ORIGINAL ARTICLE

Evaluation of Serum Calcium Level Measurement in Total Thyroidectomy Patients - A Prospective Study in Tertiary Hospitals

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ABSTRACT

Postoperative hypocalcemia is the most frequent and common complication after total thyroidectomy. It is necessary to diagnose hypocalcemia immediately after total thyroidectomy for minimizing complications. The objective of this study was to measure and to evaluate the serum calcium level in total thyroidectomy patients. This prospective observational study was carried out in the Department of Clinical Pathology in collaboration with Department of Surgery & Department of Otolaryngology of BSMMU and Department of Otolaryngology of DMCH, Dhaka, during the period of September 2010 to August 2011. Total 65 patients were enrolled those came for total thyroidectomy irrespective of age and sex. Hypocalcemia was found in 25 cases and normocalcemia was found in 40 cases. Male were 16.0% and female were 84.0%. Females were predominant. The incidence of hypocalcemia was 38.5%. Asymptomatic hypocalcemia was found in 22 and symptomatic hypocalcemia was found in 3 cases. Hypocalcemia was developed mostly in malignant thyroid diseases. The mean difference of intraoperative (20 minutes after total thyroidectomy), after 24 hours and after 48 hours calcium levels were statistically significant ($p < 0.05$) between patient with hypocalcemia and patient with normocalcemia in unpaired t-test. Serum calcium level significantly decreased after total thyroidectomy and most critical time is first 24 hours of post-thyroidectomy period. If clinical sign symptoms of hypocalcemia are not developed in this period, patient is safe and can be discharged from hospital.

Key Words: Serum Calcium, Total Thyroidectomy

Introduction

Total thyroidectomy is generally done for patients with thyroid malignancy, thyrotoxicosis or toxic multinodular goiter. Less commonly, it is performed for chronic thyroiditis[1].

Total thyroidectomy is associated with specific complications like hemorrhage/hematoma, recurrent laryngeal nerve injury and hypocalcemia[2]. Complications are more often due to some factors, such as gender of the patients, large or intrathoracic goiter and extensive malignancy[3].

Post-thyroidectomy hypocalcemia develops as a result of hypoparathyroidism secondary to parathyroid trauma, devascularization or inadvertent removal of parathyroid gland during thyroid resection[4]. Other postulated explanations include haemodilution, secondary to surgical stress, urinary calcium excretion, calcitonin release and hungry bone syndrome[5]. Disease of thyroid gland is a contributor factor of developing post thyroidectomy hypocalcaemia. Cancer, Hashimoto's thyroiditis, and Grave's disease are high risk disease process that causes more post-thyroidectomy hypocalcemia[6]. Females are major victims of thyroid diseases[7] and hypocalcemia is more common in female after total thyroidectomy[8]. The incidence of hypocalcemia ranges from 1.6% to 50%[9].

Patients with acute hypocalcemia may present with numbness of the distal extremities, circumoral paresthesias, and/or carpopedal

spasm, seizure, laryngospasm and arrhythmias[10]. Hypocalcemia following thyroid surgery is the major factor that determines length of hospital stay[11]. To minimize complications and early discharge, we should be able to identify the patients which will develop symptoms of hypocalcemia[12].

Postoperative hypocalcemia may have a delayed onset[13]. Usin the most common definition of hypocalcemia - serum calcium level is below 2 mmol/L after total thyroidectomy[14]. The lowest calcium levels are typically reached at 24 to 48 hours after thyroidectomy. Hypocalcemia may be delayed[15]. Early postoperative hypocalcemia may be due to perioperative hemodilution[16]. The common practice to assess serum calcium concentration daily until a rising trend is obtained[16]. Close monitoring of serum calcium level has been recommended, for postoperative hypocalcemia[17].

This study prospectively evaluated the ability of consecutive measurements of serum calcium levels to predict clinically relevant post-thyroidectomy hypocalcemia and also, to assess risk factors for post-thyroidectomy hypocalcaemia. The aim of the present study was to determine the patients who are likely to remain normocalcemic so that they can safely discharged earlier.

