

Preoperative Marking of a Parathyroid Adenoma : A Case Report with Literature Review

I. Introduction :

The prevalence of primary hyperparathyroidism is increasing. This increase is multifactorial, but it indicates that clinicians treating this pathology should expect to operate on a greater number of patients in the future, on which targeted investigation and effective operative technique seem vital [1]. We tried through a clinical case to achieve a clinical approach and cooperation between interventional endocrinologist and surgeon to facilitate the detection of parathyroid adenoma.

II. Case report:

This is a 39-year-old patient, married without children. Her medical history includes familial hypertension and a mother who died at a young age. The patient was operated on for breast cancer and was given chemotherapy and radiotherapy.

The clinical examination was unremarkable, but the history of her illness dates back 6 months to the appearance of diffuse joint pain, which prompted the patient to consult the rheumatology department, where a biologic workup was ordered revealing hypercalcemia with elevated PTH. She was then referred to our training center for further management. In addition, the patient reported no digestive disorders, polyuro-polydipsic syndrome or renal colic, all evolving in a context of preserved general condition.

The first step is to eliminate emergencies :

Acute hypercalcemic crisis : Clinically, there is no fever or vomiting, no abdominal pain and no signs of dehydration. The ECG is normal, with a normal QT interval. Biologically, calcemia is 129 mg/L on admission.

The patient does not express cardiovascular emergency : her BP was 130/70 mmHg put on dual therapy: Angiotensine Conversion inhibitor and amlodipine; or abdominal pain or pancreatitis

Once the emergency has been ruled out, it is advisable to confirm the hypercalcemia on 3 successive determinations coupled with albuminemia to calculate the corrected calcemia, before starting the etiological investigation:

1st corrected calcemia: 115mg/l

2nd corrected calcemia: 112mg/l

3rd corrected serum calcium: 116mg/ l

On the etiological level: Primary hyperparathyroidism is most likely due to :

- Hypercalcemia at 115mg/L
- PTH 5.5 * superior limit

- Hypophosphatemia at 20 pg/L

- Calciuria 692 mg/24H

A secondary cause is ruled out in view of normal renal function (urea: 0.2 g/L creatinine: 7mg/L) and vitamin D status (vitamin D = 25ng/L), which cannot explain the hyperparathyroidism.

Concerning the outcome:

Cardiovascular: elevated BP currently controlled with bitherapy, ECG and echocardiography normal.

Renal: normal renal function and renal ultrasound marked by absence of lithiasis

Bone: BMD: lumbar osteopenia with T score of -2

Standard X-rays (skull, spine, lower limbs, hands) returned with no particularities

Concerning the localization assessment:

It should be emphasized that the localization assessment is not a diagnostic evaluation, but rather a preoperative assessment, given the surgical indication.

A cervical ultrasound scan revealed a nodular lesion located in the Left parathyroid lodge, at the inferior pole and posterior surface of the thyroid lobe. It was vascularized by Doppler and measured 19x11mm in diameter (Figure 1).

