

Original Research Article

Identification of patients at high risk for hypocalcemia after total thyroidectomy with serial calcium estimation and intact parathyroid hormone levels-a comparative study

Pauly T. J.*, Santhosh P. V., Santhosh T. V., Vinodh M.

Department of Surgery, Government Medical College M. G. Kavu, Thrissur, Kerala 680596, India

Received: 30 August 2016

Accepted: 28 September 2016

*Correspondence:

Dr. Pauly T. J.,

E-mail: paulytj@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: In recent years, multiple retrospective and prospective studies have emerged, which support the use of postoperative serum intact parathyroid hormone (iPTH) levels can also predict hypocalcaemia in postoperative thyroidectomy patients. Therefore, the present study was designed to determine the incidence of hypocalcaemia after total thyroidectomy.

Methods: 146 patients who underwent total thyroidectomy were recruited. The incidence of hypocalcaemia was analyzed with serial calcium estimation results with 6 hours, 24 hours, 48 hours and 2 weeks post-operative calcium level estimations. The incidence of hypocalcaemia with regards to the number of parathyroid glands was determined and the results between the three groups were compared.

Results: The incidence of transient hypocalcaemia at 24hr postoperative period and intact parathyroid hormone (iPTH) level showed a significant difference ($p < 0.001$). 49% of the patients were with calcium levels < 8 mg/dl in first 24hrs of serial calcium estimation in comparison with the 51% parathormone level with < 15 pg/dl was also showed a significant difference ($p < 0.001$). Calcium levels less than 8 mg/dl. The serial calcium level after 2wks with features of hypocalcemia (< 8 mg/dl) were 18% and was more predictable and cost effective than intact parathyroid hormone (iPTH) estimation which require Rs.1000-1200 in comparison with the serial calcium estimation of around Rs. 400.

Conclusions: The serial calcium level estimations are more predictable and cost effective than intact parathyroid hormone (iPTH) estimation in predicting long term post-operative hypocalcaemia after total/near total thyroidectomy.

Keywords: Hypocalcaemia, iPTH, Thyroidectomy

INTRODUCTION

Hypocalcaemia is one of the most common complications following total thyroidectomy, occurring in 10-50% of cases. It is usually transient, but can be permanent in 0.5–10.6% of patients. It is caused by parathyroid revascularization, stunning, or incidental removal of the parathyroid glands.¹ The nadir for hypocalcaemia typically occurs at around 24-48 hours postoperatively but may be as delayed as post-op day 4. Therefore, detecting patients requiring calcium replacement therapy

with serial calcium measurements can take multiple blood tests over several days.²⁻⁵ Placing all patients on calcium therapy unnecessarily commits many patients to unnecessary treatment and puts them at risk for hypocalcaemia. A clinical laboratory method for early prediction of postoperative hypocalcaemia could, therefore, facilitate earlier implementation of treatment, and early discharge (≤ 24 hours).

In recent years, multiple retrospective and prospective studies have emerged, which support the use of

postoperative serum intact parathyroid hormone (iPTH) levels can also predict hypocalcaemia in postoperative thyroidectomy patients.^{6,7} Different groups have published considerable research on this topic, demonstrating that 1 and 6-hour postoperative PTH and Calcium levels had a high sensitivity and specificity of detecting postoperative hypocalcaemia.⁸⁻¹⁰

The purpose of this study is to determine the number of high-risk patients who develop hypocalcaemia after total thyroidectomy by serial calcium level estimation in 6 hours, 24 hours, 48 hours and 2 weeks of post-operative period and post-operative intact parathyroid hormone (iPTH) level estimation and comparing predictive value in permanent hypocalcaemia.

METHODS

The present study was conducted after the institutional ethical clearance. The study included 146 patients who are subjected to total thyroidectomy after the informed and written consent from all the patients.

The preoperative number of parathyroid glands identified in all the patients and the serial calcium levels were estimated. The patients who were admitted for total/near total thyroidectomy belonging to different age group of both genders were included.

