
PICTORIAL ESSAY

Magseed Localisation of Non-palpable Papillary Lesions: a Pictorial Essay

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INTRODUCTION

Papillary lesions of the breast may be benign or malignant and are a common cause of bloody nipple discharge. Some are clinically non-palpable and may be detected only by radiological investigations.¹

Papillary lesions can be radiologically detected on mammography, ultrasound, or magnetic resonance imaging (MRI). However, radiological features alone cannot reliably distinguish benign from malignant papillary lesions. In addition, biopsy using spring-loaded devices can result in upgrade rates of 10.2% at surgery.¹

This limitation has led to some patients and surgeons opting for surgical excision, especially when radiologically suspicious features, clinical features, or presence of papilloma with atypia are evident. With more widespread use of breast cancer screening, an increasing number of non-palpable breast lesions are inevitably detected so accurate localisation is increasingly important.

The most established approach is wire-guided localisation (WGL) before surgery to guide excision of non-palpable

breast lesions. However, this technique requires same day operation, can be associated with patient discomfort, risk of migration and may result in larger areas of tissue dissection. These factors have led to exploration of other techniques.^{2,3}

More popular localisation techniques include radioguided occult lesion localisation and radioactive iodine seed localisation, and have shown similar results in guiding intra-operative lesion localisation compared with WGL.^{2,4} However, complex logistics and exposure to radiation are some of the drawbacks, especially for resections with diagnostic intent. Regarding costs, studies have suggested that compared with WGL, radioactive iodine seed localisation is cheaper⁵ while radioguided occult lesion localisation is a similar cost.³

More recently, newer techniques such as magnetic seed localisation have been shown to be non-inferior to WGL.^{4,6,7} Magseed (Endomagnetics Ltd, London, United Kingdom) is a magnetic seed containing non-radioactive paramagnetic steel and iron oxide seed. The device measures just under 5 mm × 1 mm and seeds can be delivered to a target site to mark breast lesions via

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an 18-gauge needle. The Sentimag probe is then used to detect the Magseed magnetic signal during the operation, after applying an alternating magnetic field to the seed.⁸ This is presented to the reader with a numerical count and audio tone. Advantages include easier localisation of lesions, improved patient comfort, no need for same-day surgery and no ionising radiation. There are however unique limitations to Magseed that should be considered before placement. Detection may be limited to depths of <4 cm, interference from stainless steel surgical instruments, MRI conditional status at 1.5 and 3T and its signal void on MRI.⁴

The advantages of this technique have led to its adoption by many institutions. Accordingly, studies have evaluated the potential cost of Magseed localisation compared with established techniques. The cost of each Magseed is higher than a wire for WGL but with similar cost of use in the elective or outpatient setting.⁹ One study set in the Netherlands evaluated further, and concluded that implementation of Magseed localisation was cost-saving to its service although evaluation past this period is more complex and unclear. Beyond this phase, the cost of Magseed use per patient, mainly influenced by the number of Magseeds, is a consideration.¹⁰ This should be balanced by the savings made from freeing up personnel and services but is unique to every institution.

Recent studies, including one in Hong Kong and a systematic review, have demonstrated the efficacy of Magseed in localisation of non-palpable masses.¹¹⁻¹⁴ However, the proportion of ultrasound-guided Magseed localisation of papillary or subcentimetre lesions was low. To the best of our knowledge, performance and efficacy in this group of lesions has not been established.

We report on our experience in using ultrasound-guided Magseed localisation for non-palpable subcentimetre papillary lesions of the breast, with primary outcomes being successful localisation and excision of the lesions.

IMAGING FINDINGS

Herein, we review the imaging findings of four patients (mean age 59 years; range, 45-85) with clinically non-palpable breast lesions who underwent Magseed marker insertion. Three patients received one Magseed marker and one patient received two markers for two adjacent masses. All patients had their marker(s) inserted before the day of operation (range, 3-17 d, median=14 d). All lesions were small masses (range, 4-6 mm, mean=4.8 mm). No patient had Magseed in situ for more

than 30 days.

