THE ACCURACY OF PRE-OPERATIVE ULTRASONOGRAPHY IN LOCALIZING PARATHYROID ADENOMA FOR MINIMALLY INVASIVE PARATHYROIDECTOMY (MIP)

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ABSTRACT

OBJECTIVES

To determine the sensitivity of pre-op ultrasonography in localizing parathyroid adenoma for minimally invasive parathyroidectomy (MIP) technique.

METHODOLOGY

The study was conducted at the department of ENT and Head & Neck Surgery, MTI Hayatabad Medical Complex Peshawar. It included a retrospective analysis of records of patients who underwent MIP from Jan 1, 2019, to July 31, 2022. All patients had pre-operative meta-iodobenzylguanidine (MIBG) scans, and serum PTH, Serum calcium levels were determined. A pre-op ultrasound scan was acquired to mark the site of the parathyroid adenoma. MIP was carried out using a 3.5 to 4 cm transverse skin incision over the marked site to expose the thyroid gland. If the marked parathyroid gland was identified without using any other aids, the result was labelled as "True positive". The sensitivity of pre-op ultrasonography was calculated using SPSS v 26.0.

RESULTS

A total of 53 cases were included in the study. The male: female ratio was 1:1.8. The ages of patients ranged from 23-70 years with a mean age of 48.49 years with a standard deviation of +_ 10.818. Pre-op ultrasonography accurately localizes the site of parathyroid adenoma in 49 patients. Statistical analysis showed this to be a significant finding.

CONCLUSION

Pre-op ultrasonography is significantly helpful in localizing the parathyroid adenoma. Therefore its routine use is recommended to help localize the adenoma in minimally invasive parathyroidectomy.

KEYWORDS: *Hyperparathyroidism, Ultrasonography, Minimally invasive parathyroidectomy.*

INTRODUCTION

Historically, until the 1990s, bilateral cervical exploration for localization of all four parathyroid glands and removal of any that were grossly enlarged had been the standard surgical treatment for primary hyperparathyroidism (PHPT). Challenges with intraoperative adenoma localization and damage to surrounding structures have long hindered utilizing less invasive approaches for parathyroidectomy.[1] In the past two decades, however, significant improvements in the Accuracy and reliability of pre-operative localization studies have facilitated further advances in surgical management, allowing a more targeted, minimally invasive surgical approach.[2] Minimally invasive parathyroidectomy (MIP) is defined as any focused surgical approach that preoperatively aims to identify and remove a single enlarged parathyroid gland (focused or targeted parathyroidectomy) and may, in certain circumstances, allow examination of the ipsilateral gland as well (unilateral parathyroidectomy).[3] Because 80-90% of patients with primary hyperparathyroidism have a solitary parathyroid adenoma, resection of one gland leads to a cure in most cases while eliminating the unnecessary dissection of multiple glands or a bilateral exploration.[4] The confluence of improved adenoma localization using different pre-operative localization studies and the concomitant advent of minimally invasive approaches have led to fewer complications, shorter operative time, shorter hospitalization, a more rapid postoperative recovery, an improved cosmetic result, and greater patient satisfaction.[5] If this experience is unavailable, MIP is recommended when a parathyroid adenoma is localized preoperatively, as it can be removed without visualizing the other glands,

and the rapid intraoperative parathyroid hormone (IOPTH) assay is employed to confirm an adequate resection.[6] Recent advances in imaging technology and surgical adjuncts have increased the use of the minimally invasive parathyroidectomy approach for parathyroid surgery. This approach aims to achieve similar or higher success rates with minimal morbidity.[7] The purpose of minimally invasive parathyroid surgery is to remove the abnormal parathyroid glands and preserve the normal parathyroid glands to achieve eucalcemia. Localization of the abnormal gland is vital for a successful operative treatment.[8] Our study aims to determine the sensitivity of pre-op ultrasonography in localizing parathyroid adenoma for the minimally invasive parathyroidectomy (MIP) technique. It was a retrospective analysis of patients records who were operated on for parathyroid adenoma using the MIP technique. The study was conducted at the Deptt: of ENT and Head & Neck Surgery, MTI Hayatabad Medical Complex Peshawar, from Jan 1, 2019, to July 31, 2022. The record of a total of 53 patients undergoing MIP was examined. The inclusion criteria were patients of both genders undergoing MIP and who had pre-op ultrasonography performed for localization of parathyroid adenoma. Patients undergoing parathyroidectomy other than MIP and if the approach is widened to expose the whole thyroid gland.

METHODOLOGY

Ethical approval for conducting the study was obtained from the institutional ethical committee. The records of 53 patients with known PHPT who underwent MIP were included in the study. All these patients were primarily diagnosed and managed by qualified endocrinologists and then referred to our department for surgical management. All patients had acquired pre-operative MIB scan, serum PTH, S. calcium levels and ultrasound scan. Additional pre-op ultrasonography and lesion site marking was carried out a day before surgery in this department. MIP was carried out using a 3.5 to 4 cm transverse skin incision over the marked site, and flaps were elevated, strap muscles split, and the affected pole of the thyroid gland was exposed. The parathyroid gland was identified and excised. Per-op post excision PTH levels sent for assay. If the marked parathyroid gland was identified without using any other aids, the result was labelled as "Correctly Identified". If any other aids had been used, such as per-op ultrasonography or endoscope, widening of incision necessitating whole thyroid gland exposure or persistently raised post-excision PTH levels were found, the result was designated as "Incorrectly Identified". The sensitivity of pre-op ultrasonography was calculated using the following formula Sensitivity = Correctly Identified / Total No: of cases examined X 100. The data were recorded on a proforma and statistically analyzed using IBM software version 26.0. The Descriptive statistics for age, gender and demographic details were analyzed. The true positive and false negatives frequencies were expressed as percentages, and the sensitivity of pre-op ultrasonography in MIP was calculated.

