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Original Research

The Role of Bilateral Neck Exploration for Primary Hyperparathyroidism in the Minimally Invasive Parathyroidectomy Era

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Abstract

Objectives: In recent years, together with the contribution of new imaging methods, minimally invasive parathyroidectomy (MIP) has become the standard procedure in selected patients with the primary hyperparathyroidism (pHPT). However, some patients may still need bilateral neck exploration (BNE). In this study, we aimed to evaluate the factors associated with the necessity of BNE.

Methods: Data of the patients, operated by same single surgeon in between 2010 and 2019, were evaluated retrospectively. Patients were divided into two groups as MIP group (group 1) and BNE group (group 2). The risk factors associated with necessity of BNE were evaluated.

Results: Three hundred and forty-four patients (288 females and 56 males) were included in study. The mean age was 54.1±12.8. Pre-operative parathormone level (288 pg/mL vs. 190 pg/mL, p<0.001; respectively), compatible, inconsistent and negative imaging on scintigraphy (82.5% vs. 28.7%, 9.6% vs. 19.1, 7.9% vs. 52.25%, p<0.001; respectively), compatible, inconsistent and negative imaging in ultrasonography (USG) (72.9% vs. 20%, 7% vs. 19.1%, 20.1% vs 60.9%, p<0.001; respectively) in combination of USG and scintigraphy, two positive, single positive and negative imaging (72.5% vs. 11.3%, 25.8% vs. 55.7%, 1.7 vs. 33%, p<0.001; respectively), single adenoma, double adenoma, hyperplasia rates in pathology (96.1% vs. 79.1%, 3.1% vs. 12.2%, 0.9% vs. 8.7%, p<0.001; respectively), concomitant thyroidectomy (11.4% vs. 38.3%, p<0.001; respectively), diameter of the removed gland (2.03 vs. 1.58 cm, p<0.001; respectively), and volume of the removed gland (2.27 vs. 1.22 cm^3, p<0.001; respectively), were significantly different in group 1 compared to group 2. Low pre-operative parathormone, discordant pathological gland localization compared to pathological gland compatible with scintigraphy images (odds ratio [OR]: 3.690; p=0.027), negative scintigraphy images (OR: 9.174, p=0.000), and need for additional thyroidectomy (OR: 5.067); p=0.000) were determined as independent risk factors increasing the need for BNE in the multinomial logistic regression analysis. Long-term cure rates were similar (98.3% vs. 94.8%, p=0.079; respectively).

Conclusion: At present, BNE may be necessary in the surgical treatment of a significant proportion of patients with pHPT. According to our results, the possibility of BNE requirement is higher in patients with low PTH level compared to pre-operative high PTH values, in patients with discordant and negative scintigraphy compared to positive and compatible scintigraphy, and in patients who will undergo additional thyroidectomy. We think that BNE is not an alternative to MIP, but an effective option that is complementary to MIP to achieve optimal results in parathyroid surgery.

Keywords: Bilateral neck exploration, parathyroid adenoma, parathyroidectomy, primary hyperparathyroidism

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The primary hyperparathyroidism (pHPT) is the third most common endocrine disease after diabetes mellitus and thyroid diseases.[1] In addition, pHPT is the most common cause of hypercalcemia, affecting 0.25–0.66% of the population.[2] Surgery is the only curative treatment for pHPT. The first successful parathyroidectomy was performed by Felix Mandel with bilateral neck exploration (BNE) under local anesthesia, in Austria.[3] BNE has performed as a standard treatment for pHPT for long years since the first operation.[4] Since the pathology in most patients in pHPT is due to solitary adenoma, in the mid-1970s, removal of the parathyroid adenoma and unilateral neck exploration (UNE) including identification of the normal parathyroid gland on the same side was recommended as an alternative surgical strategy. In the first half of 1980, clinical studies demonstrated that UNE could be successfully applied in suitable patients.[5] After the use of ultrasound in the 1970s and parathyroid scintigraphy in the 1980s for parathyroid localization, imaging-guided UNEs were started to be used.[4,5] Intraoperative parathormone measurement was defined in 1988 to show the feasibility of resection of the pathological gland, and intraoperative quick parathormone measurement was reported in 1991. With the rapid developments in pre-operative parathyroid imaging methods and intraoperative PTH measurement, focused selective parathyroidectomy methods, in which only the enlarged gland is removed and the normal gland on the other side is not tried to be seen, have started to replace UNE.[4,5]