All patients proceeded to lumpectomy under Sentimag guidance. Masses were successfully located using the Sentimag device with marker removal confirmed in the surgical specimen. Pathology confirmed intraductal papilloma in all but one specimen that was found to be due to cauterisation artefact. No immediate complications were found.

There were no post excision upgrades to in situ or invasive malignancy.

Case 1

An 86-year-old woman with a history of locally invasive, invasive ductal carcinoma in the right breast, for which she underwent modified mastectomy in 2017. Subsequent ultrasound 7 months later showed a small circumscribed oval hypoechoic lesion in the subareolar region of the left breast, measuring 4 × 2 × 4 mm (Figure 1). Fine needle aspiration pathology showed papillary neoplasm with epithelial proliferation. She proceeded to lumpectomy 3 days after Magseed insertion, which was uneventful. Cauterisation artefacts were seen but pathology revealed no evidence of malignancy.

Case 2

A 55-year-old woman with a history of right breast lump excision confirmed as breast papilloma. Routine follow-up ultrasound examination revealed mild duct dilatation at the right breast 5 o'clock position subareolar region with intraductal oval circumscribed hypoechoic nodule, measuring 5 × 3 × 5 mm (Figure 2). Ultrasound-guided fine needle aspiration pathology revealed intraductal papilloma. Magseed was inserted without complications and the patient proceeded to lumpectomy 17 days later. Localisation at surgery was uneventful.

Case 3

A 45-year-old woman presented with a 3-year history of bilateral mastalgia and breast imaging from another centre that identified a small right breast 12 o'clock position subareolar complex cystic lesion measuring 5 × 5 × 6 mm (Figure 3). Biopsy of the lesion suggested intraductal papilloma and surgical excision was planned. In the interim, follow-up breast imaging at another centre identified another lesion in the same breast, 12 o'clock position, 3 cm from the nipple, measuring 3 × 3 × 5 mm (Figure 3). Biopsy pathology also showed intraductal papilloma. The patient underwent preoperative localisation of these two lesions with Magseed (Figures

