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A prospective study to determine the role of routine prophylactic oral calcium and vitamin D supplements in prevention of transient hypocalcaemia after total and near total thyroidectomy

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ABSTRACT

Background: Transient hypocalcaemia is a frequent complication after total thyroidectomy, and the symptoms are very distressing for the patients. This study is a prospective cohort study to assess the effectiveness of routine postoperative oral calcium and vitamin D supplementation in post thyroidectomy hypocalcaemia.

Methods: 135 patients undergoing near total or total thyroidectomy were divided into two groups, exposed and unexposed, based on post-operative calcium and Vitamin D administration. Both groups were followed up at day 3, at discharge and 2 weeks post operatively for the development of hypocalcaemia.

Results: Common age group was 31-40 years in both groups. The mean corrected pre-operative serum calcium was 9.06 ± 0.43 mg/dl for the exposed and 9.2 ± 0.62 mg/dl for the unexposed group (p = 0.12). The mean corrected calcium levels, on third post op day was 8.9 ± 0.61 mg/dl for exposed and 8.5 ± 0.69 mg/dl for unexposed group p = 0.001), on day of discharge was 9.2 ± 0.56 mg/dl for exposed and 9.0 ± 0.48 mg/dl for unexposed group (p = 0.019), and at 2 weeks follow-up was 9.5 ± 0.51 mg/dl for exposed and 9.2 ± 0.63 mg/dl for unexposed group (p = 0.002). Incidence of clinical symptoms of hypocalcaemia in the exposed group was 5.1% and in the unexposed group was 25.9%. Majority of these patients had transient hypo-calcaemic symptoms in the 48-72hr time period after surgery in both the groups.

Conclusions: Routine prophylactic oral calcium and Vitamin D supplementation is effective in preventing transient hypocalcaemia following total or near total thyroidectomy.

Keywords: Calcium, Hypocalcaemia, Total or near total thyroidectomy, Vitamin D

INTRODUCTION

Postoperative hypocalcaemia is one of the most important complications following thyroidectomy which still causes distress to the patient and embarrassment for the surgeon. Post thyroidectomy hypocalcaemia can be transient or permanent. Transient hypocalcaemia although not serious, has several undesirable effects. Hypocalcaemia is considered to be transient only when serum calcium levels return to normal. Until then, the prospect of it being a permanent hypocalcaemia is real and the patient

should be followed up and treated on a long term basis to prevent its complications.

Permanent hypocalcaemia may occur after thyroidectomy by the vascular necrosis and / or inadvertent removal of the parathyroid glands. Various causes are also considered for the temporary hypocalcaemia. Transient ischemia of the parathyroid glands is the mostly accepted reason. Manipulation of the thyroid gland during surgery with release of calcitonin has also been suggested. Another mechanism is the one that occurs in

thyrotoxicosis postulated to be due to bone resorption in thyrotoxic osteodystrophy.¹

Transient hypocalcaemia from surgical injury or inadvertent removal of parathyroid tissue has been reported in up-to 46% (permanent hypocalcaemia in 4%) of cases following thyroid surgery.² Symptoms include tingling numbness, muscle cramps and tetany which are very distressing to the patient. These hypocalcemic symptoms can be avoided if prophylactic Calcium and Vitamin D supplements are routinely supplemented following total or near total thyroidectomy.

Aim of the study was to determine whether routine prophylactic oral Calcium and Vitamin D administration can effectively prevent symptoms of transient hypocalcaemia after total or near-total thyroidectomy.

METHODS

A prospective cohort study was undertaken in the department of General Surgery, Medical College Hospital, Kottayam over 1 year period (February 2008 to 2009) which included 135 patients.

Inclusion criteria

All patients undergoing total or near total thyroidectomy for benign or malignant disease.

Exclusion criteria

Hemi-thyroidectomy, thyroidectomy for recurrent disease, pre-op hypocalcaemia due to any cause, parathyroids not positively identified and preserved at surgery.

