

## POST-THYROIDECTOMY HYPOCALCEMIA AND ITS RISK FACTORS

### نقص كلس الدم بعد عمليات استئصال الغدة الدرقية وعوامل الخطورة المرافقة له

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#### ملخص البحث

**هدف البحث:** يمثل نقص كلس الدم إحدى المضاعفات المعروفة جيداً لجراحة الغدة الدرقية، يحدث ذلك غالباً كحدثٍ عابر بعد إجراء استئصال الغدة الدرقية المكتف حيث يتطلب ذلك إعطاء مكملات الكالسيوم و/أو الفيتامين D لتخفيف أو منع الأعراض. كان الهدف من هذه الدراسة هو تحديد نسبة حدوث نقص كلس الدم بعد جراحة الغدة الدرقية، وتحديد عوامل الخطر المتعلقة بسن المريض، جنسه، بناء العضلات، التشخيص السريري، اتساع أو مدى الجراحة، ربط الشريان الدرقي السفلي وموجودات تقرير التشريح المرضي.

**طرق البحث:** شملت هذه الدراسة المستقبلية 50 مريضاً خضعوا لجراحة الغدة الدرقية بسبب أمراض الغدة الدرقية المختلفة في القسم الجراحي لمستشفى الكرامة التعليمي في الفترة بين كانون الثاني 2017 وحتى تموز 2018. تم تسجيل قياسات مستوى الكالسيوم في المصل المتسلسلة، تفاصيل العمل الجراحي، سن المريض، الجنس، إجراء ربط الشريان الدرقي من عدمه مع تقرير التشريح المرضي. تم اعتبار نقص كلس الدم عابراً إذا تراجعت الحالة في غضون 6 أشهر، بينما اعتبر دائماً إذا استمرت الحالة بعد مدة 6 أشهر من الجراحة، وتم إبقاء المريض على العلاج التكميلي للكالسيوم وفيتامين D. **النتائج:** بلغت نسبة حدوث نقص كلس الدم بعد جراحة الغدة الدرقية 30%، وقد كانت حالة نقص كالسيوم الدم عابرة في معظم الحالات (بنسبة 24%)، بينما كانت دائمة في 6% من الحالات فقط، وقد حدثت بشكلٍ رئيسي بعد عمليات استئصال الغدة الدرقية الكلي وفي حالات ربط الشريان الدرقي السفلي.

**الاستنتاجات:** يمكن من خلال هذه الدراسة القول بأن نقص كالسيوم الدم في الدم بعد جراحة استئصال الغدة الدرقية هو اختلاط شائع نسبياً، إلا أنه يكون عابراً في غالبية الحالات، كما أن حدوثه مرتبط بمدى واتساع الجراحة المجراة على الغدة الدرقية.

#### ABSTRACT

**Objective:** Hypocalcemia is a well-recognized complication of thyroid surgery. The aim of this study was to determine the incidence of hypocalcemia after thyroid surgery and find out the risk factors involved regarding the patient age, gender, muscular build, clinical diagnosis, extent of surgery, ligation of the inferior thyroid artery, and pathology report.

**Methods:** This prospective study was carried out

on 50 patients who underwent thyroid surgery for various thyroid diseases at the surgical department of Al-Karama Teaching Hospital in the period between January 2017 to July 2018. Serial serum calcium measurements were recorded as well as details of the operation, patient age and gender, ligation of the inferior thyroid artery or not, pathological report. Hypocalcemia was considered transient if it was resolved within 6 months and permanent if it persist after 6 months and the patient was maintained on

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*supplementation therapy of calcium and vitamin D.*

**Results:** Author found that the incidence of post-thyroidectomy hypocalcemia was 30% and in the majority of the cases (24%) was transient, while it was permanent in only (6%) of cases and had occurred mainly after total thyroidectomy and in cases with ligation of the inferior thyroid artery.

**Conclusions:** Author concluded that post thyroidectomy hypocalcemia is a relatively common complication but it is transient in the majority of the patients. Its incidence is related to the extent of the surgery and can be reduced by the good preparation of the patient preoperatively.

## INTRODUCTION

Hypocalcemia is defined as serum corrected calcium level below 8 mg/dl. Permanent hypocalcemia is defined as persistent hypocalcemia after 6 months of thyroidectomy.

