Brazilian Journal of Otorhinolaryngology 2022;88(5):740–744

Brazilian Journal of
OTORHINOLARYNGOLOGY

www.bjorl.org

ORIGINAL ARTICLE

Sestamibi scan in renal parathyroidectomy: a worthwhile preoperative exam?☆

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Received 11 July 2020; accepted 19 October 2020
Available online 16 November 2020

KEYWORDS
Chronic kidney disease-mineral and bone disorder;
Parathyroidectomy;
Hyperparathyroidism secondary;
Technetium Tc 99m sestamibi

Abstract
Introduction: Surgical treatment of hyperparathyroidism related to chronic kidney disease is a real challenge for Brazilian public health care. High cost medications and long waiting lines to perform preoperative exams, especially technetium Tc 99m Sestamibi (MIBI) are some of the reasons. Despite the reality that the aid of localization exams are questionable in this scenario, doctors are too apprehensive in performing surgery without it.
Objective: The study aimed at evaluating the efficacy of surgery for renal hyperparathyroidism without preoperative MIBI.
Methods: A total of 114 patients were surgically treated. Total parathyroidectomy with auto-transplantation and subtotal parathyroidectomy were carried out without preoperative MIBI.
Results and conclusion: Among the 114 patients undergoing surgery, 37 had secondary hyperparathyroidism in dialysis replacement, and 77 patients had post-renal transplant persistent disease. We were successful in 107 cases with only 7 failures (93.8% of success rate). Among these failures, only one parathyroid gland was not found in 4 cases, 2 parathyroid glands were not found in 2 cases and in 1 patient the 4 glands were found but this patient remained hypercalcemic and a postoperative diagnosis of supernumerary parathyroid gland was made. Surgery for treatment of renal hyperparathyroidism proved to be an effective (93.8%) and reproductible procedure, even without MIBI.

☆ Peer Review under the responsibility of Associação Brasileira de Otorrinolaringologia e Cirurgia Cérvico-Facial.

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https://doi.org/10.1016/j.bjorl.2020.10.009

Introduction

Hyperparathyroidism (HPT) related to chronic kidney disease (CKD) results from parathyroid hormone (PTH) hypersecretion associated with progressive loss of renal function. Phosphorus retention, hypocalcemia, and reduced vitamin D synthesis stimulate parathyroid gland cell hyperplasia, which over time may become autonomous.[1,2]

As this autonomy condition increases morbidity, especially due to cardiovascular events, HPT related to CKD should be treated as soon as it is identified.[1,2]

Parathyroidectomy (PTX) is the surgical option for treatment of these patients, but it is reserved for cases of clinical failure or for cases of persistent hypercalcemia after successful renal transplantation.

However, the treatment reality of these patients in Brazil is far from ideal. Medications such as calcimimetics and modern vitamin D analogues (paricalcitol) were not available for use in public health care until 2018.[3]

In addition, 10% of the approximately 130,000 hemodialysis patients across the country have PTH values above 1000 pg/mL. This more severe HPT population has shown worse response to clinical treatment, making PTX their best option.[4,5]

Unfortunately, only a fraction of these patients undergo surgery, and it happens for many different reasons, the most important of which is the restricted access to preoperative localization exams, especially Technetium Tc 99m Sestamibi (MIBI).[5]

The assumption that localization exams could facilitate surgery by avoiding failures and potential reoperations due to their ability to identify ectopic or supernumerary glands is defended by some authors.[6]

In the literature, the efficiency of localization exams in patients with HPT related to CKD has been reported.[6–10] Our experience about this subject has also been published.[11,12]

The analysis of these studies indicates that localization exams are not essential for the success of PTX in this group of patients[9] and could even be considered secondary.[12] Nevertheless, physicians across the country seem too apprehensive in performing surgery without it.

The aim of this study is to verify the efficiency of PTX in patients with HPT related to CKD, who did not undergo MIBI as a preoperative exam.

Methods

The study retrospectively analyzed patients that underwent PTX between 2010 and 2016. We included all patients undergoing PTX for HPT related to CKD who did not undergo MIBI as a localization exam and who had at least 6 months of followup after surgery. A total of 114 patients were included in the cohort.