In the literature, synonymous terms such as focused parathyroidectomy or targeted parathyroidectomy are used instead of selective parathyroidectomy. All of these surgical procedures are defined as minimally invasive parathyroidectomy (MIP). In this study, the term MIP will be used for the selective parathyroidectomy group. After the millennium, MIP has become the favorite approach among surgeons.[6]

Although MIP is accepted as the standard surgical approach in selected patients with imaging positive, BNE may still be necessary in some cases. Although MIP is the first approach in selected patients in our center, BNE is applied when necessary. In this study, we aimed to evaluate the factors related to BNE requirement in our series.

Methods

After obtaining approval from the Local Ethics Committee (Approval Number:2971, Date: September 8, 2020), the data of the patients who were operated by a single surgeon between 2010 and 2019 and whose pre-operative and post-operative data and at least 6 months follow-up were accessed were evaluated retrospectively. Data were collected in compliance with Helsinki Declaration. The patients who did not have adequate follow-up, the patients who were operated due to secondary or tertiary hyperparathyroidism, and patients with persistent/recurrent pHPT who referred from other centers were excluded from the study. The patients who were operated in our center for pHPT and have recurrent/persistent disease after this operation were included in this study to evaluate cure rates in these operations.

The patients were divided into two groups as Group 1 who underwent MIP and UNE, and Group 2, who underwent BNE. Patients who started the operation with MIP or UNE and converted to BNE were included in Group 2. Focal exploration or UNE was performed with a small open incision of 3 cm from the lateral neck in the patients who underwent MIP. Rarely, UNE was performed by entering the midline with a Kocher incision. In the case of no pathologic gland was found in suspected side or two enlarged gland were found in patients who underwent MIP or UNE, operation was converted to BNE. In the BNE group, both sides of the neck were explored with a standard Kocher incision. In the presence of concomitant thyroid disease, if parathyroid disease and thyroid disease are at the same localization the patients were included in Group 1. If parathyroid and thyroid disease is at the different localizations or bilateral disease, the patients were included in Group 2. Intraoperatively, normal localization areas of the parathyroids and, if necessary, ectopic localization areas were explored. Enlarged parathyroid or parathyroids were removed. Normal parathyroids were preserved. If four parathyroids were enlarged, subtotal parathyroidectomy was performed. In some patients with asymmetric hyperplasia, biopsy was taken from the tip of the parathyroid, which was thought to be normal. Frozen examination was performed when the excised lesion was suspicious for parathyroid. Enlarged parathyroid gland was confirmed by frozen or paraffin section examination. In single imaging positive patients, MIP was performed with intraoperative PTH measurement. Although blood was drawn for intraoperative PTH measurement in patients for whom the two imaging methods were compatible, the results were not evaluated intraoperatively, and the surgery was terminated without waiting for the PTH results. In patients with two imaging results positive, intraoperative PTH values were evaluated in the postoperative period. Compatibility of imaging methods was evaluated by comparing with intraoperative findings. The neck was divided into four quadrants as upper and lower right, lower and upper left. The lesion or lesions described in ultrasonography (USG) and scintigraphy were defined as correct localization if they were detected in the same quadrant during the operation and incorrect localization if they were inconsistent. Although a single lesion was described in the pre-operative imaging, if multigland disease was detected, it was defined as false localization. If both imaging modalities were positive for the same localization, double imaging was defined as positive, and if one was positive, single imaging was defined as positive. Assuming parathyroid adenoma as an ellipsoid shape, the adenoma dimensions (cm^3) in the pathology reports were calculated with the formula Volume(cm^3)=πxR1xR2xR3/6.