Patients having abnormal preoperative serum calcium level below the normal range of 8 mg/dl in the retrospective series were excluded. The parameters assessed were post-operative serial calcium levels in 6 hours, 24 hours, 48 hours and 2 weeks. The number of parathyroid glands identified peroperatively was recorded.

Then the patients were allotted to 3 groups namely, Group-1 (with <2 parathyroid glands), Group-2 (with 2 parathyroid glands) and Group-3 (with >2 parathyroid glands).

Meticulous dissection without much use of monopolar or bipolar cautery, identifying the glands by its color, texture and position is followed. Post-operative serum calcium level and intact parathyroid hormone (iPTH) levels were estimated using commercially available kit according to the manufacturer's guidelines.

Statistical analysis

The number of patients belongs to different group on the basis of serum calcium level was represented as percentage. Chi square test was used to find out the statistical significance. P value less than 0.005 was considered significant.

RESULTS

The present study included a total 146 patients. Among them 9% belong to Group-1, 42% belong to Group-2 and 49% belong to Group-3 (Table 1).

Table 1: Number of patients belongs to different group. N=146.

Group	n (%)
Group-1	13 (9%)
Group-2	61(42%)
Group-3	72 (49%)

Table 2: Number of patients according to their serum calcium level n (%) at different postoperative time interval; N=146.

Group vs Time period	Number of patients according to their serum calcium level n (%)		P value
	<8 mg/dl	>8 mg/dl	
6 hours post-operative period	43(29%)	103(71%)	<0.001
24 hours post-operative period	37(25%)	109(75%)	<0.001
48 hours post-operative period	29(20%)	117(80%)	<0.001
2 weeks post-operative period	27(18%)	119(82%)	<0.001

The incidence of transient hypocalcaemia at 24hr postoperative period and intact parathyroid hormone (iPTH) level was estimated and compared. It showed a significant difference (Figure 1, p<0.001).

But the permanent hypocalcaemia which required calcium supplementation were more accurate with serial calcium estimation than the intact parathyroid hormone (iPTH) levels obtained after total/near total thyroidectomy. 49% of the patients were with calcium

levels <8 mg/dl in first 24hrs of serial calcium estimation in comparison with the 51% parathormone level with 15pg/dl was observed. On statistical analysis, it showed a significant difference (Figure 2, p<0.001). 41% of the patients were with calcium levels <8 mg/dl in first 24hrs of serial calcium estimation in comparison with the 59% parathormone level with 15pg/dl was observed.

On statistical analysis, it also showed a significant difference (Figure 3, p<0.001). The serial calcium level

after 2 weeks with features of hypocalcaemia (<8mg/dl) were 18% which is more predictable and cost effective than parathormone estimation which was 26% and was more than the actual hypocalcaemia which required calcium supplementation.

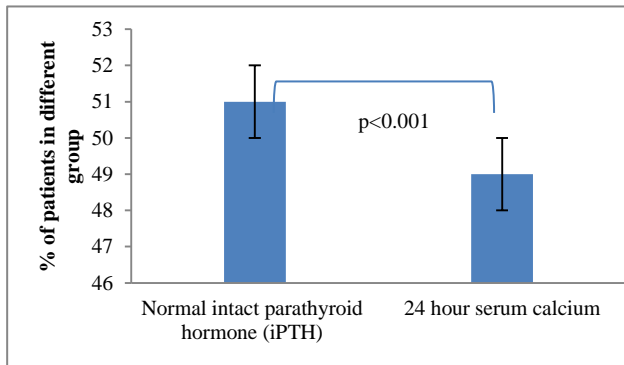


Figure 1: Comparison of number of patients with normal level of intact parathyroid hormone (iPTH) at 15pg/dl in patients with calcium levels <8 mg/dl.