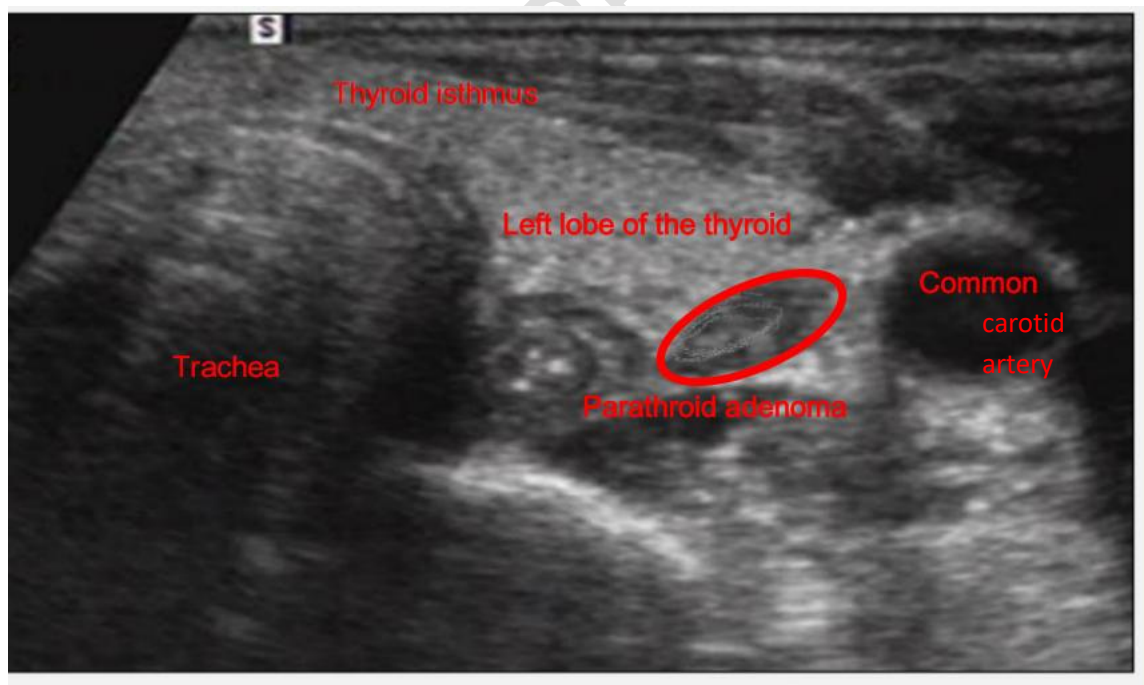


Figure 1: Sonographic location of a left parathyroid adenoma

Laterally: The jugulocarotid bundle, Posteriorly : The long neck muscle

Anteriorly: the muscular planes of the aponeurosis media

A MIBI scintigraphy was then performed, showing a pathological parathyroid process in the left lower pole.

For the NEM assessment: Requested in view of the patient's young age < 40 years, it is advisable to look for NEM:

For NEM 2A:

Pheochromocytoma : patient presents with Menard's triad with hypertension, urinary methoxylates were requested and came back negative.

Medullary thyroid carcinoma : cervical ultrasound showed no thyroid nodules and Calcitonin was negative.

For NEM 1:

On the pituitary level: Hypophysiogram came back normal and hypothalamo-pituitary MRI was unremarkable.

Hormone assays were ordered: gastrinemia, insulinemia, glucagonemia, urinary free cortisol and aldosterone, and a CT scan for other localizations, in particular a bronchial tumor, all came back negative.

SURGICAL MANAGEMENT :

On the day of surgery, the patient was taken to the operating room and placed in the supine position, lying on her back, with a block under her shoulder to lengthen her neck.



Figure 2: Preoperative position and localization of parathyroid adenoma

After induction of general anaesthesia and disinfection of the neck with an isopropyl alcohol swab (Fig. 2), a pre-operative .Ultrasound was performed to identify the parathyroid adenoma and localize it using methylene blue (BM) injected into the parathyroid adenoma. under ultrasound guidance and using a needle and a 1 cc syringe. After skin and internal BM marking, the patient was prepared and draped in the standard manner and underwent a focused parathyroidectomy (Fig. 3).

Macroscopically, the surgical specimen had taken on the characteristic purplish color of methylene blue, with the anatomopathological result showing a parathyroid adenoma (Figure 4). Post-operative PTH came back collapsed.

Post-operative management was straightforward, and the patient remained normocalcemic



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94 **III. Discussion :**

95 In 1925, Felix Mandl performed the first parathyroidectomy, but unfortunately, the patient developed
 96 recurrent hypercalcemia and died shortly after a second surgical exploration [1-2]

97 To date, parathyroid surgery has made enormous progress, but post-operative complications and the
 98 difficulty of locating parathyroids still represent a real challenge for clinicians and surgeons. The main
 99 risk factors for this surgical over-morbidity are: Extent of resection, reintervention, number of
 100 patients per surgeon and surgeon experience; meticulous dissection is a key factor in minimizing
 101 complications. [2-3]

102 Hence the importance of having adequate identification, and this is where the use of methylene blue
 103 (MB) takes on its full significance.

