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ORIGINAL RESEARCH

Preoperative localization of parathyroid adenomas with Methoxyisobutylisonitrile and Ultrasonography

[1]Dr. Rezwana Nafees, [2]Dr. Dawood Iqbal Wani, [3]Dr. Iram Saba

[1]Department of ENT, Government Medical College, Srinagar, India
[2]Department of General Surgery, Government Medical College, Srinagar, India
[3]Department of Radiodiagonosis and Imaging, SKIMS Soura Srinagar, India

Corresponding Author
Dr. Iram Saba
Department of Radiodiagonosis and Imaging, SKIMS Soura Srinagar, India

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ABSTRACT

Background: A rise in parathyroid hormone (PTH) as a result of underlying parathyroid pathology is a hallmark of the pathophysiology of primary hyperparathyroidism. The present study was conducted to assess preoperative localization of parathyroid adenomas with Methoxyisobutylisonitrile and Ultrasonography (USG). **Materials & Methods:** 56 cases of primary hyperparathyroidism of both genders were selected. Every patient in whom preoperative localization of a parathyroid adenoma was possible using MIBI, USG, or both underwent unilateral neck exploration. **Results:** Out of 56 patients, 20 were males and 36 were females. The mean preoperative serum calcium (mmol/l) was 2.71 and post-operative serum calcium (mmol/l) was 2.46, preoperative PTH was 180.4 and post-operative PTH was 67.2. MIBI and USG showed sensitivity of 72% and 91%, false-positive rate of 8% and 12% and false-negative rate of 35% and 9% respectively. The difference was significant ($P< 0.05$). **Conclusion:** We recommend USG as a first-line study with MIBI as a backup in case USG is unable to detect an anomaly because ultrasound scans alone had a statistically significantly higher sensitivity to pinpoint a parathyroid adenoma than MIBI.

Keywords: Bilateral neck exploration, Adenoma, Parathyroid hormone

INTRODUCTION

A rise in parathyroid hormone (PTH) as a result of underlying parathyroid pathology is a hallmark of the pathophysiology of primary hyperparathyroidism. Although parathyroid glandular hyperplasia (10%) or cancer may also be the cause, parathyroid adenoma development accounts for 80–85% of cases.[1] A subsequent hypercalcemia is brought on by an elevated PTH. A lesser percentage of people with primary hyperparathyroid illness may exhibit symptoms such as lethargy, memory issues, myalgia, bone pain, constipation, and acid reflux, although the majority of patients present asymptomatically. Rarely, patients may exhibit bone disorders like osteoporosis and renal issues like nephrolithiasis.[2]

Bilateral neck exploration (BNE) combined with four-gland exploration, followed by the identification and excision of the problematic parathyroid gland, was the cornerstone of treatment for primary hyperparathyroidism (HPT) in the past.[3] The preoperative visualization of the parathyroid gland has been made easier by the development of imaging techniques including technetium-99m Methoxy isobutylisonitrile (MIBI) (99mTc-MIBI or MIBI), high resolution ultrasound scan (USG), and single positron emission computed tomography (SPECT). Due to preoperative localization of the diseased parathyroid gland, unilateral neck exploration (UNE) could occur more quickly and with less invasiveness, eliminating the need for BNE and four-gland exploration.[4,5]

Methoxyisobutylisonitrile scintography is a dual phase procedure which specifically localizes hyperfunctioning parathyroid tissue. A high frequency transducer (12–15 Hz) used for high resolution USG also makes it possible to visualize parathyroid tissue prior to surgery.[6] Adenomas can be distinguished from thyroid tissue because they seem hypoechoic. In 90% of cases, ultrasound scans have been found to be successful in identifying parathyroid adenomas.[7] The present study was conducted to assess preoperative localization of parathyroid adenomas with Methoxyisobutylisonitrile and Ultrasonography (USG).