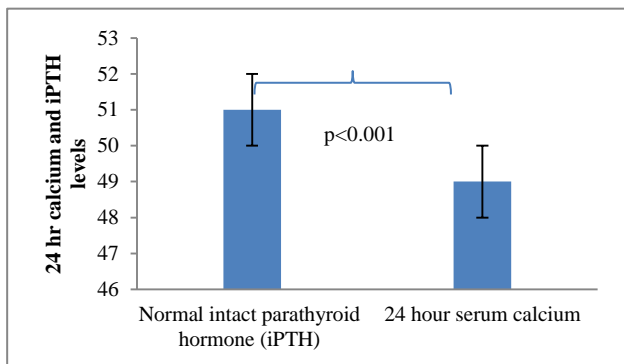


Figure 2: Comparison of number of patients with normal level of intact parathyroid hormone (iPTH) at 15pg/dl in patients with calcium levels <8 mg/dl.

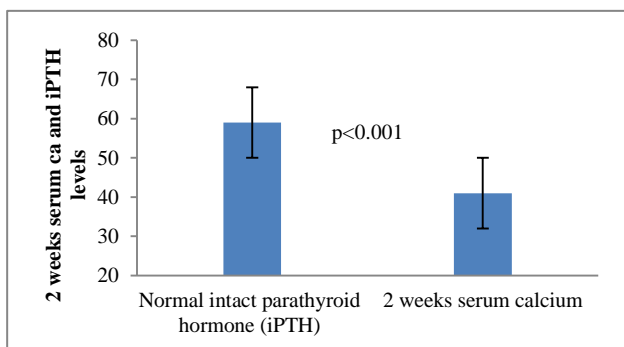


Figure 3: Comparison of number of patients with normal level of intact parathyroid hormone (iPTH) at 15pg/dl in patients with calcium levels <8 mg/dl.

DISCUSSION

The present study aimed at identifying the patients at high risk of developing hypocalcaemia following total

thyroidectomy by means of retrospective analysis of serial post-operative calcium levels in 6 hours, 24 hours, 48 hours and 2 weeks of post-operative period and post-operative intact parathyroid hormone(i PTH) level estimation and comparing predictive value in assessing permanent hypocalcaemia. The incidence of transient hypocalcaemia upto 24 hours of serum calcium and intact parathyroid hormone (iPTH) levels were comparable. But the permanent hypocalcaemia which required calcium supplementation were more accurate with serial calcium estimation than the intact parathyroid hormone (i PTH) levels obtained after total/near total thyroidectomy.

25% of the patients were with calcium levels <8 mg/dl in first 24hrs of serial calcium estimation in comparison with the 26% intact parathyroid hormone (i PTH) levels <15pg/dl i.e. Calcium levels less than 8 mg/dl. The serum calcium level after 2wks with features of hypocalcaemia (<8mg/dl) were 18% which is more predictable and cost effective than intact parathyroid hormone (i PTH) estimation which showed 26%. In the classic presentation of primary hypo-parathyroidism, the characteristic biochemical hallmark, hypocalcaemia is not always seen.¹¹ From time to time, the serum calcium may be normal. However, most of the time, the serum calcium in these patients is elevated. It is important to distinguish the patient with hypocalcaemia whose serum calcium can be normal occasionally from the entity that has surfaced more recently in which the serum calcium is always normal.¹²⁻¹⁵ The old literature, in fact, described some cohorts as “normocalcemic”, while more careful inspection has shown that these patients were intermittently normocalcemic.¹⁶⁻²⁰

The incidence of permanent hypocalcaemia which required calcium supplementation was more accurate with serial calcium estimation than the intact parathyroid hormone (iPTH) levels obtained after total thyroidectomy. The serial calcium level estimations are more predictable and cost effective than intact parathyroid hormone (i PTH) estimation in predicting long term post-operative hypocalcaemia after total/near total thyroidectomy. In first 24 hours the combined evaluation gives more accurate results than the individual evaluations.