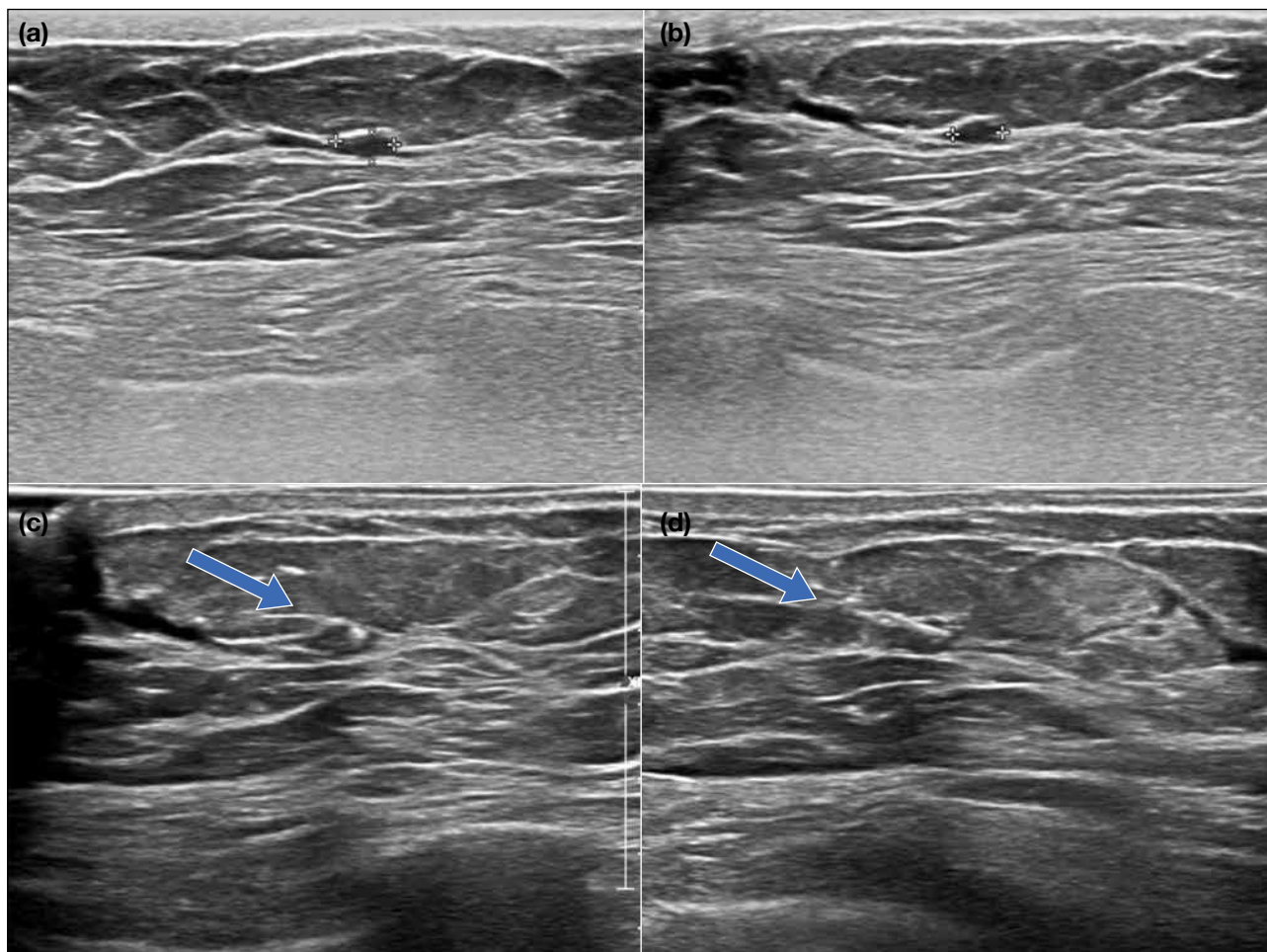


Figure 1. Case 1. An 86-year-old woman with previous right modified mastectomy for invasive ductal carcinoma. (a) Transverse and (b) longitudinal ultrasound views of a 4- \times 2- \times 4-mm circumscribed oval parallel lesion in the subareolar region of the left breast. (c) Transverse and (d) longitudinal ultrasound images confirm Magseed in situ (arrows) after ultrasound-guided placement.

4 and 5). Magseeds were inserted into both lesions, with inter-Magseed distance measured to facilitate surgical localisation. Lumpectomy was performed for both lesions 14 days after Magseed localisation. Two spikes corresponding to the two Magseed markers were detected on Sentimag intra-operatively. The final pathology report for the surgical specimen confirmed intraductal papilloma with usual ductal hyperplasia.

Case 4

A 42-year-old woman with an incidental ultrasound finding of left breast 12 o'clock position nodule, 1 cm from the nipple, measuring 6 \times 3 \times 5 mm, associated with a prominent duct (Figure 6). Ultrasound-guided biopsy showed a papillary lesion, likely to be intraductal papilloma. Magseed insertion was performed before the procedure and was uneventful (Figure 7). Seventeen days

later, lumpectomy was performed and localisation was uneventful. Pathological examination of the specimen confirmed intraductal papilloma.

DISCUSSION

Our experience suggests that success rates for ultrasound Magseed localisation and re-excision are comparable to existing studies of lesions with heterogeneous characteristics, including for lesion sizes >1 cm.^{13,14}

Insertion of Magseed and localisation of lesions with the Sentimag detector was relatively simple in these cases, even when two masses were close together (3 cm apart) and in the same breast. Most Magseed insertions were performed >1 week before surgery and were easily located without clinically consequent displacement, as evidenced by resection pathology results.

