Original Article

Parathyroid nuclear scintigraphy in patients with suspected hyperparathyroidism

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Abstract

The purpose of this study was to determine the value of nuclear medicine in demonstrating parathyroid adenomas in cases with hyperparathyroidism. Although hyperparathyroidism is one of the most commonly seen conditions by the referring physicians in their day-to-day practice, their cause is relatively unknown in 90% of cases and in majority of the cases only one of the parathyroid gland presents as a tumour while the other 3 parathyroid glands remain perfectly normal. Thus the characterizing these lesions are essential, for further management. Scintigraphic studies are non-invasive and have high sensitivity and specificity when compared to other modalities in localization of parathyroid adenomas. Sestamibi studies are seen slowly replacing other procedures such as scintigraphic imaging of adenoma, because of its sensitivity in arriving at a definitive diagnosis and its added advantage of being a non-invasive study. Various number of scintigraphic studies have proved their efficacy in detection of parathyroid adenomas. In this article we describe the imaging findings of suspected cases of parathyroid adenomas, diagnostic work-up of these lesions in clinical practice.

Keywords: Scintigraphy, Adenoma. Parathyroid

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INTRODUCTION

Parathyroid glands are four small bean shaped glands (i.e. 2 superior and 2 inferior glands), seen in posterior aspect of the thyroid gland. By far the most common lesion that affects the parthyroid gland is adenoma. Parathyroid cancer or parathyoid hyperplasia are very rarely seen. Thus Sestamibi scan plays a very important role in assessing the incidence of these lesions. In addition, they have high sensitivity and specificity for detecting ectopically located parathyroid adenomas.

MATERIALS AND METHODS

Sestamibi is prepared under a suitable lead shielding, where ^{99m}Tc Pertechnatate is eluted from a column generator and 5-10 mCi of ^{99m}Tc Pertechnatate solution is obtained using a sterile lead shielded syringe. The obtained sestamibi solution is administered intravenously using a 24 G needle. GE, Millennium-MG, anterior detector activated, Zoom:1.33, Matrix:128 x 128, Image acquisition: 1000 kcts for each view, Window width:20 %, Standard views acquired (5 minutes each): Anterior, Left Anterior Oblique (LAO), Right Anterior Oblique (RAO) and additional Mediastinal view (5 minutes each). Thirty three patients were imaged for specific symptoms like lethargy, bone pain and constipation over a period of 3 years months, from October 2011 to October 2014. In this study 22 patients had a positive clinical and imaging findings of parathyroid adenomas.

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OBSERVATION AND RESULTS:

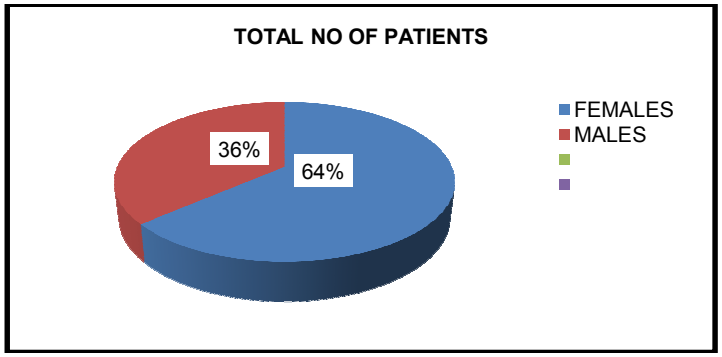


Figure 1: Sex Ratio

Totally 33 cases were referred with suspected parathyroid adenomas in which 21were females and 12 were males.

Out of the 33 cases, 22 cases were found to be positive with a female predominance (n=14) over males (n=8).

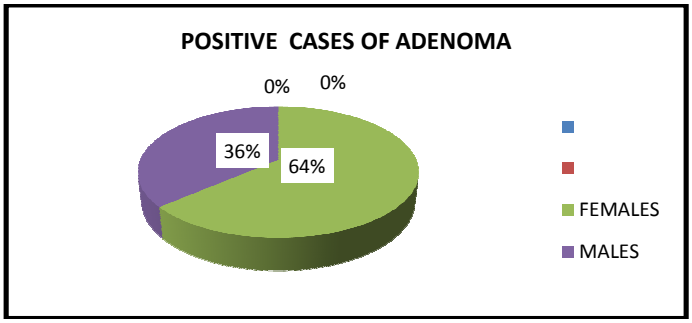
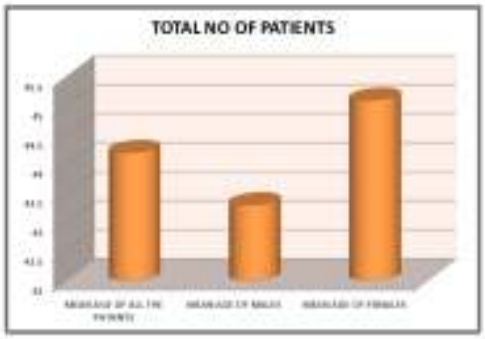


Figure 2: Mean Age

The mean age of all the patients (n = 33) was 44.2 years with a range = 17 -72 years, of which the mean age of males (n = 12) was 43.3 years (range = 17 - 64 years) and the mean age of females (n = 21) was 45.1 years (range = 20 - 72 years).



