



Ultrasound-guided coaxial aspiration for retrieval and repositioning of breast localization markers

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ABSTRACT

Breast localization marker migration or malposition may create a practical need for image-guided retrieval or repositioning. The technique was performed in two patients using a coaxial needle system and aspiration-assisted marker capture. In both cases, the displaced marker was identified sonographically and accessed with a coaxial needle. Controlled aspiration drew the marker into the coaxial needle, followed by repositioning to the targeted area or removal from the body. No immediate complications occurred. Ultrasound-guided coaxial aspiration may represent an alternative in selected cases of migrated or malpositioned markers when standard vacuum-assisted excision is technically disadvantageous.

KEYWORDS

Breast neoplasms, device removal, foreign-body migration, marker migration, ultrasonography, interventional

Post-biopsy marker placement is integral to contemporary breast biopsy and pre-neoadjuvant chemotherapy localization, supporting surgical localization, treatment planning and monitoring, and imaging correlation. However, marker displacement is not uncommon. Using a 10-mm threshold, migration rates of 13.1%–33.3% have been reported,^{1,2} with a pooled rate of 26.8% across nine studies.³ Proposed mechanisms include migration along the biopsy tract, hematoma or air within the biopsy cavity, and the accordion effect after release of breast compression. Globally, fatty breast composition has shown the strongest association with immediate migration, whereas local tissue heterogeneity may be protective. Superficial lesion location and lower breast thickness have also been reported, although inconsistently.³ Despite its frequency, management is not systematically defined and is generally individualized according to the consequences of displacement. Observation may be sufficient when the marker continues to serve its intended localization or follow-up function or when the original target remains identifiable by residual calcifications, the biopsy cavity, or biopsy-related hematoma.^{4,5} Conversely, retrieval or repositioning may be considered when migration or malposition compromises the intended use of the marker or creates a specific technical or clinical problem. Percutaneous marker retrieval has previously been described using stereotactic vacuum-assisted biopsy devices.^{6,7}

This technical note describes ultrasound-guided coaxial aspiration for direct marker capture, retrieval, or repositioning as a potential alternative in selected cases.

Technique

Written informed consent was obtained from both patients for the procedures and for publication of the cases and accompanying images. Institutional review board approval was not required because this technical report describes procedures performed as part of routine clinical care and contains no identifiable patient information. All procedures were performed by a breast radiologist with 10 years of experience in breast intervention.

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- Sonographic visualization of the marker and a safe needle trajectory are prerequisites for the technique.

- The optimal site of intervention is planned to ensure clear visualization of the marker and allow the shortest safe access route. The orientation of the marker should be considered when determining the skin entry point.

- A coaxial needle with an appropriate lumen diameter is selected based on the marker's dimensions and configuration (13-G in our series). Hydrogel-containing, ring- or coil-shaped, irregular, or oversized markers may not be suitable for the procedure because the marker may lodge at the needle tip.

- Following local anesthesia (5 mL of 2% prilocaine in our series), the coaxial needle is positioned at the proximal end of the marker under ultrasound guidance.

- While stabilizing the outer sheath, the inner stylet is withdrawn, and a 10-mL syringe is attached to the introducer hub.

- Slight axial and rotational adjustments are used to align the marker with the coaxial lumen while maintaining controlled negative pressure.

- Marker capture is confirmed by real-time sonographic disappearance of the marker from its initial position, with visualization of its entry into the coaxial lumen. Subsequent steps depend on the intended procedure.

- If marker removal is intended, the system is withdrawn from the breast under aspiration. Retrieval is confirmed outside the breast, if necessary, by advancing the stylet.

- If the same marker is to be repositioned, the needle is withdrawn to the optimal location while aspiration is maintained without substantially changing the needle trajectory.

Main points

- Marker migration or malposition is not uncommon and may require percutaneous intervention.
- Ultrasound-guided coaxial aspiration enables direct marker capture for retrieval or repositioning without intentional excision of the surrounding tissue.
- Ultrasound-guided coaxial aspiration may represent an option in selected cases when vacuum-assisted retrieval is technically disadvantageous, such as in superficially displaced markers, thin breasts, or markers adjacent to the chest wall.

