

Ligation of Inferior Thyroid Artery to Avoid Hypocalcaemia after Thyroidectomy

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ABSTRACT

Objective: Ligation of inferior thyroid artery to avoid hypocalcaemia after thyroidectomy.

Methods: We did an observational study from June 2011 to April 2012, at Qilu Hospital Jinan affiliated to Shandong University China and Sheikh Zaid Hospital Rahim Yar Khan, Pakistan.

All patients undergoing partial and total thyroidectomy, we placed them in to two groups at random. Group I had inferior thyroid artery (ITA) ligated but in Group II, ITA was not ligated.

Results: 100 patients are operated, majority of them being female. Kind of transit hypocalcaemia was observed in 4.5% patients in Group I and 3.5% patients in Group II. Permanent hypocalcaemia was observed in 1.5% and 1.10% patients in Group I and Group II, respectively. Results were statistically Insignificant (p value > 0.6).

Conclusion: The ligation of ITA did not effect as an important causal factor for occurrence of postoperative hypocalcemia after thyroidectomy was performed in our study.

Keywords: Inferior thyroid artery, Thyroidectomy, Hypocalcaemia, Hypothyroidism.

INTRODUCTION

Mortiz schiff a physiologist of geneva in 1856 showed by experiments on dogs that total extirpation of thyroid gland produce a sequence of ill effects which led to death¹. This work was overlooked more than 25 years. Neither sick reverdin nor Theodor Kocher made reference to schiff when they first reported the phenomena of surgical thyroid deprivation. Kocher is the person who refining the techniques of thyroidectomy and reduce the incidence of postoperative hemorrhage. He also recognizes importance of preserving of parathyroid glands.² Hypocalcaemia or hypoparathyroidism is the well known complications of thyroid surgery. Its incidence is a sensitive measure of the quality of thyroidectomy. In thyroid surgery morbidity and mortality is more severe as compared to some other surgeries and reported complication rates but after thyroid surgery it become vary widely between surgeons and centers. In thyroid surgery different studies have reported recurrent laryngeal nerve injury (0-15%), permanent hypothyroidism (1-13%) and post operative bleeding (0-0.5%) complications^{2,3}.

Rates difference may reflect variation in surgical experience or number of surgeries performed at that hospital. Complication risk depends on the extent of surgery, the nature of that disease and the

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experience of the surgeon. Different, specific surgical problems are encountered in different cases of recurrent thyroid disease, like goiter have different anatomical variations, retrosternal or even mediastinal localization and it can be damage to the recurrent laryngeal nerve or Parathyroid glands. We conducted a study to control the prevalence and significance of post-operative hypocalcaemia in thyroid surgery, with inferior thyroid artery ligation.

MATERIAL AND METHODS

This prospective, observational study was carried out in the Surgical Department of Sheikh Zaid Hospital and Qilu Hospital Jinan, from June 2011 to April 2012. All patients booked for thyroid surgery were included. Patients with thyroid malignancy, goiter with low pre-operative serum calcium. Patients were admitted in the hospitals thorough clinical and histopathological evaluation and preoperative protocol was followed. All patients' preoperative, operative and post-operative findings were recorded in complete details. Patients were divided into two different groups randomly. Group I patients, their inferior Thyroid arteries were ligated where as in Group II patients, were left alone. All the patients were operated by experienced surgeons of the same unit but in the different hospitals. Post-operative serum calcium level was checked on day 2 and 14, in all patients. Clinical patients for the development of hypocalcaemia was also checked routinely during the post-operative and follow up period up to one year, during the first month checked it in the night also,

monthly for three months and then every three months. Patients showing signs of hypocalcaemia, clinically or biochemically, were admitted or followed after every week for assessment depending upon the condition of the patient.

RESULTS

Hundred patients were operated. 96% were female (male to female ratio of 1:24). Twenty patients (52.58%) were included in Group I and 23(47.52%) in Group II, randomly. Majority of these patients were 40 to 50 years old, in both groups. In Group I, 7 (4.50%) patients developed transient and 3(1.50%) patients developed permanent hypocalcaemia. Whereas, in Group II, transient hypocalcaemia was observed in 5(3.5%) and permanent hypocalcaemia in 2(1.10%) patients. Statistical analysis of these findings reveals no significant difference between the groups.

Table 1: Sex distribution of patients

Gender	=n	Percentage
Male	4	4
Female	96	96

Table 2: Patients characteristics consistent with an increased risk of post thyroidectomy symptomatic hypocalcemia

- Large goiter
- High risk malignancy
- Lymphadenectomy
- Low preoperative calcium or vitamin D level
- Graves' disease
- Breast-feeding
- Reoperation
- Coincident primary hyperparathyroidism
- Calcium malabsorption
- Postgastric bypass
- Celiac disease
- Therapy with proton pump inhibitors

Table 3: Elemental calcium content in intravenous and oral calcium formulations

Formulation type amount	Elemental Ca, mg (%)
Calcium gluconate, 1g	93(9.3%)
Calcium chloride, 1g	273(27.3%)
Calcium carbonate, 1.25g	500(40%)
Calcium citrate, 1.9g	400 (21%)