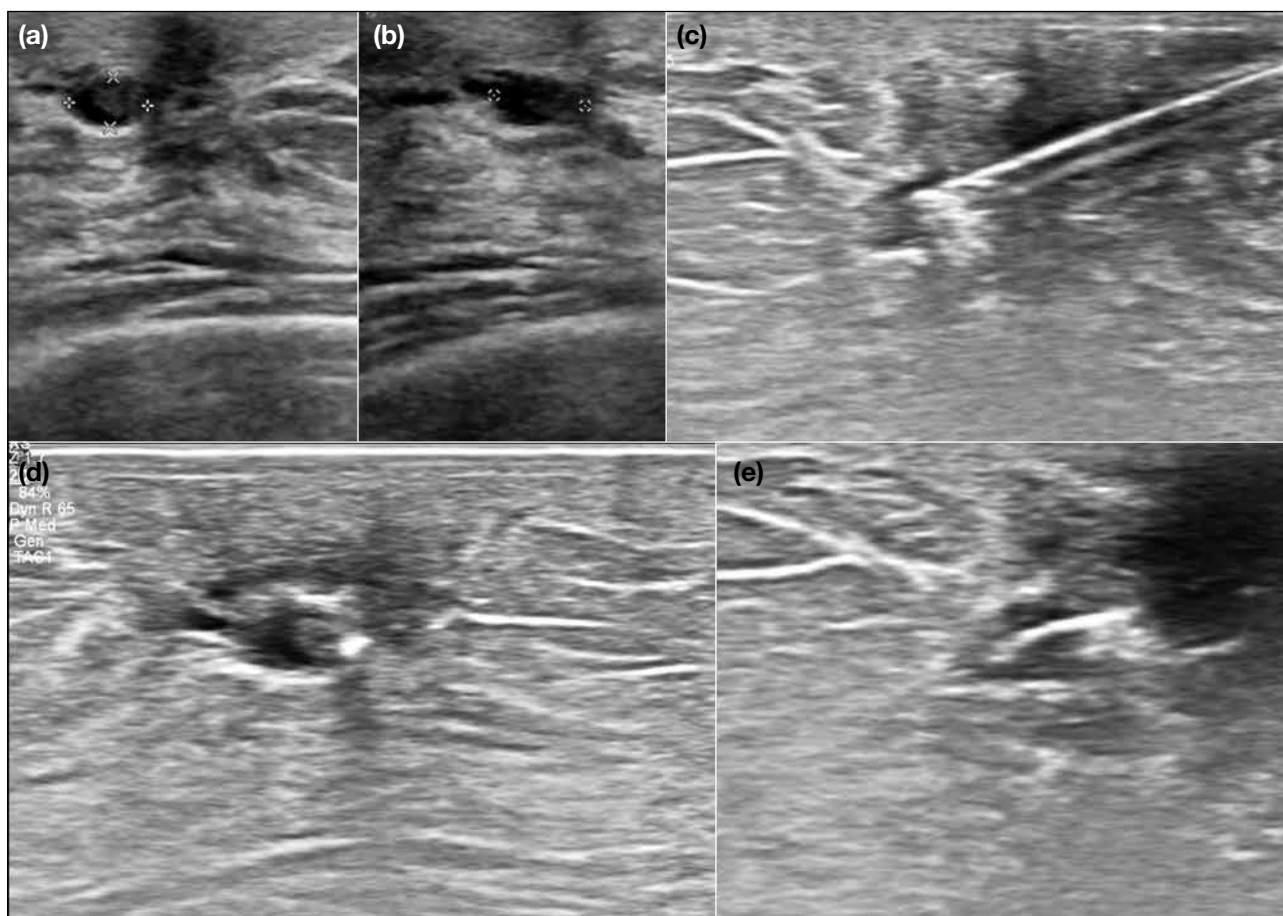


Figure 2. Case 2. A 55-year-old woman with a history of lumpectomy for right breast papilloma. (a) Transverse and (b) longitudinal ultrasound images showing an intraductal lesion measuring $5 \times 3 \times 5$ mm at right breast 5 o'clock position at the subareolar region. (c) Ultrasound image showing needle within the lesion under ultrasound guidance deploying the Magseed. (d) Transverse and (e) longitudinal ultrasound images showing of Magseed in situ.