- If sonographic visualization is uncertain, targeted mammography may be used to facilitate localization or confirm the final marker position.

- If aspiration is unsuccessful after a reasonable number of controlled attempts, the procedure should be terminated, and an alternative method should be considered.

Case 1

In a patient with contralateral breast carcinoma, the multidisciplinary tumor board planned an excisional biopsy of suspicious right-breast microcalcifications with pre-operative magnetic seed localization. The procedure was performed under mammographic guidance using a stereotactic technique. The target was first marked in the lateromedial (LM) position. The patient was then placed in the craniocaudal (CC) position, and a magnetic seed was placed Sirius Pintuition® (Sirius Medical Systems BV, Eindhoven, The Netherlands). On the postprocedural CC control mammogram, the seed was superimposed on the microcalcification cluster. However, the LM view demonstrated that the seed had migrated 24 mm from

the target, likely due to the accordion effect. Targeted ultrasound localized the magnetic seed. Aspiration was performed using a 13-G, 5-cm coaxial needle (Geotek Medical and Health Services), and the migrated magnetic seed was captured and removed under ultrasound guidance. A new magnetic seed was then placed, with its position confirmed by digital breast tomosynthesis (Figure 1).

Case 2

In a patient with human epidermal growth factor receptor 2–positive breast cancer (Ki-67, 80%), the multidisciplinary tumor board planned tumor marking before neoadjuvant chemotherapy. Ultrasound showed a 40-mm, well-circumscribed, oval lesion. A breast marker system with an 18-G, 15-cm needle and a preloaded 99.99% Pure Gold® marker measuring 1 × 4 mm (Geotek Medical and Health Services) was used for localization. During deployment, peripheral needle deviation resulted in unintended peripheral intratumoral marker placement. At the study institution, central placement is preferred before neoadjuvant chemotherapy to facilitate localization of the original tumor