CONCLUSION

In conclusion, we propose herewith the serial calcium level estimations are more predictable and cost effective than intact parathyroid hormone (i PTH) estimation in predicting long term post-operative hypocalcaemia after total thyroidectomy. In first 24 hours the combined evaluation gives more accurate results than the individual evaluations.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Thompson NW, Olsen WR, Hoffman GL. The continuing development of the technique of thyroidectomy. *Surgery.* 1973;73:913-27.
2. Shaha AR, Jaffe BM. Parathyroid preservation during thyroid surgery. *Am J Otolaryngol.* 1998;19:113-7.
3. Cheah WK, Arici C, Ituarte PH, Siperstein AE, Duh QY, Clark OH. Complications of neck dissection for thyroid cancer. *World J Surg.* 2002;26:1013-6.
4. Thomusch O, Machens A, Sekulla C, Ukkat J, Brauckhoff M, Dralle H. The impact of surgical technique on postoperative hypoparathyroidism in bilateral thyroid surgery: a multivariate analysis of 5846 consecutive patients. *Surgery.* 2003;133:180-5.
5. McHenry CR, Speroff T, Wentworth D, Murphy T. Risk factors for postthyroidectomy hypocalcemia. *Surgery.* 1994;116:641-7.
6. Demeester-Mirkine N, Hooghe L, Van Geertruyden J, De Maertelaer V. Hypocalcemia after thyroidectomy. *Arch Surg.* 1992;127:854-8.
7. Wingert DJ, Friesen SR, Iliopoulos JI, Pierce GE, Thomas JH, Hermreck AS. Post-thyroidectomy hypocalcemia. Incidence and risk factors. *Am J Surg.* 1986;152:606-10.
8. Shaha AR, Burnett C, Jaffe BM. Parathyroid autotransplantation during thyroid surgery. *J Surg Oncol.* 1991;46:21-4.
9. Olson JA, Jr, DeBenedetti MK, Baumann DS, Wells SA. Jr Parathyroid autotransplantation during thyroidectomy. Results of long-term follow-up. *Ann Surg.* 1996;223:472-8.
10. Lee NJ, Blakey JD, Bhuta S, Calcaterra TC. Unintentional parathyroidectomy during thyroidectomy. *Laryngoscope.* 1999;109:1238-40.
11. Attie JN, Khafif RA. Preservation of parathyroid glands during total thyroidectomy. Improved technic utilizing microsurgery. *Am J Surg.* 1975;130:399-404.
12. Kark AE, Kissin MW, Auerbach R, Meikle M. Voice changes after thyroidectomy: role of the external laryngeal nerve. *Br Med J. (Clin Res Ed)* 1984;289:1412-5
13. Crumley RL, Smith JD. Postoperative chylous fistula prevention and management. *Laryngoscope.* 1976;86:804-13,
14. Shaha AR, Jaffe BM. Practical management of post-thyroidectomy hematoma. *J Surg Oncol.* 1994;57:235-8.
15. Farrar WB, Cooperman M, James AG. Surgical management of papillary and follicular carcinoma of the thyroid. *Ann Surg.* 1980;192:701-4.
16. Attie JN, Moskowitz GW, Margouleff D, Levy LM. Feasibility of total thyroidectomy in the treatment of thyroid carcinoma: postoperative radioactive iodine evaluation of 140 cases. *Am J Surg.* 1979;138:555-60.
17. Lal G, Ituarte P, Kebebew E, Siperstein A, Duh QY, Clark OH. Should total thyroidectomy become the preferred procedure for surgical management of Graves' disease? *Thyroid.* 2005;15:569-74.
18. Pesce CE, Shiue Z, Tsai HL, Umbricht CB, Tufano RP, Dackiw AP, et al. Postoperative hypocalcemia after thyroidectomy for Graves' disease. *Thyroid.* 2010;20:1279-83.
19. Kihara M, Yokomise H, Miyauchi A, Matsusaka K. Recovery of parathyroid function after total thyroidectomy. *Surg Today.* 2000; 30:333-8.
20. Percival RC, Hargreaves AW, Kanis JA. The mechanism of hypocalcaemia following thyroidectomy. *Acta Endocrinol (Copenh).* 1985;109:220-6.

Cite this article as: Pauly TJ, Santhosh PV, Santhosh TV, Vinodh M. Identification of patients at high risk for hypocalcemia after total thyroidectomy with serial calcium estimation and intact parathyroid hormone levels-a comparative study. *Int J Res Med Sci* 2016;4:4894-7.