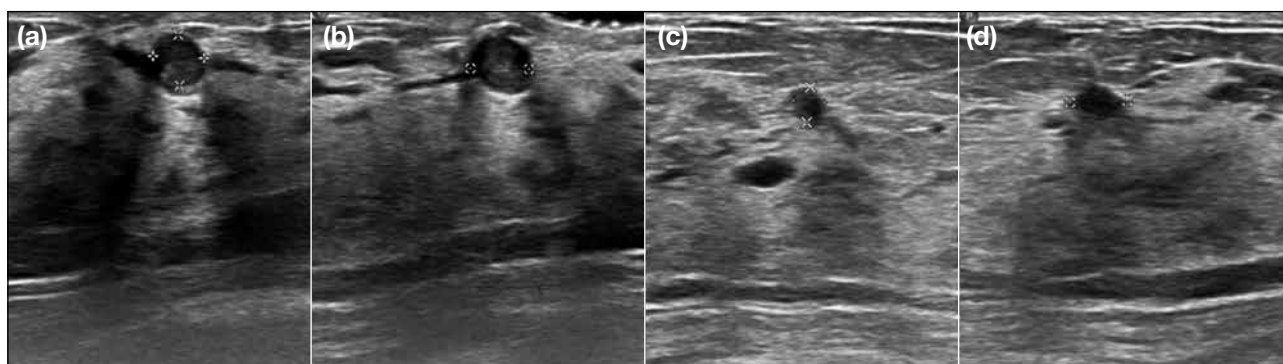


Figure 3. Case 3. A 45-year-old woman with two right breast 12 o'clock position fine needle aspiration-proven intraductal papillomata, one at the subareolar region and the other at 3 cm from the nipple. (a) Transverse and (b) longitudinal ultrasound of right breast 12 o'clock position subareolar lesion. (c) Transverse and (d) longitudinal ultrasound of right breast 12 o'clock position 3 cm from nipple lesion, measuring $3 \times 3 \times 5$ mm.