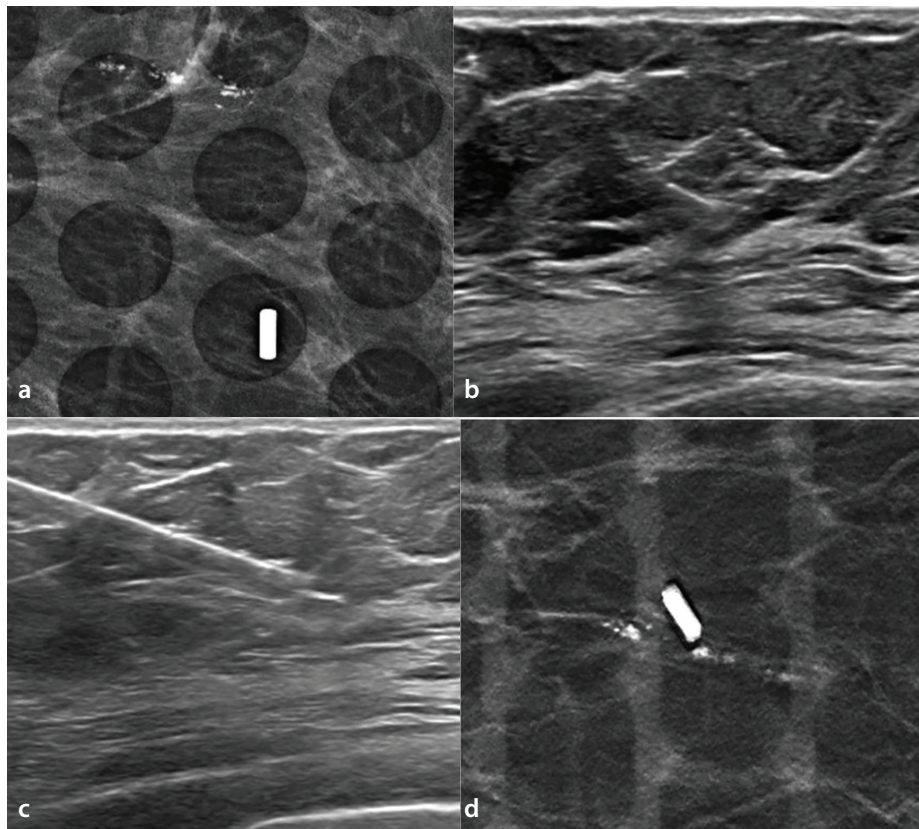


Figure 1. Imaging findings and ultrasound-guided coaxial aspiration of the migrated breast marker in Case 1. (a) Control mammogram shows migration of the marker outside the microcalcification field. (b) Sonographic evaluation demonstrates the marker within the breast after targeted search. (c) Pre-aspiration ultrasound image shows alignment of the coaxial needle tip with the marker. (d) Postprocedural tomosynthesis image confirms the position of a newly placed magnetic seed after removal of the migrated seed.

bed when the response is non-concentric or fragmented. The peripheral position was therefore considered suboptimal. Peripheral intratumoral marker placement alone is not proposed here as a routine indication for reintervention. The system was then withdrawn, and a 13-G, 5-cm coaxial needle was advanced through the lesion to-

ward the marker, parallel to the marker's long axis. With the coaxial tip adjacent to the marker, aspiration was applied with minor corrective maneuvers under real-time ultrasound guidance. During aspiration, the marker entered the coaxial lumen but was not visualized within the syringe. The coaxial needle containing the marker was

then withdrawn toward the center of the tumor. A stylet was inserted to advance the marker, resulting in successful central repositioning. Successful repositioning was confirmed by ultrasound, which demonstrated the marker at the intended central intratumoral location (Figures 2 and 3).

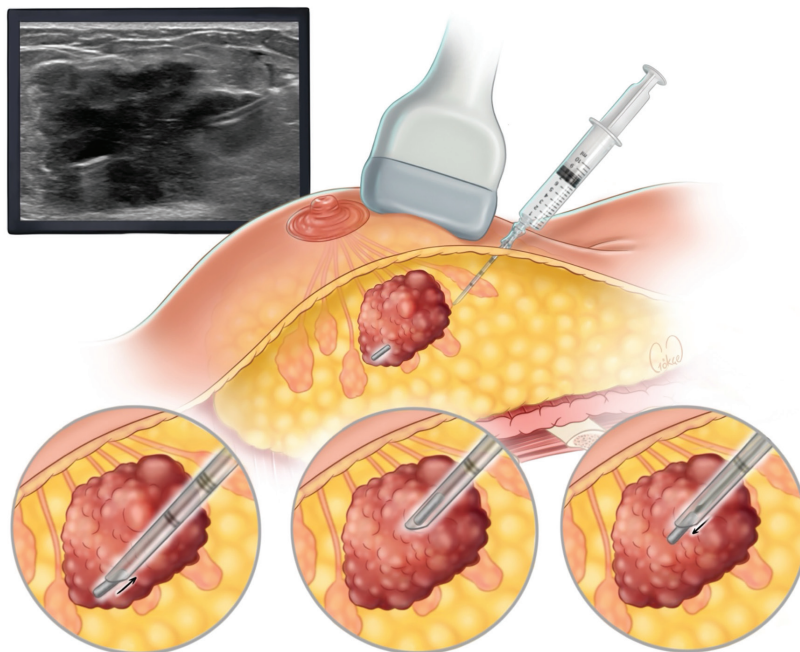


Figure 2. Medical illustration of ultrasound-guided coaxial aspiration-assisted capture and repositioning of the malpositioned breast marker in Case 2.

