Predictors factors for post-thyroidectomy hypocalcaemia

Fatores preditores para hipocalcemia pós-tireoidectomia

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A B S T R A C T

Objective: To evaluate the incidence and predictors of post-thyroidectomy definitive hypocalcemia and hypoparathyroidism. **Methods**: We assessed ionic calcium preoperatively and postoperatively (first, second and 30th day) in 333 patients undergoing thyroidectomy. In those presenting hypocalcemia, measurements were also made 90 and 180 days after surgery, when parathormone was also dosed. Patients were grouped according to the presence or absence of hypocalcemia and evaluated according to age, gender, thyroid function, thyroid volume, number of parathyroid glands identified and need to parathyroid reimplantation, type of operation, operative time, and histopathological diagnosis. **Results**: The incidence of temporary hypocalcemia was 40.8% (136 patients), and of definitive hypoparathyroidism 4.2% (14 patients). Reoperation or total thyroidectomy, neck dissection, hyperthyroidism, operative time and age above 50 years were factors related to higher incidence of hypocalcemia and definitive hypoparathyroidism ($p < 0.05$). **Conclusion**: predictors of postoperative hypocalcemia included age (> 50 years), total thyroidectomy, reoperation, neck dissection and operative time. The predictors of post-thyroidectomy definitive hypoparathyroidism included type of operation, histological diagnosis and hyperthyroidism.

Key words: Thyroidectomy. Incidence. Postoperative complications. Hypocalcemia. Hypoparathyroidism.

INTRODUCTION

Thyroidectomies have low rates of complications and acceptable sequelae that, however, can be uncomfortable and disabling[1].

The literature review shows considerable variation in the incidence of post-thyroidectomy hypocalcaemia[2-4], with the majority of cases secondary to temporary hypoparathyroidism, with recovery in three weeks to six months. However, 0% to 33% of patients will experience permanent hypoparathyroidism[3].

Many factors may be involved in the increased incidence of hypocalcemia and hypoparathyroidism after thyroidectomy, including total thyroidectomy, reoperation, neck dissection, preoperative hyperthyroidism and surgical procedure performed by inexperienced surgeons[5,6]. However, not all patients with these factors will develop such complication, probably because in order for it to happen, concur other causes, whose identification seems fundamental to its prevention.

This study aims to evaluate the incidence of post-thyroidectomy hypocalcaemia, its evolution in six months and the factors involved with hypocalcemia (clinical and laboratorial) and with definitive hypoparathyroidism.

METHODS

Patients were prospectively included in the study and in accordance with the standards of the World Health Organization concerning human research, and after signing the Informed Consent. The study design was approved by the Research Ethics Committee (COEP) of UFMG, with registry ETIC 368/04.

All patients included in the study had formal surgical indication for thyroidectomy and were operated on by surgeons of the Group of Head and Neck Surgery of the Alfa Institute of Gastroenterology (CCP-IAG) in the UFMG Clinics Hospital.

Patients with incomplete preoperative assessment, those who did not return to postoperative visits on pre-established dates and those with preoperative hypocalcemia or hyperparathyroidism proven by measurement of ionized calcium (Ca) and parathyroid hormone (PTH) were excluded .

Preoperatively, we measured ionized calcium, thyroid stimulating hormone (TSH), thyroxine (FT4) and had a thyroid ultrasonography (US) performed in all patients, and PTH in those with ionized calcium levels above the normal range.

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After thyroidectomy, patients underwent Ca measurement in the first and second days after surgery, collected at six o'clock, and at 300 days. Calcium was also measures at 90 and 180 days after surgery in those who had postoperative hypocalcemia, and also PTH I those who with sustained hypocalcemia requiring calcium replacement.

Postoperatively, only those patients who developed clinical manifestations of hypocalcemia, confirmed by laboratory tests, had calcium carbonate administered orally at a dose of 2.0 grams every 6 hours, adjusted according to clinical and laboratory findings. To patients without clinical improvement, even at high doses of this drug, vitamin D was also administered orally. Those with severe symptoms and plasma concentration of ionized calcium below 1.00 mmol/l received, until the disappearance of clinical manifestations, intravenous calcium gluconate associated with the previous treatment regimen.

