under general anaesthesia. Patients were followed up in both medical and surgical clinics to monitor calcium levels and surgical outcome.

Results

Patient characteristics

A total of 78 patients were included in this analysis, among whom 65 underwent unilateral neck exploration. The mean age of the operated patients was 57 (range, 16-90) years; 28 were males and 50 females. In all, 50% of the patients had a history of hypertension, while 19% had diabetes. The mean baseline creatine level was 85 (range, 41-350) $\mu\text{mol/L}$. Approximately 75% of the patients were asymptomatic on presentation; 12% presented with polyuria and polydipsia; 6% presented with neurological features, including syncope and weakness. Two patients presented with bone pain and three with central abdominal pain (Fig 1). In all, 39% (30/78) of the patients had urinary tract stone disease, 21% (16/78) had osteoporosis, and 6% (5/78) had a history of osteoporotic fracture at presentation (Fig 2). The mean preoperative calcium level was 2.87 (range, 2.54-3.64) mmol/L , and the median PTH level was 13.4 (range, 4.4-233) pmol/L .

Radiological correlation

Ultrasound scans were carried out in 68 patients, among whom 65 had single gland disease (adenoma or parathyroid carcinoma). The sensitivity of ultrasonography (USG) in detecting disease affecting only a single gland was 66%. Ultrasonography was not able to detect an adenoma in 22 patients having a single involved gland; among whom nine had multi-nodular goitres. Dual-phase technetium Tc99m sestamibi (MIBI) scan was carried out in 73 patients; 69 of them had a single diseased gland. The sensitivity of MIBI scan for detecting a single disease gland was 71%. Both ultrasound and MIBI scans were carried out in 65 patients. Ultrasound scans were able to detect 12 patients with single adenoma, of which nine were appeared negative on MIBI scan. While MIBI scan was able to detect single adenoma in nine patients,

TABLE. Sensitivity for localisation of single gland disease using different imaging modalities

Imaging modality	No. of scanned patients	Sensitivity
Ultrasound scan	68	66%
MIBI scan*	73	71%
Ultrasound + MIBI scan	65	85%

* MIBI denotes dual-phase technetium Tc99m sestamibi

影像導向下單側頸部探查原發性甲狀旁腺功能亢進症：一所地區醫院的八年結果總結

目的 探討利用影像導向下單側頸部探查原發性甲狀旁腺功能亢進症的結果。

設計 回顧研究。

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患者 2000年1月至2007年12月曾因原發性甲狀旁腺功能亢進症而要進行甲狀旁腺手術的病人。

主要結果測量 根據治療方法分析得出的人口學、影像學、生化學、病理學，以及手術結果。

結果 78位病人中，65位以影像導向或Tc99m sestamibi核素探測單側頸部。受損位置定位的影像敏感度方面，超聲波掃描為66%、Tc99m sestamibi為71%、兩者合併為85%。病理學分析顯示78位病人中，甲狀旁腺單發腺瘤佔74例（95%）、四個腺體增生2例、雙發腺瘤1例、甲狀旁腺癌1例。以影像導向探測單側頸部的病人中，1位失訪，其餘64位於隨訪期中位數為6個月時均有正常的鈣水平。

結論 利用影像導向單側頸部探查原發性甲狀旁腺功能亢進症是安全的，不但為病人提供另類治療方案，痊癒率更可媲美傳統療法。

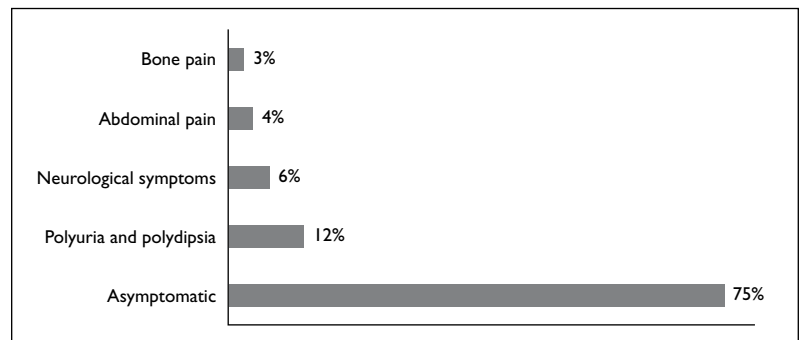


FIG 1. Presenting symptoms in operated patients (n=78)

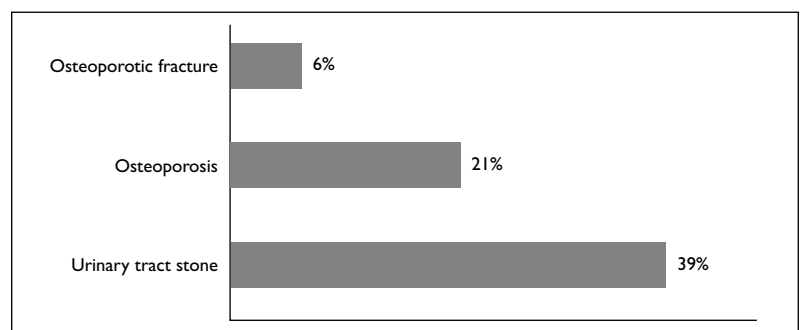


FIG 2. Complications at the time of presentation (n=78)

it was reported to be negative on ultrasound. Both investigations are therefore complementary (Table).