Surgical cure was defined as maintaining normocalcemia at 6 months postoperatively.[7] Patients in whom hypercalcemia persisted after the first operation or in whom hypercalcemia emerged within 6 months were defined as persistent. To compare the success of the first operation, the surgical cure rates after the first operation were evaluated. In some of the patients who persisted after the first operation, surgical cure was achieved by applying secondary interventions with the contribution of imaging methods performed after the first operation, and it was defined as the surgical cure rate after secondary operations. The final evaluation cure rate defines the cure rate based on the patients' last evaluated long-term results.

Pre-operative biochemical characteristics of the groups, parathyroid pathologies, diameter and volume of the pathological gland, surgery rates, persistence, and recurrent disease rates were compared.

Statistical Analysis

Data were evaluated in the IBM SPSS Statistics V25 software (IBM, Armonk, NY, USA). Data are presented as mean (Standard Deviation). Appropriate non-parametric tests were selected by testing the normal distribution of the data. Pearson Chi-square and Fisher exact test were used to compare categorically independent groups. Non-parametric comparisons were made with Mann-Whitney U-test.

To evaluate the independent factors affecting the necessity of BNE, the formula consisting of pre-operative PTH, pathological parathyroid gland diameter, scintigraphy, USG findings, parathyroid pathologies, and additional thyroidectomy were evaluated with binary logistic regression analysis. P<0.05 values were accepted statistically significant.

Results

Of the 344 patients (288F, 56M) with a mean age of 54.1±12.8 years, 236 of them planned an operation with MIP or UNE. In 229 patients, the intervention was completed with the MIP or UNE method. These patients were evaluated in Group 1. Group 2 was consisted of 115 patients. Of these patients, 108 patients were operated on with a BNE plan, and seven patients were converted from MIP or UNE to BNE. The conversion rate from MIP or UNE to BNE was 2.97%. Throughout the series, the BNE rate at the first operation was 33.4%. There was no difference between the two groups in terms of age and gender. Pre-operative Ca, P, Mg, ALP (Alkaline phosphatase), and creatinine levels were similar. Pre-operative PTH levels were higher in Group 1 compared to Group 2 (287.98±345.8 pg/mL vs. 189.9±269.6 pg/mL, p<0.001; respectively), and pre-operative 25 (OH)vitD3 was lower (17.6±12.1 ng/ml vs. 22.3±14.3 ng/ml, p=0.013; respectively) (Table 1).

Pre-operative scintigraphy and USG findings were different between the two groups (p<0.001 for both) (Table 1). The concordance rate of scintigraphic findings with intraoperative findings was higher in Group 1 than in Group 2 (82.5% vs. 28.7%, respectively); discordance rate (9.6% vs. 19.1%, respectively), and negativity rate (7.9% vs. 52.2%, respectively) were lower in Group 1 than in Group 2 (p<0.001) (Table 1). The concordance rate of USG findings with intraoperative findings was higher in Group 1 than in Group 2 (72.9% vs. 20%, respectively); discordance rate (7% vs. 19.1%, respectively); and negativity rate (20.1% vs. 60.9%, respectively) were lower in Group 1 than in Group 2 (p<0.001) (Table 1). In Group 1, compared to Group 2, the rate of both USG and scintigraphy positivity for pathological gland or glands was higher (72.5% vs. 11.3%, respectively); single imaging positivity (25.8% vs. 55.7%, respectively) and two negative imaging negativity (1.7% vs. 33%, respectively) rates were lower (p<0.001) (Table 1). The rate of additional thyroidectomy to parathyroidectomy was higher in Group 2 (38.3% vs. 11.3%, p<0.001) (Table 1).

Pathological gland characteristics were different between the two groups. Pathological gland diameter (2.03±0.99 cm vs. 1.58±0.83 cm, p<0.001, respectively) and pathological gland volume (2.27±4.48 cm^3 vs 1.22±2.62 cm^3, p<0.001, respectively) were higher in Group 1 compared to Group 2. Single adenoma rate was higher in Group 1 compared to Group 2 (96.1% vs. 79.1%); double adenoma (3.1% vs. 12.2%) and hyperplasia (0.9% vs. 8.7%, respectively) rates were lower (p<0.001) (Table 1).