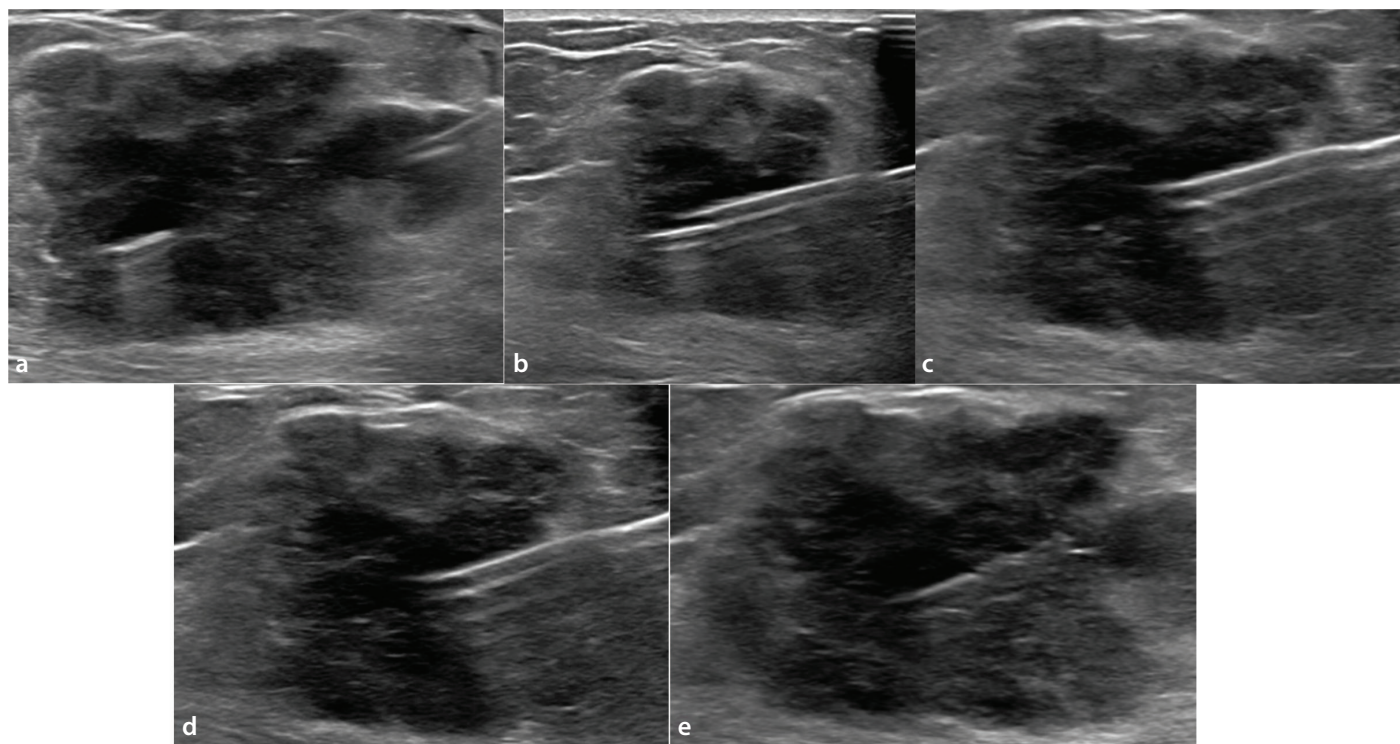


Figure 3. Ultrasound-guided coaxial aspiration-assisted capture and repositioning of the breast marker in Case 2. (a) The marker is initially deployed at the periphery of the target lesion. (b) The coaxial needle tip is aligned with the displaced marker before aspiration. (c) Following aspiration, the marker is no longer visualized at its initial peripheral position. (d) The needle is withdrawn to the intended location while aspiration is maintained without changing the needle trajectory. (e) Final ultrasound image confirms central repositioning of the marker within the target lesion.

