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A Clinical Prospective Study of Hypocalcaemia Following Thyroid Surgery.

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ABSTRACT

Background: Hypocalcaemia is one of the acute and most feared complication following thyroidectomy. Depending upon the extent of parathyroid damage, post-operative hypocalcaemia may be temporary or permanent requiring lifelong calcium supplements. **Aims and objectives:** This study aims to prospectively study and analyse the demographics and possible causes of hypocalcaemia post thyroidectomy.**Methods:** This is a prospective study of 150 patients undergoing thyroidectomy surgery from January 2015 to December 2015 in Victoria hospital, Bangalore medical college and research institute, Bangalore. Patients demographics, intra operative and pathological aspects were correlated to our hypocalcaemic findings.**Results:** Out of 150 patients, 18 patients developed temporary hypocalcaemia (12%), none of them developed permanent hypocalcaemia. Mean age of patients developing hypocalcaemia was 45.16 years. 15 (83.33%) of them were females and 3 (16.66%) were male. Hypocalcaemia was found in 9% in multinodular goitre (9 out of 99 patients), 20% in papillary carcinoma (3 out of 15 patients) and 40 % in follicular neoplasm (6 out of 15 patients). Near total thyroidectomy was the procedure in 105(70%) patients, 3 from them (2.86%) developed hypocalcaemia and the other 15 out of 45 cases (30%) were after total thyroidectomy. Mean duration of surgery was 101 mins. Average no of parathyroid glands identified was 2. **Conclusion:** Risk factor for development of hypocalcaemia is multifactorial. The recommended surgical strategy is meticulous dissection and preservation of at least one parathyroid gland and their blood supply to prevent permanent hypocalcaemia.

Keywords: Hypocalcaemia, multifactorial, parathyroid, thyroidectomy.

INTRODUCTION

Chronic hypoparathyroidism is a serious and potentially debilitating disorder that results from a variety of causes. It most commonly occurs as a complication of thyroid surgery. Some studies have concluded that the transient hyperparathyroidism prevalence rate varies from 6.9% to 46% and permanent hyperparathyroidism rates from 0.4% to 33%. [1-4]

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Hypocalcaemia may occur secondarily to surgical trauma, devascularisation, unintentional removal of parathyroid glands. [5] Huge goitre, total thyroidectomy, recurrent goitre, carcinoma and experience of the surgeons were found as the risk factors predisposing to hypocalcaemia after thyroidectomy. [6-8] These risk factors contribute to devascularisation or accidental removal of the parathyroid glands. The recommended surgical strategy is meticulous dissection and preservation of the parathyroid glands and their blood supply. [4] The best way to avoid accidental excision is properly identifying the parathyroid glands. Risk of complication is higher when fewer than three glands are identified during surgery.[3]

MATERIALS AND METHODS

This is an observational prospective study conducted on 150 patients who were posted for thyroidectomy from January 2015 to December 2015 in Victoria hospital, Bangalore medical college and research institute, Bangalore. Following patients were excluded from the study

1. Recurrent thyroid
2. Concurrent lymph node dissection
3. Pre-existing hypocalcaemia

Serum albumin and calcium levels were estimated a day before surgery, serum calcium levels were repeated 6 hours after surgery, post op day 1 and day 2 at 8 AM.

Hypocalcaemia was diagnosed when corrected calcium levels was below 8mg/dl. Permanent hypocalcaemia was defined as persistent corrected calcium levels less than 8mg/dl for 6 months after surgery. Patients with hypocalcaemia were treated accordingly.

The following parameters were also collected to correlate with hypocalcaemia

Patients gender, age, clinical diagnosis

Surgical details- type of surgery, time duration of surgery, number of parathyroid identified

Post-operative HPE.

RESULTS

A total of 150 patients were included in the study with median age in this study being 32 years. The age ranged from 20 to 80 years with maximum incidence in age group in 30 to 39 years [Figure 1] [Table 1]. Sex ratio was 1:9 in favour of females depicted in fig 2. Age, sex distribution of the patients has been shown in [Figure 3].

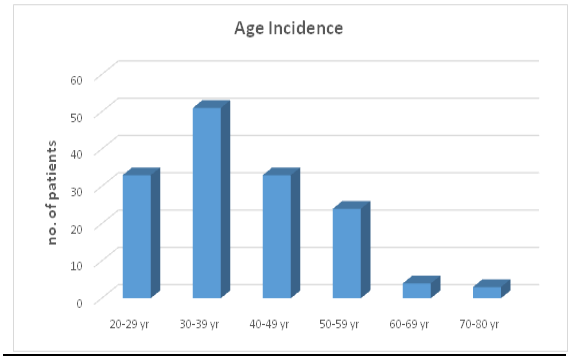

Figure 1: Distribution of Age.

