



CORRELATION BETWEEN CALCIUM LEVEL WITH THE INCIDENCE OF POST-OPERATIVE HYPOCALCEMIA IN PARATHYROID ADENOMA IN A TERTIARY CARE CENTER

General Surgery

**Mohanapriya
Thygarajan**

Associate Professor general surgery, Sri Ramachandra Institute of Higher Education and Research, Chennai 116

**Rajasenthil
Viswanathan***

Associate Professor general surgery, Sri Ramachandra Institute of Higher Education and Research, Chennai 116.*Corresponding Author

KEYWORDS

INTRODUCTION:

Parathyroid adenoma is a benign tumour of parathyroid glands affecting one or more of it, and it is the most common cause of primary hyperparathyroidism. Primary Hyperparathyroidism refers to a condition where in parathyroid gland secretes an excess of parathormone leading to signs and symptoms of hypercalcemia. In this study we have analysed the correlation between pre-operative parathormone, alkaline phosphatase and calcium level with the incidence of post-operative hypocalcemia and the correlation between the serum calcium level and the size parathyroid adenoma.

AIM:

To analyse the correlation between the pre-operative calcium, alkaline phosphatase and parathormone level with the incidence of post-operative hypocalcemia and the correlation between the serum calcium level and the size parathyroid adenoma.

METHODS:

All patients diagnosed with parathyroid adenoma between the age of 18 and 70 were included in this prospective study. Patients diagnosed with parathyroid carcinoma and parathyroid hyperplasia were excluded from the study. Our study included 35 patients with parathyroid adenoma seen over a period of two years from jan 2018 to dec 2019 in sri ramachandra institute of higher education and research, Chennai.

For all the patients serum calcium, parathormone, serum phosphate, Alkaline phosphatase, 1,25- dihydroxy Vitamin D level, 24 hour urinary excretion Ca level, Ultrasound- whole abdomen and neck, X-ray of the hand & skull was done. All patients underwent preoperative localization with sestamibi SPECT scan (MIBI scan)

All patients had increased serum calcium levels and increased parathormone levels. All patients underwent parathyroid adenoma excision (FIG 1) under general anaesthesia. All histopathology examination report came as parathyroid adenoma (FIG 2)

Results:

The age distribution was between 20-60 years, 18 out of 35 patients were female. There was myriad presentation of symptoms like Gastric symptoms, Bone pain, bone fracture, Neck swelling, Renal stones, Psychiatric symptoms, Numbness, pancreatic symptoms, and muscle pain. Each patient presented with more than 2 of the above symptoms. All patients had increased pre-operative serum calcium levels increased alkaline phosphatase level and increased parathormone levels. (Table 1)

Parathyroid adenoma was localized with sestamibi scan and the adenoma was excised through small incision under general anaesthesia. Intra-operative parathormone was done to confirm the excision of parathyroid adenoma. All histopathology examination report came as parathyroid adenoma. In the post-operative period 30 out of 35 patients developed hypocalcemia. The symptomatology in patients with parathyroid adenoma are not related to the calcium level and size of the tumour cannot be predicted by the calcium level (Table 2). Lower the pre-operative serum calcium level, higher is the incidence of post-operative hypocalcemia and longer to revert back to normal level (Table 3). These was negative correlation between pre-operative and post-operative calcium levels.

DISCUSSION:

Parathyroid adenoma is a benign tumour of the parathyroid glands. It is the commonest cause of primary hyperparathyroidism which causes increased production of parathyroid hormone by the overactive parathyroid gland with a incidence of 2.5/1000 in India¹. The other causes of primary hyperparathyroidism are lithium therapy, therapeutic ionising radiation, familial hereditary hyperparathyroidism, MEN syndrome.

Primary hyperparathyroidism (pHPT) is defined as an autonomous overproduction of parathyroid hormone (PTH). This overproduction is in approximately 80-90% of cases caused by a solitary parathyroid adenoma and in most other cases by diffuse hyperplasia, rare multiple adenomas or carcinoma².

Female preponderance was observed in our study, this is similar to the study done by Mallikarjuna et al³. In India, the incidence is common in below 40 years where as in the western countries the incidence is between 55-62 years^{4,5}. In our study, 8 out of the 12 were less than 40 years. In one study from India, most of the patients were <45 years of age⁶.

