

3D Surgery of Primary Hyperparathyroidism: Initial Experience with Freehand-SPECT Using a Manual Gamma Camera (CrystalCam)

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CASE REPORT

Parathyroid adenoma is the main cause of primary hyperparathyroidism, and surgical intervention is the common treatment approach. Pre-surgical tests such as ultrasound and 99mTc-MIBI scintigraphy are widely utilized.^[1] In the operating room, we have isotope guidance techniques that provide scintigraphic images, enabling more precise and minimally invasive surgeries.

The CrystalCam® (Crystal Photonics, Berlin, Germany) is a handheld gamma camera equipped with a CdZnTe sensor, offering a 40x40 mm² field of view and weighing 800 grams. This device allows for preoperative and intraoperative studies with planar and tomographic images. When combined with the declipseSPECT® navigation system (SurgicEye, Munich, Germany), it enables the acquisition of hybrid and three-dimensional images (Figure 1).^[2,3]

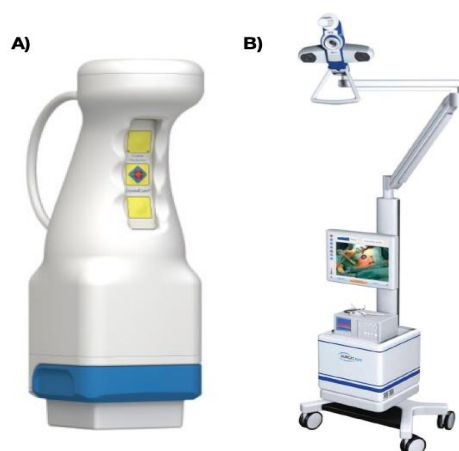


Figure 1A: CrystalCam® handheld gamma camera

We present a case of radioguided parathyroid surgery using a CrystalCam® manual gamma camera coupled with the declipseSPECT® navigation system.

A 73-year-old male with primary hyperparathyroidism exhibited elevated plasma levels of Ca (10.7 mg/dL), PTH (86 pg/mL), and a history of recurrent calcium kidney stones.

A pre-surgical study was conducted, including parathyroid scintigraphy and ultrasound using a double-phase technique with images taken at 20 and 120 minutes after intravenous administration of 20 mCi of ^{99m}Tc-MIBI. The imaging revealed a pathological right parathyroid gland (Figure 2).

