TO LIGATE OR NOT THE INFERIOR THYROID ARTERY TO AVOID HYPOCALCAEMIA AFTER THYROID SURGERY

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Background: Hypocalcaemia is a well recognized complication of thyroid surgery. We have compared the prevalence of hypocalcaemia in our patients following ligation and non-ligation of the inferior thyroid artery (ITA) during thyroid surgery. **Methods:** A prospective observational study was done from January 2000 to December 2004, at Fauji Foundation Hospital, Rawalpindi. All patients undergoing subtotal or total thyroidectomy were placed in two groups at random. Group I had ITA ligated whereas in Group II, ITA was not ligated. **Results:** 310 patients were operated, majority of them being female (97.10%). Transient hypocalcaemia was observed in 4.29% patients in Group I and 3.4% patients in Group II. Permanent hypocalcaemia was observed in 1.84% and 1.36% patients in Group I and Group II, respectively. Results were statistically insignificant (p value > 0.5%). **Conclusion:** There is no significant difference in post-operative hypocalcaemia whether or not the ITA is ligated.

Keywords: Thyroidectomy; Hypocalcaemia; Inferior thyroid artery

INTRODUCTION

Theodor Kocher is credited with refining the techniques of thyroidectomy and reducing the incidence of postoperative hemorrhage. He also recognized the importance of preservation of parathyroid glands[1]. Hypocalcaemia or hypoparathyroidism is among the well recognized complications of thyroid surgery and its incidence is a sensitive measure of the quality of thyroid surgery. 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. Different studies have reported recurrent laryngeal nerve injury (0-14%), permanent hypothyroidism (1-11%) and post operative bleeding (0-1%) [2,3]. This difference in complication rates may reflect variation in surgical experience or number of surgeries performed at that center. The risk of complications depends on the extent of surgery, the nature of underlying disease and the experience of the operating surgeon. Furthermore, specific surgical problems are encountered in cases of recurrent thyroid disease, large goitre, anatomical variations, retrosternal or even mediastinal localization and damage to the recurrent laryngeal nerve or Parathyroid glands.

We conducted a study to assess the prevalence and significance of post-operative hypocalcaemia following thyroid surgery, with or without ITA ligation.

MATERIAL AND METHODS

This prospective, observational study was carried out in the Surgical Department of Fauji Foundation Hospital, Rawalpindi, a tertiary care center, from January 2000 to December 2004.

All patients booked for thyroid surgery were included. Patients with recurrent goiter, thyroid malignancy, low pre-operative serum calcium and those who could not complete one year follow up, were excluded. Patients were admitted and thorough clinical, biochemical and histopathological evaluation and pre-operative workup protocol was followed. All pre-operative, operative and post-operative findings were recorded in detail. Patients were divided into two groups at random. In Group I patients, main trunks of inferior thyroid arteries were ligated where as in Group II, these were left alone. All the patients were operated by senior and experienced surgeons of the same unit. Post-operative serum calcium level was done on day 2 and 15, in all patients. Clinical assessment of the patients for the development of hypocalcaemia was also done routinely during the post-operative and follow up period up to one year, fortnightly during the first month, monthly for three months and than after every three months. Patients showing features of hypocalcaemia, clinically or biochemically, were admitted or followed after every week for assessment depending upon the condition of the patient. Results were evaluated and statistical analysis was done.

RESULTS

310 patients were operated. 97.1% were female (male to female ratio of 1:33.4). 163 patients (52.58%) were included in Group I and 147 (47.52%) in Group II, randomly. Majority of these patients were in the 4th and 5th decade of their life, in both groups (Table 1). In Group I, 07 (4.29%) patients developed transient and 03 (1.84%) patients developed permanent hypocalcaemia. Whereas, in Group II, transient hypocalcaemia was observed in 05 (3.4%) and permanent hypocalcaemia in 02 (1.36%) patients (Table 2). Statistical analysis of these findings (Table 3) reveals no significant difference between the groups.

Table 1. Age and sex distribution (n = 310)

Age Group	Male		Female		Total	
	No.	%	No.	%	No.	%
11-20	5	55.56	30	9.96	35	11.29
21-30	-	-	30	9.96	30	9.68
31-40	2	22.22	91	30.23	93	30
41-50	1	11.11	112	37.21	113	36.45
51-60	1	11.11	27	8.97	28	9
>60	-	-	11	3.65	11	3.55
Total	**9**	**2.9%**	**301**	**97.1%**	**310**	

Table 2. Hypocalcaemia secondary to ligation versus non-ligation of ITA (n = 310)

	ITA ligated (n=163)			ITA not ligated (n=147)		
AGE	**No of patients**	**Hypocalcaemia transient**	**Hypocalcaemia permanent**	**No of patients**	**Hypocalcaemia transient**	**Hypocalcaemia permanent**
11-20	19	1	-	16	-	-
21-30	13	2	1	17	-	-
31-40	49	2	2	44	2	2
41-50	56	2	-	57	2	-
51-60	19	-	-	09	1	-
>60	7	-	-	4	-	-
TOTAL	**163 (52.58%)**	**7 (4.29%)**	**3 (1.84%)**	**147 (47.42%)**	**5 (3.40%)**	**2 (1.36%)**

Table 3. Post-operative Serum Calcium status

Status of Hypocalcaemia	Ligation of Inferior Thyroid Artery		Total
	ITA Ligated	ITA not Ligated	
Transient Hypocalcaemia	07 (4.29%)	05 (3.4%)	12 (3.87%)
Permanent Hypocalcaemia	03 (1.84%)	02 (1.36%)	05 (1.61%)
No Hypocalcaemia	153 (93.87%)	140 (95.34%)	293 (94.52%)
Total	163	147	310
Statistical Analysis: Chi-square Value 0.29 *p* value at df 2= 0.86 (> 0.05 not significant)			

DISCUSSION

Post operative hypocalcaemia is a relatively common side effect of thyroid surgery and most often is a transient event after extensive thyroid surgery. Carpopedal spasm and tetany are typical clinical manifestations, usually occurring within a week after surgery. The first clinical sign of hypocalcemia may be less typical and may include numbness, tingling sensations, and symptoms of raised intracranial pressure or epileptic seizures [2,4]. Hypocalcaemia may 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 post-operative 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 surgery [7]. Calcitonin release as a cause of hypocalcemia has been refuted in different studies done in past [5, 7]. Among 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 1907 [10] 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 non-ligation 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 al [7] and Nies et al [11] 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 Aranjo et al [12] 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 colleagues [9] claimed reduction in incidence of hypocalcemia after non-ligation of inferior thyroid artery in their study.

Thomusch et al [13] 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 literature [14]. 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 hypocalcemia[14]. 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 al [11] and Kovacs and his colleagues [15] 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 J et al[17] 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. George and his colleagues [4] reported transient hypocalcemia in only one patient (1.12%) out of 89 patients, on which they performed minimally invasive non-endoscopic thyroid surgery.

One of the interesting observations in our study is that the hypocalcaemia is observed more in comparatively younger age in both groups. This might be because of the increased uptake of calcium by skeleton under the influence of the androgens in the young, growing age and the decreased serum calcium might 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 symptoms [18]. 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 [10,16,19].

CONCLUSION

It is concluded that the ligation of the inferior thyroid arteries does not have any significant effects on the parathyroid function, post-operatively.

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