Patients were grouped according to the presence or absence of clinical and laboratory hypocalcemia, and evaluated according to: 1) age and gender; 2) preoperative thyroid function assessed by measurement of TSH and free T4, irrespective of the use of thyroid hormone or antithyroid drugs (patients with subclinical hypothyroidism with TSH values above the normal range and normal free T4 were considered hypothyroid and those with subclinical hyperthyroidism with TSH values below normal and normal free T4 were considered hyperthyroid); 3) preoperative thyroid volume in cm^3 measured in U.S.; 4) number of parathyroid glands identified intraoperatively and the need to reimplant them; 5) type of operation; 6) operative time in minutes; 7) histological diagnosis.

Transient hypocalcemia was considered the drop in blood calcium levels below the normal range (reference value: 1.12 to 1.32 mmol/l) and lasting up to six months. Hypocalcemia was considered to be laboratorial when patients remained asymptomatic, and symptomatic, in the presence of symptoms caused by the drop in calcium levels.

Definitive hypoparathyroidism was defined as persistent hypocalcemia for more than six months of operation, requiring treatment with calcium, and PTH levels below the reference value (10 to 65pg/ml).

The operations were defined as follows: 1) partial thyroidectomy (PT): lobectomy + isthmectomy; 2) subtotal thyroidectomy (ST): lobectomy + isthmectomy + contralateral partial lobectomy; 3) total thyroidectomy (TT); 4) total thyroidectomy + neck dissection (TT + ND), when at least the recurrent chain, uni or bilaterally, was dissected; 5) reoperation: completion thyroidectomy in patients undergoing previous partial operation, held 30 days after the first operation and the operated region reassessed; 6) totalization (TTL): completion of thyroidectomy in patients submitted to previous PT in whom the operated side had not been assessed.

We used the nonparametric chi-square test of independence for qualitative variables of greatest interest to this study and others that were categorized as needed. The use of Yates correction was admitted to compare proportions in 2x2 tables.

For quantitative variables, we used the Student t test for independent samples to compare groups. The significance level adopted was of 5%.

RESULTS

We studied 333 patients of both genders and of unspecified age who underwent thyroidectomy. Of the 333 patients, 29 (8.7%) were male and 304 (91.3%) female. Ages ranged between eight and 88 years, mean 45 ± 15 years and a median of 46 years; 303 patients (91%) were euthyroid, nine (2.7%) had hypothyroidism and 21 (6.3%) were hyperthyroid.

The mean preoperative calcium was 1.24 ± 0.07 mmol / l. The thyroid volume averaged 47.23 ± 82.52 cm^3 and median of 25cm^3.

Table 1 shows the types of operations performed, their frequencies and the complication rate of each. Table 2 shows the frequency of histological types found, as well as the complication rate in each.

The incidence of temporary hypocalcemia was 40.8% (136 patients), and of permanent hypoparathyroidism, 4.2% (14 patients).

No significant difference was observed in relation to gender or gland volume, considering the incidence of postoperative hypocalcemia ($p = 0.946$ and $p = 0.475$), the presence of symptoms ($p = 0.948$ and $p = 0.648$) and definitive hypoparathyroidism ($p = 0.724$ and $p = 0.723$).

There were no significant differences in thyroid function when compared with the incidence of postoperative hypocalcemia ($p = 0.653$), nor with the presence of symptoms ($p = 0.212$). However, patients with hyperthyroidism had significantly higher incidence of permanent hypoparathyroidism than the euthyroid ones ($p = 0.002$).

Regarding age, by distributing patients into two groups – Group 1 – over 50 years, and Group 2 – 50 years or less – we observed that in the first group the mean Ca on the first (1.12 ± 0.10 mmol / l) and the second (1.14 ± 0.12 mmol / L) postoperative days (POD) were lower than those of the second group (1.16 ± 0.12 mmol / l in the first POD and 1.17 ± 0.09 mmol / l in the second POD), these differences being statistically significant ($p = 0.001$ on 1st POD and $p = 0.007$ in the 2nd POD) (Figure 1).