Cohorts were assembled according to the practice followed by different units of the department of general surgery for prevention/treatment of post thyroidectomy hypocalcaemia. Cohorts were divided into exposed group with 58 patients and unexposed group comprising 77 patients.

Exposed cohort received oral calcium (3g/day) and vitamin D (1500 I.U) supplementation from the day of surgery till 2weeks of follow-up. Both groups were monitored for the development of hypocalcaemic symptoms and signs. Unexposed cohort were administered the therapy only when symptomatic hypocalcaemia developed.

Corrected calcium levels were obtained preoperatively, on the 3rd postoperative day, at discharge and at 2 weeks follow-up, using the formula- Corrected serum calcium $(mg/dl) = (4.0\text{-albumin}) \times 0.8 + \text{total}$ serum calcium. Normal serum calcium level in this study was taken as 8.5-10.5mg/dl. Any value less than 8.5mg/dl (corrected calcium) was regarded as hypocalcaemia.

t-test was used for comparing continuous variables

between different groups; the paired t test was used for comparison of paired samples; and the chi-square test was used for categorical data analysis, with SPSS 11.0 for Windows (SPSS Inc, Chicago, IL). Data from each group were expressed as mean, standard error of the mean. P < 0.05 was regarded as statistically significant.

RESULTS

Age of the patients ranged from 28 yrs to 70 yrs in exposed group and from 22 to 60 yrs in case of unexposed group. Mean age was 42.9±8.5 years in the exposed and 39.7±9.8 in unexposed group (p >0.05). In 135 patients studied prospectively, there were 3 males and 55 females in exposed group, and 12 males for 65 females in unexposed group.

Majority of cases in both in groups were multinodular goitres - 46 in exposed (79.3%) and 60 in unexposed (77.9%). Papillary carcinoma was present in 7% of exposed (4 cases) and 10% of unexposed (8 cases). Follicular neoplasm accounted for 13.8% (8 cases) in exposed and 11.7% (9 cases) in unexposed group.

The duration of the swelling ranged from 2months to 20 yrs in exposed and 1 month to 15 yrs in case of unexposed group. Maximum numbers of cases were in the 1-3 yr duration (exposed group) and 2-4 yr duration (unexposed group).

Of the 58 patients in exposed group, 32 had near-total thyroidectomy (55.1%), 24 underwent total thyroidectomy (41.4%) and 2 patients had total thyroidectomy with lymph node dissection (modified radical neck dissection-MRND or central compartment neck dissection).

Table 1: Type of surgery (thyroidectomy).

Category	Surgery	Frequency	Percent
Exposed	Total Thyroidectomy	24	41.4
	Near total thyroidectomy	32	55.1
	Total Thyroidectomy with lymph nose dissection	2	3.5
	Total	58	100.0
Unexposed	Total Thyroidectomy	30	39.0
	Near total thyroidectomy	41	53.2
	Total Thyroidectomy with lymph nose dissection	6	7.8
	Total	77	100

Of the patients in unexposed group 41 had near-total thyroidectomy (53.2%), 30 underwent total thyroidectomy (39%) and 6 patients had total thyroidectomy with lymph node dissection (MRND or Central compartment neck dissection) (Table 1).

The mean pre-operative serum calcium was 9.06 ± 0.43 mg/dl for the exposed and 9.2 ± 0.62 mg/dl for the unexposed group (p = 0.12) (Table 2).

Table 2: pre-operative serum calcium levels.

	Category	No.	Mean	Std. deviation	Std. error
Pre- operative	Exposed	58	9.064	0.4254	0.0559
Corrected Calcium (mg/dl)	Unexpos ed	77	9.212	0.6179	0.0704

The mean corrected serum calcium level, on third post op day was 8.9 ± 0.61 mg/dl for exposed and 8.5 ± 0.69 mg/dl for unexposed group (p = 0.001) (Table 3).

Table 3: Corrected calcium on day 3.

