

Bilateral Neck Exploration for Primary Hyperparathyroidism

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Despite the current vogue for unilateral/focused cervical exploration in patients with primary hyperparathyroidism (HPT), bilateral (four-gland) neck exploration should remain in the armamentarium of all surgeons today. In reality, worldwide, bilateral neck exploration remains the most commonly used method for treatment of this disease, and may well be the favored surgical approach, particularly in those regions of the world where surgeons/endocrinologists may not have ready access to excellent preoperative localizing modalities such as ultrasonography (US) and technetium 99m Sestamibi (MIBI) scanning.

The surgical results of bilateral exploration are well documented, and in many institutions, it has the same operative outcome as minimally invasive parathyroidectomy.^{1,2} In centers favoring a focused approach, bilateral exploration is still considered in patients with negative preoperative localization studies (US, MIBI and differential jugular venous sampling) and in those with a higher percentage of multiglandular disease such as in patients with multiple endocrine neoplasia (MEN I in particular), non-MEN familial and lithium induced hyperparathyroidism. Even when a focused parathyroidectomy is the approach of choice, 10 to 20% of patients will require bilateral neck exploration, either due to presence of multiglandular disease, or inaccurate preoperative localization studies.

The traditional belief that “for a successful parathyroidectomy one should only need to localize an experienced surgeon” is especially true during bilateral neck exploration. It is therefore essential for the parathyroid surgeon to be comfortable and proficient in this approach.

When a preoperative localization study is performed and it is positive, cervical exploration should be initiated on the side of the suspicious lesion. The patient is placed in the supine position with cervical hyperextension either under general or local anesthesia and a cervical block. A small

(3 cm) incision is made in a natural skin crease, about 2 cm above the suprasternal notch, and the platysma muscle is divided. Flaps are elevated superiorly and inferiorly immediately posterior to the platysma muscle. The midline is opened in an avascular plane providing visualization of the thyroid gland. Retracting the strap muscles laterally and the thyroid gland medially, allows exposure of the parathyroid glands. The middle thyroid vein should be ligated and divided to facilitate thyroid mobilization. The location of the parathyroid glands is quite variable and they can be located anywhere in the central or the lateral neck compartments as well as the mediastinum. Most commonly the inferior glands are located just anterior to the confluence of the inferior thyroid artery and the recurrent laryngeal nerve. If not found in this anatomical site, attention should turn to the thyrothymic ligament and to the possibility of a subcapsular (not intrathyroid) gland on the anterior surface of the lower pole of the thyroid gland. The superior parathyroid glands are usually identified at the upper third of the superior pole of the thyroid gland at the level of the thyroid cartilage and are best seen after take-down of the superior pole. They are in a more posterior plane than the inferior glands and may descend inferiorly in the tracheoesophageal groove when they are enlarged. When this occurs, they may be inferior to the inferior glands reminding us that “when the superior gland is missing, look inferior to the inferior for the superior”. Conversely, if the inferior gland is missing, consideration should be given to an undescended gland which may be high in the neck, well above the superior gland. Thus, “if the inferior gland is missing, look superior to the superior for the inferior”. Both glands are usually supplied by the inferior thyroid artery (80%) therefore this vessel should not be ligated at any time during parathyroidectomy to avoid devascularization of normal parathyroid glands. After identification of both glands, the opposite side is explored in the same fashion. When all 4

parathyroid glands have been visualized, enlarged gland(s) is (are) excised with a biopsy of the specimen sent for frozen section for tissue confirmation. If a parathyroid gland is not identified in one side of the neck, transcervical thymectomy should be performed. If this is unsuccessful, rare ectopic sites, such as the retropharyngeal, tracheo-esophageal and retroesophageal spaces as well as the carotid sheath should be explored. When the elusive parathyroid gland is still missing after extensive exploration, biopsy of the 3 identified parathyroid glands should be performed with careful protection of gland vascularity. If the 4th gland remains elusive and biopsy of the remaining 3 glands confirms parathyroid tissue, a thyroid lobectomy on the side of the missing gland should be considered in search of a truly rare intrathyroid parathyroid gland. Preoperative and possibly intraoperative ultrasonography can be helpful in localizing glands in the lateral neck and within the thyroid gland. Sternotomy and mediastinal exploration in an attempt to localize the missing gland is not indicated at the initial operation, especially if a preoperative localization study was not performed or it was negative. Following this extensive exploration, surgeons should assure proper vascularization and viability of the remaining glands left *in situ*. If a normal parathyroid gland is devascularized, it should be minced and transplanted in the sternocleidomastoid muscle.

In cases where all 4 parathyroid glands are enlarged, 3.5-gland excision is indicated. As an initial step, the most "normal-appearing" gland is partially excised leaving approximately 50 mg of parathyroid tissue *in situ* marked with a titanium clip. Excision of the remaining glands should only be carried out after viability of the first, partially excised, gland is assured. If the initial partially excised gland becomes ischemic, there are 3 other chances to leave viable parathyroid tissue *in situ*. As a precaution, any excised gland should remain in the back table in saline solution and on ice, in case autotransplantation becomes necessary later in

the surgical procedure. A transcervical thymectomy in patients with hyperplasia should be strongly considered since supernumerary glands, or embryologic parathyroid remnants, can be present in the thymus potentially causing persistent or recurrent hyperparathyroidism.

When total parathyroidectomy is elected, a portion of the most viable and normal appearing gland is minced and autotransplanted either in the sternocleidomastoid muscle, nondominant forearm or in a subcutaneous pocket anterior to the sternum depending on the surgeon's preference. We prefer subtotal (3.5 gland) parathyroidectomy and have abandoned cryopreservation.

We routinely utilize intraoperative PTH monitoring in all parathyroid explorations. The technique/results of this adjunct tool for prediction of operative success are well-documented.^{3,4}

The most important consideration for surgeons during parathyroidectomy, bilateral explorations in particular, is to not excise or injure normal parathyroid glands, which is a common mistake when this procedure is performed by inexperienced surgeons.

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