Follow-up times of Groups 1 and 2 were similar (22.29±18.03/month vs. 23.1±17.4/month, respectively; p=0.543). Cure rates after first operation (93.9% vs. 94.8%, p=0.738) and long-term cure rates (98.3 vs. 94.8%, respectively, p=0.079) were similar. The surgical cure rate at the 6th month after the second operation was higher in Group 1 than Group 2 in patients who underwent secondary operation due to persistence after the first operation (99.1% vs. 94.8%, respectively, p=0.039) (Table 1).

In the multinominal logistic regression analysis, low pre-operative parathormone, negative, or inconsistent scin-

Table 1. Comparison of the characteristics of patients with pHPT who underwent MIP or UNE (group 1) and BNE (group 2)

	Total (%)	Minimal invasive parathyroidectomy (n=115) (%)	Bilateral exploration (n=229) (%)	p
Age	54.1±12.78 (17–88)	53.8±12.7 (17–88)	54.7±12.9 (21–85)	0.521
Gender				
Female	288 (83.7)	192 (83.8)	96 (83.5)	0.931
Male	56 (16.3)	37 (16.2)	19 (16.5)	
Pre-operative PTH (pg/mL) (mean±SD) (min–max)	255.5±325.5 (38.6–3308)	287.98±345.8 (53–3308)	189.9±269.6 (38.6–2610)	**<0.001**
Pre-operative Ca (mg/dL) (mean±SD) (min-max)	11.2±0.9 (8.6–17)	11.3±0.9 (9.27–17)	11.06±0.8 (8.59–12.9)	0.193
Pre-operative Mg mg/dL) (mean±SD) (min-max)	1.96±0.23 (1.05–2.7)	1.97±0.23 (1.05–2.7)	1.95±0.22 (1.24–2.4)	0.479
Pre-operative P (mg/dL) (mean±SD) (min-max)	2.66±0.55 (1.1–5.4)	2.63±0.56 (1.1–5.4)	2.73±0.54 (1.2–4.2)	0.139
Pre-operative ALP (U/L) (mean±SD) (min-max)	118.6±161.8 (26.3–2555)	126.9±193.7 (26.3–2555)	101.2±48.7 (29–426)	0.935
Pre-operative Creatinine (mg/dL) (mean±SD) (min-max)	0.76±0.26 (0.36–2.2)	0.76±0.25 (0.38–2.2)	0.76±0.28 (0.36–2.03)	0.467
Pre-operative 25 (OH) vitamin D3 ng/ml (mean±SD) (min-max)	19.1±12.9 (2–84)	17.6±12.1 (2–84)	22.3±14.3 (2–68)	**0.013**
Scintigraphy findings				
Correct	222 (64.5)	189 (82.5)	33 (28.7)	**<0.001**
Incorrect	44 (12.8)	22 (9.6)	22 (19.1)	
Negative	78 (22.7)	18 (7.9)	60 (52.2)	
US findings				
Correct	190 (55.2)	167 (72.9)	23 (20.0)	**<0.001**
Incorrect	38 (11.0)	16 (7.0)	22 (19.1)	
Negative	116(33.7)	46 (20.1)	70 (60.9)	
Imaging findings				
Double positive	179 (52.0)	166 (72.5)	13 (11.3)	**<0.001**
Single positive	123 (35.8)	59 (25.8)	64 (55.7)	
Negative	42 (12.2)	4 (1.7)	38 (33.0)	
Maximum diameter of excised parathyroid gland (cm)	1.88±0.97 (0.5–6.5)	2.03±0.99 (0.7–6.5)	1.58±0.83 (0.5–5)	**<0.001**
Volume of the excised parathyroid gland (cm^3)	1.94±4.01 (0.03–33.8)	2.27±4.48 (0.03–33.8)	1.22±2.62 (0.04–20.9)	**<0.001**
Pathology result				
Single adenoma	311 (90.4)	220 (96.1)	91 (79.1)	**<0.001**
Double adenoma	21 (6.1)	7 (3.1)	14 (12.2)	
Hyperplasia	12 (3.5)	2 (0.9)	10 (8.7)	
Follow-up duration (months)	22.6±17.8 (2.5–120)	22.29±18.03 (6–120)	23.1±17.4 (2.5–96)	0.543
Concomitant thyroidectomy				
–	274 (79.7)	203 (88.6)	71 (61.7)	**<0.001**
+	70 (20.3)	26 (11.4)	44 (38.3)	
Cure rates in first operation				
Cured	324 (94.2)	215 (93.9)	109 (94.8)	0.738
Persistant	20 (5.8)	14 (6.1)	6 (5.2)	
Cure rates after second operation				
Cured	336 (97.7)	227 (99.1)	109 (94.8)	**0.039**
Persistent	5 (1.5)	1 (0.4)	4 (3.5)	
Recurrent	3 (0.9)	1 (0.4)	2 (1.7)	
Cure rates at the last evaluation				
Cured	334 (97.1)	225 (98.3)	109 (94.8)	0.079
Persistent	5 (1.5)	1 (0.4)	4 (3.5)	
Recurrent	5 (1.5)	3 (1.3)	2 (1.7)	