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MATERIALS & METHODS

The study was carried out on 56 cases of primary hyperparathyroidism of both genders. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. Every patient in whom preoperative localization of a parathyroid adenoma was possible using MIBI, USG, or both underwent unilateral neck exploration. An incision was made in the middle of the horizontal midline, 3 to 4 cm from the thyroid gland to the suprasternal notch. In each instance, the inferior thyroid artery and recurrent laryngeal nerve were located and isolated. Using fresh frozen sampling for histological diagnosis, the surgery's goal of accurately identifying the parathyroid adenoma was verified intraoperatively. By expanding the incision and examining the contralateral side, the surgery was changed to a BNE in the small percentage of patients where the abnormal parathyroid tissue could not be found. Results thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Total- 56		
Gender	**Male**	**Female**
Number	20	36

Table I shows that out of 56 patients, 20 were males and 36 were females.

Table II Assessment of parameters

Parameters	Mean	SD
Preoperative serum calcium (mmol/l)	2.71	1.1
Post-operative serum calcium (mmol/l)	2.46	1.3
Preoperative PTH	180.4	25.2
Post-operative PTH	67.2	11.1

Table II, graph I shows that mean preoperative serum calcium (mmol/l) was 2.71 and post-operative serum calcium (mmol/l) was 2.46, preoperative PTH was 180.4 and post-operative PTH was 67.2.

Graph I Assessment of parameters

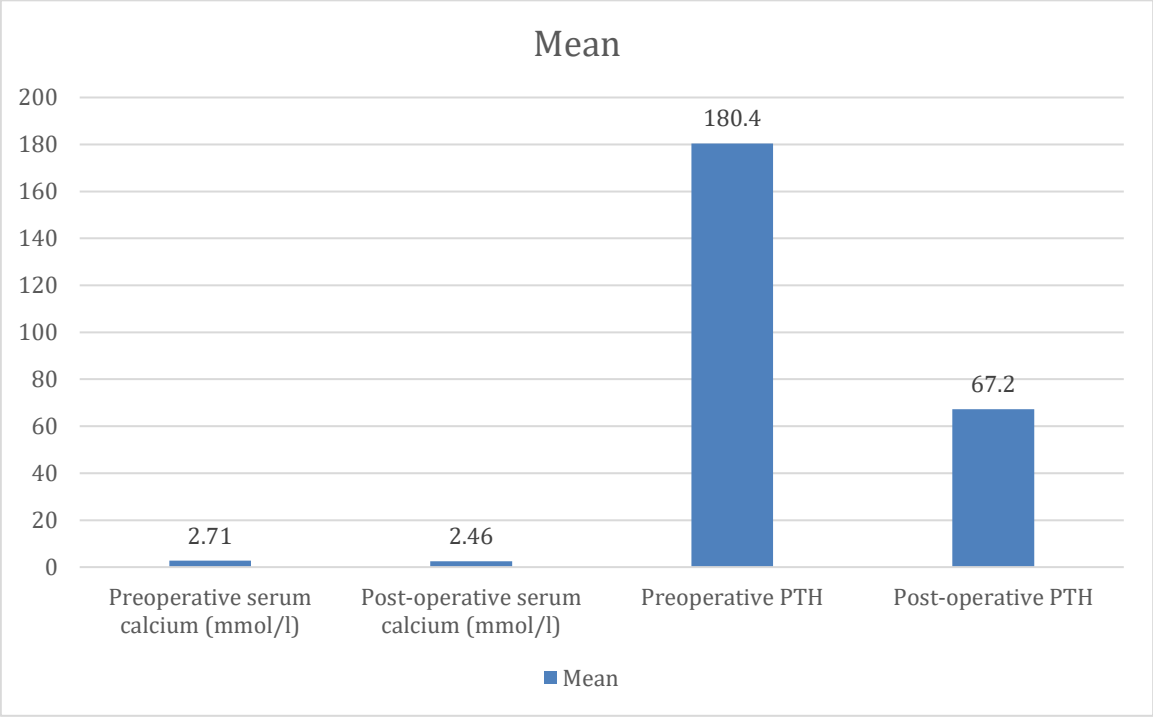

Table III Accuracy of MIBI and USG

Parameters	MIBI	USG	P value
Sensitivity	72%	91%	0.04
False-positive rate	8%	12%	0.05
False-negative rate	35%	9%	0.01