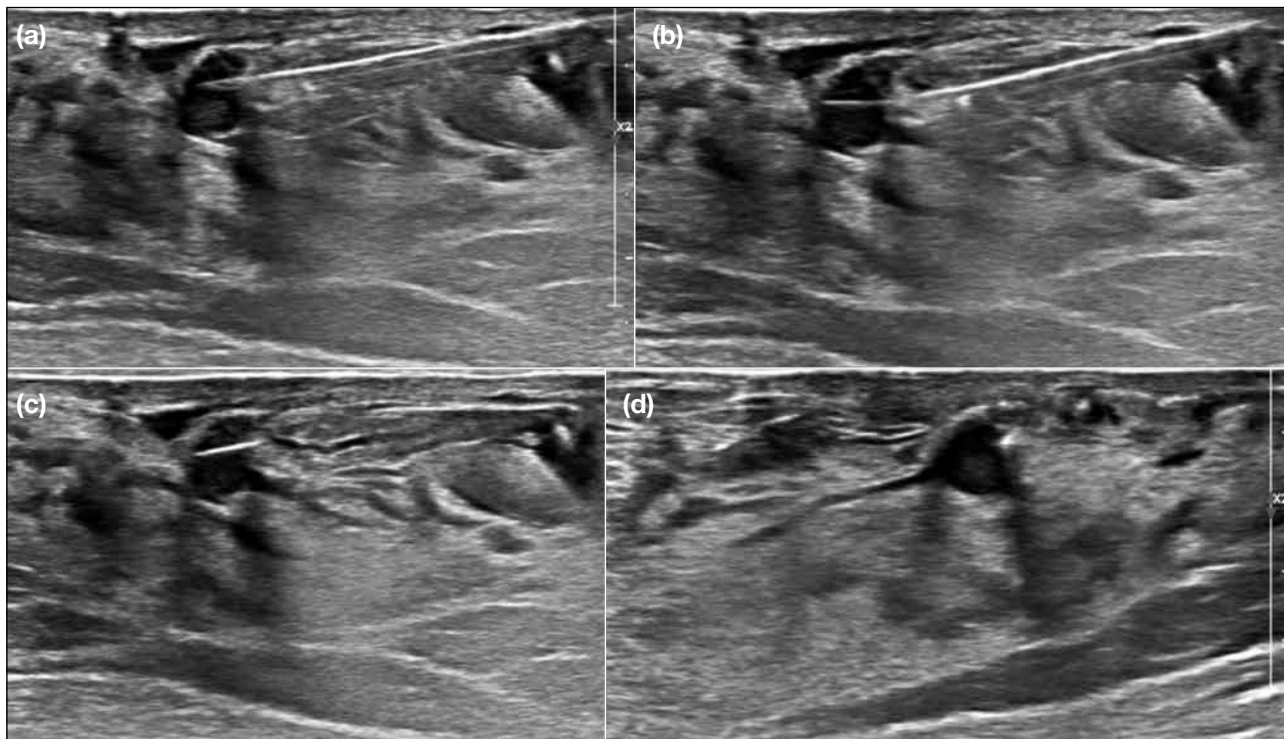


Figure 4. Case 3. Magseed insertion for subareolar lesion. (a) Needle with tip within the lesion and (b) subsequent release of Magseed marker. (c) Transverse and (d) longitudinal ultrasound images showing Magseed marker in situ after the procedure.

None of the excised papillary lesions were upgraded to cancer after surgical resection. However, there are significant papillary lesions diagnosed via fine needle aspiration or biopsy that may require resection of the index lesion with diagnostic intent to confirm the absence of cancer. Therefore, accurate localisation is important.

Using this technique enables flexibility in scheduling without the need for same day surgery or use of radioisotopes. Our surgical colleagues also reported more accurate assessment of the depth of the lesion compared with other techniques such as skin marking or WGL, potentially enabling far less tissue to be excised.

The potential to lower services and personnel needs may compensate for some of the drawbacks of Magseed. In our subgroup of patients, MRI examination of the breast between placement and surgery was less likely, for example. Although the impact of potential instrumentation interference is possible, studies have shown that re-excision rates following Magseed are non-inferior to WGL.⁴ The manufacturer and other studies

have revealed that Magseed can be detected beyond 4 cm, even up to 12 cm through palpation in a supine position.⁴

Future studies that focus on this population would be helpful to confirm the efficacy of Magseed localisation of small papillary breast masses. Further secondary outcome analysis or objective measures such as tissue excision weight can be explored. Cost-benefit analysis should be individualised to governing health bodies or individual institutions.

CONCLUSION

Ultrasound-guided Magseed localisation is safe, less complex and allows more flexibility of scheduling. In our case series of non-palpable subcentimetre papillary breast masses, there were no upgraded cases nor need for re-excision. Potential issues with Magseed such as MRI artifacts are less of an issue in this patient subgroup. Our experience suggests that ultrasound-guided Magseed localisation of these lesions shows similar efficacy to that of other studies that have explored non-palpable lesions in general.

