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Association for Academic Surgery

Inadvertent parathyroidectomy: incidence, risk factors, and outcomes

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ARTICLE INFO

Article history:
Received 3 February 2016
Received in revised form
18 May 2016
Accepted 7 June 2016
Available online 16 June 2016

Keywords:
Inadvertent parathyroidectomy
Hypoparathyroidism
Central compartment
neck dissection

ABSTRACT

Background: Parathyroid glands are ≤5 mm, often subcapsular or intrathyroidal, and obscured by lymph nodes, making preservation a challenge. The purpose of this study was to determine the incidence of inadvertent parathyroidectomy (IP) and whether it contributes to hypoparathyroidism after thyroidectomy.

Materials and methods: A retrospective review of all thyroidectomies by a single surgeon from January 2010 to August 2014 was completed to determine the rate of IP and permanent hypoparathyroidism. Medical records were assessed for demographics, extent of thyroidectomy, central compartment neck dissection, thyroid gland weight, parathyroid autotransplantation, reoperation, pathology, postoperative calcium levels, and number of parathyroid glands removed.

Results: A total of 386 patients underwent thyroidectomy. Mean age was 52 y, and 327 (85%) patients were women. There were 25 (7%) patients who underwent reoperation, 40 (10%) who underwent central compartment neck dissection, and 128 (33%) who underwent parathyroid autotransplantation. IP occurred in 78 (20%) patients. Permanent hypoparathyroidism occurred in 7 (2.7%) of 258 patients after total or completion thyroidectomy, four (6.7%) with IP compared with three (1.5%) without IP ($P = 0.033$). Logistic regression analysis revealed that female gender (odds ratio = 2.768, $P = 0.040$), central compartment neck dissection (odds ratio = 9.584, $P = 0.001$), and thyroid gland weight (odds ratio = 0.994, $P = 0.022$) were independent factors associated with IP.

Conclusions: IP, which occurred in 20% of patients undergoing thyroidectomy, is a potentially remediable factor associated with a higher rate of hypoparathyroidism. Central compartment neck dissection is an independent risk factor for IP.

Introduction

Thyroidectomy is performed for a variety of indications, including thyroid cancer, nodular thyroid disease with an indeterminate or nondiagnostic fine needle aspiration biopsy, a symptomatic goiter or a goiter with tracheal or esophageal impingement, substernal extension, and thyrotoxicosis. The estimated number of thyroidectomies performed yearly in the

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0022-4804/$ – see front matter
http://dx.doi.org/10.1016/j.jss.2016.06.019

United States exceeds 92,000.[1] As with any operation, challenges include minimizing complications. The major complications of thyroidectomy include recurrent laryngeal nerve injury (1.2%-7.6%),[2-4] bleeding requiring reoperation (0.6%-1.6%),[2,3,5,6] and permanent hypoparathyroidism (1.2%-5.5%).[2,7-10]

The parathyroid glands can be challenging to identify intraoperatively. A parathyroid gland weighs approximately 35 mg, measures 5 mm in maximum dimension, and is usually surrounded by adipose and loose connective tissue. Parathyroid glands can become discolored with bleeding and can be mistaken for thyroid, nodal, or adipose tissue. Parathyroid glands that are subcapsular may be flattened in appearance, making them more difficult to identify and more vulnerable to removal during thyroidectomy. Parathyroid glands are often embedded with lymph nodes and can be more difficult to identify in patients with enlarged lymph nodes in the central compartment of the neck from cancer or Hashimoto's thyroiditis. Hypoparathyroidism is reported to be higher in patients undergoing thyroidectomy with central compartment neck dissection,[8,9,11] suggesting that parathyroid glands may be more vulnerable to removal during central compartment neck dissection compared with thyroidectomy alone. Parathyroid glands may also be intrathyroidal, and their removal cannot be prevented.

