

ORIGINAL ARTICLE

CORRELATION BETWEEN PARATHYROID ADENOMA VOLUME AND BIOCHEMICAL PARAMETERS

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ABSTRACT

Introduction: Predicting the size of the parathyroid adenoma may be useful for the surgeon, hence assessing the correlation between the biochemical parameters and the dimensions of the parathyroid adenoma is important.

Materials and methods: A retrospective study was conducted using 6-year (2012-2017) data on patients operated on for parathyroid adenoma and who had records on biochemical assessment. The volume of the adenoma was estimated using its measured dimensions and a mathematical formula.

Results: Thirty five patients including 30 women and 5 men were operated for parathyroid adenoma. The mean age was 54 years. A correlation between the volume of the parathyroid adenoma and the values of preoperative PTH, calcium and phosphorus as well as the postoperative PTH were found. However, there was no correlation with intraoperative PTH or postoperative calcium.

Conclusion: Biochemical parameters can predict the size of a parathyroid adenoma.

Keywords: Parathyroid Adenoma, Calcium, Phosphorus, Parathormone, Parathyroidectomy, Volume

INTRODUCTION

Primary hyperparathyroidism is a common endocrinopathy affecting calcium metabolism characterized by hypercalcemia with excessive secretion of parathormone (PTH) by one (80% of the cases) or multiple parathyroid glands (1). It may be secondary to parathyroid carcinoma in less than 1% of the cases or may be part of multiple endocrine neoplasia (MEN I or II) (2).

Curative treatment is surgery and is based on a bilateral neck exploration of the parathyroid glands but this method is increasingly supplanted by minimally invasive approach under local anesthesia (3). This selective approach requires a precise pre-operative topographic diagnosis associating functional imaging with ^{99m}Tc-MIBI scintigraphy and structural imaging such as cervical ultrasonography (4).

However, the sensitivity of ultrasonography decreases for small parathyroid adenomas (4) ; hence the interest of finding parameters that makes it possible to predict the volume of the adenoma. The aim of this work is to find a correlation between parathyroid adenoma volume and biochemical parameters.

MATERIALS AND METHODS

A retrospective study was performed at the Head and neck department of Charles Nicolle Hospital over a 6-year period (2012-2017) including all patients operated in the department for parathyroid adenoma; these patients had a pre- and post-operative biochemical assessment and imaging by ^{99m}Tc-MIBI scintigraphy and cervical ultrasonography.

Criteria for non-inclusion were double adenoma, parathyroid hyperplasia and parathyroid carcinoma. Patients with renal impairment or associated malignancy have been also excluded. Data collection was carried out through patient records (clinical, biochemical histopathological and radiological informations).

Biochemical parameters studied were preoperative blood calcium and phosphorus, preoperative PTH, intraoperative PTH measured 10 minutes after adenoma excision, and postoperative PTH and calcium a year after surgery.

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These biochemical parameters were measured by ABBOTT ARCHITECT. Parathyroid adenoma volume was estimated according to a mathematical formula: $\text{Volume} = (4/3) * \pi * a * b * c$ with a, b and c are the dimensions of the adenoma measured by an anatomopathologist and $\pi = 3.14159$.

Data were collected and analyzed using the Statistical Package for the Social Sciences (SPSS) program version 20 designed for Windows. Quantitative variables were expressed with mean and standard deviation. Correlation study was performed by the Pearson chi-square test. Difference was considered significant if $p < 0.05$.

RESULTS

During this study period, 35 patients were operated for parathyroid adenoma including 30 women and 5 men. The average age was 54 years old.

The discovery of hyperparathyroidism was secondary to bone pain in 19 cases, renal lithiasis in 10 cases, brown tumor in 2 cases and incidentally in 4 cases.

The location of the adenoma was inferior in 88% of the cases (right inferior in 16 cases and left inferior in 15 cases) and right superior in 4 cases. The mean volume of the adenoma was 23.34 cm³ (1.05-87.96).

Means of the biochemical parameters as well as the standard deviations are detailed in Table 1.

A correlation between parathyroid adenoma volume and the preoperative values of PTH, calcemia and phosphoremia as well as the postoperative PTH were found. However, no correlation was found with postoperative calcium or intraoperative PTH (Table 2).

Table 1: Values (mean and standard deviation) of measured biochemical parameters, Charles Nicolle Hospital, 2012-17

	Mean	Standard deviation
Preoperative calcium (mmol/L)	2.8118	0.23357
Preoperative Phosphorus (mmol/L)	0.7650	0.24638
Preoperative PTH	961.6314	1174.10444
Intraoperative PTH	89.5697	105.94757
Postoperative PTH	138.5467	184.86847
Postoperative calcium (mmol/L)	2.2866	0.14345

Table 2: Correlation between calculated parathyroid adenoma volume and measured biochemical parameters, Charles Nicolle Hospital, 2012-17.

	Correlation coefficient	P
Preoperative calcium	0.426	0.012
Preoperative Phosphorus	-0.641	0.001
Preoperative PTH	0.358	0.035
Intraoperative PTH	0.322	0.068
Postoperative PTH	-0.325	0.069
Postoperative calcium	0.407	0.026

DISCUSSION

Primary hyperparathyroidism is a common pathology treated surgically since Felix Mandl in 1925 performed the first parathyroidectomy (5). This surgical management involves a bilateral cervical exploration of the 4 parathyroid glands.

Nevertheless, the improvement of surgical and imaging techniques induces a shift from standard exploration to a minimally invasive approach under local anesthesia with smaller incision, and shorter recovery time but with a higher risk of recurrence or persistence and the need for precise localization of the adenoma by preoperative imaging (6).

The combination of ^{99m}Tc-MIBI scintigraphy and cervical ultrasonography is an optimal first-line imaging strategy to localize the adenoma, but the sensitivity of ultrasound decreases for small parathyroid adenomas, hence the interest in finding parameters that allow to predict the volume of the adenoma (4).

Several studies have sought a correlation between the preoperative biochemical parameters and the volume or weight of the adenoma; which has been confirmed by some (7-12) ; and rejected by others (13-16).

The lack of correlation in some studies may be explained by the non-exclusion of patients with parathyroid hyperplasia, parathyroid carcinoma, double adenoma or renal failure (8).

In addition, Ozbey reported that the weight of parathyroid adenoma was significantly higher in patients with low levels of vitamin D which could give heterogeneous groups (17).

As for Hwang-Bo, he found that this correlation can be influenced by the presence of cystic lesions, hemorrhage and necrosis within the adenoma (13). In addition, Stern found a correlation between the percentage of primary cells in the adenoma and its weight (10).

Indeed, most parathyroid adenomas are composed mainly of chief cells but other subtypes of parathyroid adenoma may exist such as oxyphil cells, clear cells or lipoadenoma (18).

Conclusion

Biochemical parameters can help to predict the size of a parathyroid adenoma. Therefore, surgeon may know if s/he will deal with a small or large adenoma which can be useful in minimally invasive approach.

Ethical considerations

This is a retrospective study using data collected routinely for any patient hospitalized for primary hyperparathyroidism. These data were used anonymously. Ethical approval was not required.

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Competing interest

The authors declare that this manuscript was approved by all authors in its form and that no competing interest exists.

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