Theodore Kocher may be credited for refining the systems for thyroidectomy what's more diminishing that occurrence about post-operative discharge. He additionally perceived the vitality of protection for parathyroid organs.<sup>1</sup> Post-operative hypocalcemia is a champion among the troubles for thyroidectomy, its recurrence will be a more prominent sum as a relatable point following total thyroidectomy over after other a more noteworthy sum preservationist thyroidectomy.<sup>2</sup> The reported recurrence rate of transient hypocalcemia ranges from 1.6-9.3%, following subtotal thyroidectomy likewise from 6.9-42% at that point a short time later out and out thyroidectomy. On differentiate, immutable hypocalcemia requires been accounted already, 0.2-3% from guaranteeing patients after subtotal thyroidectomy, moreover secured close by 0.4-29% in patients following total thyroidectomy.<sup>2</sup> It regularly shows itself in the essential 24 hours post-operatively, on the other hand inside the 2 to 5 days after task; nonetheless, greatly rarely those beginning might be put off 2-3 weeks.<sup>3</sup> Done most by far patients it is transient that decides precipitously likewise best couple patients make enduring hypocalcemia.<sup>4</sup> Completed 80% for cases it decides in with respect to 12 months.<sup>5</sup> The peril about this obfuscating depends on the degree for

medical procedure, the nature of the hidden disease and the information of the working authority.

Moreover, specific careful issues require help experienced already, instances of dreary thyroid sickness, extensive goiter, anatomic varieties, retrosternal on the other hand without a doubt mediastinal zone what's more damage of the parathyroid organs. Hypocalcemia is more incessant in broad thyroidectomy when contrasted with minor resections of the thyroid organ, in the ligation of the sub-parathyroid supply route and has been identified with the specialist's understanding.<sup>6</sup>

The body of a youthful grown-up human contains around 1100 g (27.5 mol) of calcium. Ninety-nine percent of the calcium is in the skeleton. The serum calcium, regularly around 10 mg/dl (5 meq/l-2.5 mmol/l) was halfway bound to protein and incompletely diffusible. Serum calcium is dispersed among three structures which is protein bound (40%), complexed to phosphate and different anions (10%) and ionized (half).<sup>7</sup>

## METHODS

This observational study was conducted on 50 patients operated for thyroid diseases in the surgical department of Al-Karama teaching hospital from January 2017 to July 2018. Patients, who had undergone total, near total or subtotal thyroidectomy by bilateral exploration were included in the study. The patients with concurrent lymph node dissection and pre-existing hypocalcemia were excluded.

Preliminary work up included complete clinical examination, biochemical assay of hormone profile. Ultrasound imaging of the thyroid gland and neck in general was done routinely. Aspiration cytology was performed from all solitary nodules and nodules showing suspicious features on clinical examination or ultrasound imaging. Plain helical computerized tomography was done when clinical evidences of mediastinal extension were noted. Hyperthyroidism was controlled before operation. Vocal cords were assessed by indirect laryngoscopy prior to operation.

Operation was performed by members of surgical

team noted under general anesthesia, good muscle relaxation and endotracheal tube.

On the operating table, patients should be supine, and it must be tilted up (15°) at the end of head to lower venous engorgement. A gel pad is put transversely under the shoulder, and the neck to be extended to make the gland clearer and to provide tension to skin. A gently curved skin incision was done midway between the thyroid cartilage notch and the suprasternal notch. Flaps of skin, subcutaneous tissue and platysma were raised to the superior thyroid notch and down wards to the suprasternal notch. The sternothyroid muscle is mobilized off thyroid gland lobes with being careful to be near the muscle and outside capsule.

The lateral mobilization was done by the capsular dissection technique to identifying parathyroid glands and recurrent laryngeal nerves. Total, near total, or subtotal resection of each lobe was performed, absolute haemostasis can be maintained by vessels ligation and by thyroid remnants suture to the tracheal fascia. The cervical fascia and pre-tracheal muscles were sutured and the wound was closed. Randomized clinical trials have proven that routine drainage to deep cervical space is not necessary. Vocal cords were reassessed after extubation by direct laryngoscopy.

Hypocalcemia was diagnosed when serum calcium level dropped below 8 mg/dl. Patients with transient hypocalcemia received oral calcium supplementation (1 g three or four times/day).

Patients who developed neuromuscular symptoms received intravenous infusion of calcium gluconate, 10 ml of 10% calcium gluconate (equivalent to 8.4 mg or

2.3 mmol calcium) was administrated (1 mg elemental calcium/kilogram body weight/h). Serum calcium was estimated to screen for the parathyroid insufficiency at the first review (4-6 weeks following surgery).<sup>3</sup>

Patients who developed complications were reviewed monthly for 12 months or more. Hypocalcemia is defined as serum corrected calcium level below 8 mg/dl. Permanent hypocalcemia is defined as persistent hypocalcemia after 6 months of thyroidectomy.

