

Incidence of Hypocalcemia Post Thyroidectomy: Results from Dubai Hospital, Dubai, UAE

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ABSTRACT

Introduction and Background: Thyroidectomy is one of the common endocrine surgery performed. Hypocalcemia is one of the most common complication post thyroidectomy. Incidence varies between 6.4-20.5% for transient and 1.5 to 2.69 for permanent hypocalcemia. Meticulous surgical technique is the key for preservation of blood supply to parathyroid gland and hence decreasing the incidence of post op hypocalcemia. Once identified should be treated with multidisciplinary approach with proper follow up.

Objective: To determine the incidence of transient and permanent hypocalcemia in patients undergoing thyroidectomy in our institute for various reasons.

Methods: Records of 120 patients who underwent thyroidectomy from Jan 2017 till July 2020 were retrospectively reviewed. Calcium levels were checked at 6 hours post operatively to find the incidence of transient hypocalcemia and at 6-8 months interval to calculate for permanent hypocalcemia. All patients were followed till 2 years post operatively and treatment started for those with hypocalcemia and repeated calcium levels were checked and treatment was tapered and gradually stopped once normal serum calcium levels reached normal.

Results: The incidence of transient hypocalcemia in our study is 4.1 % while only 0.8 % patients had permanent hypocalcemia.

Conclusion: Hypocalcemia being one of the most common complication of thyroidectomy, the incidence can be reduced by paying attention to meticulous surgical technique. It is seen mostly in patients undergoing total thyroidectomy and advanced and prolonged surgery for malignancy.

Keywords:

Hypocalcemia, Thyroidectomy, Thyroid disease, Parathyroid.

Introduction

Thyroid disorders are the second most common endocrine disorders [1]. Among them those requiring surgical intervention can be either benign or malignant. Thyroidectomy is associated with a number of complications and hypocalcemia is one of the most common of these with a reported incidence of 6.4-20.5% for transient and 1.5 to 2.69 for permanent hypocalcemia [2]. Hypocalcemia is defined as total serum calcium level of less than 2 mM/L (8.0 mg/dL) or an ionized calcium level less than 1.1 mM/L (0.275 mg/dL). It is transient immediately after surgery till 6 months post operatively but if it persists after 6 months is permanent [3-5]. This complication arises because of close proximity of thyroid gland to parathyroid gland. 50% of total serum calcium is ionized and 40% is albumin bound while 10% is bound to phosphate and citrate. It is always important to check serum corrected calcium with the use of following formula "corrected calcium" (mg/dL)=Total calcium ÷ 0.8 (4-albumin level (gm/dL)).

The risk of developing hypocalcemia post thyroidectomy is attributable to many factors such as [6]:

- The superior parathyroid glands are drained almost entirely by thyroid circulation so thyroidectomy will affect their drainage and function leading to hypocalcemia
- Parathyroid glands lie in the capsule of thyroid gland specially in large goiters and can be intra thyroidal as well in some cases and are extremely difficult to identify during surgery specially inferior parathyroid glands, leading to accidental removal of these glands and hypocalcemia. Incidental parathyroidectomy during thyroid surgery: an underappreciated complication of thyroidectomy
- Nodal dissection for malignant thyroid diseases can often result in removal of lower parathyroid glands [7]
- Repeat surgery poses risk because of adhesions, difficulty and prolonged procedures jeopardizing the vascularity of parathyroid glands [8]
- Young age and female sex [9]

To avoid incidence of hypocalcemia following measures should be taken in peri operative period [4, 10-12]:

- Pre-operative measures of serum calcium (corrected calcium) along with vitamin D should be checked for all patients and any deviation from normal should be investigated and treated with help of endocrinologist
- During surgery staying close to thyroid gland is the key for preservation of parathyroid blood supply
- Branches of inferior thyroid artery should be ligated close to thyroid
- Use of cautery should be avoided near parathyroid glands
- Thorough search should be made to localize and find parathyroid glands and one should try best to preserve them and at least 2 of them should be preserved
- Sparing of peri glandular fat for parathyroid glands during surgery
- In case of accidental injury to glands they should be auto transplanted in sternocleidomastoid muscle

There is no uniform consensus regarding treatment of hypocalcemia, ideally levels should be checked 6 hours post operatively and if patients are hypocalcemic but not symptomatic treatment is not necessary. However, if treatment is needed it should be started with involvement of medical endocrine team and combined therapy with calcium and vitamin D in the form of calcitriol should be given. Nadir for hypocalcemia usually occurs 48 hrs after the surgery. Patient should be informed fully regarding occurrence of this complication and signs and symptoms of hypocalcemia and full arrangements should be made regarding investigation and treatment of entity both as in patient and out patient services as some times patient are discharged 24-48 hrs after the surgery and symptoms can appear while patients are at home [13].