The parathyroid glands were identified in 293 (88%) operations and not identified in 40 (12%) thyroidectomies. Considering only cases where both sides were manipulated in the same operative time, ie TT + ND or TT alone. no significant difference was observed in relation to hypocalcemia ($p = 0.441$ and $p = 0.222$), presence of symptoms ($p = 0.481$ and $p = 0.445$) and

Table 1 - Types of operation and incidence of clinical and laboratorial hypocalcemia and definitive hypoparathyroidism.

Type of Operation	Frequency (%)		Laboratorial Hypocalcemia		Clinical Hypocalcemia		Permanet Hypoparathyroidism	
TT	142	(42.7%)	85	(59.9%)	32	(22.5%)	11	(7.8%)
TP	127	(38.1%)	19	(15.0%)	1	(0.8%)	0	(0.0%)
TTL	25	(7.5%)	8	(32.0%)	3	(12.0%)	1	(4.0%)
TT+EC	18	(5.4%)	14	(77.8%)	9	(50.0%)	1	(5.6%)
ST	17	(5.1%)	6	(35.3%)	1	(5.9%)	0	(0.0%)
Reop	4	(1.2%)	4	(100.0%)	1	(25.0%)	1	(25.0%)
TOTAL	333		136		47		14	

Table 2 - Histologic Types and incidence of clinical and laboratorial hypocalcemia and definitive hypoparathyroidism.

Histologic Types	Frequency (%)		Laboratorial Hypocalcemia		Clinical Hypocalcemia		Permanet Hypoparathyroidism	
Colloid goiters (BC)	180	(54.1%)	64	(35.6%)	11	(6.1%)	2	(1.1%)
Papillary carcinoma (PC)	68	(20.4%)	40	(58.8%)	20	(29.4%)	6	(8.8%)
Follicular adenoma (FA)	41	(12.3%)	11	(26.8%)	2	(4.9%)	0	(0.0%)
Basedow-Graves disease (GD)	19	(5.7%)	10	(52.6%)	7	(36.8%)	4	(21.1%)
Thyroiditis (Tir)	15	(4.5%)	6	(40.0%)	4	(26.7%)	1	(6.7%)
Follicular carcinoma (FC)	5	(1.5%)	1	(20.0%)	0	(0.0%)	0	(0.0%)
Medullary carcinoma (MC)	5	(1.5%)	4	(80.0%)	3	(60.0%)	1	(20.0%)
TOTAL	333		136		47		14	

definitive hypoparathyroidism (p = 0.339 and p = 0.275), regardless of the number of parathyroid glands identified.

Forty (12%) parathyroid glands were reimplanted, but there was no significant relationship between the need for reimplantation and postoperative hypocalcemia (p = 0.090), presence of symptoms (p = 0.687) and definitive hypoparathyroidism (p = 0.986).

Mean operative time was 126 ±51 minutes, being 119.49 ± 51.40 minutes for patients without hypocalcemia and 137.29 ± 48.81 minutes for hypocalcemic ones (p = 0.006). The longer the operative, the lowest the ionized calcium in the first (r = -13.1%) and second (r = -25.7%) PODs.

Considering all patients, there was a significantly higher incidence of hypocalcemia (p = 0.001) and presence of symptoms (p = 0.000) in those undergoing neck dissection, no difference being found in relation to definitive hypoparathyroidism (p = 0.272). When considering only patients who underwent TT (with or without neck dissection), those who underwent neck dissection had significantly higher incidence of symptoms of hypocalcemia (p = 0.012) when compared to those not dissected. There was, however, no differences regarding laboratory hypocalcemia (p = 0.142) and definitive hypoparathyroidism (p = 0.606).

Considering the extent of the operation, by using the ANOVA we found lower rates of hypocalcemia in the comparison of partial versus total thyroidectomy, total thyroidectomy + neck dissection, reoperation (p = 0.000), subtotal thyroidectomy (p = 0.038) , totalization (p = 0.042), total thyroidectomy versus totalozation (0.010), subtotal versus total thyroidectomy + neck dissection, thyroidectomy + neck dissection versus totalization (p = 0.002), and reoperation versus totalization (p = 0.009).