The technique was attempted in two patients and was technically successful in both, with retrieval of the migrated magnetic seed in Case 1 and repositioning of the malpositioned marker in Case 2. No unsuccessful procedures occurred. The duration of the aspiration-assisted retrieval or repositioning phase and the number of aspiration attempts were 2 minutes and two attempts in Case 1 and 30 seconds and one attempt in Case 2. Procedure duration referred only to the aspiration-assisted phase, from initiation of aspiration to completion of retrieval or repositioning. The immediate outcome was confirmed by digital breast tomosynthesis in Case 1 and ultrasound in Case 2. No immediate complications occurred, and both patients were discharged after routine postprocedural observation. Clinical success was also achieved. In Case 1, the microcalcification field was successfully excised at subsequent surgery using the newly placed magnetic seed, whereas in Case 2, the marker remained in the intended position without remigration during 4 months of follow-up. The characteristics of the patients, markers,

and procedural outcomes are summarized in Table 1.

Discussion

The main novelty of this technique is that the marker is captured through the coaxial needle rather than removed together with surrounding tissue. Previous reports have mainly described the use of large-bore vacuum-assisted devices to remove the marker together with surrounding breast tissue. In contrast, the current approach enables direct marker capture for either retrieval or repositioning without excision of the surrounding tissue.

Coaxial aspiration may be useful in anatomically constrained locations. Vacuum-assisted retrieval requires sufficient tissue depth for chamber deployment and blade movement, whereas coaxial aspiration targets the marker through a narrow needle lumen. This difference is relevant for superficially located markers, very thin breasts, or markers close to the pectoralis muscle or chest wall.^{7,8} Thin breast thickness has also

been associated with marker migration and may make subsequent vacuum-assisted retrieval more difficult.⁵

This technique has several limitations. This two-case report is limited by short-term follow-up because of the procedural nature of the intervention and relies strictly on sonographic visibility. Aspiration may fail for deeply located markers or markers embedded in dense tissue. When tissue sampling of the surrounding area is intended in addition to marker retrieval, vacuum-assisted excision may represent a superior alternative.⁷ Re-marking, residual microcalcifications, the biopsy cavity, hematoma, or routine clinical follow-up may obviate the need for reintervention.^{4,5} As this study is presented as a technical note, comparative clinical outcomes of the technique could not be evaluated.

In conclusion, we describe ultrasound-guided coaxial aspiration as a potential alternative technique in carefully selected cases. The safety, reproducibility, and success rates of the technique require further evaluation in larger patient cohorts.

Table 1. Patient, marker, and procedural characteristics of the cases

	Case 1	Case 2
Clinical indication	Marker removal	Marker repositioning
Initial lesion type	Calcifications	Mass
Initial marker placement guidance	Stereotactic	Ultrasound
Marker system	Pintuition® Marker	Pure Gold® Marker
Marker shape	Cylindrical	Cylindrical
Marker material	Titanium (magnetic seed)	Gold
Marker dimensions	1.65 × 5.2 mm	1 × 4 mm
Marker location	Deep parenchymal	Deep parenchymal
Displacement distance	24 mm	12 mm [†]
Skin-to-marker depth on ultrasound	12 mm	22 mm
Marker-to-pectoralis muscle distance on ultrasound	3 mm	7 mm
Sonographic visibility	Faintly visible	Clearly visible
Coaxial system used for marker deployment	14-G, 12-cm	18-G, 15-cm
Coaxial system used for aspiration	13-G, 5-cm	13-G, 5-cm
Needle trajectory	Oblique to skin	Oblique to skin
Technical outcome	Retrieved*	Repositioned
Procedure duration	2 min	30 s
Aspiration attempts	2	1
Confirmation imaging	Digital breast tomosynthesis	Ultrasound
Immediate complication	None	None
Follow-up	18 days**	4 months

*The migrated magnetic seed was retrieved, and a new magnetic seed was subsequently placed and confirmed on tomosynthesis. ** Short-term follow-up corresponds to the interval between marker placement and subsequent surgery. [†]For Case 2, displacement distance was measured from the intended tumor epicenter to the actual peripheral marker position.

Footnotes

Conflict of interest disclosure

The author declared no conflicts of interest.

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