Parathyroid adenoma usually presents classically with pentad of symptoms like kidney stones (nephrocalcinosis- polyuria, polydipsia, nocturia), painful bones, abdominal groans, psychic moans, fatigue overtones. It also presents with heart burns, GERD, thinning of hair, high blood pressure, 50% recurrent headaches, heart palpitations, arrhythmias in older age groups. Similarly in our study, patients presented with gastric, pancreatic symptoms, bone fracture, psychic moans, renal symptoms, muscle pain.

According to our study, symptomatology in patients with parathyroid adenoma are not related to the calcium level. Similar observation was seen in a study done by Md. Arif Hossain Bhuyan et al⁷.

In our study 11 (32%) patients had bone pain whereas in a study by Gopal et al 75% of the patients had bone pain.⁸

Lower the preoperative serum calcium, higher the incidence of post-operative hypocalcemia and longer is the duration to revert to normocalcemia in our study (table 2). In our study, 21 (60%) patients had preoperative calcium levels of less than 13 mg/dl and 14 (40%) patients more than 13 mg/dl. The time taken for the post-operative calcium levels to normalise is higher in patients with preoperative low calcium levels. In our study 5 patients had normalised calcium levels on day 5 with preoperative calcium level of less than 11 mg/dl. This observation is similar to studies done by Shawn steen et al⁹ & Hamouda M et al¹⁰.

Size of the tumour cannot be predicted by the calcium level and there is no correlation between presenting symptoms & size of the tumour (table 3). This observation is similarly to the study by spanheirner et al¹¹.

CONCLUSION:

Parathyroid adenoma have myriad presentation. Symptomatology in patients with parathyroid adenoma are not related to the calcium level and size of the tumour cannot be predicted by the calcium level. Lower the preoperative serum calcium level, higher is the incidence of

postoperative hypocalcemia and longer time for serum calcium level to revert back to normal level.

TABLE 1 : CORRELATION OF SERUM MARKERS & IMAGING MODALITIES

S. No	Serum Calcium	Alk. Phos Phatase	S. Phosphorus	Parathormone	USG – Abdomen	Isotope Scan
1	14.2	70	2.4	130	Left renal calculus	RT. Inferior
2	12.1	90	2.3	124	Normal	RT. Inferior
3	11.3	97	2.3	244	Normal	LT. Inferior
4	12.6	1432	2.4	1268	Right renal calculus	RT. Inferior
5	10	947	2.4	842	Normal	LT. Inferior
6	13.1	184	2.4	460	Nephrocalcinosis	RT. Inferior
7	11.7	876	2.1	324	Right renal calculus	RT. Inferior
8	14.5	195	1.9	529	Nephrocalcinosis	LT. Inferior
9	14	1800	1.6	230	Pancreatic Calcification	LT. Inferior
10	12.5	342	3.9	842	Normal	LT. Inferior
11	14.8	563	1.8	244	B/L renal calculus	LT. Inferior
12	12.8	120	2.0	1108	Right renal calculus	LT. Inferior
13	12.1	116	2.4	1205	Left renal calculus	Right inferior
14	11.4	900	2.3	130	Nephrocalcinosis	Right superior
15	11.6	97	2.6	116.5	b/l renal calculus	Left inferior
16	11.4	114	2.3	260.7	Normal	Right superior
17	17.3	103	1.8	890.6	Right renal calculus	Right inferior
18	11.4	197	2.4	478.1	Normal	Right inferior
19	11	179	2.1	198.6	Pancreatic calcification	Right inferior
20	12.6	110	2.6	980	B/l renal calculus	Left inferior
21	11.9	105	2.8	193.3	Nephrocalcinosis	Right superior
22	15.2	86	1.8	15.9	Normal	Right inferior
23	16.6	74	1.8	504	Normal	Right inferior
24	17.4	80	2	480	Right renal calculus	Right inferior
25	13.2	306	2.1	743.2	Normal	Right inferior
26	16.2	82	1.8	504	Normal	Left inferior
27	17.7	90	1.8	480	Pancreatic calcification	Left inferior
28	10.6	545	2.6	1228.8	Normal	Right inferior
29	12.6	106	2.3	209.2	Normal	Left inferior
30	10.6	600	2.6	97.7	B/L renal calculus	Left inferior
31	16.8	84	1.6	494	Normal	Left inferior
32	10.3	560	2.4	98	Normal	Right superior

33	17.8	90	1.6	143	Normal	Right inferior
34	16.4	78	1.8	510	Left renal calculus	Left inferior
35	10.8	620	2.6	1030	Right renal calculus	Left inferior