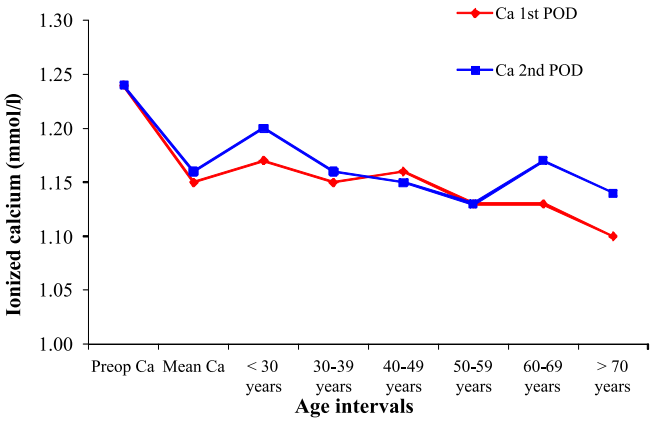
Symptoms of hypocalcemia were less frequent in the comparison between groups PT and TT (p = 0.007), TT + ND (p = 0.000) and TTL (p = 0.030).

We also found a lower rate of permanent hypoparathyroidism between PT x TT and Reop (p = 0.000), TT + ND (p = 0.008) and TTL (p = 0.030), and ST x Reop (p = 0.04).

Considering histological types, the ANOVA test showed lower rates of hypocalcemia when comparing colloid goiter versus papillary carcinoma (p = 0.001) and medullary carcinoma (p = 0.045); the same happened with follicular adenoma versus papillary carcinoma (p = 0.001) and medullary carcinoma (p = 0.016).

Symptoms of hypocalcemia were less frequent in colloid goiters when comparing to Basedow-Graves disease, papillary carcinoma, medullary carcinoma (p = 0.000) and thyroiditis (p = 0.003); when comparing follicular adenoma to medullary carcinoma (p = 0.000), Basedow-Graves disease (p = 0.001), thyroiditis (p = 0.0019) and papillary carcinoma (p = 0.002), and when follicular carcinoma to medullary carcinoma (p = 0.040).

We also found a lower rate of permanent



Preop Ca = Preoperative inonized Calcium; Mean Ca = Overall mean of inonized Calcium; Ca 1st POD = Inonized Calcium in the first preoperative day; Ca 2nd POD = Inonized Calcium in the first preoperative day.

Figure 1 - *Average of preoperative ionized calcium (mmol / l), genera,l on the first and second days after surgery with respect to age intervals (n = 333 patients).*

hypoparathyroidism colloid in goiters between when compared to Basedow-Graves disease (p = 0.000), papillary carcinoma (p = 0.010) and medullary carcinoma (p = 0.009); and when comparing follicular adenoma to Basedow-Graves disease (p = 0.001) and medullary carcinoma (p = 0.004).

The final logistic regression model that best fits the data (goodness of fit of 0.996) is the model that includes patient age. The patients over age 50 had 1.9 times higher chance of hypocalcemia when compared to the younger group (p = 0.005).

DISCUSSION

According to DeMeester-Mirkine et al.[1], hypocalcemia is a complex, multifactorial phenomenon, where decreased function of the parathyroid glands seems to be the main contributing factor[4], and it may occur even when preserving the glands and their vascularization. Lam and Kerr[7] showed decrease in PTH levels in 83% of total thyroidectomies one hour after the procedure, indicating greater susceptibility of the parathyroid glands to surgical trauma.

When all glands are compromised by injury of the vascular pedicle, resection or inadvertent surgical manipulation occurs and sudden significant drop in levels of PTH, leading to more intense and faster hypocalcemia and hence triggering the symptoms. With partial maintenance of the function of the parathyroid glands, the PTH decrease is less expressive, remaining so until there is recovery or repair of the remaining glands of the ischemic parathyroid cell. In such cases, the calcium concentration falls more slowly and with less intensity, consequently less likely to cause clinical symptoms.

A systematic search of the parathyroid glands may, theoretically, increase the risk of them being injured, being a contributing factor to hypocalcemia[2,3]. For this reason, in our Service, the parathyroid glands are not systematically searched. When only cases of TT were studied, eliminating the variable neck dissection, no statistically significant results were found regarding the identification or not of these glands during surgery. Therefore, identification or otherwise of the parathyroid glands during surgery did not interfere with calcium homeostasis in the present study.