## RESULTS

A total of 50 patients aged from 20 to 70 years underwent a thyroidectomy in the period between January 2017 to July 2018 at the surgical department of Al-Karama teaching hospital, 46 were females and 4 were males. Most of patients (70%) had simple multinodular goiter, 12% had Grave's disease, 8% had toxic nodular goiter, 6% had thyroiditis, and 4% had cancer, Table 1.

| Thyroid disease            | Hypocalcaemia |    | Total |
|----------------------------|---------------|----|-------|
|                            | Yes           | No |       |
| Multinodular goiter/simple | 7             | 28 | 35    |
| Toxic nodular goiter       | 2             | 2  | 4     |
| Thyroiditis                | 2             | 1  | 3     |
| Grave's disease            | 2             | 4  | 6     |
| Cancer                     | 2             | 0  | 2     |
| Total                      | 15            | 35 | 50    |

Table 1. Distribution of the occurrence of hypocalcaemia by the type of thyroid disease.

Total thyroidectomy was performed for 10% of patients, near total thyroidectomy for 22% of patients,

| Type of surgery          | MNG      | CA     | Thyroiditis | Grave's | Toxic nodular goiter | Total    |
|--------------------------|----------|--------|-------------|---------|----------------------|----------|
| Total thyroidectomy      | 0        | 2 (4%) | 0           | 2 (4%)  | 1 (2%)               | 5 (10%)  |
| Near total thyroidectomy | 5 (10%)  | 0      | 1 (2%)      | 3 (6%)  | 2 (4%)               | 11 (22%) |
| Subtotal thyroidectomy   | 30 (60%) | 0      | 2 (4%)      | 1 (2%)  | 1 (2%)               | 34 (68%) |
| Total                    | 35       | 2      | 3           | 6       | 4                    | 50       |

Table 2. Distribution of cases according to the type of the surgical procedure and thyroid disease.

and subtotal thyroidectomy for 68% of patients, as shown in Table 2 .

Among the 5 patients with total thyroidectomy, 4% was diagnosed as CA, 4% as Grave's disease and 2% as toxic nodular goiter. While among those with near total thyroidectomy 10% was from MNG group, and 2% with thyroiditis, 6% with Grave's disease and 4% with toxic nodular goiter.

Finally; for subtotal thyroidectomy, 60% had MNG, while 4% was had thyrpoiditis, 2% was diagnosed as Grave’s disease, and another 2% as toxic nodular goiter. Around 30% of patients developed hypocalcaemia postoperatively; in 24% of them it was transient, and in 6% was permanent. There was 1 out of the 3 patients who developed permanent hypocalcaemia had underwent total thyroidectomy, and the other one had underwent near total thyroidectomy, and the last patient had underwent subtotal thyroidectomy, Table 3.

All the patients with CA had post thyroidectomy hypocalcemia, while 66.66% of patients with

thyroiditis had hypocalcemia, 33.33% of those with Grave’s disease had hypocalcemia, 50% of those with toxic nodular goiter had hypocalcemia and only 20% of those with simple multi-nodular goiter had hypocalcemia.

There were 11 patients out of the 12 (91.66%) who developed transient hypocalcemia were females, and 2 patients out of the 3 (66.66%) who developed permanent hypocalcaemia were females also. While one patient out of 12 (8.3%) who develop transient hypocalcemia were male and one patient out of the 3 (33.3%) who developed permanents hypocalcemia were male also, as shown in Figure 1.

All of the patients who underwent total and near total thyroidectomy, 16 patients had underwent bilateral ligation of the inferior thyroid artery, 10 patients of them (66.6%) had hypocalcemia, while 15 patients out of the 34 who underwent subtotal thyroidectomy had underwent a unilateral ligation of the inferior thyroid artery, and only 5 of them (33.4%) had hypocalcemia postoperatively. All the 4 patients who developed

| Type of surgery          | Hypocalcaemia |           | No hypocalcaemia | Number & % of patients |
|--------------------------|---------------|-----------|------------------|------------------------|
|                          | Transient     | Permanent |                  |                        |
| Total thyroidectomy      | 3 (6%)        | 1 (2%)    | 1 (2%)           | 5 (10%)                |
| Near total thyroidectomy | 4 (8%)        | 1 (2%)    | 6 (12%)          | 11 (22%)               |
| Subtotal thyroidectomy   | 5 (10%)       | 1 (2%)    | 28 (56%)         | 34 (68%)               |
| Total                    | 12 (24%)      | 3 (6%)    | 35 (70%)         | 50 (100%)              |

Table 3. Distribution of cases according to the type of the surgical procedure and the occurrence of hypocalcaemia.