Embryologically, the parathyroid glands develop from the third and fourth branchial pouches. The superior parathyroid glands arise from the fourth branchial pouch along with the lateral lobes of the thyroid gland. The inferior parathyroid glands develop from the third branchial pouch along with the thymus. The normal anatomic location of the superior parathyroid gland is fairly constant, with 80% of superior glands found near the posterior aspect of the upper thyroid lobe at the level of the cricoid cartilage where the recurrent laryngeal nerve enters the larynx posterior to the inferior pharyngeal constrictor muscle.[12] It is typically posterior and superior to the recurrent laryngeal nerve, approximately 1 cm cephalad to the junction of the inferior thyroid artery and the recurrent laryngeal nerve.[13] Ectopic superior glands can be found in the tracheoesophageal groove, in a paraesophageal, retroesophageal or retropharyngeal location, in the posterior mediastinum, within the carotid sheath or within the thyroid gland.[14]

The normal anatomic location of an inferior parathyroid gland is approximately 1 cm caudal to the junction of the inferior thyroid artery and the recurrent laryngeal nerve and anterior to the recurrent laryngeal nerve on the posterior aspect of the inferior pole of the lobe of thyroid gland.[13] Because of its more extensive migration during embryologic development, an inferior parathyroid gland is more likely to be found in an ectopic location. An ectopic inferior parathyroid gland may be found in the thymus, the thyrothymic ligament, the anterior mediastinum, undescended in a submandibular location, or within the thyroid gland.[14]

Due to the small size and variable location of the parathyroid glands, preservation of the parathyroid glands can be a challenge during thyroidectomy. The purpose of this study was to determine the incidence of inadvertent parathyroidectomy (IP) during thyroidectomy at our institution, its risk factors and whether it is associated with the development of hypoparathyroidism.

Materials and methods

A retrospective review of electronic medical records and a prospectively maintained database was completed for a consecutive group of patients who underwent thyroidectomy by a single surgeon from January 2010 through August 2014. The pathology reports for all study patients were reviewed to determine whether one or more parathyroid glands were unexpectedly found in the specimen submitted to pathology. During the study period, a routine protocol for processing the thyroid gland was followed at our institution. Pathologists completed a gross examination of the thyroid gland and the excised contents of the central compartment of the neck. A routine pathologic examination of all thyroid nodules as well as one representative section for every 1 cm of the remainder of the thyroid gland was completed. IP was defined as the unrecognized removal of a parathyroid gland or any parathyroid tissue that was found in the specimen submitted for paraffin evaluation. The determination of an incidentally discovered parathyroid gland or parathyroid tissue was made on the basis of microscopic pathologic examination. An intrathyroidal parathyroid gland was defined as a gland that was completely surrounded by thyroid parenchyma.

A systematic search for parathyroid glands, which were not identified during the course of the normal operative dissection, was not performed. The distal branches of the inferior thyroid artery were ligated adjacent to the thyroid gland. Ligation of the trunk of the inferior thyroid artery was avoided. If a parathyroid gland could not be preserved *in situ* or was thought to be devascularized during the course of the thyroidectomy, confirmation of parathyroid tissue was obtained with a frozen section examination, and the remainder of the gland was minced and autotransplanted into the ipsilateral sternocleidomastoid muscle. A parathyroid gland that was removed and later autotransplanted did not constitute IP.

Patient medical records were assessed for potential risk factors that might contribute to IP and to determine whether IP contributed to the development of hypoparathyroidism. Data that were obtained included demographics, extent of thyroidectomy, central compartment neck dissection, thyroid gland weight, retrosternal goiter, parathyroid autotransplantation, reoperative thyroidectomy, pathology, and postoperative calcium levels. Serum calcium levels were measured on the first postoperative day in all patients who underwent total or completion thyroidectomy. Follow-up calcium levels were obtained in an outpatient setting for patients with hypocalcemia, patients placed on calcium supplementation, and patients who developed symptoms of hypocalcemia.

A patient was determined to have permanent hypoparathyroidism if he or she required vitamin D and/or calcium for maintenance of eucalcemia for 6 mo after thyroidectomy.

Statistical analyses were performed using IBM SPSS version 22 (IBM, Armonk, NY) software. Continuous variables were compared using the Student's *t*-test or Mann–Whitney *U* test. Categorical data were compared using chi-square test or Fisher's exact test. Multivariate logistic regression analysis was performed to determine the independent risk factors for IP. Means are reported as mean ± standard deviation. Median