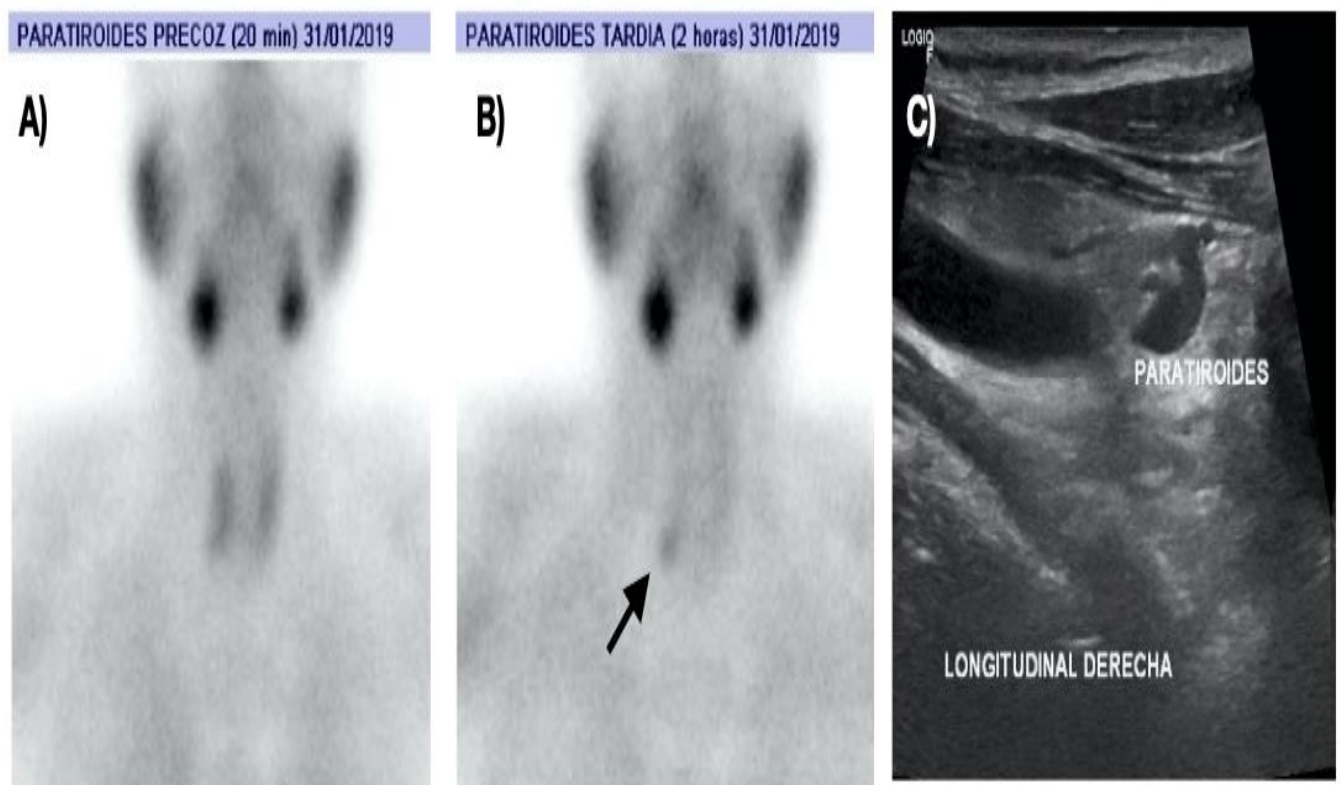


Figure 2: Parathyroid scintigraphy, initial study at 20 minutes (A) and late at 120 minutes. (B) where there is a focal deposit of the radiopharmaceutical, persistent in the late phase, projected onto the lower pole of the right thyroid lobe, indicative of abnormal parathyroid. C) Parathyroid ultrasound: oval and hypoechoic nodule, 5 x 10 mm, behind the lower third of the right thyroid lobe.

Intraoperative localization was achieved by employing the CrystalCam along with the declipseSPECT® system, 25 minutes after administering 5 mCi of ^{99m}Tc-MIBI. Initial scans were performed for one minute in all three axes, continuing until reaching a minimum of 25% of the total count required to generate a tomographic image. Intraoperative PTH determination demonstrated a 69% decrease following gland removal. Pathological analysis confirmed the presence of a 1x0.6 cm, 0.34-gram parathyroid adenoma.

Finally, a verification scan of the surgical site was conducted, confirming the absence of the uptake focus observed in the initial scan and the excised adenoma (Figure 3).

The utilization of the CrystalCam® facilitated accurate tracking of the area of interest and reduced acquisition time due to its larger detection area compared to conventional probes. Furthermore, it allowed for the acquisition of intraoperative tomographic images of the affected region.

Based on the positive outcome of this case, we aim to further investigate the application of manual gamma cameras in parathyroid surgery and explore additional potential applications of this innovative technology.

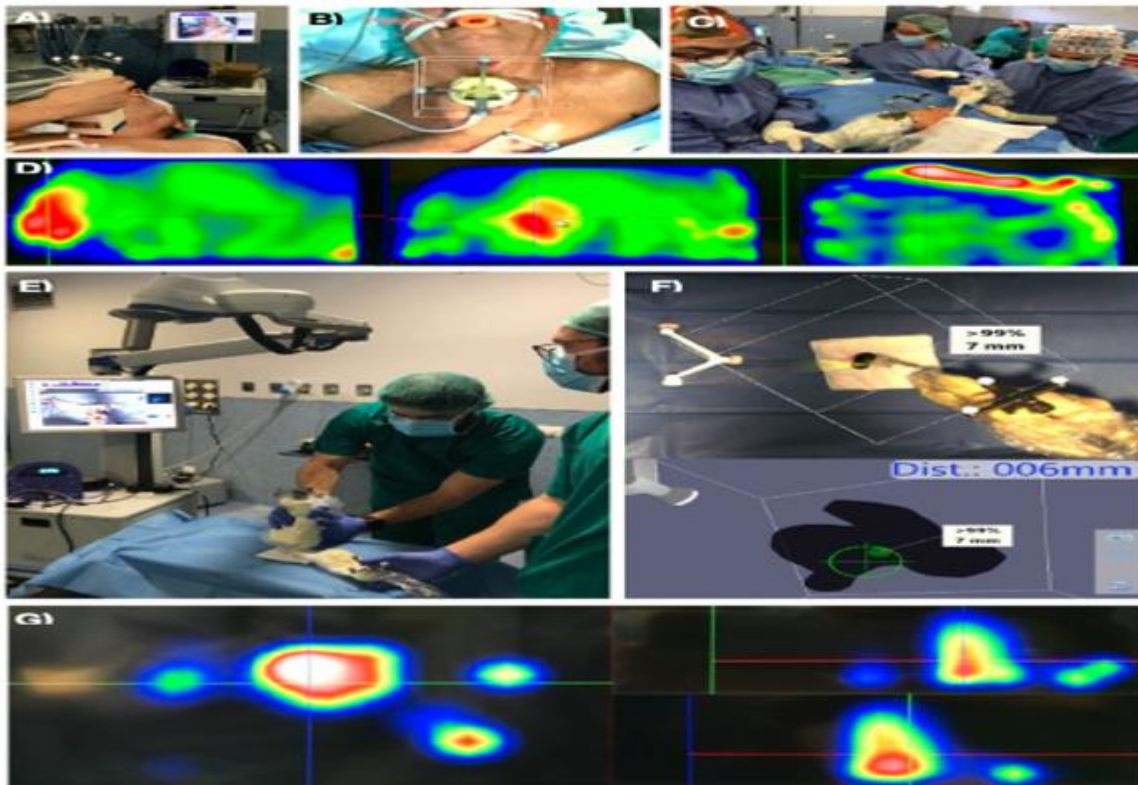


Figure 3A and B: Placement of a manual gamma camera on the patient and fixation of the 20 cc virtual cube to perform initial cervical scan. C) Probe confirmation of the location of maximum activity. D) Tomographic sections obtained with a focus of greater activity in the lower right location. E) Tracking of surgical specimen with manual gamma camera and declipse®SPECT. F) Three-dimensional hybrid image and navigation with a declipse probe marking the point of greatest activity. G) Tomographic images obtained after tracing the surgical specimen with a manual gamma camera showing focus of activity compatible with the pathological parathyroid gland.

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