

Minimally invasive radioguided parathyroidectomy



Ann. Ital. Chir., LXXIV, 4, 2003

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Introduction

Primary hyperparathyroidism (HPT) is the most common cause of hypercalcemia. Its prevalence is up to 4 per 1,000 in women aged over 60 years, and its incidence is approximately 42 per 100,000 (19). The annual rate of primary HPT has increased by 3.5 since 1970, when patients usually referred signs and symptoms related to hypercalcemia (12). With the introduction of routine biochemical screenings the disease become more common, and a 1998 cross-selection survey of North American Endocrine Surgeons showed that more than 70% of patients with primary HPT who underwent surgery were asymptomatic or minimally symptomatic (21). In the past, a major challenge in the management of primary HPT was how to select patients who should undergo surgery. The NIH Consensus Conference that took place in 1990 suggested parameters for treating the disease, and in particular considered the markedly reduced cortical bone mineral density as an accepted guideline for parathyroidectomy (16). Primary HPT now typically presents as an asymptomatic disease, and the finding of mild hypercalcemia is usual, since the improved testing procedures in PTH assay has raised awareness of asymptomatic HPT (20).

Bilateral neck exploration has represented for years the standard initial surgical procedure in patients requiring surgery. However, since 1990s, with the aim of reducing operative time, discharging earlier patients after surgery, and having better cosmetic results, minimally-invasive

Riassunto

PARATIROIDECTOMIA MININVASIVA RADIOGUIDATA

Negli ultimi anni al fine di ridurre il tempo richiesto per l'intervento e ottenere dei risultati estetici migliori, la paratiroidectomia mininvasiva (MIP) è diventata una pratica estesamente utilizzata. Diverse tecniche sono attualmente disponibili, tra cui la paratiroidectomia videoassistita e quella radioguidata.

I pazienti sottoposti ad una paratiroidectomia radioguidata ricevono una iniezione intravenosa di ^{99m}Tc -sestamibi 60-90 minuti prima dell'intervento. Le prime quattro immagini sono ottenute 5 minuti dopo la somministrazione del radiofarmaco con lo scopo di confermare la sede e il sito esatto di localizzazione della paratiroide patologica. Intraoperatoriamente si effettua un mappaggio della radioattività del radionuclide sui 4 quadranti a livello cervicale con l'impiego di una sonda.

Individuata la sede della ghiandola patologica, si effettua una incisione di 2-3 cm; la successiva dissezione chirurgica è guidata dalla sonda stessa; la asportazione della paratiroide patologica comporta la riduzione della radioattività nel corrispettivo quadrante. Tramite il dosaggio del qPTH intraoperatorio è possibile controllare la completezza dell'intervento; riduzioni inferiori al 50% rispetto ai livelli preoperatori dopo 10 minuti dall'escissione devono far sospettare la presenza di una malattia a coinvolgimento multighiandolare; in tali casi è consigliabile l'esecuzione di una esplorazione bilaterale del collo.

La MIP è una tecnica sicura, e rappresenta un'alternativa efficace all'esplorazione bilaterale; essa dovrebbe essere considerata la procedura di scelta in pazienti con iperparathyroidismo primario quando le tecniche di imaging preoperatorie suggeriscono la presenza di un'adenoma paratiroide singolo.

La MIP radioguidata può incrementare le percentuali di successo nei pazienti con iperparathyroidismo primario.

Parole chiave: Chirurgia mininvasiva radioguidata, monitoraggio intraoperatorio del qPTH.

Abstract

In the last years, with the aim of reducing operative time and having better cosmetic results, minimally-invasive parathyroidectomy (MIP) has become to be extensively performed. Several techniques are available, including video-endoscopic techniques, and radioguided parathyroidectomy. In patients undergoing radio-guided parathyroidectomy

receive an intravenous injection of ^{99m}Tc -sestamibi 60-90 minutes before the operation was scheduled to start. Four early images are obtained 5 minutes after radiopharmaceutical administration, with the aim of confirming the side and site of the enlarged PT gland. Intraoperative nuclear mapping using a hand-held gamma probe and quantitative gamma camera counting in the four quadrants is obtained. A 2-3 cm incision is made, and the enlarged PT gland excision is guided by the probe, resulting in a decline in radioactivity in the corresponding quadrant. Intraoperative quick PTH is routinely assayed. When the PTH levels at 10 min fail to fall to less than 50% of the preoperative levels, a multiglandular disease should be suspected and a bilateral neck exploration is usually required. MIP is a safe, cost-effective alternative to bilateral exploration, and should be considered the procedure of choice in patients with primary HPT, when preoperative imaging tests have suggested the presence of a PT adenoma. Radioguided MIP may improve the success rate of surgery in patients with primary hyperparathyroidism.