Table 1: Distribution of Age.

Age Group	No. of Patients	Percentage
20-29	33	22%
30-39	51	34%
40-49	33	22%
50-59	24	16%
60-69	4	4%
70-80	3	2%
Total	**150**	**100%**

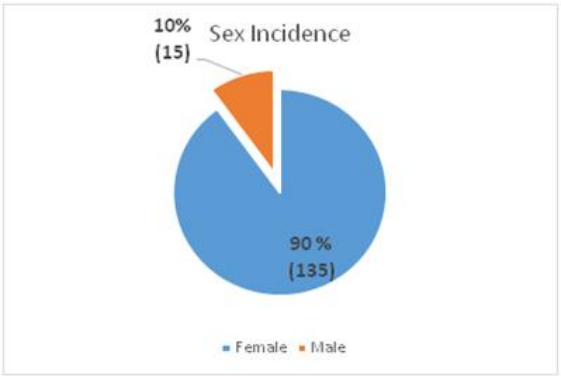

Figure 2: Distribution of gender.

Out of 150 patients, 99 patients (66%) were diagnosed pre-operatively as multinodular goitre, 21 patients (14%) presented with solitary nodule thyroid, 15 patients (10%) were diagnosed as papillary carcinoma thyroid and the remaining 15 patients (10%) with follicular neoplasm [Figure 4] [Table 2].

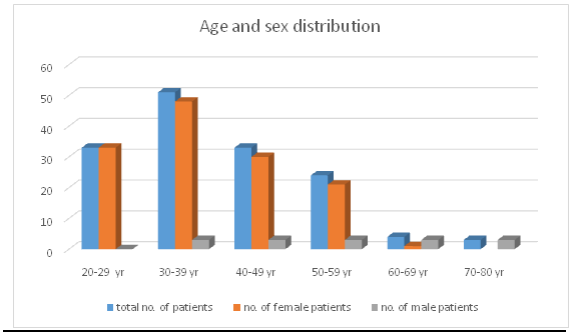

Figure 3: Age and Sex Distribution.

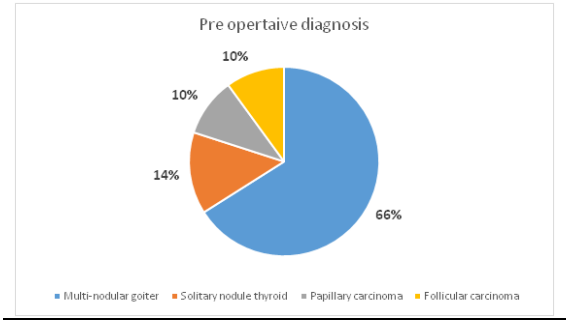

Figure 4: Pre-operative diagnosis.

Table 2: Pre-operative diagnosis.

Pre-operative diagnosis	No. of cases	Percentage
Multi-nodular goiter	99	66%
Solitary nodule thyroid	21	14%
Papillary carcinoma	15	10%
Follicular carcinoma	15	10%
Total	**150**	**100%**

105 patients (70%) underwent near-total thyroidectomy, 45 patients (28%) total thyroidectomy [Figure 5]. The average duration of surgery was 73 min [Figure 6] [Table 3].

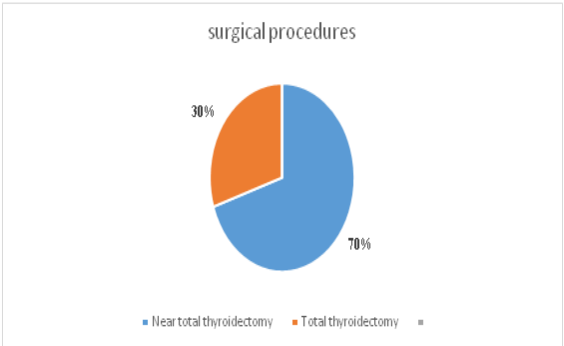

Figure 5: Surgical procedures.

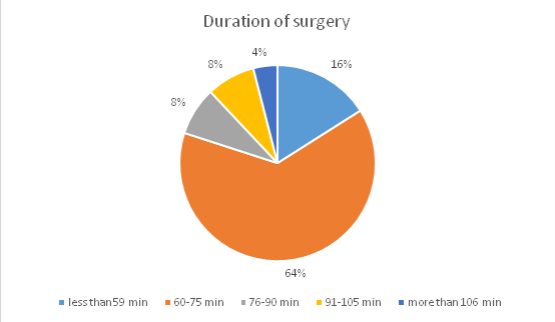

Figure 6: Duration of Surgery.

Table 3: Duration of Surgery.