All surgeries were indicated based on recommendations of the Brazilian Society of Nephrology.[13] Localization exams included only neck ultrasound performed by several radiologists.

Table 1 Demographic data of the two cohort groups.

	HPTS	pTxHPT
Number of patients	37	77
PTH	2057,3	508,9
Age	44.5	50.8
Time of hemodialysis	8.33	5.81
Time of since kidney transplant	–	4.05

Note: Number of patients in absolute number; PTH in mean value (reference range 15–68.3 pg/dL); age in mean years; time of hemodialysis in mean years and time since kidney transplantation in mean years.

The procedures performed were total PTX with autotransplantation or subtotal PTX, according to the institutional standards.[12] Intraoperative parathyroid hormone (ioPTH) was collected, but due to the laboratory routine in our institution, its result was evaluated only retrospectively, not influencing the surgical decision.

Surgical success was considered when all criteria were met at least 4 intraoperative parathyroid glands identified during surgery, ioPTH decay greater than 70%[14] and patients becoming normocalcemic during followup.

Procedures were performed at 2 tertiary hospitals. All surgeries were performed by the same surgeon.

Institution review board approval number 638.873 and Plataforma Brazil approval number CAAE 30650514.4.0000.5505.

Reference range for laboratorial exams: ionic calcium (Cai) 1.00–1.35 mmoL/dL; PTH 15–68.3 pg/dL.

Results

Among the 114 patients who were included in the analysis, 37 were currently in hemodialysis at the time of surgery and will be called the secondary HPT (SHPT) group and 77 patients had a kidney transplantation and will be called the post-kidney transplantation HPT (pTxHPT) group. The other demographic data in both groups are presented in Table 1.

The number of parathyroid glands correctly identified by ultrasound was 0, 1, 2, 3 and 4 glands respectively in 34 (23.6%), 47 (32.6%), 37 (25.7%), 14 (9.7%) and 12 (8.3%) patients.

According to the established criteria, surgical success was obtained in 107 patients along with 7 failures, resulting in an initial surgical success rate of 93.8%.

In these 107 patients who obtained surgical success, 82 (76.6%) underwent total PTX with autotransplantation and 25 (23.3%) underwent subtotal PTX. The mean values of ioPTH and the 6 months of postoperative iCa and PTH of this successful group are shown in Table 2. The mean ioPTH decay was 82.6%.

The 7 (6.2%) cases of failure occurred due to: in 4 patients only 3 parathyroid glands were identified; in 2 patients only 2 parathyroid glands were identified; and in 1 case, 4 glands were identified and removed, but the patient remained hypercalcemic due to a supernumerary gland.

Table 2 Laboratorial data of the surgical success group.

Group	Number of patients	ioPTH	iCa (6 month)	PTH (6 months)
SHPT	35	86.31%	1.03	346
pTxHPT	72	81.07%	1.05	65.2

Note: Patients in absolute value, ioPTH mean decay; iCa mean values (reference range 1.00–1.35 mmoL/dL); PTH mean values (reference range 15–68.3 pg/dL).

Table 3 Laboratorial data of the surgical failure group.

Groups	Number of patients	ioPTH	iCa (6 month)	PTH (6 months)
SHPT	2	57.35%	1.25	704.9
pTxHPT	5	38.32%	1.41	118.87

Note: Patients in absolute value, ioPTH mean decay; iCa mean values (reference range 1.00–1.35 mmoL/dL); PTH mean values (reference range 15–68.3 pg/dL).

The mean values of ioPTH and the 6-months of postoperative iCa and PTH of this group are presented in Table 3.

Discussion

This study demonstrated that PTX performed as the treatment of patients suffering from HPT-related to CKD has a high surgical success rate of 93.8%, even when carried out without performing preoperative MIBI.

The importance of the localization exams in the primary HPT is indisputable, aiming at performing a focus surgical dissection. However, when facing SHPT or pTxHP, focus surgery is no longer an option and the importance of localization exams becomes questionable.