Signs and symptoms of hypocalcemia are usually numbness, paresthesias and neuromuscular excitability. If symptoms occur treatment should consist of calcium supplement (1000-2000 mg) along with vitamin D as calcitriol at an initial dose of 0.5-1 µg two times a day. Thereafter doses should be titrated based on weekly levels of calcium, parathyroid hormone levels and vit D until biochemically normal values are achieved.

Acute severe hypocalcemia (calcium <1.75 mM/L, <7 mg/dL), with tetany, muscular fasciculations, carpo-pedal spasm, and/or positive Chvostek sign with accompanying risks of cardiac decompensation or laryngospasm should be treated urgently with intravenous calcium gluconate (1 or 2 ampoules of 10% solution) for 24-48 hours plus oral supplements of calcium (3 gm) and 2 to 3 µg of dehydrocholecalciferol plus 1-2 gm of magnesium if hypomagnesemia is present. Calcium gluconate can be administered as an initial one-ampoule intravenous bolus followed by infusion of 1 to 3 mg of calcium gluconate in 500 ml of D5W over 12 hours. The major risks of profound hypocalcemia are cardiac decompensation due to arrhythmias [14].

This treatment should be continued for at least ten days, or until the clinical symptoms resolve. Patients requiring long term treatment with large doses of calcium and calcitriol also require long term laboratory surveillance and should be thoroughly investigated for hypocalcemia by medical endocrinologist. Another important concern is avoidance of hypercalcemia as

in the presence of hypercalcemia hyperuricemia occurs which exposes the patient to the risks of renal insufficiency and kidney stones [15].

To prevent these complications, one should aim for a calcium x phosphate product of 4.44 mM/L and a 24-hour urine calcium excretion of less than 300 mg (7.5 mM/L) [14]. Functional recovery of parathyroid glands is usually delayed for several months so dose should be tapered gradually over a period of 12-18 months and replacement should be stopped once calcium levels reach normal biochemical limit. All these patients need follow up by medical endocrinologists.

This retrospective study was conducted to find out the incidence of hypocalcemia for all thyroidectomies done in specified duration and to compare it with international figures.

Objectives

To determine incidence of transient and permanent hypocalcemia in patients undergoing thyroidectomy in our institute for various reasons.

Operational Definitions

Hypocalcemia

Hypocalcemia is defined as total serum calcium level of less than 2 mM/L (8.0 mg/dL) or an ionized calcium level less than 1.1 mM/L (0.275 mg/dL). It is transient immediately after surgery till 6 months post operatively but if it persists after 6 months is permanent [2-4].

Materials and Methods

Ethical approval was taken from Dubai Scientific Research Ethics Committee (DSREC) before starting the study. Since it was a retrospective cross sectional/observation study so patients consent was not taken.

Settings: Department of General Surgery, Dubai Hospital, Dubai, UAE.

Duration of study: Jan 2017 till July 2020.

Sample Size: total 136 patients underwent thyroidectomies during the study period .

16 patients were excluded from study because of deranged serum calcium levels and presence of concomitant hyperparathyroidism requiring parathyroidectomy as well .

Sample size: Continuous sampling.

Sample selection

Inclusion criteria

Patients who underwent thyroidectomies in specified duration were recruited for inclusion in the study.

Exclusion criteria

- Patients with concomitant hyper or hypoparathyroidism
- Patients having pre operative hypocalcemia

Study design

Retrospective cross sectional.

Data collection

Data was collected retrospectively using electronic record system of hospital.

Data analysis

All analysis was done using the Statistical Package for Social Sciences (SPSS) version 28.

The variables included were age, sex, type of procedure, type of surgery, calcium levels after 6 hours post operatively and calcium levels 6-8 months post operatively.