A parathyroid gland with intact vascular pedicle and clinically viable should be left *in situ*[8]. Nonetheless, its viability may be difficult to define clinically. In cases of inadvertent resection or of evident ischemia, parathyroid reimplantation can significantly reduce the incidence of permanent hypoparathyroidism[5,9,10]. Some authors consider that the use of intraoperative ultrafast PTH could define the viability of the parathyroid glands. PTH values below normal range would indicate reimplantation of at least one parathyroid, and thus might reduce the risk of permanent hypoparathyroidism. This approach, however, is debatable because eventually one can resect a viable gland and leave an ischemic one, since there is still no efficient way to determine which parathyroid gland should be reimplanted and when to do it. In the current study, reimplantation was not associated with higher or lower incidence of hypocalcemia or with definitive hypoparathyroidism.

Regarding gender, the literature shows conflicting data. As stated by other authors[4,11], it was demonstrated that the gender did not interfere with calcium homeostasis postoperatively. In contrast, Prim et al.[11] and Yamashita et al.[12] showed significantly higher incidence of postoperative hypocalcemia in women.

Few authors mention the interference of age in the index of hypocalcemia[6]. It is known that the elderly have a higher incidence of osteoporosis and hence less amount of exchangeable calcium capable of supplying the postoperative hypocalcemia. The elderly may also lose some of their ability to regulate the renal production of 1,25 dihydroxyvitamin D, either by renal dysfunction and/or by PTH deficiency. This could explain the decrease in intestinal calcium absorption in these individuals and contribute to the onset of osteoporosis[13].

We observed that patients over age 50 were 1.9 times more likely to present with hypocalcemia than those with less than 50 years. Furthermore, when comparing patients above 50 years of age with those with or under 50 years, the mean difference of the Ca in the first and second PODs was significantly lower in the first group. No studies corroborating these results were found in the literature.

Few authors relate thyroid volume with postoperative hypocalcemia. Yamashita et al.[6] assessed thyroid volume was by ultrasound and observed that the massive goiter was associated with longer operative time and, consequently, with a higher incidence of hypocalcemia.

They did not find a higher incidence of post-thyroidectomy hypocalcemia in patients with large goiters.

The thyroid hormone primarily increases the rate of bone remodeling, and both fecal and urinary excretion of calcium and reabsorption of phosphorus[13]. Thus, the prolonged untreated hyperthyroidism can lead to osteoarthritis and, further, to hypocalcemia after total thyroidectomy due to rapid recalcification ("hungry bone") for the loss of stimulation of thyroid hormone[14].

The use of antithyroid drugs lead, in a few months, to significant recovery of bone density in patients with thyrotoxicosis, reducing the incidence of post-thyroidectomy hypocalcemia[1,6].

Zambudio et al.[15] and McHenry et al.[16] conducted a multivariate logistic regression analysis and found hyperthyroidism as an independent predictor of postoperative hypocalcemia, both transient and permanent, finding a incidence of symptomatic hypocalcemia in patients with Basedow-Graves disease of 50% for the medically treated and 43% for the untreated, with no statistical difference between them[15].

We observed a significantly higher incidence of permanent hypoparathyroidism in patients with hyperthyroidism when compared to those with preoperative normal thyroid function. Although the former patients had been treated in order to present with normal or partially controlled thyroid function at operation, hyperthyroidism predisposed to definitive hypoparathyroidism, a fact already noted by other authors[15,16]. Hypothyroidism did not affect the evolution of postoperative calcium in the patients evaluated in this study.

The extent of surgery is directly related to the severity of hypocalcemia, as well as its incidence, although less extensive operations can evolve with decrease in serum calcium[17,18]. Thyroidectomies in which both sides of the neck were manipulated were associated with significantly higher incidence of hypocalcemia with and without symptoms, which corroborates the fact that the failure of the parathyroid glands is the main cause of maintenance of hypocalcemia after thyroidectomy.