Materials and Methods

This prospective study was carried out in the Department of Clinical Pathology in collaboration with Department of Surgery, Department of Otolaryngology of BSMMU and Department of Otolaryngology of DMCH, Dhaka, during the period of September 2010 to August 2011. All patients who came for total thyroidectomy were included in this study irrespective of age and sex. Known patients of hypoparathyroidism and patients of chronic renal failure were excluded from this study. After taking informed consent, a careful history and the details information were recorded by the investigator in a predesigned questionnaire. With all aseptic precaution preoperatively 3ml blood was taken for serum calcium level measurement. Then intraoperatively (20 minutes after total thyroidectomy), after 24 hours & 48 hours of total thyroidectomy, 3 ml blood was taken for serum calcium level measurement. Serum calcium was measured by semi automated analyzer (3000 Evolution) in the Department of Clinical Pathology, BSMMU. Statistical analysis was done by unpaired Student t-test using window based computer software devised with Statistical Packages for Social Sciences (SPSS-15).

Results

This study included 65 patients. The mean (±SD) age of the patients was 39.15±13.18 years with range from 15 to 75 years. The table-I shows the that of the total subjects male was 15 and female was 50. The male female ratio was 1:3.3. Females are predominant. The fig 1 shows the sex distribution of the hypocalcemic patients. Male was found 16.0% and female was 84.0%. Female were predominant. The table II shows that hypocalcemia was found in 38.5% and normocalcemia was found in 61.5% of the study patients. The table III shows that among 25 hypocalcaemic patients asymptomatic hypocalcemia was found in 22 patients and symptomatic hypocalcemia was found in 3 patients.

Table IV shows the hypocalcemia developing time of the hypocalcemic patients. Hypocalcemia was found in 15 cases intraoperatively, 7 developed after 24 hours of total thyroidectomy and 3 developed after 48 hours of total thyroidectomy.

Table V shows the hypocalcemia developed in different diseases of the study patients. Hypocalcemia developed 44.0% in papillary carcinoma patients, 40.0% in multinodular goitre patients, 8.0% in follicular carcinoma patients, 4.0% in medullary carcinoma patients, and 4.0% in Hashimoto's thyroiditis patients.

Table VI shows the serum calcium level (mmol/L) of the all study patients. The mean(±SD) of preoperative calcium level was 2.2±0.2 mmol/L with range from 2.0 to 2.6mmol/L. The mean(±SD) of intraoperative

calcium level was 2.0 ± 0.3 mmol/L with range from 1.6 to 2.5mmol/L. The mean of serum calcium level (± SD) after 24 hours of total thyroidectomy was 2.0 ± 0.3 mmol/L with range from 1.5 to 2.5 mmol/L. The mean of seurm calcium level (± SD) after 48 hours of total thyroidectomy calcium level was 2.0 ± 0.2 mmol/L with range with 1.5 to 2.6mmol/L.

Table VII shows the comparison of intraoperative, after 24 hours and after 48 hours calcium level between patients with hypocalcemia and patient with normocalcemia. The mean (± SD) of intraoperative, after 24 hours and after 48 hours calcium levels were 1.9 ± 0.2, 1.8 ± 0.2, 1.8 ± 0.1 mmol/L respectively in patients with hypocalcemia and in patients with normocalcemia, the mean(± SD) of intraoperative after 24 hours and after 48 hours calcium levels were 2.1 ± 0.1 2.2 ± 0.2, 2.1 ± 0.1 mmol/L respectively. The mean difference of intraoperative calcium, after 24 hours calcium and after 48 hours calcium were statistically significant ($p < 0.05$) between patients with hypocalcemia and patient with normocalcemia in unpaired t-test.