Results

Over the period of 1.6 years a total of 120 underwent thyroid surgery for different reasons. The indications for surgery was benign goiters for pressure symptoms, atypical thyroid nodules and malignant thyroid nodules. Two of our patients underwent central and lateral neck dissection bilaterally for papillary thyroid cancer as well while 12 underwent total thyroidectomy for grave’s disease.

The mean age was 49.9 years. Age distribution is shown in Figure 1 and Figure 2.

90/120 were female while 30 patients were male. Sex distribution is shown in Figure 3 and 4.

64/120 under went hemi thyroidectomy while 56/120 underwent total thyroidectomy.

107 patients had open surgery while 13 underwent minimal access thyroidectomy. Minimal access procedures included trans oral as well as trans axillary approaches.

Procedure types are explained in figure 5.

Only those patients with pre operative corrected calcium levels within normal limit were included in study (8.0 -9.2 mg/dl).

Normal level of corrected calcium was taken as 8.0 mg/dl-9.2 mg/dl. Patients having postoperative corrected calcium level below 8 mg/dl were labelled as having hypocalcemia. However as a policy all patients post thyroidectomy were started immediately post operatively on 1200 mg of oral calcium with vit d regardless of serum calcium level. Medical endocrine team was consulted for all patients with hypocalcemia and they were given oral calcium supplement 1500-2000 mg/day with vit d. Patients having calcium levels below 7 mg/dl and those symptomatic were given iv calcium and calcium levels were repeated every 24 hours.

The lowest calcium levels at 6 hours post operatively was found to be 6.7 mg/dl with a range from 6.7 to 10.7 mg/dl .The incidence of hypocalcemia at 6 hours post operatively i;e transient hypocalcemia was found to be 4.1% while incidence of permanent hypocalcemia was 0.8%. Results of hypocalcemia are shown in Figure 7-10. All patients having hypocalcemia under went total thyroidectomy, non of patient with hemithyroidectomy had either transient or permanent hypocalcemia.

One patient discharged home with serum calcium of 7.6 on oral calcium required re admission with hypocalcemia of 6.8 mg/dl and required treatment with iv calcium for 4-5 days however, calcium levels after 4 months became normal.

All patients were followed up and serum calcium levels were checked till 2 years post operatively. while supplemental calcium was withdrawn gradually over a period of 6-12 months.

Calcium levels at 6 hours post operatively as well as 6-12 months are shown in Figure 6-9.

Result Statistics

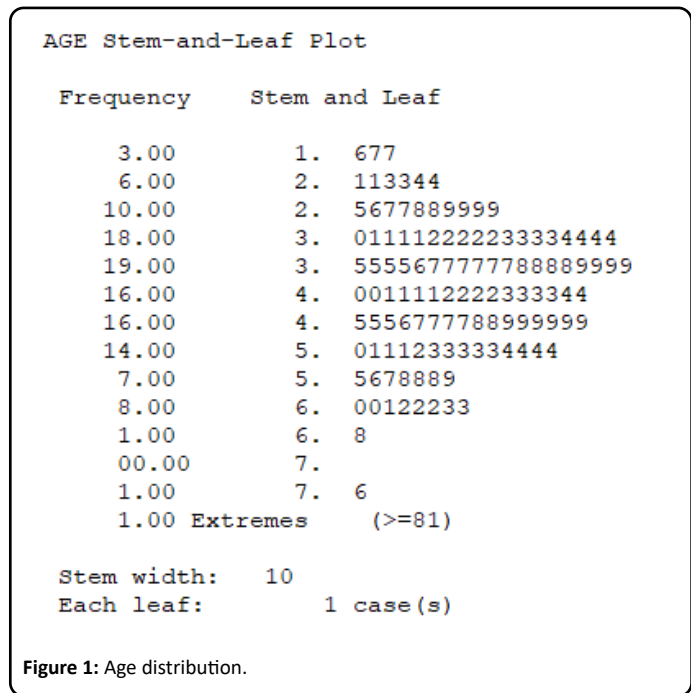


Figure 1: Age distribution.

