Ligation of Inferior Thyroid Artery and Early Hypocalcaemia after Subtotal Thyroidectomy

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Abstract

Objective: To analyze if there is any association between ligation of inferior thyroid artery and early hypocalcemia and its related complications after subtotal thyroidectomy.

Methodology: This quasi-experimental study was conducted in surgical units of Benazir Bhutto and Holy Family Hospitals Rawalpindi over a period of six months from 20th March to 3rd August 2008. A total of 60 patients undergoing subtotal thyroidectomy were divided into two treatment groups, i.e. A and B, with 30 patients in each group. In Group A, inferior thyroid artery was not ligated, while in Group B, inferior thyroid artery was ligated.

Results: In group A, mean pre-operative serum calcium level was 9.207 mg/dl ± 0.430 SD and in group B it was 9.303 ± SD mg/dl. Comparison of baseline calcium levels showed no significant difference between the 2 groups. Post-operative calcium levels on day 3 in group A and B were 9.023 ± 0.621 and 8.327 ± 0.627 SD mg/dl, respectively. Day 7 post-operative calcium levels in group A were 9.303 ± 0.390 SD mg/dl and 9.260 ± 0.424 SD mg/dl in group A and B, respectively. There was no significant change in calcium levels observed on day 3 and on follow-up at day 7 in both the groups.

Conclusion: The subtotal thyroidectomy is a safe and effective procedure for simple goiter and ligation of the inferior thyroid arteries does not have any significant effects on the parathyroid functions postoperatively.

Key words: Hypocalcaemia; Subtotal thyroidectomy; Inferior Thyroid artery.

Introduction

In thyroid surgery morbidity and mortality are more severe as compared to some other routinely performed surgeries. Further, the reported complication rates after thyroid surgery vary amongst surgeons and centers. Different studies have reported recurrent laryngeal nerve injury (0-4%), permanent hypothyroidism (1-11%) and postoperative bleeding (0-1%). Hypocalcemia and hypoparathyroidism are well recognized complications of thyroid surgery and their frequency is a sensitive measure of quality of thyroid surgery.1 Theodor Kocher was the first one to recognize the importance of preservation of parathyroid glands.2 Main source of blood supply to the parathyroids is through inferior thyroid artery. About 80-86% of upper and 90-95% of lower parathyroid arteries originate from inferior thyroid artery.3 Hypocalcaemia after thyroidectomy mainly depends on the operation done and the underlying thyroid disease.4,5 There are discrepancies among various series regarding the incidence of transient symptomatic hypocalcaemia and rates of up to 20-83% have been reported by many investigators.5

Permanent hypoparathyroidism can occur in 1-5% of patients after bilateral subtotal resection, and its frequency is higher after total thyroidectomy.6,7 Four commonly observed possibilities of postoperative parathyroid insufficiency are accidental devascularization of one or more parathyroid glands, infarction during manipulation, inadvertent removal of parathyroids with thyroid lobes, or release of calcitonin due to manipulation during surgery.8 Postoperative hypocalcaemia after thyroidectomy is a serious concern because it is one of the most frequent complications after thyroid surgery although in most cases it is transient.9 The occurrence of significant hypocalcaemia commonly determines the length of hospital stay.10,11 If it occurs, result is several days of hospitalization for close observation and frequent laboratory evaluations of serum calcium level.11 Preservation of the parathyroid glands is the key to prevent postoperative hypocalcaemia as the main source of blood supply to the parathyroids is through inferior thyroid artery. This prospective study was undertaken to assess whether preservation of the inferior thyroid arteries reduces the frequency of injury to the parathyroids by evaluating the patient clinically and analyzing its affects on serum calcium level in early postoperative period after bilateral subtotal thyroidectomy.

Materials and Methods

This quasi-experimental study was conducted in the surgical units (I and II) of Benazir Bhutto and Holy Family hospitals from 20th March to 3rd August 2008. A total of 60 patients >18 years age belonging to both genders undergoing subtotal thyroidectomy were included in study. We excluded all the patients with malignant and metastatic disease, toxic goiter, hypocalcaemia preoperatively, diabetes, hypertension, chronic liver disease, bleeding disorders, and...
abnormal protein values. Bilateral subtotal thyroidectomy was done by a standard technique; each superior thyroid vascular pedicle was divided between ligatures. The posterior capsule of the lobes and the parathyroid were preserved in situ. On each side a 4-6 g remnant of thyroid tissue was left in place.

The patients were divided equally into 2 groups, and the effect of bilateral truncal ligation of the inferior thyroid artery on post operative hypocalcaemia were prospectively analyzed in patients treated by subtotal thyroidectomy, without (Group A) and with (Group B) truncal ligation of inferior thyroid artery and comparing serum calcium level between two groups in early postoperative period. In each patient, serum calcium levels were measured before the operation and on the 3rd and 7th postoperative days on follow up. The patients were also assessed for clinical signs and symptoms of hypocalcaemia during the postoperative period and on follow up. All data were entered in SPSS version 10.0 for analysis. Results are expressed as Mean ± Standard deviation (SD). Categoric variables (gender, diagnosis, operation, symptoms of hypocalcaemia) are expressed as percentages and ratios. Continuous variables (age, and serum calcium level) were compared between the two groups, applying student t-test.

Results

Initially 74 patients were enrolled in the study. Out of these patients 14 patients lost the follow-up in the study period and were excluded; the remaining 60 patients were included in study. Out of 60 patients, 9 (15%) were males and 51 (85%) were females. Age range of patients in Group A was between 22-70 years with mean age of 38.60 yrs S.D ±12.4; in group B age ranged between 20-60 years with mean age of 34.0 years S.D ± 9.89.