After PT hypocalcemia is relatively rare and usually asymptomatic, resolved in a few days. Rosato et al.[3] found 0.4% of cases of hypocalcemia after PT, 0.1% of them being definitive, in a sample of 14,934 patients. In these cases, hypocalcaemia is mostly non-specific and may be associated with hemodilution, hypothermia, hypoalbuminemia, decreased tubular reabsorption of calcium and increased release of calcitonin, which may be observed in other operations[16]. It is believed that even in the PT procedure in which only one side of the neck is manipulated, suppression of parathyroids may occur in the operated side, thereby disrupting their function[8]. In this study, from the 127 patients undergoing PT, 19 progressed to postoperative hypocalcemia, one of which required oral calcium replacement, featuring occurrence of temporary hypoparathyroidism, but none progressed to definitive hypoparathyroidism.

After TT, the incidence of postoperative transient hypocalcemia ranges from 8.9% to 53%, with zero to 25% of permanente hypoparathyroidism[20-22]. The ST postoperative incidence of transient hypocalcemia ranges from five to 29%, and permanent, from zero to 2.3%[3]. The data in this study were similar to the literature's [3,5,19,20].

In this study, we separated the procedures Reop and TTL, since in the former the operated side had been previously handled. In the latter only the contralateral side of the thyroid, not addressed initially, was operated and therefore there was no fibrosis. Precisely due to the presence of fibrotic tissue, Reop cases were always considered more than 30 days of the first surgical procedure.

The TTL can be compared to TT, justifying the significantly higher incidence of postoperative hypocalcemia in relation to PT. A finding that confirms the insufficiency of parathyroid glands as a predisposing factor for post-thyroidectomy hypocalcaemia is its significantly higher incidence in patients undergoing this TT or TT + ND when compared to TTL. The time between the first operation (PT) and second (TTL) appears to be sufficient for the opposite side parathyroids undertake the greater production of PTH. Thus, during TTL, these glands could be removed, but the contralateral ones would have already provided normal function. Hence the lowest rate of this complication.

Reoperation may increase by ten times the risk of iatrogenic injury to the parathyroid glands[11]. The incidence of transient hypocalcemia ranges from three to 44.1%, and permanent, from zero to 11%[17-20]. Inflammation, bleeding, friability of tissues and adhesion structures are factors that hinder the identification of parathyroid glands and pose a higher risk of injury to the parathyroid vascular pedicle[16.17]. We observed a significant increase in the incidence of hypocalcemia in reoperations when compared to PT and to TTL. In TT, where all parathyroid glands were at risk, there was no statistically significant difference in relation to Reop.

Neck dissection of level VI is associated with increased incidence of postoperative hypoparathyroidism, ranging from 14 to 54.6% (transient) and four to 17.4% (permanent), and also to a greater incidence of inadvertent resection of the parathyroid[4,19,20]. In this study, we observed an increased incidence of hypocalcemia and post-thyroidectomy symptoms for the other procedures (TT and Reop), confirming the literature data[17,20].

It is reported that the transient hypocalcemia after thyroidectomy for cancer ranges from 13.6% to 19.3%[5], reaching 75%[16], and definitive hypoparathyroidism, from 3.3% to 5.8%[5], cancer being the main predictive factor for the development of these complications[8,18,19].

We observed a direct relationship between diseases requiring more aggressive treatment and significantly higher incidence of hypocalcemia, presence

of symptoms and definitive hypoparathyroidism. This fact was evident in the cases of medullary carcinoma, where the minimum acceptable treatment in our Service is TT associated with neck dissection of levels II, III, IV and VI, bilaterally, and level VII, when compared with colloid goiter and follicular adenoma. Although neck dissection was not a predictive factor for definitive hypoparathyroidism in this study, perhaps the bilateral neck dissection is. The small number of medullary carcinomas/bilateral neck dissections of this series does not allow definitive conclusion.

Papillary carcinoma was associated with greater incidence of postoperative hypocalcemia, since its treatment is in many cases associated with neck dissection, also associated with this complication.

The follicular carcinoma, with treatment is restricted only TT due to the extremely low rate of regional metastasis, was not associated with increased incidence of hypocalcemia. The small number of cases can be one of the reasons for this finding.

The suspect nodule and the follicular adenoma are usually treated with PT, unless the disease affects both thyroid lobes, and therefore the incidence of hypocalcemia, symptoms and definitive hypoparathyroidism were lower.