TABLE 2 : Duration of postoperative hypocalcemia

S. NO	PRE OPERATIVE CALCIUM LEVEL(mg/dl)	POST OPERATIVE DAY-CALCIUM CAME BACK TO NORMAL LEVEL
1	14.2	DAY – 3
2	12.1	DAY – 3
3	11.3	DAY – 4
4	12.6	DAY – 3
5	10.0	DAY – 4
6	13.1	DAY – 3
7	10.7	DAY – 5
8	14.5	DAY – 3
9	14.5	DAY – 3
10	12.5	DAY – 4
11	14.8	DAY – 3
12	12.8	DAY – 3
13	12.1	DAY-4
14	11.4	DAY-3
15	11.6	DAY-3
16	11.4	DAY-4
17	17.3	DAY-2
18	11.4	DAY-4
19	11	DAY-4
20	12.6	DAY-3
21	11.9	DAY-3
22	15.2	DAY-2
23	16.6	DAY-2
24	17.4	DAY-2
25	13.2	DAY-3
26	16.2	DAY-2
27	17.7	DAY-2
28	10.6	DAY-5
29	12.6	DAY-3
30	10.6	DAY-5
31	16.8	DAY-2
32	10.3	DAY-5
33	17.8	DAY-2
34	16.4	DAY-3
35	10.8	DAY-5

TABLE 3 : CORRELATION OF PRE OPERATIVE CALCIUM, SYMPTOMS & SIZE IF ADENOMA

S. NO	PRE OPERATIVE CALCIUM	SYMPTOMS	HIPE – SIZE (cm)
1	14.2	Neurological, Renal , Psychiatric	2 X 2
2	12.1	Bone pain, Neck swelling, Renal	2 X 3
3	11.3	Bone pain, Bone Fracture	4 X 4
4	12.6	Bone pain, Bone Fracture, Muscle pain	3 X 2
5	10.0	Gastric, Bone pain, Pancreatic Symptom, Muscle pain	2 X 2
6	13.1	Gastric, Psychiatric, Pancreatic Symptom, Muscle pain	2 X 1.5
7	11.7	Renal	5 X 3
8	14.5	Gastric, Neck swelling, Psychiatric	2 X 3
9	14.0	Gastric, Neurological Muscle pain	4 X 4
10	12.5	Neck swelling	4 X 4
11	14.8	Gastric, Neurological, Renal	3 X 3

12	12.8	Bone Pain, renal	4 X 4
13	12.1	Neck swelling, renal	4 X 4
14	11.4	renal, muscle pain	2 X 2
15	11.6	Renal	2 X 1
16	11.4	Gastric, Muscle pain	2 X 2
17	17.3	Renal	2 X 2.2
18	11.4	Bone pain, neurological	1 X 0.5
19	11	Pancreatic symptoms	1X 1.5
20	12.6	Gastric, Neurological, Renal	2 X 2.4
21	11.9	Renal, neck swelling	4 X 4
22	15.2	Gastric, Neck swelling, Psychiatric	2 X 1.5
23	16.6	Gastric, Neurological Muscle pain	2X 1
24	17.4	Neck swelling, Renal	4 X 4.2
25	13.2	Bone pain, psychiatric	2.5 X 1
26	16.2	Neck swelling, Bone pain, Muscle pain	4.5 X 4
27	17.7	Gastric, Bone pain, Pancreatic Symptom, Muscle pain	1.5 X 2
28	10.6	Muscle pain	4 X 2
29	12.6	Neck swelling, Bone pain, Muscle pain	3.5 X 2
30	10.6	Renal	2 X 1
31	16.8	Neck swelling	4X 4
32	10.3	Neck swelling	4.6 X 4
33	17.8	Bone pain, Muscle pain	2.8 X 1.2
34	16.4	Gastric, Neurological, Renal	2 X 1.5
35	10.8	Bone Pain, renal	2 X 1

