

Bilateral Inferior Thyroid Artery Ligation and Transient Hypocalcaemia: A Comparison of Two Surgical Techniques

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ABSTRACT

Objective To compare the frequency of hypocalcaemia in thyroid surgery after ligation of inferior thyroid artery trunk and ligation of Inferior thyroid artery branches at gland surface.

Study design Quasi experimental comparative study.

Place & Duration of study Department of Surgery, Combined Military Hospital Rawalpindi, from February 2008 to August 2008.

Methodology The patients were assigned to two equal groups, Group 'A' and Group 'B'. Estimation of serum calcium (Ca) levels was done before surgery in both the groups. In group 'A' patients underwent thyroid surgery with ligation of inferior thyroid artery (ITA) trunk, while in group 'B' terminal branches of ITA were ligated on gland capsule. Following the surgery serum calcium levels was measured 6 hours after surgery. Afterwards levels of serum calcium were checked daily for three days. The two groups were compared for the frequency of transient hypocalcaemia.

Results Four patients in group A (13.3%) developed transient hypocalcaemia (serum corrected Ca < 2.0mmol), while in group B three patients (10%) developed transient hypocalcaemia. Fishers Exact test was applied and this difference was found statistically insignificant at $p=1.0$. Over all frequency of transient hypocalcaemia in this study was 11.6%.

Conclusion Ligation of ITA trunk does not increase the risk of hypocalcaemia in thyroid surgery.

Key words Hypocalcaemia, Thyroidectomy, Hypoparathyroidism, Tetany.

INTRODUCTION:

Preservation of parathyroid glands and maintaining their blood supply during the thyroid surgery is of paramount importance. Hypocalcaemia may arise after inadvertent removal of parathyroid glands in surgery, devascularisation of glands, hypothermia or direct trauma to parathyroid glands.¹ Reported incidence of temporary hypocalcaemia after thyroid surgery has been in the range of 2% - 53%. Incidence of persistent hypocalcaemia has been reported in the range of 0.4-13.8%.¹ In a local study incidence of hypocalcaemia was 5.48%.² Inadequate level of

parathormone (PTH) after surgery leads to hypocalcaemia. Blood supply of parathyroid glands originates from inferior thyroid artery in 80% of cases.³ In 20% of cases superior parathyroid is supplied by a branch from superior thyroid artery which may sometimes be associated with an anastomotic branch running between superior and inferior thyroid artery regions.³

Researchers have laid stress upon peripheral ligation of tertiary branches of inferior thyroid artery on the gland surface in order to preserve the blood supply of parathyroid glands.^{3,4} However many surgeons performing thyroid surgery ligate inferior thyroid artery trunk in order to save blood loss during surgery.⁵ Some recent studies have supported this approach by showing that there is no increase in incidence of hypocalcaemia after ligation of ITA trunk.^{5,6}

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The objective of this study was to compare the frequency of post operative hypocalcaemia in patients where ITA trunk was ligated with the patients in whom ITA branches were ligated during thyroid surgery.

METHODOLOGY:

This comparative study was carried out at the Department of Surgery, Combined Military Hospital Rawalpindi from February 2008 to August 2008. Patients were assigned to two equal groups, Group 'A' and Group 'B'. Estimation of serum Ca levels was done before surgery in both the groups. In group 'A' patients underwent bilateral ligation of ITA trunk, while in group 'B' terminal branches of ITA were ligated on the gland capsule. Following the surgery serum calcium levels were measured 6 hours after surgery. Afterwards daily levels of serum calcium were checked for three days. Serum phosphate levels were obtained in these patients to rule out other causes of hypocalcaemia. A normal to high level of serum phosphate in presence of hypocalcaemia points towards inadequate PTH function. The two groups were compared for the frequency of transient hypocalcaemia, which was defined as serum corrected calcium level below 2.0 mmol/l in any one of the samples taken after surgery. Patients with malignancy and toxic goiter were excluded.

The data obtained were analyzed for descriptive statistics using SPSS version 10.0. The frequency of transient hypocalcaemia in first group was compared with frequency of transient hypocalcaemia in second group and Fisher's Exact test was used to determine whether the observed difference in frequency of two groups was statistically significant.

Paired sample t test was applied to find out the statistical significance of the observed difference in serum calcium level pre and post operatively in two groups at $p=0.05$ as significant difference. Independent sample t test was applied to find out the statistical significance of observed difference in calcium level in two groups at $p=0.05$ as significant difference post operatively and at day 1, 2 and 3 of surgery. Serum phosphate levels were also compared pre and post operatively in two groups.

RESULTS:

A total of 60 patients were enrolled and divided into two groups of 30 each. Mean age in group A (ITA trunk ligation) was 34.4 ± 10.7 year and in group B (ITA branches ligation) 42.8 ± 13.3 year. There were 4 males and 26 females in group A (male to female ratio 1:6.5) and 10 males and 20 females in group

B (male to female ratio 1:2). In group A 8 (26.6%) patients underwent near total and 22 (73.3%) patients subtotal thyroidectomy. In group B 19 (63.3%) patients underwent near total and 11 (36.6%) patients subtotal thyroidectomy.