104 the use of BM in medicine dates back to the 19th century, and its first role was in the treatment of
 105 malaria. Since then, it has been used in a variety of conditions, including the identification of
 106 tuberculosis and monitoring compliance with psychiatric treatment (the agent stains urine blue) [4].

107 today, it is used to treat priapism and vasoplegic shock, and remains an effective treatment for
 108 methemoglobinemia.

109 On a study carried out in the general surgery department in San Francisco USA between 2008-2013
 110 [5], using preoperative echoguided methylene blue labeling in 9 patients with a history of at least one
 111 neck surgery and primary hyperparathyroidism; all patients were reported cured after surgery. a
 112 single recurrence, after 18 months of normocalcemia, occurred in a patient with parathyroid
 113 carcinoma who, to date, has opted for observation rather than a fifth neck exploration. The

complication rate was acceptable, with only one transient laryngeal paralysis. Previous studies of recurrent parathyroidectomy have noted permanent recurrent nerve palsy in 3-10% and permanent hypoparathyroidism in 10-20% of patients [6-7].

Previous authors have reported the use of intravenous infusion of BM to facilitate parathyroid surgery. [11-22]; given its preferential tropism for the parathyroid glands. Unfortunately, complications of intravenous infusion can occur, ranging from simple confusion to severe status epilepticus, metabolic encephalopathy and anaphylactic shock. [8-9] Problems that do not appear to exist with percutaneous injection.

The advantages of BM marking :

- Targeted locating
- Marked shortening of operating time

IV. Conclusion:

Ultrasound-guided marking with methylene blue is a safe, inexpensive and effective tool for any parathyroidectomy, considerably reducing operating time and morbidity in this procedure; and more specifically in difficult and recurrent patients. Nevertheless, further studies are needed to assess the safety and efficacy of this technique.

V. References :

- [1]. Welbourn RB, Friesen SR, Johnston ID, Sellwood RA: The History of Endocrine Surgery . Greenwood Publishing Group, Boston; 1990
- [2]. Bergenfelz A, Jansson S, Kristoffersson A, Mårtensson H, Reihner E, Wallin G, Lausen I: Complications to thyroid surgery: results as reported in a database from a multicenter audit comprising 3,660 patients. Langenbecks Arch Surg. 2008, 393:667-73.
- [3]. Zambudio AR, Rodríguez J, Riquelme J, Soria T, Canteras M, Parrilla P: Prospective study of postoperative complications after total thyroidectomy for multinodular goiters by surgeons with experience in endocrine surgery. Ann Surg. 2004, 240:18.
- [4]. Schirmer RH, Adler H, Pickhardt M, Mandelkow E. 'Lest we forget you-methylene blue...' . Neurobiol Aging 2011; 32: 2325.e7-2325.e16
- [5]. Leah Candell, Ultrasound-Guided Methylene Blue Dye Injection for Parathyroid Localization in the Reoperative Neck
- [6]. Grant CS, van Heerden JA, Charboneau JW, James EM, Reading CC (1986) Clinical management of persistent and/or recurrent primary hyperparathyroidism. World J Surg 10:555-565.

- 146 [7]. Jaskowiak N, Norton JA, Alexander HR, Doppman JL, Shawker T, Skarulis M, Marx S, Spiegel A,
147 Fraker DL (1996) A pro-spective trial evaluating a standard approach to reoperation for
148 missed parathyroid adenoma. *Ann Surg* 224:308–321
- 149 [8]. Dudley NE (1971) Methylene blue for rapid identification of the parathyroids. *Br Med J* 3:680–681
- 150 [9]. Patel HP, Chadwick DR, Harrison BJ, Balasubramanian SP (2012) Systematic review of intravenous
151 methylene blue in parathyroid surgery. *Br J Surg* 99:1345–1352

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