A systematic review by Magnabosco et al. containing 23 studies and 947 patients in which MIBI was performed reached a surgical success of 67.4% in renal HPT patients.[15] As all included studies had different surgical success criteria, a direct comparison between these rates is not possible even though it demonstrates that even without carrying out preoperative MIBI, PTX is an efficient procedure.

Our group has previously published studies that have shown how minimal is the aid of localization exams in surgery for renal HPT.[11,12,16] In one of them, in 518 consecutive surgeries there was a 97% rate of surgical localization of parathyroid glands, despite the fact that most localization exams have identified 2 or less glands.[12]

This poor diagnostic performance also applies to the ultrasound. At this study cohort, less than 20% of the exams correctly identified 3 or more glands, which is in line with our previous experience.[12] Despite that, we still acknowledge the importance of ultrasound to analyzing the thyroid gland for nodules and concomitant pathologies

Other authors have also pointed out the small help that localization exams confer to PTX in renal patients. Lai et al. in 2007 showed that MIBI correctly located only 36.6% of parathyroid glands[10] and Spence et al. in 2019 showed that 51% of MIBI were completely flawed; 40% had only partial success, leaving less than 9% at a high identification rate.[9]

Gasparri et al.,[8] in a similar study to ours, showed only 6.2% persistence in 187 patients operated without MIBI and ioPTH (similar result to this study). The same author observed 4.9% persistence in 209 patients when only ioPTH was performed and 0.1% persistence when both were performed.[8] However, statistical analysis showed that only ioPTH presented any difference and that MIBI alone was not able to change patient's persistence or relapse rates.

Nevertheless, we acknowledge that the correct identification of all glands is paramount for surgical treatment, and that ectopic parathyroid represent a major surgical challenge. It is also understandable that high-volume services with experienced surgeons can achieve higher successful surgical rates.

In this sense, there are authors such as Karipineni et al.[6] and Loftus et al.[7] that understand MIBI as an important tool in identifying these ectopias and they consider the localization exam mandatory even for the first surgery.

Even though some patients may benefit from the location of ectopic parathyroid glands, in general, the MIBI exam shows a minimal cost-benefit ratio.

Choosing not to routinely perform MIBI in these patients involves secondary gains. The first and most obvious is the reduction in the overall cost of treatment by the potential reduction of more than 90% of the exams, as they would be performed only in specific cases or in persistence or recurrence.

Another relevant aspect is the time saved in the definitive treatment. The public health care in Brazil has a huge restriction on the treatment of these patients. The last census carried out in the country pointed out that there are more than 13,000 patients waiting for surgery,[4] and that MIBI represents the main restrictive cause of access to PTX.[5]

The potential gain in time and the facilitated access to surgery due to the non-obligation in performing preoperative MIBI can bring incalculable advantages. Araujo et al. in 2017 showed that the cost of annual clinical treatment of these patients is R$ 27,712.95 against an annual surgery cost of only R$ 16,841.85.[3] Obviously, these clear surgical cost advantage happens only in severe HPT cases, the patients that really benefit from surgical treatment.

Beside all these advantages, a more efficient treatment can reduce the number of hospitalizations and improve clinical condition, especially by preventing complications secondary to HPT related to bone and mineral disorders such as improved blood pressure control, reduced anemia, enhanced nutritional status and quality of life.[17]

The high volume of this kind of surgery at our tertiary hospital may help mitigate the anxiety of performing PTX without MIBI. Nevertheless, the objective of this study is to show the plausibility and safety of performing the surgery despite the absence of MIBI, even in low volume centers. Our failures patients will maintain close clinical surveillance and in the face of a new surgical indication, localization exams, including a MIBI, must be performed.

Conclusion

Total or subtotal PTX is an effective and reproducible procedure even without preoperative MIBI. Localization exams play a more important role in persistence and recurrence cases being quite essential in reoperations. In the Brazilian

public health care system, the non-compulsory preoperative performance of MIBI can facilitate patients' access to surgical treatment, considerably reducing the long waiting list.

Funding

Name of the funding agency of the study: CAPES — Coordenação de Aperfeiçoamento de Pessoal de Nível Superior.

Conflict of interest

The authors declare no conflicts of interest

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