Duration of surgery	No. of cases	Percentage
Less than 59 min	24	16%
60-75 min	96	64%
76-90 min	12	8%
91-105 min	12	8%
More than 106 min	6	4%
Total	**150**	**100%**

Out of 150 patients, all four parathyroid glands were identified in 69 patients of whom none developed post-op hypocalcaemia. Three parathyroid glands were identified in 63 patients among whom only 3 patient developed hypocalcaemia (4.7%). Two parathyroid glands were identified in 15 patients and 12 among them developed hypocalcaemia (80%). One gland was identified in 3 patients who also developed hypocalcaemia (100%) [Figure 7] [Table 4]. Out of 150 patients, 42 patients (28%) were diagnosed having hashimoto's thyroiditis, 78 patients (52%) presented with colloid goitre, 15 patients (10%) were diagnosed as papillary carcinoma thyroid, 6 patients(4%) with follicular adenoma and the remaining 9 patients (6%) with follicular carcinoma. [Figure 8] [Table 5].

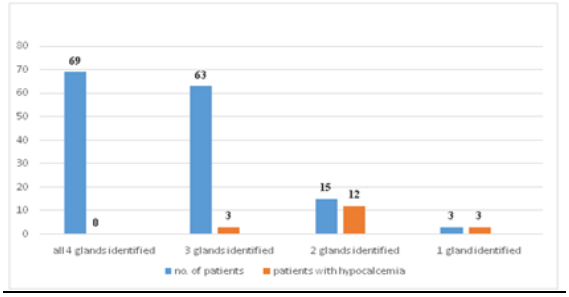

Figure 7: Number of Parathyroid glands.

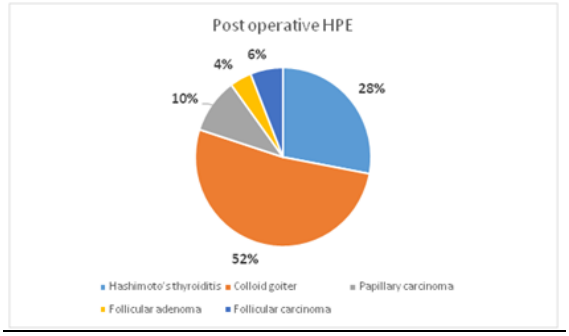

Figure 8: Post-operative HPE.

Table 4: No. of parathyroid glands identified.

No. of parathyroid glands identified	No. of patients	Incidence of hypocalcemia in this group	Percentage incidence of hypocalcemia in the group
All 4 glands identified	69	0	0%
3 glands identified	63	3	4.7%
2 glands identified	15	12	80%
1 gland identified	3	3	100%

Table 5: Post operative HPE.

Post operative HPE	No. of cases	Percentage
Hashimoto's thyroiditis	42	28%
Colloid goiter	78	52%
Papillary carcinoma	15	10%
Follicular adenoma	4	4%
Follicular carcinoma	9	6%
Total	**150**	**100%**

Out of 150 patients, 18 patients developed temporary hypocalcaemia (12%), none of them developed permanent hypocalcaemia. Mean age of patients developing hypocalcaemia was 45.16 years. 15 (83.33%) of them were females and 3 (16.66%) were male. Hypocalcaemia was found in 9% in multinodular goitre (9 out of 99 patients), 20% in papillary carcinoma (3 out of 15 patients) and 40 % in follicular neoplasm (6 out of 15 patients). Near total thyroidectomy was the procedure in 105(70%) patients, 3 from them (2.86%) developed hypocalcaemia and the other 15 out of 45 cases (30%) were after total thyroidectomy. Mean duration of surgery was 101 min. Average no of parathyroid glands identified was 2.

DISCUSSION

Hypocalcaemia is a major concern following thyroid surgery. The incidence of hypocalcaemia was noticed in the first post-operative day among our patients. The patients mainly complained of circum-oral numbness and tingling sensation. On examination, carp-pedal spasm was seen in 1 patient. Serum calcium was decreased in all the 18 patients. Although Sasson et al[11] and Lin et al[9] did not find any association between hypocalcaemia and incidental parathyroid removal (IPE), Sippel et al[12] reported that the incidental parathyroid removal group had significantly lower postoperative calcium levels, and this is in line with our findings. Injury,

devascularisation and unintentional excision of the parathyroids have all been cited as the causes of postoperative hypocalcaemia. Other specific factors have been studied, the cause of postoperative hypocalcaemia remains to be multifactorial.[13] Hypocalcaemia reverses spontaneously in most patients, it can remain permanently when caused by an injury or removal of the parathyroid glands.[14-17] The overall incidence of temporary hypocalcaemia among our patients was 12%.