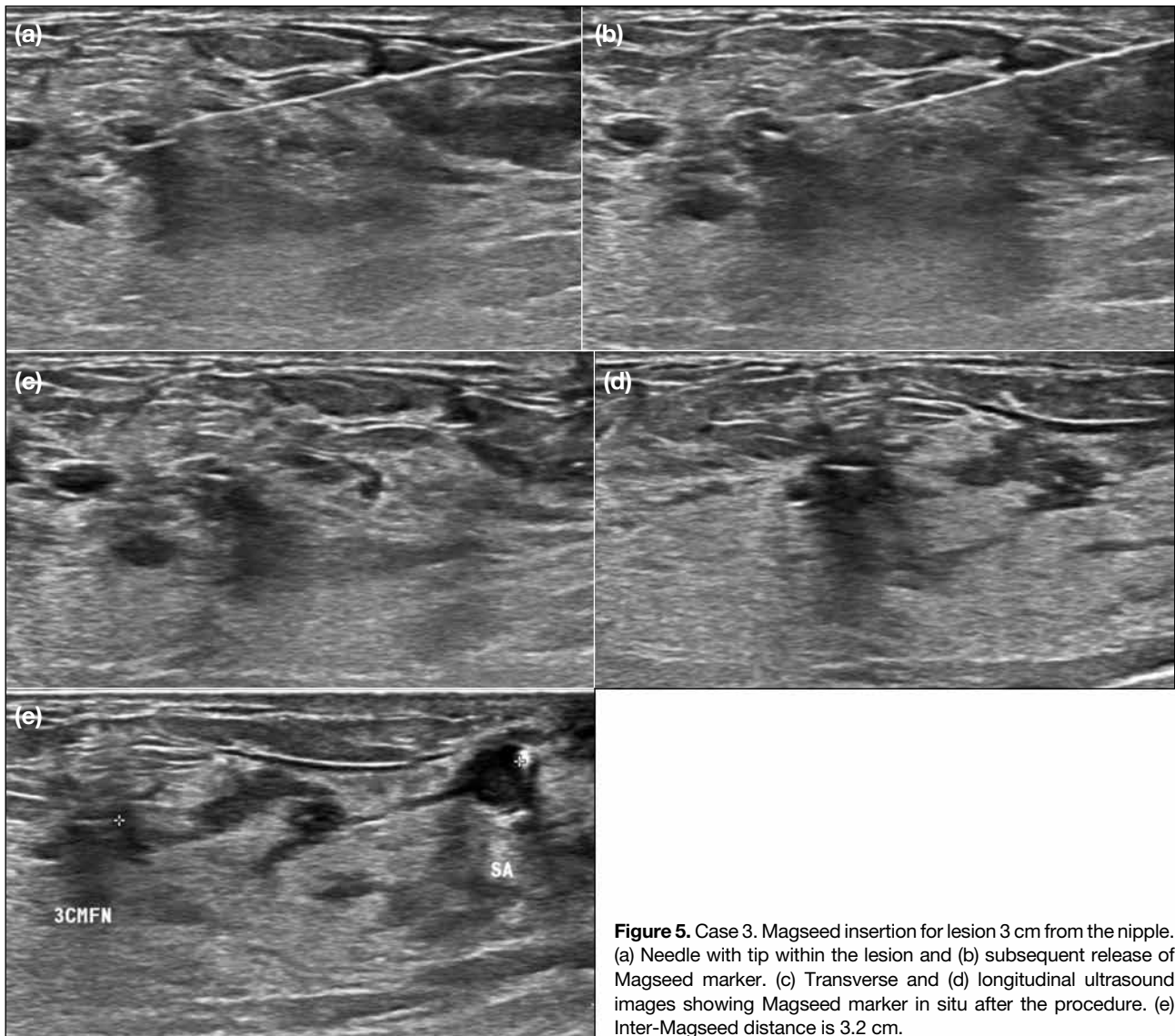


Figure 5. Case 3. Magseed insertion for lesion 3 cm from the nipple. (a) Needle with tip within the lesion and (b) subsequent release of Magseed marker. (c) Transverse and (d) longitudinal ultrasound images showing Magseed marker in situ after the procedure. (e) Inter-Magseed distance is 3.2 cm.