The mean age of all the patients (n = 22) was 42.7 years with a range = 17 -72 years, of which the mean age of males (n = 8) was 39 years (range = 17 - 56 years) and the mean age of females (n = 14) was 46.5 years (range = 26 - 72 years).

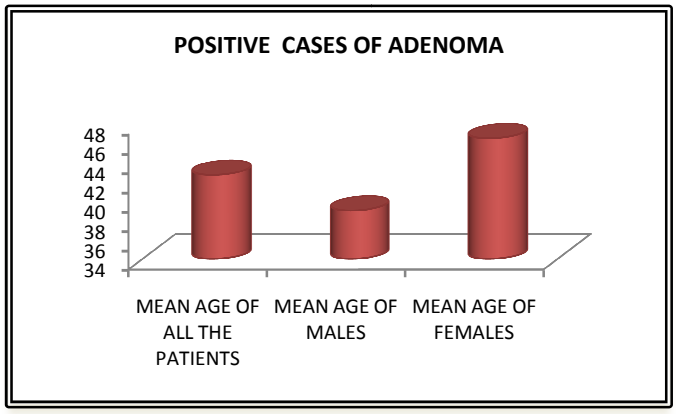


Figure 3: Clinical Symptoms

The commonest associated history was lethargy (n=29), bone pain (n=25) and constipation (n=17). However symptomatically normal patients (n=4) with incidental finding of high blood calcium level were also seen to have a positive scan. The positive cases were found to have increased mean serum PTH (448.85pg/ml) and serum calcium (11.63mg/dl) levels when compared to the negative cases (serum PTH -218.89pg/ml and serum calcium - 10.01mg/dl).

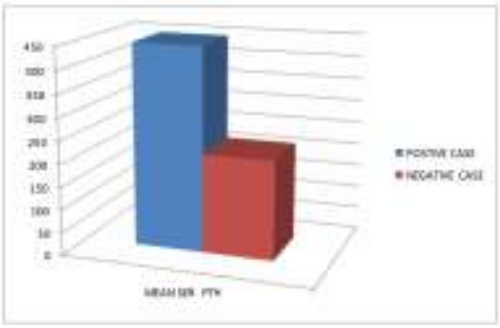


Figure 4: Mean serum calcium and PTH levels

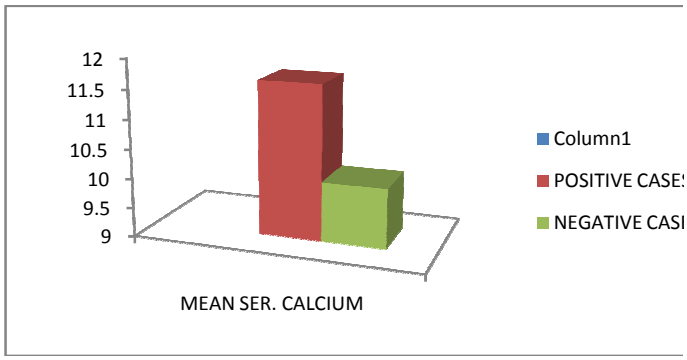
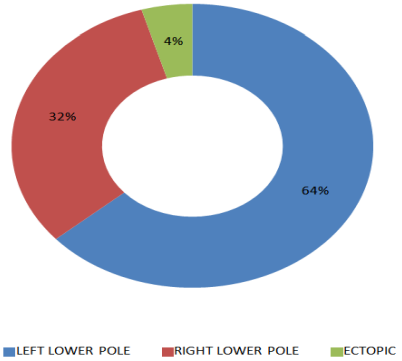


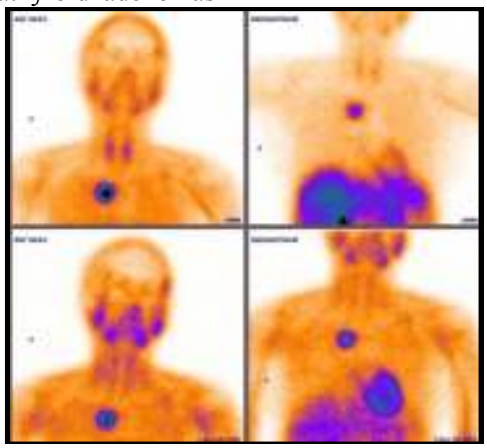
Figure 5: Location of Adenomas in Positive Cases

Only inferior pole adenomas were seen in our study, with predominance of left lower lobe parathyroid adenomas (n=14) over the right lower lobe parathyroid adenoma (n=7). An ectopic (n=1) was also noted in intra-thoracic location.