- Hyperparathyroidism in South India: Emerging Roles of Minimally Invasive – Parathyroidectomy and Preoperative Localization with Methionine Positron Emission Tomography-Computed Tomography Scan. *Indian J Endocrinol Metab.* 2018;22(3):355–361. doi:10.4103/ijem.IJEM.445.16
4. McHenry CR et al; Hyperparathyroid disorder; *British J Surgery* 2002; 89:821-823.
5. Bilezikian JP. Primary hyperparathyroidism. In: De Groot LJ, Chrousos G, Dungan K, et al; *Diseases of Bone and Mineral Metabolism.* South Dartmouth, MA: MDTEXT.COM, Inc. 2000-2018.
6. Maskey R, Panchani R, Varma T, Goyal A; Primary hyperparathyroidism in India: A cocktail of contemporary and classical presentations: Lesson from 47 cases. *Indian J Endocrinol Metab* 2013; 17 Suppl1:S209-11.
7. Md. Arif Hossain Bhuyan, Abu Yusuf Fakir, Md. Nurullah et al; Clinical Profile and Management Outcome of Parathyroid Adenoma - A 7 Years Retrospective Study; *Bangladesh J Otorhinolaryngol* 2014; 20(1): 27-34
8. Gopal RA, Acharya SV, Bandgar T et al; Clinical profile of primary hyperparathyroidism from western India: A single center experience; *J Postgrad Med* 2010; 56:79-84.
9. Shawn Steen, MD, Brandon Rabeler, MD, Tammy Fisher, RN et al; Predictive factors for early postoperative hypocalcemia after surgery for primary hyperparathyroidism; *Proc (Bayl Univ Med Cent)* 2009; 22(2):124–127.
10. Hamouda, N, Ben Dhia, S, Aloui et al; Predictors of Early Post-operative Hypocalcemia after Parathyroidectomy for Secondary Hyperparathyroidism; *Saudi J Kidney Dis Transpl* 2013; 24(6):1165-1169, 2013; Saudi Center for Organ Transplantation.
11. Philip M. Spanheimer, MD, Andrew J. Stoltze, BA, James R. Howe, MD et al; Do Giant Parathyroid Adenomas Represent a Distinct Clinical Entity? *Surgery.* 2013 October; 154(4): 714–719; doi:10.1016/j.surg.2013.05.013

FIG 1 : PARATHYROID ADENOMA EXCISION

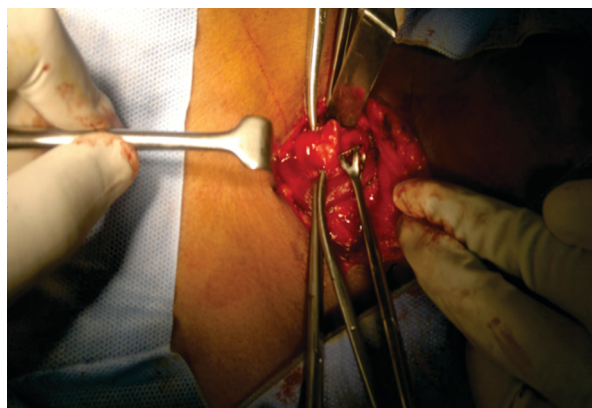
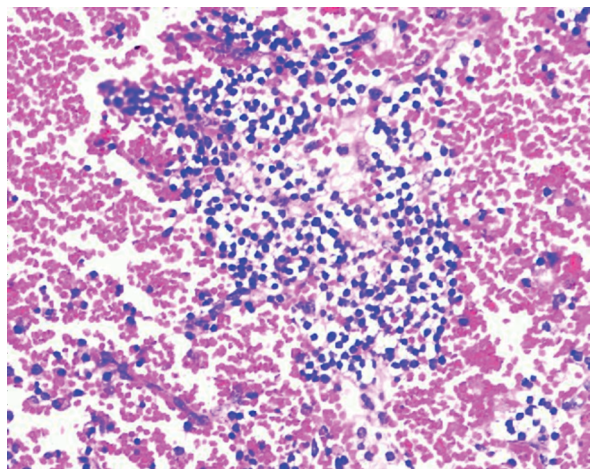


FIG 2 : SLIDE SHOWING ADENOMA CELLS IN 20 X



REFERENCES:

1. Pradeep PV, Jayashree B, Mishra A, Mishra SK. Systematic review of primary hyperparathyroidism in India: the past, present, and the future trends. *Int J Endocrinol*; 2011;2011:921814. doi:10.1155/2011/921814.
2. Bilezikian JP, Brandi ML, Eastell R, et al. Guidelines for the management of asymptomatic primary hyperparathyroidism: summary statement from the Fourth International Workshop. *The Journal of Clinical Endocrinology and Metabolism.* 2014;99(10):3561–3569
3. Mallikarjuna VJ, Mathew V, Ayyar V, et al. Five-year Retrospective Study on Primary