Breast Biopsy Marker Migration: Significance and Potential Solutions

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Migration of breast biopsy markers, immediate or delayed, is frustrating for breast radiologists, particularly during mammography-guided vacuum-assisted biopsy (MGVAB). These biopsies are often performed in either the conventional biopsy approach or the lateral arm biopsy approach. Studies show that no matter the approach, marker migration is a common complication. Breast marker migration rate for MGVAB ranges from 2% to 44% across all methods and marker types when migration is defined as a distance of 1 cm or greater between the final marker clip location and the targeted biopsy site.[1] A retrospective study by Teichgraeber et al reported a migration rate of 38% when migration was defined as greater than 0.5 cm from the site of biopsy. The study also found migration to be more likely with decreased breast density.[2] Another study of migration associated with older- and newer-generation markers reported a migration rate of 35.6%, with no significant difference according to marker type or generation. However, older-generation markers migrated an average of 0.7 cm farther than newer-generation markers. The study also reported less migration occurrence in dense breasts.[3] Funaro et al reported that the migration rate after magnetic resonance imaging–guided biopsy was 14%, with 38% of those migrations occurring within fatty breast tissue.[4] Understanding the significance, causes, and potential solutions of marker migration can ease breast imager frustration with this complication of MGVAB.

Significance of Marker Migration and Impact on Patient Outcomes

With breast biopsy markers serving as important landmarks indicating biopsy sites for both malignant and benign findings, the placement of metallic markers after breast biopsy is important for future reference. When a finding is benign, markers make it easy to monitor changes on future mammograms, so migration can affect lifelong surveillance.[5] When atypical or malignant pathology is discovered, the marker aids in localizing the area for subsequent surgery and ensuring accurate excision. For patients undergoing neoadjuvant therapy, the malignancy may change and become more difficult to visualize. Thus, the marker remains as mammographic evidence of the initial site of malignancy. Migration or displacement of the biopsy marker may contribute to inaccurate preoperative needle localization, positive margin rates, and increased re-excision rates. Marker misplacement is typically noted on postprocedure images immediately after biopsy. However, marker migration has been reported days, weeks, or even months after placement of the marker, although such delayed migration is rare.[2,3,5,6]

Causes of Marker Migration

Multiple studies have aimed to discern the reasons for marker migration in MGVAB, although there is no certainty on any particular theory. Breast density, hemorrhage, and gravity may all be contributing factors. Patient age, the type of marker used, and the breast imager's technique have been studied in relation to marker migration. A study published in the *American Journal of Surgery* in 2002 found that migration of biopsy markers did not change according to the age of the patient, the size of the breast, or the location within the breast.[7] However, more recent studies published in 2020 and 2021 by Weaver et al, Teichgraeber et al, and Stahl et al found that breast density was a significant factor in marker migration and that migration was more likely in patients with decreased breast density.[1-3] Additionally, a study by Lee et al published in 2022 reported that intrinsic breast composition was the most important determinant for accurate marker placement.[8] Thin breasts, superficial lesion location, high specimen number, and a more posterior biopsy location were associated with significant marker migration in a study by Wang et al published in November 2020.[9] Another cause of marker migration is the accordion effect, which occurs when breast tissue compressed for biopsy is allowed to re-expand after the biopsy, forcing the marker to move along the z-axis away from the original target during re-expansion.[1,5]

Solutions for Marker Migration

Continued research is needed to assess solutions for breast biopsy marker migration. However, breast radiologists may consider a number of options to reduce marker migration. Postprocedure imaging considerations include the type of projection used and decompression techniques after biopsy. Baker reported a marker migration rate of only 23% when the first view obtained after marker deployment was the same as that used for the stereotactic core biopsy. Baker also reported an 83% rate of clip migration when the first view obtained after marker deployment was orthogonal to the view used for the core biopsy.[10] Conversely, the type of projection

used to obtain the first view on the postbiopsy mammogram, relative to that used during the stereotactic biopsy procedure, did not affect biopsy marker clip migration in a study by Le-Petross et al.[11]

For certain biopsy devices, such as the Eviva [Hologic], steps can be made to try to reduce the biopsy cavity in order to decrease the risk of migration. Allison Boatman, MD, suggested on the SBI Connect forum that after obtaining biopsy samples and lavaging the biopsy cavity, the saline flush can be disconnected. This allows one to aspirate the cavity with air. In doing so, it is believed that this helps collapse the cavity and dry it out so that it stays collapsed.[12] Then, when the biopsy clip is placed, the hope is that the clip is in a smaller cavity space in order to improve marker localization and accuracy of the biopsy site.

The following decompression technique used by Dianne Georgian-Smith, MD, during wire localizations improved the accuracy of marker/seed placement: when deploying a marker in a compressed breast, manually release the compression by 4 to 5 mm while at the same time manually adding forward pressure to the back of the needle. By doing so, the tissues slide up the needle shaft, minimizing the accordion effect on marker placement.[13]

Parikh[6] and Philpotts et al[14] recommend obtaining repeat craniocaudal and lateral mammography images on the day of the localization before the procedure regardless of the time between biopsy and surgical excision. Since migration can occur days or weeks after the procedure, orthogonal views obtained on the day of the localization will confirm accuracy. Other methods can also be used to ensure accuracy during preoperative needle localization. On the day of the localization, the z-axis depth of the marker can be compared with the z-axis depth of the lesion on the day of the biopsy to determine significant z-axis migration. This technique can be used if digital stereotactic guidance is used with the same approach and equipment as the original stereotactic biopsy. When mammograpic-guided localization is done, obtaining views orthogonal to the initial approach of the biopsy allows for comparison of the depths of the localizing needle, the marker, and the location of the lesion on the prebiopsy views. Postbiopsy hematoma can be localized if sonogram guidance is used.[6]

Breast biopsy marker migration after MGVAB continues to be a common complication and can be attributed to a number of causes. Given the high rate of marker migration, Funaro et al suggest that informed consent documents include information on the possibility of marker migration during biopsy procedures.[4] The numerous potential solutions to marker migration are encouraging; however, no single specific method has been widely accepted as a standard solution to this frequent complication. Continued research efforts may help identify a few of the most effective approaches to mitigate this biopsy complication.

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