SD: Standard deviation, PTH: parathormone, Mg: Magnesium, Ca: Calcium, P: Phosporus, ALP: Alkaline Phosphatase, US: Ultrasonography

Table 2. Multinomial logistic regression analysis for factors affecting the requirement for bilateral neck exploration

	Odds ratio	p
Pre-operative PTH levels	1.001 (1.000–1.003)	0.048
Volume of excised parathyroid gland	0.31 (0.546–1.266)	0.389
Scintigraphy		
Concordant	1 (reference)	
Discordant	3.690 (1.149–9.880)	**0.027**
Negative	9.174 (2.702–31.250)	**0.000**
Ultrasonography		
Concordant	1 (reference)	
Discordant	2.400 (0.083–1.010)	0.202
Negative	3.460 (0.990–12.048)	0.052
Pathology		
Single Adenoma	1 (reference)	
Double adenoma	4.486 (80.153–121.209)	0.354
Hyperplasia	18.700 (0.759–460.975)	0.073
Concomitant thyroidectomy	1 (reference)	**0.000**
	5.067 (2.142–11.985)	

PTH: Parathormone

tigraphy result with the pathological gland (false positive), and the need for thyroidectomy was determined as risk factors that increased the requirement for BNE. According to the compatibility of the scintigraphy with the pathological gland, the probability of the necessity of BNE is approximately 3.4 times higher when it is inconsistent, 9.2 times higher when it is negative, and approximately 5.1 times higher when additional thyroidectomy is required (Table 2). In the ROC curve analysis performed to determine the cutoff value for the pre-operative PTH value, the AUC (area under the curve) value was 0.369, and an effective cutoff value could not be determined.

Discussion

pHPT pathology is due to single adenoma in 80–85% of patients, multigland hyperplasia in 10–15%, and parathyroid carcinoma in <1% of patients.[8] Pathological parathyroid gland or glands can be localized with pre-operative imaging methods in 80–90% of pHPT patients.[9] Today, MIP is accepted as the ideal approach in selected patients with the contribution of these pathological and radiological evidences and intraoperative PTH. However, BNE may still be needed for the curative treatment of pHPT in some patients. In our study, low pre-operative parathormone, negative, or inconsisent scintigraphy result and the need for additional thyroidectomy was determined as independent risk factors that increased the requirement for BNE.