Studies	Year	Number of cases	Percentage
Lin et al.[9]	2004	14,934	8.3
Bhattacharya[10]	2002	517	6.2
Sasson et. al[11]	2007	3250	6.6
Present series	2014	50	12

In the present study, a risk factor for the incidental parathyroid removal included total thyroidectomy. As expected in total thyroidectomy, dissection, which includes bilaterally, puts all four glands at risk. In addition, in the current study, total thyroidectomy was done mainly for MNG and malignancy was reported to be a strong predictor of IPE in earlier studies. [18,19] In the present as well as earlier studies,[18,20,21] total thyroidectomy was found to be a risk factor for the incidental parathyroid removal. Near total thyroidectomy can also be a risk factor for IPE but lesser than total thyroidectomy.

Although extrathyroid extension was not found to be a risk factor in a recent study,[22] in the present study, we found it to be another strong predictor of IPE. Extrathyroid extension occurs in malignant lesions, and patients undergoing surgery for thyroid malignancy, particularly with a more aggressive approach, are at a higher risk. In our study, the factors such as modified radical neck dissection and completion thyroidectomy were not considered.

All the cases were temporary hypoparathyroidism because subsequent follow up showed normal serum calcium levels. This was attributed to temporary spasm of the vessels supplying the parathyroid glands and hence the resulting tetany.

To avoid hypoparathyroidism, it is important to preserve the parathyroid glands and their vascular supply during thyroid surgery. Despite meticulous care, parathyroid glands are occasionally found in the surgical specimens. Usually the parathyroid glands are located extracapsularly on the posterior surface of the thyroid gland. However, their location can vary; they were found in extracapsular (58%), intracapsular (20%), and intrathyroidal (22%) locations. The superior parathyroid glands are usually located at the superior pole of the posterior thyroid gland near the cricothyroid junction, while the inferior parathyroid glands are usually found in the lower pole of the thyroid gland, but can be located elsewhere including the thymus and mediastinum. Thus, it is difficult to identify all four parathyroid glands in some cases. In another study, the parathyroid glands in the resected specimens were found to be intrathyroidal in 50% of the thyroidectomies[23]. Thus, it is more reliable to evaluate the number of preserved parathyroid glands from the number of parathyroid glands identified in the surgical specimens than from the number of preserved parathyroid glands seen intraoperatively by the surgeons with the naked eye. In our study, we estimated the number of preserved parathyroid glands by subtracting from four the number of parathyroid glands in the surgical specimen. However, a limitation of this method is that some patients have supernumerary parathyroid glands. In a cadaveric dissection of 942 patients, a fifth parathyroid gland was found in 5% of the individuals, and three parathyroid glands (instead of four) were found in 2%.[24]

While identification of all four parathyroid glands is traditionally recommended to reduce postoperative hypoparathyroidism [25,26], there are recent studies suggesting that the identification of a greater number of identified parathyroid glands intraoperatively does not reduce the incidence of hypoparathyroidism. [27,28] However, in cases with Central neck dissection (CND), we recommend identifying the parathyroid glands to perform a thorough CND, and to consider that CND without identifying the parathyroid gland can lead to insufficient lymph node dissection or blind trauma of parathyroid gland vasculature regardless of capsular dissection. Only a few studies have examined whether the number of parathyroid glands preserved affects the likelihood of hypoparathyroidism. In one study, the rate of permanent hypoparathyroidism increased if fewer than three parathyroid glands had been identified and preserved intraoperatively. [29] In another study, multivariate analysis in 5,846 patients showed that intraoperative identification and preservation of fewer than 2 parathyroid glands resulted in an increased rate of permanent postoperative hypoparathyroidism. The current study differed from these previous studies, which evaluated numbers of preserved parathyroid glands intraoperatively, in that the number of parathyroid glands preserved was deduced indirectly from histopathological examination of the resected surgical specimens.

In our study, the incidence of transient hypoparathyroidism increased when less than 3 parathyroid gland was preserved and there was no permanent hypoparathyroidism. Hence, our data suggest that the preservation of at least one viable parathyroid gland prevents permanent hypoparathyroidism. In addition to preserving as many viable parathyroid glands as possible, the blood supply of parathyroid gland should be preserved with great care and careful dissection of

tissue to maintain the viability of the parathyroid glands.

CONCLUSION

The following conclusions were drawn from the present study which was done in 150 patients who were admitted and operated in Victoria Hospital attached to Bangalore Medical College & Research Institute, Bangalore during the study period from January 2015 to December 2015.

1. Post-operative hypocalcaemia is the most complication following thyroid surgery.
2. Although multifactorial, total thyroidectomy is the most important risk factor for hypocalcaemia.
3. Other factors are related to the chosen surgical procedure and its impact on devascularization or accidental removal of the parathyroid glands. The recommended surgical strategy is meticulous dissection and preservation of at least one parathyroid gland and their blood supply to prevent permanent hypoparathyroidism.

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