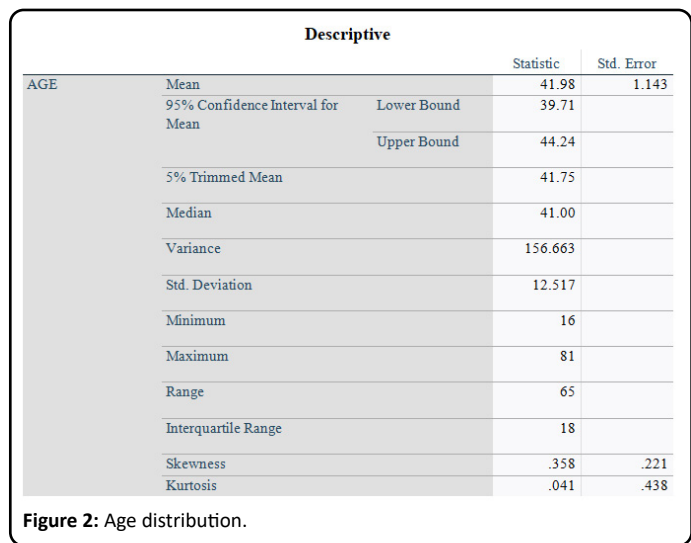


Figure 2: Age distribution.

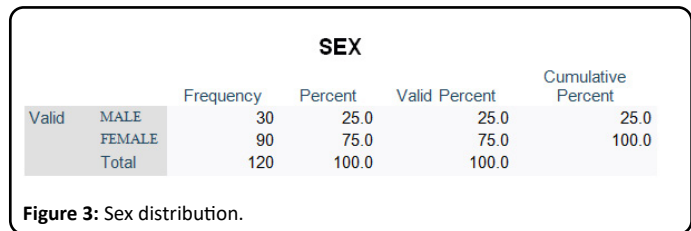


Figure 3: Sex distribution.

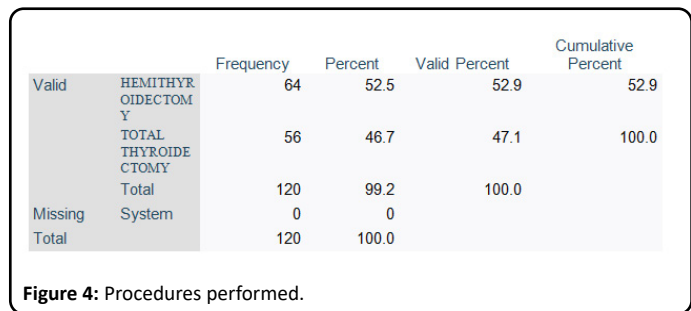


Figure 4: Procedures performed.

Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	OPEN	107	89.2	89.2	89.2
	MINIMAL ACCESS	13	10.8	10.8	100.0
	Total	120	100.0	100.0	

Figure 5: Types of procedures performed.

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post op calcium Stem-and-Leaf Plot

Frequency      Stem and Leaf

3.00 Extremes      (=6.7)
0.00      7.
1.00      7.  4
2.00      7.  67
1.00      7.  8
12.00     8.  0000011111111
8.00      8.  22222333
21.00     8.  44444444555555555555
19.00     8.  6666666677777777777
13.00     8.  88888888888999
17.00     9.  00000001111111111
10.00     9.  2222223333
7.00      9.  4444445
2.00      9.  77
3.00      9.  899
1.00 Extremes      (>=10.7)

Stem width:    1.0
Each leaf:     1 case(s)
    
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Figure 6: Post-operative calcium levels at 6 hours post op.

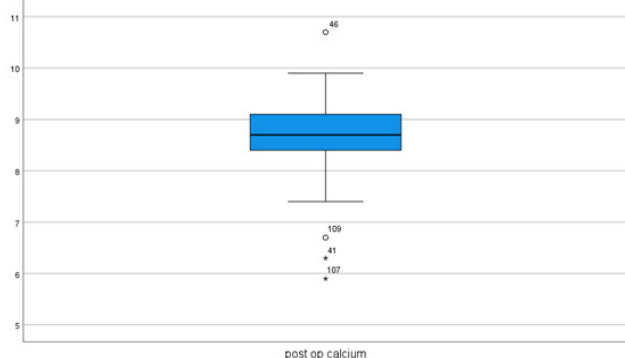


Figure 7: Post-operative calcium levels at 6 hours post operatively.