Basedow-Graves disease was associated with higher incidence of symptomatic hypocalcemia when compared to colloid goiter and follicular adenoma and to the presence of symptoms, the same happening with permanent hypoparathyroidism when compared to colloid goiter. Factors that may have contributed to it are the more difficult technique in the surgical treatment of Basedow-Graves disease and the presence of hyperthyroidism.

The operative time was also associated with higher incidence of hypocalcemia. This data is directly linked to the size of the operation and should always be considered in conjunction with the type of surgical procedure.

In conclusion, the predictors of postoperative hypocalcemia include age (> 50 years), extensive surgical procedures and neck dissection. Thyroid diseases indirectly lead to postoperative hypocalcemia in cases of more extensive operation, the same occurring with operative time. The predictors of post-thyroidectomy permanent hypoparathyroidism included type of operation, histological diagnosis and hyperthyroidism.

R E S U M O

***Objetivo**: Avaliar a incidência e os fatores preditores da hipocalcemia e hipoparatireodismo definitivo pós-tireoidectomia. **Métodos:** Foi dosado cálcio iônico no pré e no pós-operatório (primeiro, segundo e 30°dia) em 333 pacientes submetidos à tireoidectomia. Naqueles que apresentaram hipocalcemia, as dosagens foram feitas também aos 90 e 180 dias de pós-operatório, quando se dosou também o paratormônio. Os pacientes foram agrupados segundo a presença ou ausência de hipocalcemia e avaliados segundo idade, sexo, função tireoidiana, volume tireoidiano, número de paratireoides identificadas e necessidade de reimplante de paratireoides, tipo de operação, tempo operatório e diagnóstico histopatológico. **Resultados**: A incidência de hipocalcemia temporária foi de 40,8% (136 pacientes), e hipoparatireoidismo definitivo de 4,2% (14 pacientes). Tireoidectomia total ou reoperação, esvaziamento cervical, hipertireoidismo, tempo operatório e idade acima de 50 anos foram fatores determinantes de incidência significativamente maior de hipocalcemia e hipoparatireodismo definitivo (p<0,05). **Conclusão**: os fatores preditores da hipocalcemia pós-operatória incluem idade (>50 anos), tireoidectomia total, reoperação, esvaziamento cervical e tempo operatório. Os fatores preditores do hipoparatireoidismo definitivo pós-tireoidectomia incluíram tipo de operação, diagnóstico histológico e hipertireoidismo.*

***Descritores:** Tireoidectomia. Incidência. Complicações pós-operatórias. Hipocalcemia. Hipoparatireoidismo.*

REFERENCES

1. Demeester-Mirkine N, Hooghe L, Van Geertruyden J, De Maertelaer V. Hypocalcemia after thyroidectomy. Arch Surg, 1992; 127: 854-8.
2. Page C, Strunski, V. Parathyroid risk in total thyroidectomy for bilateral, benign, multinodular goitre: report of 351 surgical cases. J Laryngol Otol, 2007; 121: 237-41.
3. Rosato L, Avenia N, Bernante P, De Palma M, Gulino G, Nasi PG, Pelizzo MR, Pezzullo L. Complications of thyroid surgery: analysis of a multicentric study on 14,934 patients operated on in Italy over 5 years. World J Surg, 2004; 28: 271-6.
4. Lombardi CP, Raffaelli M, Princi P, Dobrinja C, Carrozza C, Di Stasio E, D'Amore A, Zuppi C, Bellantone R.. Parathyroid hormone levels 4 hours after surgery do not accurately predict post-thyroidectomy hypocalcemia. Surgery, 2006; 140: 1016-25.
5. Thomusch O, Machens A, Sekulla C, Ukkat J, Brauckhoff M, Dralle H. The impact of surgical technique on postoperative hypoparathyroidism in bilateral thyroid surgery: a multivariate analysis of 5846 consecutive patients. Surgery, 2003; 133: 180-5.
6. Yamashita H, Noguchi S, Tahara K, Watanabe S, Uchino S, Kawamoto H, Toda M, Murakami N.. Postoperative tetany in patients with Graves' disease: a risk factor analysis. Clin Endocrinol (Oxf), 1997; 47: 71-7.
7. Lam A, Kerr, PD. Parathyroid hormone: an early predictor of postthyroidectomy hypocalcemia. Laryngoscope, 2003; 113: 2196-200.
8. Lo CY, Lam, KY. Postoperative hypocalcemia in patients who did or did not undergo parathyroid autotransplantation during thyroidectomy: a comparative study. Surgery, 1998; 124: 1081-7.
9. Roh JL, Park, CI. Intraoperative parathyroid hormone assay for management of patients undergoing total thyroidectomy. Head Neck, 2006; 28: 990-7.