Table III shows that MIBI and USG showed sensitivity of 72% and 91%, false-positive rate of 8% and 12% and false-negative rate of 35% and 9% respectively. The difference was significant (P< 0.05).

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DISCUSSION

Preoperative localization of a parathyroid adenoma facilitates effective surgical unilateral neck exploration (UNE).[8,9] In comparison to bilateral neck exploration (BNE) it requires a smaller incision which provides better postoperative cosmesis as well as a shorter time in theatre and reduced postoperative complications, such as bleeding, injury to the recurrent laryngeal nerve and postoperative hypoparathyroidism.[10,11]The present study was conducted to assess preoperative localization of parathyroid adenomas with Methoxyisobutylisonitrile and Ultrasonography (USG).

We found that out of 56 patients, 20 were males and 36 were females. Ridyard et al[12] identified whether the combination of Methoxyisobutylisonitrile (MIBI) and ultrasound scan (USG) in localizing the parathyroid gland preoperatively is more effective than either MIBI or USG alone. The combination of MIBI and USG provided a statistically significant improvement in preoperative localization of parathyroid adenoma over MIBI or USG alone ($p = 0.033$ and $p = 0.043$ respectively).

We found that mean preoperative serum calcium (mmol/l) was 2.71 and post-operative serum calcium (mmol/l) was 2.46, preoperative PTH was 180.4 and post-operative PTH was 67.2. We found that MIBI and USG showed sensitivity of 72% and 91%, false-positive rate of 8% and 12% and false-negative rate of 35% and 9% respectively. Scheiner JD et al[13] in patients with primary hyperparathyroidism (PHPT), compared nuclear medicine scintigraphy (NM) and power and color Doppler ultrasound (US) for the preoperative localization of parathyroid adenomas. In order to determine the location of parathyroid adenoma, 31 patients with biochemical evidence of PHPT had pre-operative US and NM. Both studies were interpreted independently without prior knowledge of the other study's findings. The parathyroid adenoma was surgically removed from all patients using either minimally invasive unilateral surgery or traditional neck exploration, and the levels of circulating parathyroid hormone were quickly measured in serum. At surgery, every patient had a single parathyroid adenoma. With a 100% positive predictive value, the prospective sensitivities for the US, NM, and both investigations taken together were 65%, 68%, and 74%, respectively. The adenoma was localized by only one imaging modality in 16%.

Scattergood et al[14] in their study all patients who underwent parathyroidectomy for primary hyperparathyroidism were selected. Operative findings were correlated with radiological and histological results. Sensitivity and specificity of ultrasound, sestamibi scintigraphy and the two together were calculated for diagnostic precision and compared. One hundred and eighty-four patients met the inclusion criteria, of whom 81.5% had a histological diagnosis of a parathyroid adenoma. Ultrasound had higher sensitivity than sestamibi scintigraphy. Used together, ultrasound and sestamibi scintigraphy performed better than either ultrasound or sestamibi scintigraphy alone ($P< 0.001$). Twenty-two of 184 cases had no lesion located by either ultrasound or sestamibi scintigraphy preoperatively. Where neither ultrasound nor sestamibi scintigraphy located the lesion, additional computed tomography led to the excision of parathyroid pathology in one in ten patients.

The shortcoming of the study is small sample size.

CONCLUSION

We recommend USG as a first-line study with MIBI as a backup in case USG is unable to detect an anomaly because ultrasound scans alone had a statistically significantly higher sensitivity to pinpoint a parathyroid adenoma than MIBI.

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