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<th>Table 1: Laboratory Data in Group A (without truncal ligation of ITA*) and Group B (with ligation) n=60</th>
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*ITA Inferior thyroid artery; **Operative

Three patients in group A and four patients in group B had perioral numbness and positive Chvostek sign. In group A, the mean pre operative calcium level was 9.207mg/dl ± 0.430 SD and in group B it was 9.303 ± SD mg/dl. Comparison of baseline calcium levels showed no significant difference between the 2 groups. Post operative calcium levels on day 3 in group A and B were 9.023 ± 0.621 and 8.327 ± 0.627SD mg/dl, respectively. Day 7 post-operative calcium levels in group A were 9.303 ± 0.390 SD mg/dl and 9.260 ± 0.424 SD mg/dl in group A and B, respectively. There was no significant change in calcium levels observed on day 3 and on follow-up at day 7 in both the groups. The laboratory data of group A and B are depicted in table 1.

Discussion

Postoperative hypocalcemia is a common side effect after thyroid surgery but is often transient.8 The initial clinical signs of hypocalcemia may be less typical and may include numbness and tingling sensation.15 Halsted and Evans15 showed that parathyroid arteries are the end arteries arising from the inferior thyroid artery, and to preserve parathyroid circulation, the inferior thyroid arteries should not be ligated during thyroid surgery. However Curtis16 showed that anastomotic branches between the parathyroid arteries and the thyroid remnant could be enough to preserve tissue perfusion. In thyroid surgery morbidity and mortality is more severe as compared to some other surgeries being performed routinely and reported complication rates.

After thyroid surgery vary widely between surgeons and centers. After subtotal thyroidectomy postoperative hypocalcaemia is assessed on basis of clinical manifestations and biochemical profile. Carpopedal spasm and tetany are typical clinical manifestations, usually occurring within a first few days after surgery. Hypocalcaemia may be considered permanent in those patients who needs calcium supplement after one year.17-18

Hypocalcaemia can be graded into five grades; Grade I – No spontaneous hypocalcaemia, Grade II – Occasional hypocalcaemia, Grade III - Serum Ca < 8.5mg %, Grade IV - Serum Ca < 7.5mg% and Grade V- Serum Ca< 6.5 mg %.1

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 surgery19. 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 3. Bilateral subtotal thyroidectomy is a commonly performed procedure in our set up for nontoxic and benign goitres. We excluded thyroid malignancies and toxic goitres. We think that identification of all parathyroids and meticulous surgical technique to preserve the parathyroid circulation is essential during thyroidectomy. Patients with Graves disease were also excluded to rule out hungry bone phenomenon. Bleeding is
a relatively common complication in such large goitres both peroperatively and postoperatively. Truncal ligation of the inferior thyroid artery results in a more or less bloodless field and it becomes easier to dissect the parathyroids from the thyroid gland. In the past few studies concluded that truncal ligation of the inferior thyroid arteries during bilateral subtotal thyroidectomy for non-toxic nodular goitre did not cause an increased risk of postoperative hypoparathyroidism. These clinical experiences were supported by three recent studies using laser Doppler flowmetry. In these studies blood supplies to the parathyroids other than the inferior thyroid artery were found to be equal to or in some cases even more important than that from the inferior thyroid artery. The authors found that the vessels within the thymothyroid cord and in the connective tissue between the parathyroid glands and the thyroid lobe were the other routes that supplied sufficient blood to the parathyroids to maintain their viability. In our study only 3 patients in group A had circumoral numbness and Chvostek sign positive as compared to 4 patients in group B on 3rd post operative day. Trousseau’s sign was positive in 2 patients in Group A as compared to 3 in Group B on 3rd post operative day. None of the patient had Tetany.

In our study, p value for serum calcium level was not significant on day 3rd and 7th post operative day. Our results suggest that truncal ligation of the inferior thyroid arteries during bilateral subtotal thyroidectomy has no effect on the incidence of hypocalcaemia after thyroidectomy. The inferior thyroid arteries could be ligated truncally to obtain a bloodless field during operation particularly for larger goitres and could reduce bleeding complications postoperatively without disturbing the parathyroid circulation. On 7th postoperative day, only 1 patient from group B had persistent symptoms proving that hypocalcaemia is transient in majority of cases. Up to 30% incidence of postoperative asymptomatic transient hypocalcaemia on first post operative and 6% of temporary hypocalcaemia necessitating calcium supplement is reported in literature. 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 hypocalcaemia. Hypocalcaemia following thyroid surgery should be considered permanent in those patients who continue to require calcium supplement after one year of surgery. Iqbal J et al noticed that patients undergoing total thyroidectomy developed asymptomatic hypocalcaemia in 18.8%, and transient symptomatic hypocalcaemia 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. It has been observed that transient mild hypocalcaemia may not be due to parathyroid insufficiency only but it can also be observed after other operations accompanied by blood loss or development of hypoproteinemia. They are of the opinion that fluid shifts and dilutional effects can cause temporary hypoproteinemia; 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 he asymptomatic hypocalcaemia in the immediate postoperative period. Hypoparathyroidism can be responsible for severe or prolonged hypocalcaemia which is observed rarely. 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 symptoms. Regarding the hypothesis of devascularization of parathyroid glands, there is such a rich anastomotic network of the capillaries in the neck that if the arterial supply of the parathyroid glands is even compromised, still these should regenerate and revascularize in the much natural way as opposed to the auto-transplanted glands when accidentally or willingly removed.

Conclusion

It is concluded that the subtotal thyroidectomy is a safe and effective procedure and ligation of the inferior thyroid arteries does not have any significant effects on the parathyroid function postoperatively. Patients of hypocalcaemia can have biochemical hypocalcaemia without any sign and symptoms.

References