Table I: Sex distribution of the study patients (n = 65)

Sex	Number of patients	Percentage	Ratio (Male: Female)
Male	15	22.5	
Female	50	77.5	:3.3
Total	65	100	

Table II: Distribution of postoperative hypocalcemic and normocalcemic patients (n = 65)

	Number of patients	Percentage
Hypocalcemia	25	38.5
Normocalcemia	40	61.5
Total	65	100

Table III: Distribution of symptomatic hypocalcemic and asymptomatic hypocalcemic patients (n = 25)

	Number of patients	Percentage
Asymptomatic hypocalcemia	22	88
Symptomatic hypocalcemia	03	12
Total	25	100

Table IV: Distribution of postoperative hypocalcemia developing time (n = 25)

Developing time of hypocalcemia (n = 25)	Number of patients	(n = 25) Percentage
Intraoperative (20 minutes after total thyroidectomy)	15	60.0
After 24 hours of total thyroidectomy	7	28.0
After 48 hours of total thyroidectomy	3	12.0
Total	25	10 0

Table V: Distribution of hypocalcemia in different diseases (n = 25)

Diseases (n = 25)	Number of patients	Percentage
Papillary carcinoma	11	44.0
Multinodular goitre	10	40.0
Follicular carcinoma	2	8.0
Medullary carcinoma	1	4.0
Hashimoto's Thyroiditis	1	4.0
Total	25	100

Table VI: Pre- and postoperative serum calcium (Ca + +) level of the study subjects at different time interval (n = 65)

Serum calcium (Ca + +) level (mmol/L) Mean	All patients (n = 65) ± SD	Min -Max
Preoperative calcium	2.2 ± 0.2	(2.0 -2.6)
Intraoperative (20 minutes after total thyroidectomy) calcium	2.0 ± 0.2	(1.6-2.5)
After 24 hours (of total thyroidectomy) Calcium	2.0 ± 0.3	(1.5-2.5)
After 48 hours (of total thyroidectomy) Calcium	2.0 ± 0.2	(1.5-2.6)

Table VII: Comparison of intraoperative, after 24 hours and after 48 hours calcium (Ca + +) level between patients with hypocalcemia and patient with normocalcemia (n = 65)

Serum calcium level (mmol/L)	Patient with hypocalcemia (n = 25) Mean ± SD	Patient with normocalcemia (n = 40) Mean ± SD	P value
Intraoperative calcium	1.9 ± 0.2	2.1 ± 0.1	0.001s
Range (min-max)	(1.6 -2.5)	(2.0 -2.5)	
After 24 hours calcium	1.8 ± 0.2	2.2 ± 0.2	0.001s
Range (min-max)	(1.5 -2.3)	(2.0 -2.5)	
After 48 hours calcium	1.8 ± 0.1	2.1 ± 0.1	0.001s
Range (min-max)	(1.5 -1.9)	(2.0 -2.6)	

S = Significant

P value reached from unpaired t-test

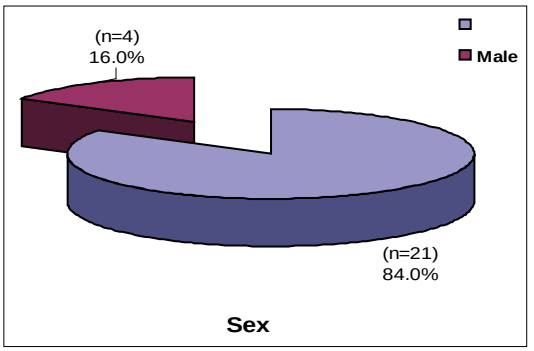

Fig 1: Sex distribution of the hypocalcemic patients (n = 25)

Discussion

Postoperative hypocalcemia is a common and major problem following thyroid surgery[2]. It often extends the duration of the hospital stay and the need for biochemical tests; when severe, it can lead to serious complications. To focus our study on clinically significant hypocalcemia, we considered as hypocalcemic patients only with a serum calcium level under 2.0 mmol/L[14]. Postoperative hypocalcemia after total thyroidectomy has been reported to range from 1.6% to 50%[9].