RESULT

A total of 53 cases were included in the study. The male: female ratio was 1:1.8. The ages of patients ranged from 23-70 years with a mean age of 48.49 years with a standard deviation of +_ 10.818. The maximum number of patients was in the age group 41-50 years. The age-wise distribution of genders is shown in Table 1. Pre-operative ultrasonography could not localize the parathyroid adenoma in 20% of the patients in the age group 31-40 years. The details of adenoma localization are given in Table 2. Pre-operative ultrasonography accurately localizes the site of parathyroid adenoma in all male patients, as shown in Table 3. The overall sensitivity of pre-op ultrasonography in minimally invasive parathyroidectomy has been depicted in Table 4. A Chi-square test was performed, and the p-value was calculated at .021, which is <.05. It shows that pre-op ultrasonography is a significantly helpful tool in localizing the parathyroid adenoma in minimally invasive parathyroidectomy.

Table 1: Age Groups with Gender of Patients; Crosstabulation

		Gender of Patients	
		Male	Female
Age in Years	20-30	01	02
	31-40	03	09
	41-50	08	11
	51-60	04	08
	61-70	03	04
Total		19	34

Table 2: Age Groups with Sensitivity of Ultrasonography; Crosstabulation

		Sensitivity of Ultrasonography	
		Correctly Identified	Incorrectly Identified
Age in years	20-30	03	0
	31-40	10	02
	41-50	19	0
	51-60	11	01
	61-70	06	01
Total		49	04

Table 3: Gender of Patients with Sensitivity of Ultrasonography; Crosstabulation

		Sensitivity of Ultrasonography	
		Correctly Identified	Incorrectly Identified
Gender of Patients	Male	19	0
	Female	30	04
Total		49	04

Table 4: The Sensitivity of Pre-Op Ultrasonography in Minimally Invasive Parathyroidectomy

Sensitivity of Ultrasonography	N (%)
Correctly Identified	49 (92.5%)
Incorrectly Identified	04 (7.5%)

DISCUSSION

The prevalence of primary hyperparathyroidism (pHPT) amounts to 0.78-1.07% in the general population in the United States, Latin America, Europe and Canada. About 3.3% of women and 1.4% of men are diagnosed with pHPT in Canada.[9] Minimal invasive parathyroidectomy (MIP) is the standard treatment for primary hyperparathyroidism. The increasing number of these surgeries in recent years has allowed for the development of improved pre-operative imaging modalities. Intraoperative parathormone levels, frozen specimen pathology, scintigraphy, ultrasonography, SPECT-CT, and magnetic resonance imaging can all be employed for pre- and postoperative assessment, while a gamma probe is used for radio guidance. Some of these may even be utilized for evaluation during surgery. Although scintigraphy and ultrasonography are the most frequently used techniques for localizing the parathyroid gland prior to surgery, research is still being conducted to assess the efficacy of additional localization techniques.[10] Primary hyperparathyroidism is reported most often in women over the age of 50 years. Beyond that, little is known about the epidemiology of this condition, and no studies have specifically examined the age and gender distribution of patients with pHPT.[11,12] In our series, primary hyperparathyroidism was more common in females than males, and the mean age was 48.49 years. Though all our cases had a single adenoma, about 85% of patients with primary hyperparathyroidism harbor a single adenoma and are cured by resectioning the single lesion. The remaining patients display double adenomas (3-5%) or four-gland hyperplasia (10–15%).[13] Pre-operative ultrasonography is routinely performed because it is effective, noninvasive, and inexpensive. The limitations include operator dependency and inability to image mediastinal adenomas because they are limited to the neck.[13] The normal parathyroid gland is generally too small to be visualized sonographically, whereas the parathyroid enlargement seen in primary hyperparathyroidism is often identified as a homogeneously hypoechoic extrathyroidal ovoid mass. Parathyroid adenomas are typically vascular, and an arterial branch can often be followed to the superior or inferior pole of the lesion. By itself, ultrasound has approximately a 50-75% true-positive rate with generally better rates for larger glands.[15] Solorzano et al. found that 77% of pre-operative localization performed correctly and with ultrasonography performed by endocrine surgeons was equally as successful as scintigraphy. In this study, there were only five cases in which an experienced sonologist could not localize parathyroid gland pathology.[16] While Vincent B et al. recorded 91% accuracy of sestamibi scan coupled with ultrasound.[17] In all of our cases, adenomas diagnosed on sestamibi scan and referred by endocrinologists were subjected to ultrasonography. The generally accepted sensitivity of pre-operative ultrasonography for localization of parathyroid adenomas ranges from 90-95%.[18] Our study's overall sensitivity of pre-op ultrasonography was 92.5%, which is compatible with generally accepted figures.

LIMITATIONS

Some factors limit the Accuracy of ultrasound imaging, including operator skill and experience, obesity, small gland size, concurrent thyroid pathology (thyroiditis or multinodularity), revision cases, previous neck surgery, retrotracheal, retroesophageal and mediastinal location.

CONCLUSION

Pre-op ultrasonography is a significantly helpful tool in localizing the parathyroid adenoma. Therefore its routine use is recommended to help localize the adenoma in minimally invasive parathyroidectomy.

CONFLICT OF INTEREST: None

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