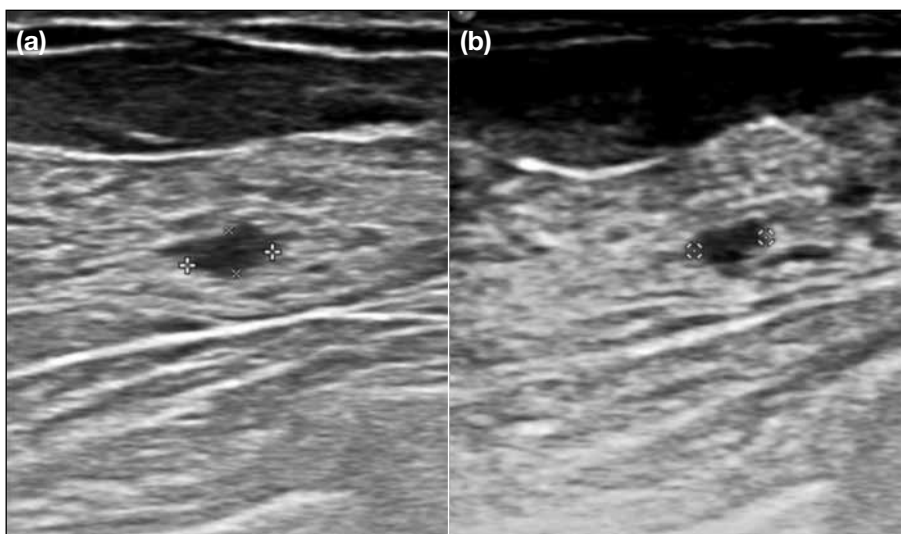


Figure 6. Case 4. A 42-year-old woman with incidental detection on ultrasound of left breast 12 o'clock position nodule, 1 cm from the nipple, measuring 6 × 3 × 5 mm, associated with a prominent duct. Ultrasound-guided biopsy showed a papillary lesion, in favour of intraductal papilloma. Before surgery, the patient underwent uneventful Magseed insertion. 17 days later, she proceeded to lumpectomy where localisation was uneventful. Pathological specimen confirmed intraductal papilloma. (a) Transverse and (b) longitudinal images showing the left 2 o'clock position 1 cm from nipple lesion, measuring 6 × 3 × 5 mm.

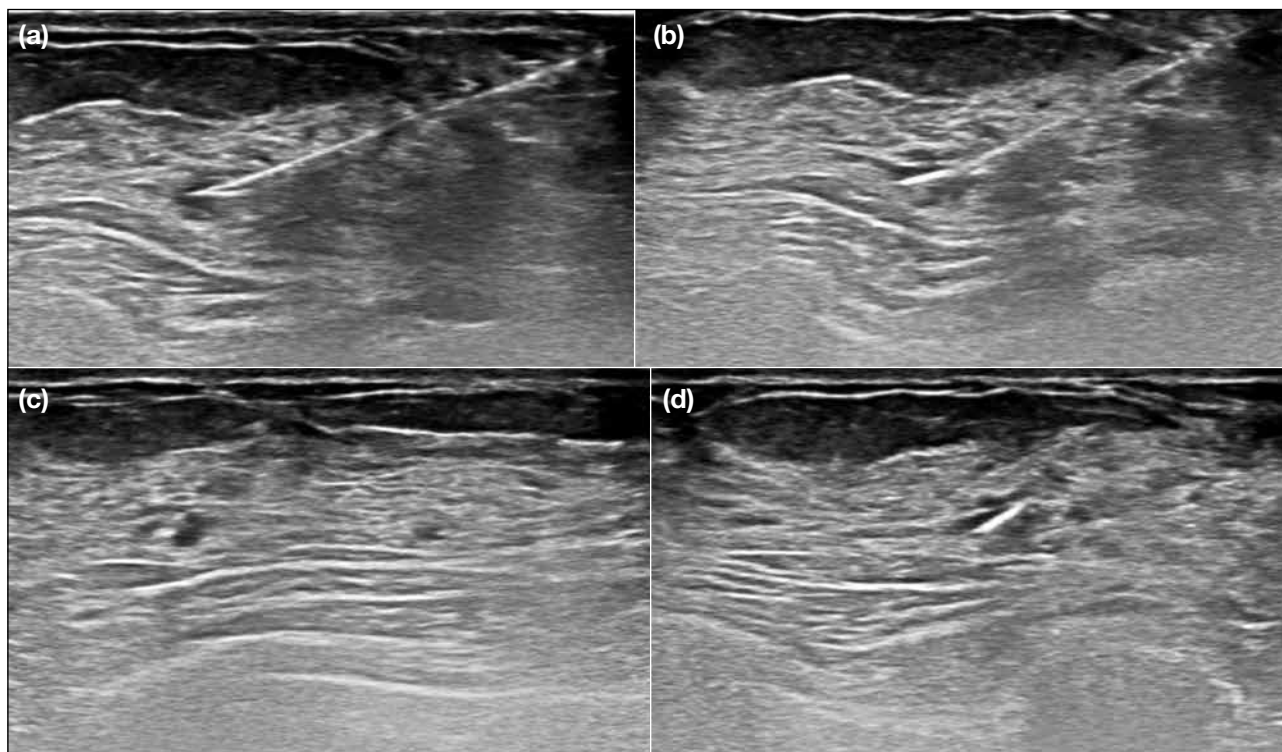


Figure 7. Case 4. Magseed insertion for lesion 1 cm from the nipple. (a) Needle with tip within the lesion and (b) subsequent release of Magseed marker. (c) Transverse and (d) longitudinal ultrasound images showing the marker in situ after the procedure.

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