Four (13.3%) patients in group A developed transient hypocalcaemia (serum corrected Ca < 2.0mmol), while in group B 3 (10%) patients developed transient hypocalcaemia. Fishers Exact test was applied and this difference was found statistically insignificant at $p=1.0$. Overall frequency of transient hypocalcaemia in this study was 11.6%. Out of four patients in group A who developed transient hypocalcaemia three were females and in group B all three patients with transient hypocalcaemia were also females. Overall 6 (85.7%) out of 7 patients who developed transient hypocalcaemia were females. Symptomatic hypocalcaemia was only seen in two patients in group A and both were females.

When calcium levels were compared pre operatively and post operatively it was found that there was a statistically significant fall in serum Ca levels at 6 hours and day 1 of surgery in both groups, while at day 2 and 3 of surgery the change became statistically insignificant in both the groups. Ca levels were compared between two groups and it was seen that the observed difference between two groups was insignificant at 6 hours ($p=.066$), day 1 ($p=.64$), day 2 ($p=.151$) and day 3 ($p=.082$) [table I].

On studying the serum phosphate levels it was seen that there was a very small but statistically significant rise in serum phosphate level at post operative day 1 in both the groups. When both groups were compared it was seen that the difference in phosphate levels was statistically insignificant on all days after surgery.

DISCUSSION

Many authors favor the truncal ligation of ITA as they debate that it does not cause any difference in post operative PTH and Ca levels. Others argue that there is only a transient fall in Ca level which becomes normal quickly and thus favor this technique to save time, blood loss and recurrent laryngeal nerve damage. There are still others who believe that truncal ligation leads to permanent hypocalcaemia and thus should be avoided. Hence the debate goes on. Some degree of hypocalcaemia always occurs after thyroid surgery as was seen in our study as well, but it usually corrects itself in a few days.⁷ This hypocalcaemia is attributable to dilutional effect leading to hypoalbuminemia

Table I: Independent Samples T Test For Calcium Levels

Post operative Calcium	t	Df	Sig.(2-tailed)	Mean Difference	Std Error Difference
At 6 hours	-1.872	58	.066	-2.573E-02	1.3747E-02
On day 1	-.458	58	.649	-1.100E-02	2.4016E-02
On day 2	-1.454	58	.151	-2.833E-02	1.9491E-02
On day 3	-1.786	58	.082	-4.833E-02	2.7340E-02

and the manipulation of parathyroids leading to their temporary insufficiency.⁸ However severe symptomatic hypocalcaemia occurs if parathyroids are damaged irreversibly or removed. This may get corrected after 6 months to one year depending upon the number of parathyroids damaged or the patient may become permanently hypoparathyroid, requiring life-long calcium supplementation.⁹

Many authors have concluded in their studies that there is no statistically significant difference in post operative calcium levels when ITA trunk is ligated as compared with ligation of ITA branches.¹⁰⁻¹⁵ They have favored the ligation of ITA trunk to save blood loss and damage to recurrent laryngeal nerve.

There are some authors who have concluded in their studies that the peripheral ligation of ITA branches near the capsule decreased the incidence of permanent hypocalcaemia. Kosinski B in their study on 84 patients concluded that in early post operative period the changes in serum calcium and PTH levels were more marked in patients in whom ITA trunk was ligated and these were statistically significant. However after three months serum Ca levels and serum PTH levels were higher in these patients as compared to the group in which ITA was not ligated at trunk.¹⁶ Thomusch O et al in a multivariate analysis of 5846 patients involving 45 hospitals have favored the peripheral ligation of ITA branches near the capsule as it decreased the incidence of permanent hypocalcaemia.⁴ Kerlan MS et al have also favored ligation of terminal branches of ITA in order to reduce the incidence of hypocalcaemia.¹⁷

Chaudhary IA et al studied 310 patients and found no statistically significant difference in postoperative temporary and permanent hypocalcaemia whether or not ITA trunk was ligated.¹⁸ In a study conducted by Khan JS et al, 100 patients were studied in two equal groups with and without ligation of ITA. It was concluded that with the ligation of ITA trunk there was a statistically significant fall in serum Ca level but it was transient as on second post operative day the serum Ca levels increased to normal range and

difference became statistically insignificant.¹⁹

Our study is in accordance with and its results are comparable to other studies done nationally and internationally. In this study we concluded that temporary hypocalcaemia after thyroid surgery was seen in both the groups. Difference between two groups was statistically non significant. All patients with significant hypocalcaemia recovered by third post operative day.

In our study frequency of temporary hypocalcaemia after thyroid surgery was 11.6%. Frequency of hypocalcaemia after thyroid surgery has been quoted in different studies as 2 to 53%³, 5.48%⁴ and 7.3%.⁶ Low frequency of hypocalcaemia in our study may be due to the fact that all cases in which there was toxic goiter and malignancy were excluded thus removing two major risk factors for developing hypocalcaemia.²⁰

Patients who developed symptomatic hypocalcaemia were females. Also significant hypocalcaemia was seen in 85.7% females. It has been pointed out in few studies that female gender is a separate risk factor for developing hypocalcaemia after thyroid surgery.²¹ Whether this is true for our population and what were the factors leading to frequent hypocalcaemia in females needs further research.

CONCLUSION:

Truncal ligation of ITA in bilateral thyroid surgery does not increase the risk of hypocalcaemia in immediate post operative period.

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