10. Mehta N, Watts NB, Welge JA, Steward D. Comparison of serum calcium change following thyroid and nonthyroid neck surgery. Otolaryngol Head Neck Surg, 2006; 134: 901-6.
11. Scurry WC Jr, Beus KS, Hollenbeak CS, Stack BC Jr. Perioperative parathyroid hormone assay for diagnosis and management of postthyroidectomy hypocalcemia. Laryngoscope, 2005; 115: 1362-6.
12. Prim MP, de Diego JI, Hardisson D, Madero R, Gavilan J. Factors related to nerve injury and hypocalcemia in thyroid gland surgery. Otolaryngol Head Neck Surg, 2001; 124: 111-4.
13. Yamashita H, Noguchi S, Murakami T, Uchino S, Watanabe S, Ohshima A, Kawamoto H, Toda M, Yamashita H.. Calcium and its regulating hormones in patients with Graves' disease: sex differences and relation to postoperative tetany. Eur J Surg, 2000; 166: 924-8.
14. Raisz LG. Hormonal regulation of bone growth and remodelling. Ciba Found Symp, 1988; 136: 226-38,Riggs BL, Melton, LJ, 3rd. Osteoporosis and age-related fracture syndromes. Ciba Found Symp, 1988; 134: 129-42.
15. Mosekilde L, Christensen, MS. Decreased parathyroid function in hyperthyroidism: interrelationships between serum parathyroid hormone, calcium-phosphorus metabolism and thyroid function. Acta Endocrinol (Copenh), 1977; 84: 566-75,
16. Yamashita H, Noguchi S, Murakami T, Watanabe S, Uchino S, Ohshima A, Kawamoto H, Toda M, Yamashita H.. Seasonal changes in calcium homeostasis affect the incidence of postoperative tetany in patients with Graves' disease. Surgery, 2000; 127: 377-82.
17. Zambudio AR, Rodríguez J, Riquelme J, Soria T, Canteras M, Parrilla P.. Prospective study of postoperative complications after total thyroidectomy for multinodular goiters by surgeons with experience in endocrine surgery. Ann Surg, 2004; 240: 18-25.
18. McHenry CR, Speroff T, Wentworth D, Murphy T. Risk factors for postthyroidectomy hypocalcemia. Surgery, 1994; 116: 641-8.
19. Szubin L, Kacker A, Kakani R, Komisar A, Blaugrund S.. The management of post-thyroidectomy hypocalcemia. Ear Nose Throat J, 1996; 75: 612-4, 616.
20. Ozbas S, Kocak S, Aydintug S, Cakmak A, Demirkiran MA, Wishart GC.. Comparison of the complications of subtotal, near total and total thyroidectomy in the surgical management of multinodular goitre. Endocr J, 2005; 52: 199-205.
21. Bergamaschi R, Becouarn G, Ronceray J, Arnaud JP. Morbidity of thyroid surgery. Am J Surg, 1998; 176: 71-5.
22. Sousa AA, Porcaro-Salles JM, Soares JMA, Moraes GM, Carvalho JR, Savassi-Rocha PR. Course of Ionized Calcium After Thyroidectomy. World J Surg, 2010; 34: 987–92.

Received on 20/04/2012
Accepted for publication 06/07/2012
Conflict of interest: none
Source of funding: no

How to cite this article:
Sousa AA, Salles JMP, Soares JMA, Moraes GM, Carvalho JR, Savassi-Rocha PR. Fatores preditores para hipocalcemia pós-tireoidectomia. Rev Col Bras Cir. [periódico na Internet] 2012; 39(6). Disponível em URL: http://www.scielo.br/rcbc

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