Approaches to prediction of hypocalcemia are based on serum calcium values at different times after surgery have proven useful[18]. The purpose of this study was to evaluate the ability of consecutive serum calcium level measurements in predicting hypocalcemia at the earliest time after total thyroidectomy.

In this study, a total 65 cases were evaluated. The mean age of the patients was 39.15 ± 13.18 years ranging from 15 to 75 years. In study by Qari FA19 reported that mean age (mean ± SD) was 39.35 ± 13.97 which is consistent with this study. In this study, 15 were male and 50 were female. The male-female ratio was 1:3.3. Females are major victim of thyroid diseases[7]. So, our observation is consistent with the others.

Hypocalcemia is more common in female after total thyroidectomy[8]. In our study, hypocalcemic patients were 25 of which 16.0% were male and 84.0% were female. Females are more prone to develop hypocalcemia. So, this observation is consistent with that of others.

Patients were stratified into the 'hypocalcemic' and 'normocalcaemic' groups depending on whether they had postoperative calcium level less than 2.00 mmol/L[14]. Mean ± SD of intraoperative, after 24 hours and after 48 hours calcium level were 2.1 ± 0.1, 2.2 ± 0.2, and 2.1 ± 0.1 mmol/L respectively.

The incidence of hypocalcemia was 38.5% after total thyroidectomy. Post-operative hypocalcemia after total thyroidectomy has been reported to range from 1.6% to 50%[9]. Incidence of hypocalcemia in this study was within the international norms. In this study, total hypocalcemic patients were 25. Asymptomatic hypocalcemia was found in 88% patients and symptomatic hypocalcemia was in 12% patients. In a study with 100 study populations, the percentage of symptomatic hypocalcemia was 9%[15] and in the study of Gac EP et al[20] with 448 study population, the symptomatic hypocalcemia was 15%. So, the result of this study is within the international norms.

Diseases of thyroid gland is a contributor factor of developing post-thyroidectomy hypocalcemia. Cancer, Hashimoto's thyroiditis, and Grave's disease are high risk disease processes that causes more post-thyroidectomy hypocalcemia. Higher incidence of hypocalcaemia with malignant 25% and toxic goitre 11.4% than that in simple nodular goitre 3.6%, the high incidence of hypocalcemia in thyrotoxicosis was also noted by Wingert DJ et al[16]. In this study, hypocalcaemia developed in 44.0% papillary carcinoma patients, 40.0% in multinodular goitre patients, 8.0% in follicular carcinoma patients, 4.0% in medullary carcinoma patients, and 4.0% in Hashimoto's thyroiditis patients. Here, malignancy is also the first contributor factor of developing hypocalcemia. So, it is consistent with the other study.

Postoperative hypocalcemia may have a delayed onset[13]. The lowest calcium levels are typically recognized 24 to 48 hours after thyroidectomy though hypocalcemia may be delayed[15]. It is usually evident in the first 24 hours[21]. In this

study, total hypocalcemic patients were 25. Hypocalcaemia was developed in 15 intraoperatively, 7 developed after 24 hours of total thyroidectomy and 3 developed after 48 hours of total thyroidectomy. The mean difference of intraoperative calcium level, after 24 hours calcium level and after 48 hours calcium level were statistically significant ($p < 0.05$) between patients with hypocalcemia and patients with normocalcemia in unpaired t test. So, the hypocalcemia developing time is consistent with the others.

The symptoms of hypocalcemia make patients meet unwanted situations. These symptoms can occur later, so the patients have to stay in hospital for observation of calcium level after the symptoms occur. However only 3 hypocalcaemic patients developed symptoms in our study.

In conclusion, the study suggests that serum calcium level significantly decreases after total thyroidectomy and most critical time is the first 24 hours of post thyroidectomy period. Hypocalcemia developed more in female and in malignant thyroid diseases. If clinical sign symptoms of hypocalcemia are not developed in this period, patient is considered safe. The result, can guide which patients will be discharged early as well as closely monitor calcium level and early calcium supplementation.

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