

# Magseed Application for Detecting Recurrent Lymph Node Metastasis in Papillary Thyroid Cancer: A Novel Minimally Invasive Approach

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## Introduction

Papillary thyroid cancer (PTC) has an excellent prognosis. However, it is associated with lymph node metastasis and tumor recurrence that need repeated surgery, resulting in fibrosis, tissue adhesion, and changes in anatomical structures in the neck. Metastasis surgery in the cervical region entails technical challenges with an increased risk of complications. Magseed is a non-radioactive paramagnetic metal coil for localizing small, non-palpable lesions. This detection technique is feasible and well-studied in breast cancer surgery.

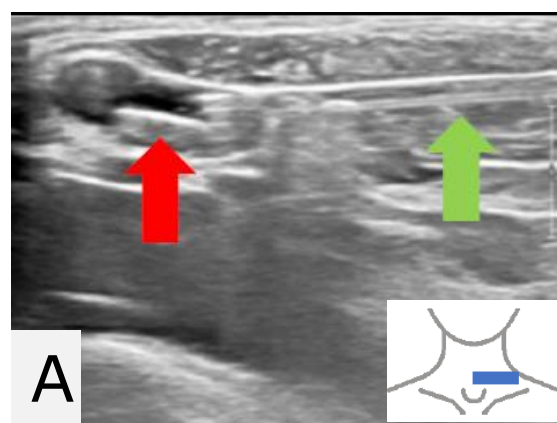
## Case report

In this case series (n=5), we explore the feasibility of Magseed-guided localization of non-palpable lymph node metastasis during the reoperation of patients with recurrent PTC (Table 1). The patients had previously undergone metastatic surgery due to PTC. Lymph node metastases were not palpable, but verified by FNA-guided cytology. All patients had given written consent to participate. All patients were treated at Karolinska University Hospital, Stockholm, Sweden, between 2023 and 2024.

### Case 1

A 51-year-old man who underwent the first operation for PTC 25 years ago. Treated with repeated surgery due to lymph node metastasis in the lateral right cervical compartment. Now lymph node metastasis in right region 4. Magseed was injected in the lymph node with the guiding of ultrasonography, Magseed was intraoperatively detected with a handheld magnetometer probe, Sentimag (Figure 1).

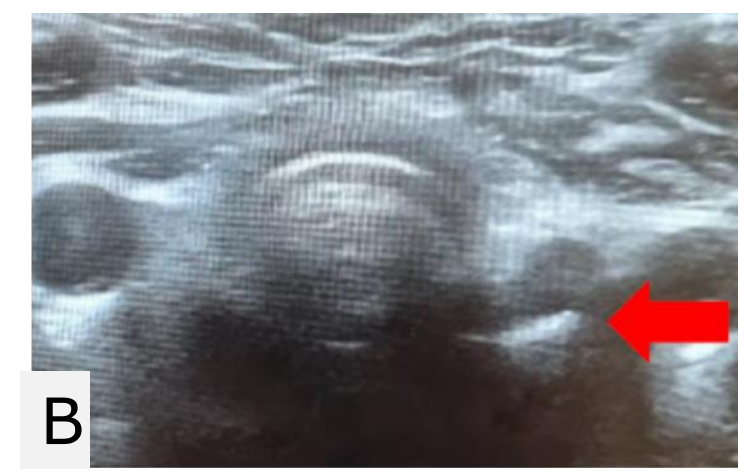
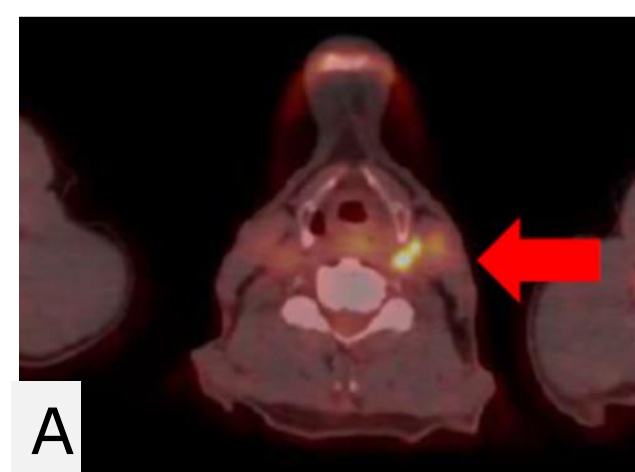
	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Age (years)	51	49	24	35	37
Gender	Male	Male	Female	Male	Female
Lesion size (mm)	9	15	13	4	13
Type of lesion	LN met	LR	LN met	LN met	LN met
Cervical region	Right 4	3	Right 5a	Left 4	Left 2



**Figure 1:** (A) Ultrasonography image illustrating an injected Magseed into the target lymph gland (red row) and the injection needle (green row) through which the Magseed was placed into the gland. (B) Image from gross cutting by a pathologist, demonstrating the Magseed (red row) inside the target lymph node

### Case 2

A 49-year-old man underwent total thyroidectomy in 2020 due to poorly differentiated PTC. After surgery he was treated with external radiotherapy, 2 Gy x 34 sessions to the tumor recurrence area, 1.8 Gy x 34 to the thyroid bed, and 1.52 Gy x 34 to regions 2-6 bilaterally. After 6 months the patient had local tumor recurrence in the left side of larynx. The tumor recurrence was not palpable and difficult to delineate with computed tomography. Magseed was injected in the tumor recurrence with the guiding of ultrasonography and intraoperatively detected with a handheld magnetometer probe, Sentimag (Figure 2).



**Figure 2:** (A) Positron emission tomography/computed tomography with the glucose analogue 2-[18F] fluoro-2-deoxy-d-glucose image showing local recurrence of poorly differentiated papillary thyroid cancer in the left cervical region 3 (red row). (B) Ultrasonography image showing the Magseed coil inside the local tumor recurrence (red row).

## Discussion/conclusion

Other tissue marking methods used to detect PTC lymph node metastasis include carbon nanoparticle marking, hook needle insertion and tattooing with blue dye. Compared to these methods, Magseed remains in the injected tissue, allowing for elective surgery without considering the risk of the tracer's potential dissipation or diffusion into surrounding tissues.

In conclusion, the use of Magseed to detect lymph node metastases and local tumor recurrence in patients with recurrent thyroid cancer and previously repeated surgery is safe, user-friendly, reliable, and well-tolerated by patients.

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