Corrected	Category Exposed	No. 58	Mean 8.966	Std. deviation 0.6109	Std. error 0.0802
Calcium (mg/dl) on day-3	Un- exposed	77	8.555	0.6995	0.0797

On day of discharge was 9.2 ± 0.56 mg/dl for exposed and 9.0 ± 0.48 mg/dl for unexposed group (p = 0.019) (Table 4).

Table 4: Corrected calcium at discharge.

	Category	No.	Mean	Std. deviation	Std. error
Corrected	Exposed	58	9.222	0.5629	0.0739
Calcium (mg/dl at discharge)	Unexposed	77	9.009	0.4783	0.0545

At 2 weeks follow-up was 9.5 ± 0.51 mg/dl for exposed and 9.2 ± 0.63 mg/dl for unexposed group (p = 0.002) (Table 5).

Table 5: Corrected calcium at 2 weeks follow up.

Corrected	Category Exposed	No. 58	Mean 9.555	Std. deviation 0.5161	Std. error 0.0678
Calcium (mg/dl) at 2 weeks	Unexposed	77	9.230	0.6337	0.0722

Incidence of clinical symptoms of hypocalcaemia in the exposed group was 5.1% (3 of 58) and in the unexposed

group was 25.9% (20 of 77). Majority of these patients had transient hypo-calcaemic symptoms in the 48-72hr time period after surgery in both the groups. Among all the patients who underwent near-total thyroidectomy, 5 of 41 patients in the unexposed group had hypocalcaemic symptoms compared to none of 32 in the exposed group. In the total thyroidectomy group, 12 among 30 patients in the unexposed group and 1 among 24 in the exposed group were symptomatic. Hypocalcaemic symptoms were seen in 3 of 6 patients who underwent total thyroidectomy with lymph node dissection in the unexposed group and in each of the two patients in the exposed group. This showed that total thyroidectomy with lymph node dissection had the maximum risk of developing transient hypocalcaemia (41.6%), followed by total thyroidectomy (24%).

Among the patients in the exposed group (55patients), who did not have any symptoms or signs of hypocalcaemia, one had asymptomatic laboratory hypocalcaemia (Serum calcium ≤ 8.4mg/dl) at discharge. Similarly, 8 patients had asymptomatic hypocalcaemia (range of 8-8.4mg/dl) at discharge in the unexposed group. Asymptomatic hypocalcaemia was not observed in any of the patients in the exposed group while 3 patients from the unexposed group had asymptomatic hypocalcaemia at 2 weeks follow-up. Hypocalcaemia or other side effects were not observed in the exposed group.

Commonest symptom of hypocalcaemia observed in both groups was acral and perioral paraesthesia (tingling, numbness of face fingers and toes) followed by fatigability, muscle cramps and headache. Chvostek's sign was found positive in 1 out of 3 symptomatic patients of exposed cohort and 4 out of 20 symptomatic patients of unexposed cohort, whereas five patients of unexposed group showed Trousseau sign. Average hospital stay for asymptomatic patients of both cohorts was 6±2 days, whereas for hypocalcaemia patients, it was 7±3days.

DISCUSSION

Transient hypocalcaemia from surgical injury or inadvertent removal of parathyroid tissue has been reported in upto 46% (permanent hypocalcaemia in 4%) of cases following thyroid surgery.2 Nair et al reported the incidence of hypocalcaemia after total thyroidectomy as 23.6% and that of permanent hypocalcaemia as 1.61%, which is similar to the transient hypocalcaemic symptoms noted in the unexposed group in this study.³ Total thyroidectomy with lymph node dissection had the maximum risk of developing transient hypocalcaemia (41.6%), followed by total thyroidectomy (24%) in our study, consistent with the well-known fact that there is higher chance of hypocalcaemia after thyroidectomy.4

There was significant difference in mean corrected serum calcium levels on postoperative day 3, at discharge and at 2 week follow up visit between the exposed and unexposed groups in the present study. In another study by Szubin et al, total serum calcium values measured during postoperative days were lower in all the 40 patients after total thyroidectomy and the critical period of developing hypocalcaemia was between 48-96 hours post surgery.⁴