DISCUSSION

Post operative hypocalcemia is a common and most often transient event after extensive thyroid surgery. it may reveal iatrogenic injury to the parathyroid glands and permanent hypoparathyroidism. We

prospectively evaluated the incidence of hypocalcemia and permanent hypoparathyroidism in total or subtotal thyroidectomy. Tetany and Carpopedal spasm are clinical manifestations, which usually occur within a week after surgery. The first clinical sign of hypocalcemia is numbness, tingling sensations, and symptoms of high intracranial pressure or epileptic seizures^{2,4}. Hypocalcaemia can be considered permanent in those patients who needs calcium supplement after one year^{5,6}. Hypocalcaemia can be graded into five grades; Grade I – No spontaneous hypocalcemia, Grade II – Occasional hypocalcemia, Grade III - Serum Ca <8.5mg%, Grade IV - Serum Ca <7.5mg% and Grade V- Serum Ca<6.5mg%². Four commonly cited possibilities of postoperative parathyroid insufficiency in literature are accidental devascularization of one or several parathyroid glands, infarction during manipulation, inadvertent removal of the parathyroids with the thyroid lobes or release of calcitonin due to manipulation during surgery⁷. Calcitonin release as a cause of hypocalcemia has been refuted in different studies done in past^{5,7}. Some other possibilities of the hypocalcemia after thyroidectomy, hypoparathyroidism has been considered as the most widely accepted^{5,7,8}. Main source of blood supply to parathyroid glands is inferior thyroid artery. About 80-86% of upper and 90-95% of lower parathyroid arteries originate from the inferior thyroid artery^{8,9}. Halsted and Evans in 1907¹⁰ first time concluded from anatomical studies that to preserve parathyroid circulation, inferior thyroid artery should not be ligated during thyroid surgery. Since then the issue of inferior thyroid artery ligation during surgery as a cause of hypoparathyroidism has been addressed in several publications. Several studies have been done in the past in different parts of the world to compare the effect of ligation of ITA versus nonligation with equivocal results. Some surgeons recommend the ligation of branches of inferior thyroid artery at the capsule of thyroid gland to avoid devascularization of parathyroid glands. Bashir et al⁷ and Nies et al¹¹ found no significant statistical difference between truncal ligation of inferior thyroid artery versus ligation of branches of inferior thyroid artery at capsule of thyroid gland. Similarly Arango et al¹² has reported no significant difference in post operative serum calcium levels between truncal ligation of inferior thyroid artery and non ligation of inferior thyroid artery. Schmauss and his colleagues⁹ claimed. Reduction in incidence of hypocalcemia after nonligation of inferior thyroid artery in their study.

Thomusch et al¹³ recommended that ligation of inferior thyroid artery at thyroid capsule is a better technique and having less incidence of hypocalcemia. We found, statistically, no significant

difference regarding post-operative hypocalcaemia between truncal ligation and non-ligation of inferior thyroid arteries. Postoperative hypocalcaemia is transient in majority of cases. Among them, some patients develop asymptomatic transient hypocalcemia and some develop symptomatic transient hypocalcemia within week of surgery which may persist for few weeks to few months. Up to 30% incidence of postoperative asymptomatic transient hypocalcemia on first post operative and 6% of temporary hypocalcemia necessitating calcium supplement is reported in literature¹⁴. Transient hypocalcaemia can be observed after any operation on thyroid and these patients improve with calcium supplement. Only few patients (0.1-3%) develop postoperative permanent hypocalcemia¹⁴.

Hypocalcaemia following thyroid surgery should be considered permanent in those patients who continue to require calcium supplement after one year of surgery^{5,6}. Prevalence of permanent hypocalcaemia was less than 2% in both groups, in this study. Incidence of permanent hypocalcaemia reported in different studies are 0.7%⁵, 5%¹², 5.4%¹⁵ and 7.7%¹⁶. Nies et al¹¹ and Kovacs and his colleagues¹⁵ observed that transient mild hypocalcaemia may not be due to parathyroid insufficiency. It can also be observed after other operations accompanied by blood loss or development of hypoalbuminaemia.

They are of the opinion that fluid shifts and dilutional effects can cause temporary hypoalbuminaemia; calcium binding capacity is thereby reduced causing a decrease in total serum concentration. Ionized calcium levels are not influenced by this effect. It may also be a cause of the asymptomatic hypocalcaemia in the immediate postoperative period. Hypoparathyroidism can be responsible for severe or prolonged hypocalcaemia which is observed rarely. Iqbal et al¹⁷ noticed that patients under going total thyroidectomy developed asymptomatic hypocalcaemia in 18.8%, and transient symptomatic hypocalcemia needing calcium supplements in 5.45% of the patients. None of the patients in their study had permanent hypoparathyroidism. They stress on adherence to strict capsular dissection during surgery.

Melanie¹⁸ reported in a study the thyroid surgeon is ultimately responsible for preventing hypocalcemia. the amount of thyroid tissue removed directly correlates with the risk of parathyroid injury. Patient who undergo a thyroid lobectomy are virtually guaranteed not to have hypoparathyroidism.

Richards¹⁹ post-thyroidectomy hypoparathyroidism is usually related to disruption in blood supply rather than to inadvertent removal of parathyroid glands. when parathyroid gland are of uncertain

viability they are minced and autotransplanted into a strap muscle. although a patient needs only a single healthy parathyroid gland to have normal parathyroid function the surgeon goal is to leave the patient with four function parathyroid glands. One thing observed in our study is that the hypocalcaemia is observed more in comparatively younger age in both groups. This may be because of the high uptake of calcium by skeleton under the influence of the androgens in the young, growing age and the decreased serum calcium may be at the expense of the skeletal integrity of the growing skeleton. The biochemical thresholds at which hypocalcaemic symptoms appear are variable and unpredictable. The mechanism of this is unclear but it may be because of the neuromuscular adjustment and lowering of the threshold for hypocalcaemic symptoms²⁰.

CONCLUSION

The ligation of ITA was not an important causal factor for occurrence of postoperative hypocalcemia after thyroidectomy.

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