Key words: Radioguided parathyroidectomy, qPTH assay.

parathyroidectomy (MIP) has become to be extensively performed (5, 3, 15, 9, 22). Several techniques are available, including video-endoscopic techniques, and radioguided parathyroidectomy (14, 17, 7). An improved sensitivity of localizing studies is subsequently required when MIP have been chosen. In a recent review we reported that the sensitivity of ultrasonography and ^{99m}Tc -sestamibi scan may range from 77% to 100% (median 75%), and from 63% to 100% (median 82%), respectively (13). Currently, by combining two or more techniques, a MIP may be safely performed in more than 90% of patients, with similar results in patients with ectopic parathyroid (PT) adenomas (10, 1).

Anatomical consideration

Superior and inferior PT glands develop from the fourth and third pharyngeal cleft, respectively. The inferior PT glands may descend along with the developing thymus, and so are more inconstant in location and they are mostly encountered in a relatively anterior plane compared with the superior PT glands (1).

The superior PT adenomas are usually found close to the posterolateral aspect of the thyroid lobe, posteromedially to the recurrent laryngeal nerve. They are encountered at the cricothyroid junction, 1 cm cranially to the intersection between the recurrent laryngeal nerve and the inferior thyroid artery, in 80% of cases (2).

An inferior PT adenoma is usually found along the thyrothymic ligament and the inferior thyroid pole, anterior to the recurrent laryngeal nerve and below the inferior thyroid artery. However, the distribution of locations varies widely, and 25% of the inferior PT glands are encountered within the thymus, since enlarged PT glands tend to migrate into the anterior mediastinum (4).

Technique

Prior to surgery all patients should have undergone both ^{99m}Tc -sestamibi scintigraphy and neck ultrasonography, and an unequivocal localization of a solitary parathyroid adenoma should be obtained.

Patients receive an intravenous injection of 370 MBq ^{99m}Tc -sestamibi 60-90 minutes before the operation was scheduled to start. Four early images are obtained 5 minutes after radiopharmaceutical administration, with the aim of confirming the side and site of the enlarged PT gland. Methylene blue dye preoperative infusion (7.5 mg/kg for 60-90 minutes) has also been suggested with the aim of facilitating intraoperative identification of both normal and abnormal PT glands (7).

The surgical approach is usually undertaken under general anesthesia, with the patient in supine position and the neck in slight extension, although regional or local anesthesia may also be performed (6, 8). In the operating room intraoperative nuclear mapping using a hand-held 11 mm gamma probe is obtained, and quantitative gamma camera counting in the four quadrants is performed (Figure 1 and 2).

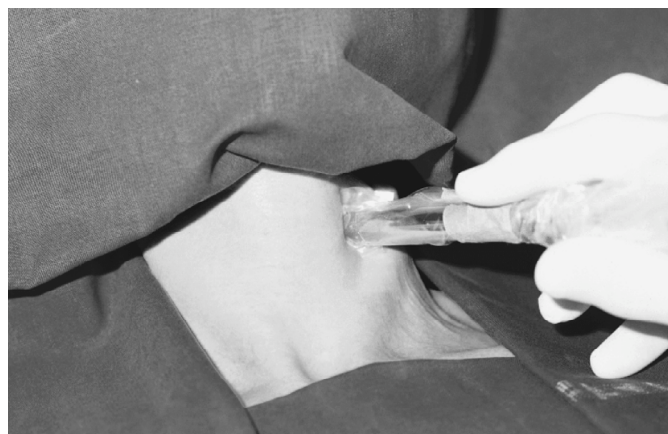


Figure 1: Radio-guided parathyroidectomy: Intraoperative nuclear mapping of the upper left quadrant of the neck.