The surgical cure rates of Group 1 and Group 2 were similar after first surgery (93.9% vs. 94.8, p=0.738, respectively). After the evaluation of persistent patients after the first surgery with imaging methods, the surgical cure rate increased to 99.1% in Group 1 with secondary surgeries, the surgical cure rate did not change in Group 2 (94.8%), and a higher surgical cure rate was achieved in Group 1 (p=0.039). Due to there is no additional contribution of post-operative imaging methods in BNE, no additional intervention was applied in BNE group. The contribution of intraoperative PTH measurement in patients with two positive imaging results is still debatable in the literature. In our clinic, intraoperative PTH results were not evaluated in the operation in patients with positive and concordant two imaging studies. According to the results of our last study, if intraoperative PTH had been evaluated in these patients during the operation, the cure rate in the first operation could have been increased by approximately 4.3% by expanding the exploration in persistent patients.[10] The long-term cure rates of Groups 1 and 2 were similar due to recurrences during follow-up in Group 1 (98.3% vs. 94.8%, respectively, p=0.079). The BNE rate in our study was 33.4%, which was similar to the 26.9–40% BNE rates reported in other large series.[11–14]

Kiernan et al.[13] reported that the rate of BNE was 40% and the conversion rate from MIP was 15% in the evaluation of the data of 5597 patients by the collaborative endocrine surgery quality improvement program between 2014 and 2017. The authors stated that this can be explained by the increased rate of patrathyroidectomy in patients with mild, asymptomatic and non-localized pHPT, where the probability of multigland disease is higher, and the lower BNE application threshold compared to intraoperative findings in high-volume surgeons.

Today, pre-operative imaging methods are routinely applied in patients with pHPT who have surgical indications, and first-line imaging methods are USG and scintigraphic modalities. USG and scintigraphy are combined in many centers like ours.[13,15,16] Pathological gland or glands cannot be localized by non-invasive imaging methods in 12–18% of patients.[17] In our study, the rates of discordant and negative imaging were 12.8%, 22.7% in scintigraphy, and 11% and 33.7% in USG, respectively, and the two imaging modalities being negative was 12.2%. In Group 2 compared to Group 1, discordant and negative USG (19.1% vs. 7%, 60.9% vs. 20.1%, p<0.001) and/or scintigraphy rates (19.1% vs. 9.6%, 52.2% vs. 7.9, respectively) %, p<0.001), both imaging negatives (33% vs. 1.7%, p<0.001) were significantly higher. The necessity of BNE compared to UNE or MIP increases approximately 4-fold in discordant scintigraphy findings about pathological gland and 9.2-fold in negative scintigraphy findings about pathological gland.

Many factors can affect the sensitivity of scintigraphy. Symptomatic patient, pre-operative higher Ca, pre-operative higher PTH value, vitamin D deficiency, higher oxyphil cell ratio in adenoma, inferior parathyroid adenoma, suppression of thyroid gland, and stimulation of parathyroid glands are factors that can increase the sensitivity of scintigraphy.[9,16] Multiple gland disease, small parathyroid adenoma, and multinodular goiter are important factors that reduce the sensitivity of parathyroid scintigraphy.[18] In this study, the negative scintigraphy rate was high in the BNE group, as well as lower PTH level, higher 25-OH VitD3 level, lower parathyroid adenoma volume, higher rates of multiple gland disease, increased rate of thyroidectomy in addition to parathyroidectomy due to concomitant thyroid disease, and these features are factors that can reduce the sensitivity of scintigraphy. Although lower pre-operative PTH level is an independent risk factor for BNE, an effective cutoff value for pre-operative PTH could not be determined (AUC: 0.369). A significant correlation was found by Schachter et al.[19] between the pre-operative PTH level and the uptake rate in scintigraphy (r=0.41; p=0.04). In most studies, a higher rate of positive scintigraphy was found in patients with higher PTH values.[18] Siegel et al.[20] found a higher PTH level in patients with true-positive scintigraphy (367 pg/mL) than in patients with false-positive and false-negative scintigraphy (148 pg/mL) and found a correlation between PTH value and scintigraphy sensitivity. However, they reported that the overlap of PTH values in patients with positive and negative scintigraphy did not allow them to confidently preselect candidates for pre-operative scintigraphic screening.