In our study, incidence and proportion of clinical symptoms of hypocalcaemia in the exposed group was 3 out of 58 (5.1%) and among unexposed group was 20/77 (25.9%). On calculating the Odd's ratio, the value was found to be 0.155 with 95% confidence interval of 0.44-0.55, hence giving prophylactic oral calcium and vitamin-D is protective in preventing transient hypocalcaemia following total or near total thyroidectomy. Bellantone et al reported in a prospective control study that only 3 of 26 patients (11%) receiving oral calcium supplement (3g/d) had symptoms related to hypocalcaemia after total thyroidectomy, whereas 11 of 27 patients (40%) not receiving calcium supplement had symptoms.⁵ In the study by Roh et al, routine oral calcium and vitamin D supplements significantly reduced the incidence of hypocalcaemia after total thyroidectomy. The incidence of symptomatic and laboratory hypocalcaemia were significantly lower in the oral calcium/vitamin D group than in the group not receiving the supplement: 3 of 45 patients (7%) versus 11 of 45 (24%) and 6 of 45 (13%) versus 16 of 45 (36%) respectively.⁶ Postoperative treatment prevented a significant decrease of serum calcium levels as well as the subsequent development of major hypocalcemic symptoms after total thyroidectomy. In the supplement group, the symptoms were minimal and patients did not experience hypocalcemic crisis. By contrast, hypocalcemic symptoms were more severe in the group that did not receive supplement.⁶

In a study by Uruno et al, calcium solution infusion was found to be beneficial in preventing the development of symptomatic hypocalcaemia thereby reducing patient distress,however no patients required intravenous calcium for symptomatic hypocalcaemia in the present study. Oral administration of 1 μ g of calcitriol twice per day and 500 mg of calcium salts 3 times per day after total thyroidectomy significantly decreased the risk of severe postoperative hypocalcemia. 8

These studies suggest that post thyroidectomy hypocalcaemia can be considerably prevented by the routine prophylactic administration of calcium and vitamin D supplements.

CONCLUSION

Routine prophylactic oral calcium and vitamin-D supplementation is protective in preventing transient hypocalcaemia following total or near-total thyroidectomy.

Therefore, authors recommend routine oral calcium and vitamin D supplements in the prevention of postoperative hypocalcaemia, rather than waiting for symptoms to develop. This will ultimately lead to avoidance of the distressing symptoms of hypocalcaemia and improved patient satisfaction following thyroidectomy.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

REFERENCES

- 1. Michie W, Stowers JM, Duncan T. Mechanism of hypocalcemia after thyroidectomy for thyrotoxicosis, The Lancet. 1971;1:508.
- Demeester-Mirkine N, Hooghe L, Van Geertruyden J, De Maertelaer V. Hypocalcemia after thyroidectomy. Arch Surg. 1992;127:854-8.
- 3. Nair CG, Babu MJ, Menon R, Jacob P. Hypocalcaemia following total thyroidectomy: an analysis of 806 patients'. Indian J Endocr Metab. 2013;17:298-303.
- 4. Szubin L, Kacker A, Kalkani R. Kowisor A. The management of post thyroidectomy hypocalcaemia. Ear Nose and throat J. 1996;75(9):612-4,616.
- 5. Bellantone R, Lombardi CP, Raffaelli M, Boscherini M, Alesina PF, De Crea C, et al. Is routine supplementation therapy (calcium and vitamin D) useful after total thyroidectomy. Surgery. 2002Dec;132(6):1109-12.
- 6. Roh JL, Park CI. Routine oral calcium and vitamin D supplements for prevention of hypocalcaemia after total thyroidectomy. Am J Surg. 2006 Nov;192(5):675-8.
- 7. Uruno T, Miyauchi A, Shimizu K. A prophylactic infusion of calcium solution reduces the risk of symptomatic hypocalcemia in patients after total thyroidectomy. World J of Sur. 2006 Mar;30(3).
- 8. Tartaglia F. Randomized study on oral administration of calcitriol to prevent symptomatic hypocalcemia after total thyroidectomy. The American J of Sur. 2005;190:424-9.

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