Preoperative localisation for parathyroid surgery in primary hyperparathyroidism: a study to evaluate the clinical utility of different imaging modalities

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Introduction

Primary hyperparathyroidism (PHPT) is caused by a solitary benign adenoma in 80-85% of cases, but may also be due to multi-gland or ectopic disease, hyperplasia, and rarely parathyroid carcinoma. Preoperative localisation studies are important to identify patients suitable for minimally invasive parathyroid surgery.

The aim of this study was to evaluate the accuracy of ultrasound (US), parathyroid scintigraphy (MIBI) and computed tomography (CT) utilised in the preoperative setting in a district general hospital, with limited access to single photon-emission computed tomography (SPECT).

Methods

A retrospective study of 88 consecutive patients, who underwent parathyroidectomy for PHPT at a single unit between 2010 and 2014, was conducted. Patients were identified using discharge codes from locally held coding data. The sensitivity and specificity of each imaging modality was compared against histology as the gold standard.

Results

Eighty-eight patients (female to male ratio 5.8:1 and mean age 61.5±11.3 years) were studied. Eighty-two (93%) patients were first presentations of PHPT and six (7%) were relapses, requiring remedial surgery. At surgery, a solitary adenoma was identified in 72 (82%) patients; eight (9%) had parathyroid hyperplasia and one (1%) had parathyroid carcinoma. Clinical characteristics of the study population are summarised below in Table 1.

Table 1. Summary of clinical characteristics of patients with parathyroidectomy (n=88).

Characteristic	Frequency (Valid %) (n=88)
Gender	
• Male	13 (14.8%)
• Female	75 (85.2%)
Age (years) (mean (SD))	61.5 (11.3)
Presentation	
• First time	82 (93.2%)
• Relapse	6 (6.8%)
Histology	
• Adenoma	72 (81.8%)
• Hyperplasia	8 (9.1%)
• Carcinoma	1 (1.1%)
• Normal	6 (6.8%)
• Unknown	1 (1.1%)
Imaging Modality utilised	
• Ultrasound (US)	88 (100%)
• Parathyroid scintigraphy (MIBI)	82 (93.2%)
• Computed tomography (CT)	52 (59.1%)
• Magnetic Resonance Imaging (MRI)	2 (2.3%)
• Single-photon emission computed tomography (SPECT)	22 (25.0%)
Failure of localisation studies	13 (14.8%)
Cure rate	81 (92.0%)

Results (cont'd)

Preoperatively 100% of patients had US, 82 (93%) MIBI and 67 (59%) CT. Three (3%) had single image modality, 30 (34%) had two and 43 (49%) had three imaging modalities.

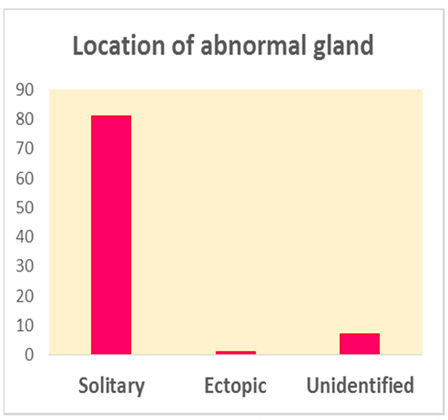

Figure 1. shows the location of the abnormal gland at surgery. Y-axis represents frequency.

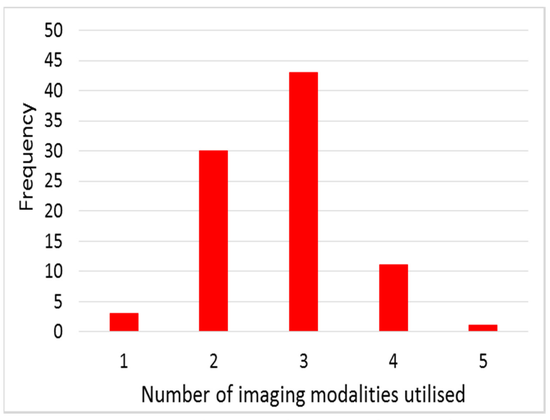

Figure 2. shows the total number of imaging modalities utilised

Forty-three (53%) parathyroid adenomas were identified with US, 39 (52%) with MIBI and 31 (67%) with CT. Combined US/MIBI were carried out in 82 patients, yielding a sensitivity of 63%. Paired US/CT had a sensitivity of 75% in 52 patients. These findings are illustrated in Tables 2 and 3 respectively.

Table 2. Summary of the sensitivities and specificities with associated 95% confidence intervals (CIs), for each of the 4 methods assessed on an individual basis.

METHOD	SENSITIVITY		SPECIFICITY	
	Best estimate	95% CI	Best estimate	95% CI
USS	53.1% (43/81)	(42.2%, 64.0%)	87.5% (7/8)	(64.6%, 100.0%)
MIBI	52.0% (39/75)	(40.7%, 63.3%)	87.5% (7/8)	(64.6%, 100.0%)
CT	67.4% (31/46)	(53.8%, 80.9%)	85.7% (6/7)	(59.7%, 100.0%)
SPECT	76.9% (10/13)	(54.0%, 99.8%)	85.7% (6/7)	(59.7%, 100.0%)

Table 3. Summary of the sensitivities and specificities with associated 95% confidence intervals (CIs), of each of the 6 combined pairs of methods assessed on an individual basis.

METHODS	SENSITIVITY		SPECIFICITY	
	Best estimate	95% CI	Best estimate	95% CI
USS + SPECT	85.7% (18/21)	(70.7%, 100.0%)	71.4% (5/7)	(38.0%, 100.0%)
USS + CT	**74.5% (35/47)**	**(62.0%, 86.9%)**	100.0% (6/6)	-
MIBI + SPECT	70.0% (7/10)	(41.6%, 98.4%)	71.4% (5/7)	(38.0%, 100.0%)
USS + MIBI	62.7% (47/75)	(51.7%, 73.6%)	83.3% (5/6)	(53.6%, 100.0%)
CT + SPECT	50.0% (3/6)	(10.0%, 90.0%)	83.3% (5/6)	(53.6%, 100.0%)
CT + MIBI	47.1% (33/70)	(35.4%, 58.8%)	100.0% (6/6)	-

Conclusion

In the absence of SPECT, combined USS/CT was superior for accurate preoperative localisation of solitary parathyroid adenomas over any single or combined imaging modality.

References

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