Surgical outcome

Scan-directed unilateral neck exploration was performed in 65 patients based on the results from USG and MIBI scans. During the operation, single gland disease (adenoma or carcinoma) was identified in all cases by unilateral exploration. No patient required conversion to bilateral exploration. The median postoperative hospital stay was 1 day (range, 1-18 days). Five (8%) had transient hypocalcaemia after the operation and required calcium supplementation. One patient defaulted follow-up and the remaining 64 had achieved normal calcium levels at their 6-month follow-up.

Among these 65 patients, one had a parathyroid carcinoma. During the operation, a hard irregular nodule was noted at the lower pole of the right thyroid gland. The nodule was also fixed to the recurrent laryngeal nerve. Frozen section confirmed the presence of parathyroid tissue. Eventually, a right-sided parathyroidectomy with right hemithyroidectomy and central compartment lymphadenectomy were performed. The final pathology confirmed it was a parathyroid carcinoma, with direct invasion into the thyroid, surrounding soft tissues and nerve bundles. External radiotherapy was given for focal margin involvement on histology. After 18-month follow-up, there were no recurrences; postoperative MIBI scans, and calcium and PTH levels were all normal. After the operation, the patient complained of hoarseness, and flexible laryngoscopy confirmed a right-sided vocal cord palsy. That was the patient with postoperative hoarseness in our series of 65 patients.

Discussion

The conventional treatment for PHP is bilateral neck exploration. In expert hands, 95 to 98% of patients become normocalcaemic after the operation.¹ However, around 85% of PHP is caused by a single adenoma,² and therefore do not require bilateral exploration. With advancements in imaging, minimally invasive techniques have been developed for parathyroidectomy in order to focus on the diseased gland and avoid unnecessary dissection. Ultrasound and sestamibi scans are commonly used imaging modalities for preoperative localisation. The sensitivity of USG is reported to be between 60 and 80%, and its specificity is around 80%.^{3,4} However, it is operator-dependent. Moreover, a single adenoma situated in an atypical position (retro-oesophageal, retrosternal, and retrotrachea), or within a multinodular goitre is difficult to detect. In this series, the sensitivity of ultrasound was 66%; 41% of the false negatives were associated with multinodular goitres. For sestamibi scan, the reported sensitivity is around 80 to 90% and specificity approaches 90%.^{2,4-6} In our

series, the sensitivity of MIBI scan was 71%. Among the false negatives, 20% were due to the presence of multinodular goitre, making the interpretation difficult. The sensitivity could be improved with the use of dual-isotope subtraction scanning (sestamibi and thallium chloride). This is expensive however.

Both ultrasound scan and sestamibi scan complement each other. Among 65 patients having both performed, around 18% of the single adenomas were detected solely by USG; while 14% of single adenomas was detected solely by MIBI scans. Combining both investigations, the sensitivity for detecting single gland disease reached 85% (Table). Other imaging modalities like computed tomography, magnetic resonance imaging, or positron emission tomography have also been used for preoperative localisation. Because of the high costs however, they are usually reserved for re-operation cases.

Different surgical approaches have been advocated for PHP, including scan-directed unilateral neck dissection or minimally invasive parathyroidectomy (MIP) with or without intra-operative PTH measurement. In a large-scale systematic review, scan-directed unilateral neck dissection was shown to confer a similar cure rate as the conventional approach, while the patients encountered less morbidity, shorter operating times, and shorter hospital stays.⁷ In this series, the cure rate of scan-directed unilateral neck dissection for PHP was similar to the gold standard of bilateral neck dissection. In terms of morbidity, one patient had a cord palsy after resection of the parathyroid carcinoma with recurrent laryngeal nerve involvement. Otherwise, no other major morbidity was reported. The use of intra-operative quick PTH assay to ensure the removal of the diseased gland is valuable as shown by several reports.⁸⁻¹¹ Nevertheless, its routine use is expensive and subject to measurement error (depending on the cut-off time and value).¹² Some surgeons advocate MIP without intra-operative PTH assay. In the study by Pang et al,¹³ 500 consecutive patients underwent MIP based on imaging, without the use of intra-operative PTH assays, and achieved a cure rate of 97%. In the series by Mihai et al,¹⁴ 150 patients underwent MIP without intra-operative PTH assay; the cure rate was 100%. Thus, in well-selected patients using preoperative imaging alone, this can also achieve good results.¹³⁻¹⁶ The use of intra-operative PTH may nevertheless improve the cure rate of scan-directed parathyroidectomy, but may not be necessary for routine purposes.

Conclusion

Scan-directed unilateral neck exploration is a safe alternative for the treatment for PHP, with a similar curative rate to conventional therapy.

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