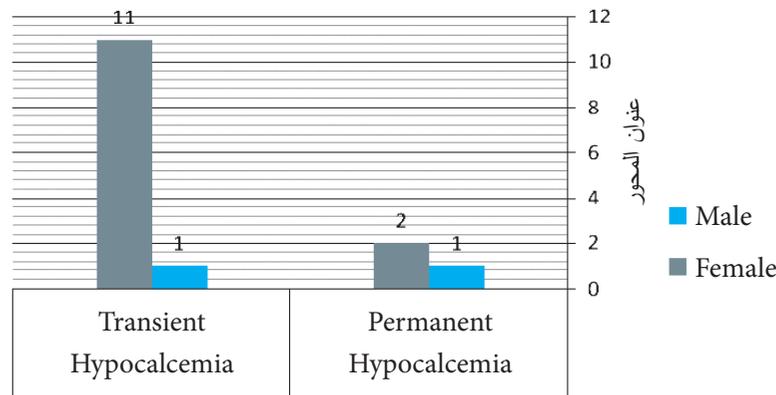


Figure 1. Distribution of hypocalcaemia and gender.

hypocalcemia following total thyroidectomy were of normal or under normal muscular build, with only one patient out of the 5 who had hypocalcemia following near total thyroidectomy was obese and of a short neck, and one patients out of the 6 who had hypocalcemia following subtotal thyroidectomy were obese and of a short neck also.

## DISCUSSION

Postoperative hypocalcemia is a relatively common complication of thyroid surgery, and is known as a major cause of postoperative morbidity but most often it is a transient event that occurs after extensive thyroid surgery. The result of this study showed that the incidence of post-thyroidectomy hypocalcaemia is 30% and that it was transient in the majority of the cases.

One third of the patients who had transient hypocalcemia (33.3%) and two thirds of the patients who had permanent hypocalcemia (66.6%) belong to the 31-40 years age group, which is nearly similar to the results of Chaudhary, et al study.<sup>1</sup> Most of the patients who had transient hypocalcemia (91.7%), and most of the patients who had permanent hypocalcemia (66.7%) were females, which is similar to the results of Thomusch, et al study.<sup>9</sup>

Regarding the type and extent of the surgical procedure, we found that the incidence of transient hypocalcaemia was 60% after total thyroidectomy, 36.3% after near-total thyroidectomy, and only 14.7% after subtotal thyroidectomy. The incidence of permanent hypocalcemia was 20% after total thyroidectomy, 9% after near-total thyroidectomy and only 2.9% after subtotal thyroidectomy. These figures are consistent with those reported in other studies (Chaudhary, et al and Nair et al, and Wingert DJ, et al), which showed that the extent of resection and surgical technique has a greater impact on the rate of post-thyroidectomy hypocalcaemia.<sup>1,10,11</sup>

Regarding the ligation of the inferior thyroid artery, the current study found that (66.6%) of the patients who underwent bilateral ligation of that artery had post-thyroidectomy hypocalcaemia, while (33.4%)

of the patients who underwent a unilateral ligation of that artery had hypocalcaemia, so making that procedure as an important risk factor. This result was due to the inadvertent excision of parathyroid gland in total thyroidectomy and belong to the 31-40 years age group the interference with the blood supply of the parathyroid gland in case of truncal inferior thyroid artery ligation.<sup>12,13</sup>

Regarding the clinical and the pathological diagnosis, the current study found that all the patients with CA had post thyroidectomy hypocalcemia, while 66.66% of patients with thyroiditis had hypocalcemia, and only 33.33% of those with Grave's disease had hypocalcemia, and 50% of those with toxic nodular goiter had hypocalcemia and only 20% of those with simple multi-nodular goiter had hypocalcemia. These findings are in agreement with other studies showed that the thyroid cancer is a risk factor for inadvertent parathyroid excision.<sup>9,10,14</sup> This was due to the radical removal of thyroid tissue, excessive dissection and truncal ligation of inferior thyroid A.

Regarding the muscular built of the patient, author found that only 13.3% of the patients who had post-thyroidectomy hypocalcemia were obese and of a short neck, so making that parameter is not so significant.

All these factors might lead to unintentional removal of parathyroid gland and subsequent hypocalcaemia.<sup>15,16</sup>

## CONCLUSIONS

It was concluded that post-thyroidectomy hypocalcemia is relatively common phenomenon, especially after extensive thyroid surgery, but it is transient in most of the cases. Its incidence is related to the extent of the surgical procedure, especially if this was associated with ligation of the inferior thyroid artery, and it can be only reduced using the correct surgical procedures.

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