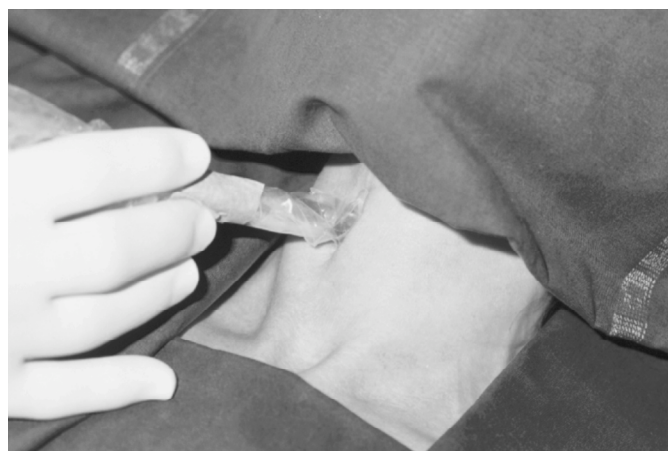


Figure 2: Radio-guided parathyroidectomy: Intraoperative nuclear mapping of the upper right quadrant of the neck.



Figure 3: Radio-guided parathyroidectomy: the adenoma identification is guided by the probe.

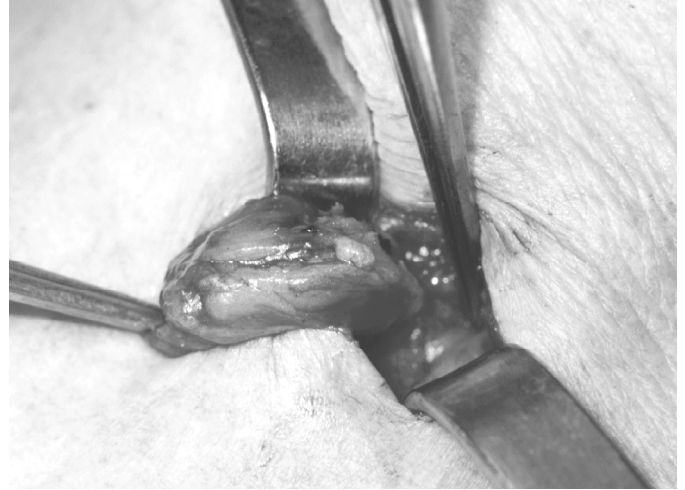


Figure 4: Radioguided parathyroidectomy: the removed adenoma.

The site of neck incision is different for patients with superior or inferior PT adenomas. A 2-3 cm incision is made one or two finger-breadths above the sternal notch, lateral or medial to the medial margin of the sternocleidomastoid muscle, depending on the localization of inferior or superior PT gland, respectively. The sternocleidomastoid muscle is lifted and retracted laterally, the sternohyoid and sternothyroid muscles are retracted medially, the middle thyroid vein is ligated and divided, and the inferior pole of the thyroid lobe is exposed (1). The adenoma identification is guided by the probe, and removal of the diseased PT gland results in a decline in radioactivity in the corresponding quadrant (Figure 3). Finally, the probe is directed away from the patient and the radioactivity of the removed adenoma is measured and compared with the residual radioactivity obtained scanning the thyroid gland (Figure 4).

When the preoperative localizing procedures and preincision radioactivity measurements did not clearly identify increased radioactivity on one side of the neck, a bilateral neck exploration should be performed (7).

In our experience both quick intraoperative PTH assay (baseline time, and 10 and 20 minutes after PTx) and frozen section examination are routinely used. A chemiluminescent PTH assay is used, and the results are available within 15 minutes. When the PTH levels at 10 min fail to fall to less than 50% of the preoperative levels, a multiglandular disease should be suspected and a bilateral neck exploration is usually required. Frozen section examination is useful for excluding a PT carcinoma, and may improve the accuracy of intraoperative quick PTH measurement (11). Although some consider clinical identification of a PT adenoma by an experienced surgeon to be the most valuable method of diagnosis, intraoperative frozen section pathology is also necessary in confirming the PT origin of an equivocal-looking tissue (1).

Conclusions

When the MIP and bilateral cervical exploration was compared, a significantly shorter operative time, length of hospital stay and lower costs were found (6, 8). A recent survey of members of the International Association of the Endocrine Surgeons (IAES) showed that 95% of the surgeons currently perform MIP, use this technique for 44% of patients with primary HPT, and 92% use a small-incision technique, either central or lateral (18). Thus, MIP is a safe, cost-effective alternative to bilateral exploration, and should be considered the procedure of choice in patients with primary HPT, when preoperative imaging tests suggested the presence of a PT adenoma. Radioguided MIP may improve the success rate of surgery in patients with primary HPT.

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