Although USG findings in the present study were significantly different between the two groups in pairwise comparison, in the multivariance analysis, USG findings were not an independent risk factor. Negative or discordant USG findings were significantly higher in the BNE group. Inexperience of the radiologist, multinodular goiter, multiple gland disease, lesions located posterior to the thyroid or intrathyroidal lesions, small adenomas, and obesity are the factors that reduce the sensitivity of USG.[9,18] As discussed in the scintigraphic characteristics, especially in the BNE group, the small adenoma volume, multiple gland disease, and higher rates of additional thyroid disease were suggested as important factors in negative and inconsistent USG imaging.

In our center, especially negative imaging was one of the important factors in the choice of BNE. However, with the use of intraoperative PTH, it has been reported that UNE with intraoperative PTH can be performed in 28–36% of patients with negative or inconsistent imaging.[12,21,22] It has been reported by Nehs et al. that intraoperative PTH and UNE application may increase the operation time in patients with imaging inconsistency compared to BNE, especially due to waiting for the PTH result. The authors emphasized that BNE is still an excellent option as the first surgical intervention, especially in patients with discordant imaging.[18,23]

In our study, the necessity of concomitant thyroidectomy, which is one of the independent risk factors for BNE, increases the need for BNE approximately 5-fold. The rate of concomitant thyroidectomy in Group 2 was higher than in Group 1 (38.3% vs. 11.4%, respectively, p<0.001). Although concomitant thyroid disease has been reported in a wide range of 12–67% in patients with pHPT in the literature, the relationship between pHPT and thyroid disease is still not understood. Thyroid disease should be evaluated in these patients, the indication for surgery is the same as in isolated thyroid diseases. Thyroidectomy should be performed simultaneously with parathyroidectomy when necessary.[7] Although the intervention to be applied to the thyroid varies depending on whether the thyroid disease is unilateral or bilateral, BNE is usually required, especially in endemic regions like ours.[24] Norman and Politz evaluated the pre-operative and intraoperative factors that may affect the surgeon's application of UNE or BNE in a prospective study of 3000 patients. Pre-operative factors (with decreasing frequency) with positive predictive value in choosing UNE were found to be positive sestamibi, previous parathyroid/thyroid surgery, age over 80 years, use of anticoagulation drugs, morbid obesity, and presence of large goiter (all p<0.001). Pre-operative parameters with positive predictive value (with decreasing frequency) for choosing BNE were negative sestamibi, multiple foci in sestamibi, contralateral thyroid disease, family history, lithium use, radiation history, MEN, age younger than 20 years, and pregnancy (all p<0.001). Intraoperative parameters affecting conversion from UNE to BNE were false-positive sestamibi, insufficient decrease of hormone levels, abnormal ipsilateral gland, and identified contralateral thyroid pathology (all p<0.001). Gender, calcium level and/or parathyroid hormone elevation, and age between 20 and 80 years of age were not significant predictive factors. Surgical cure rates for UNE and BNE (BNE: 99.9% and UNE: 99.0%; p=0.057) were similar.[25]

Since MIP is generally applied in parathyroid surgery nowadays, this may cause younger surgical residents to see less BNE during their training. Laparoscopic cholecystectomy has become the gold standard in the treatment of cholelithiasis, causing surgeons to engage less in open cholecystectomy operations during their training and have more limited experience in this regard.[26,27] The surgeon dealing with parathyroid surgery should have sufficient experience in both MIP and BNE. It should not be forgotten that BNE is the cornerstone of parathyroid surgery in parathyroid surgery training. Otherwise, the negativity experienced in open cholecystectomy will also be valid for parathyroid surgery.

Conclusion

As a conclusion, BNE may still be necessary in the surgical treatment of a significant proportion of patients with pHPT today. According to our results, the probability of BNE requirement is higher in patients who will undergo concomitant thyroidectomy (OR: 5.067), in patients with low PTH level compared to pre-operative high PTH values, inconsistent (OR: 3.269), and negative scintigraphy findings (OR: 9.174) compared to positive and compatible scintigraphy findings. We think that BNE is not an alternative to MIP, but an effective option that is complementary to MIP to achieve optimal results in parathyroid surgery.

Disclosures

Ethics Committee Approval: The study was approved by the Sisli Hamidiye Etfal Research and Training Hospital Local Ethics Committee (date: 08/09/2020, no: 2971).

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