CASE - I

A 37 year old female, came with complaints of abdominal pain, bone pain, constipation, fever with chills and rigors and dysuria. Blood calcium and PTH values were elevated.

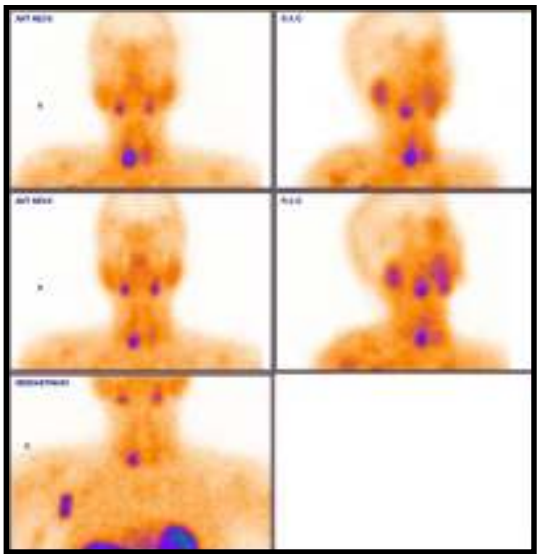


^{99m}Tc Sestamibi scan**:** Ectopic parathyroid adenoma in Intra-thoracic location.

CASE II

A 26 year old female who was apparently normal, after delivery with no specific complaints. However the baby had 3 episodes of seizures which resolved on intra-venous administration of calcium gluconate. Retrospectively the mother was evaluated, and found to have elevated Blood calcium (11.9) and PTH (247.70) values.

USG: A well defined oval hypoechoic lesion in the inferior pole of right thyroid gland.



^{99m}Tc Sestamibi scan: Right parathyroid adenoma

DISCUSSION

In suspected cases of parathyroid adenomas with high serum blood calcium and PTH levels, it is very essential for proper diagnosis with utmost certainty to avoid unwanted surgery. The ability of sestamibi scan to differentiate between normal and adenomatous tissue in both normal and ectopic locations, ensures proper patient management. Adequate localization of parathyroid adenoma allows the surgeon to use a minimally invasive surgical approach. A total of 33 patients with high blood serum calcium and PTH levels, suspected of having parathyroid adenomas were subjected to ^{99m}Tc Sestamibi scan using dual phase scintigraphy technique. Out of the 33 cases that were done and adenomas were found in 22 patients, which is similar with the diagnostic success rates of other studies[41,45]. None of the patients had any complications. In our study the incidence of parathyroid adenoma had a female predominance with a female to male ratio of 1.5:1. The fact that female predominance over males in incidence of parathyroid adenomas was also seen in a study done by J Levi chazen *et al*., where a female to male ratio of 2.5:1 was found[31]. Few other concordant studies in incidence of adenomas were also noted[2,6,51]. The total mean age of the positive cases was 42.7 years, which was less when compared to other studies like a study done by Koksal *et al*. where the mean age was found to be 54.5 years[51]. The practical difficulties in our study were that, most of the patients were referred from other hospitals for localizing adenoma; as our hospital is a tertiary care centre. Hence the histopathological correlation in identifying adenomas was not seen in all the patients. However out of the 22 positive cases, 10 cases were operated in our hospital and were histopathologically confirmed as parathyroid adenomas. Furthermore the 22 positive cases were found to have higher serum PTH and calcium levels (Mean Ser.PTH - 448.85pg/ml and Mean Ser.Ca+ - 11.63mg/dl) when compared to the negative cases (Mean Ser.PTH - 218.89pg/ml and Mean Ser.Ca+-10.01mg/dl). The commonest associated history was lethargy (n=29), bone pain (n=25) and constipation (n=17). However symptomatically normal patients (n=4) with incidental finding of high blood calcium level were also seen to have a positive scan. Only inferior pole adenomas were only seen in our study, with predominance of left lower lobe parathyroid adenomas (n=14) over the right lower lobe parathyroid adenoma (n=7). An ectopic parathyroid adenoma (n=1) was found in intra-thoracic location. Multi-modality comparisons were made by Shah et.al, where he concluded that sestamibi and ultrasound had high sensitivities in detecting parathyroid adenomas in patients with hyperthyroidism. CT and MRI were considered as second line of investigation[3]. The incidence of parathyroid adenomas may be missed by other imaging modalities. Dual phase radio-nuclide is highly specific and sensitive for proper localization of the parathyroid adenomas in normal and ectopic locations. Hence, definitive diagnosis of parathyroid adenoma can be made with utmost certainty in a non-invasive method.

CONCLUSION

Though Scintigraphic study is highly sensitive imaging modality for detecting parathyroid adenomas, Ultrasound, MRI are commonly used preoperatively as they are easily available and non-Invasive. However they lack specificity in detecting adenomas and high false negatives are seen, especially in ectopically located adenomas. Thus unwanted surgery can be avoided with scintigraphic study.

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