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Calcium 6-MONTHS TO 2 YEARS Stem-and-Leaf Plot

Frequency      Stem and Leaf

6.00 Extremes      (<=8.20)
1.00      85.  0
1.00      86.  0
1.00      87.  0
2.00      88.  00
9.00      89.  000000000
25.00     90.  0000000000000000000000000
13.00     91.  000000000000000
16.00     92.  00000000000000000
9.00      93.  000000000
11.00     94.  0000000000000
5.00      95.  00000
4.00      96.  0000
9.00      97.  000000000
5.00      98.  00000
2.00      99.  00
1.00 Extremes      (>=91.0)

Stem width:    .1
Each leaf:     1 case(s)
    
```

Figure 8: Post-operative calcium levels at 6 months to 2 years after surgery.

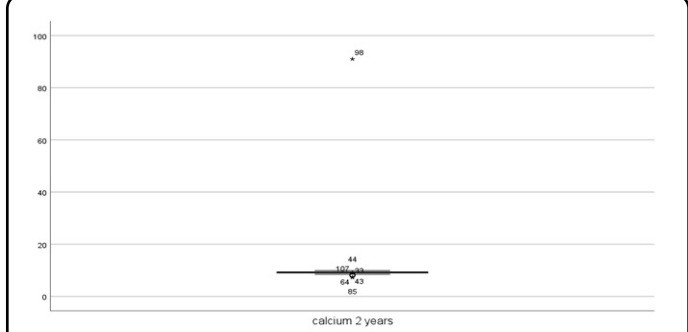


Figure 9: Post-operative calcium levels at 6 months to 2 years after surgery.

Discussion

Hypocalcemia is one of the most common complication post thyroidectomy and its incidence varies between 6.4-20.5% for transient and 1.5 to 2.69 for permanent hypocalcemia [2]. It is most common after total then hemithyroidectomies. We have a number of other complications related to thyroidectomy but this study highlights only post operative hypocalcemia. The incidence of hypocalcemia in our study is very low. We had incidence of transient hypocalcemia at rate of 4.1% while permanent hypocalcemia was found in 0.8% patients. This low rate can be attributable to meticulous surgical technique by staying close to thyroid inside its capsule and ligated inferior thyroid artery branches very close to thyroid gland, minimal to no use of electrocautry (bipolar if needed with water). Further, identifying at least 2 parathyroid glands and sparing dissection at peri glandular area is the key for low levels of post operative hypocalcemia. One patient requiring re admission and iv calcium supplements was a case of papillary thyroid cancer requiring bilateral lateral neck dissection.

Studies emphasize on meticulous surgical technique as number one factor preventing post thyroidectomy hypocalcemia [16]. Also staying close to gland, identifying and preserving as many glands as possible, minimal to no use of diathermy near glands are all factors responsible for low incidence of post operative hypocalcemia [17]. In our institute we follow all these techniques during surgery and this may be the reason for our low hypocalcemia rates. Many studies describe correlation between hypocalcemia and age of patient [18], between hypocalcemia and sex [19] as well as primary pathology responsible for surgery for example incidence is more in patients with carcinoma [20] and graves disease.

Also, studies point out that its more common in total thyroidectomy rather than hemithyroidectomy [21].

We did not find any significant relation ship between age and sex of patient with post operative hypocalcemia. however, all our patients who had hypocalcemia post operatively under went total thyroidectomy. Also one patient in our study who had sever hypocalcemia requiring re admission and iv management for 5-6 days was having papillary thyroid carcinoma and under went extensive neck surgery with lymph node dissection.

Conclusion

- Hypocalcemia post thyroidectomy being one of the most common complication can be reduced by meticulous surgical technique

- Patients should be counselled regarding incidence of this complication and should be aware of signs and symptoms of the condition
- Pre operative corrected serum calcium and vit d should be checked for all patients undergoing thyroidectomy and any deficiencies should be fully investigated and treated before surgery
- Protocols and policies should be made for post operative detection and treatment of hypocalcemia for both in patient as well as out patient set up as many patents are discharged within 24-48 hours of surgery and their post operative calcium levels should be checked as needed and treatment to be initiated accordingly
- Post-operative calcium levels should be followed up to 1-2 years post surgery as treatment should be gradually tapered and stopped upon biochemical achievement of normocalcemia

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