Clip migration after stereotactic macrobiopsy and presurgical localization: technical considerations and tricks

C Chaveron, F Bachelle, I Fauquet, N Rocourt, M Faivre-Pierret and L Ceugnart

Résumé
Déplacement de clip post-macrobiopsie sous guidage stéréotaxique et repérage préopératoire : trucs et astuces
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Objectif. Les migrations de clips existent en pratique courante (13 à 20 %), quelle que soit la technique d’abord. Le but de cet exposé est de proposer des astuces afin de diminuer les migrations et d’optimiser le repérage préopératoire ultérieur.


Résultats. Sur ces 59 clips, on constate plus de migrations de clips en compression crânio-caudale (16,6 %) qu’en compression médiolatérale (5,2 %). Cette différence est statistiquement significative. On propose donc de privilégier la compression médiolatérale. Cette position permet également d’optimiser le repérage préopératoire ultérieur en cas de migration de clip, en installant la patiente dans la même position et en modulant la profondeur en fonction de l’importance du déplacement.

Conclusion. Dans un souci de qualité, il est impératif de connaître la topographie du clip par rapport à la cible initiale. En comprimant le sein en médiolatéral avec un abord latéral, on peut diminuer le déplacement du clip et optimiser le repérage préopératoire ultérieur évolutif.


Abstract
Purpose. Clip migration occurs frequently in clinical practice (13-20%), irrespective of the approach. The purpose of this article is to suggest tricks in order to decrease clip migration and optimize presurgical localization.

Materials and methods. Retrospective study of breast macrobiopsy from a lateral approach performed between March 2003 and June 2004: 447 clips were placed. Sixty clips showed migration>20 mm, due to the accordion effect in 59 cases (98.4%). These 59 procedures were analyzed to try and understand the underlying mechanisms of clip migration.

Results. From these 59 clips, more migrations were noted on CC compression (16.6%) compared to MLO compression (5.2%). This difference was statistically significant. Therefore, we promote the use of MLO compression. This incidence also allows optimal presurgical localization in case of clip migration, by placing the patient in the same position while modulating depth based on the extent of clip displacement.

Conclusion. For quality purposes, it is imperative to know the clip position relative to the initial target. By using MLO compression from a lateral approach, it is possible to reduce clip migration and optimize future presurgical localization.

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retrospective review, solutions to decrease clip migration and optimize future presurgical localization procedures.

Materials and methods

Between March 2003 and June 2004 (16 months), 604 patients aged 24 to 84 years (mean: 56.2 years) underwent vacuum-assisted macrobiopsy at our institution because of suspicious breast lesions. In all cases, the biopsy was performed in the prone position on a dedicated mammography table (Mammotest, Fisher Imaging, Denver, Colorado) using an 11G vacuum-assisted macrobiopsy device (Mammotome, Biopsys/Ethicon-Endosurgery, Cincinnati, Ohio). On average, two passes were obtained. Additional biopsies were obtained based on lesion size and degree of lesion excision on post-biopsy images. All procedures were performed using a lateral approach (fig. 1). All lesions corresponded to clusters of microcalcifications. The procedure was unsuccessful in 5 patients because the lesions could not be demonstrated on the pre-biopsy stereotactic images. Clips were placed in 447 of 601 patients after biopsy, when cluster removal appeared complete to subtotal. The Micromark II clip was used (Biopsys/Ethicon-Endosurgery). The clip was placed according to the technique described in the user manual, with satisfactory immediate post-placement stereotactic follow-up images (fig. 2 and 3).

Follow-up CC and lateral mammograms were obtained at one week to compare clip position relative to the biopsy site. The images obtained prior to and following macrobiopsy in 447 patients where clips were placed were retrospectively reviewed. For each patient, the following data were collected: cluster size, number of samples obtained, axis of compression (mediolateral or craniocaudal), breast density, cluster site, size of post-biopsy hematoma and histology (benign, borderline, malignant).

The clip-biopsy site distance (measured as follows: distance between the center of the target and the clip along a line parallel to the axis of compression) was then measured from CC and ML projections by two independent experienced radiologists. The clip-biopsy site distance was classified as follows: <10mm, 10-20mm and >20mm. The number of clip migrations was then correlated with each of the studied variable.

All data were analyzed using a statistical analysis software (Statgraphics Software). Statistical concordance was calculated using the $\chi^2$ test with and without Yates correction.

In cases of presurgical localization, radiographs of the surgical specimen were compared to presurgical localizing radiographs. All presurgical localization procedures were performed by blue dye and contrast injection on a conventional mammography unit equipped with a digital interventional module. Blue dye injection allowed targeting of the residual lesion when still visible. If there was a significant distance between the clip and the residual lesion, only the latter was localized. All surgical specimens were radiographed peroperatively to confirm complete excision.

Results

All 447 biopsied lesions corresponded to clusters of microcalcifications: 79.9% were smaller than 10 mm in size, 10.8% were between 10 and 20mm in size and 9.3% were larger than 20mm in size. Biopsy was performed with CC compression and mediolateral or lateral approach in 313 patients (70.4%). Biopsy was performed with mediolateral compression and superior or inferior approach in the remaining 133 patients (29.6%). The average number of cores was 12.5 (range: 6-48).

A total of 447 clips were deployed at the site of breast biopsies. The measured distances between clip and lesion on CC and ML radiographs are summarized on table II. The clip-biopsy site distance was less than 10 mm on both CC and lateral radiographs in 306 cases (68.5%), between 10 and 20mm on at least one radiograph in 81 cases (18.1%) and over 20mm in 60 cases (13.4%). For clip migration over 20 mm, seen on both CC and lateral projections, a single migration was recorded.

No significant concordance was noted between clip migration and cluster size, breast density, lesion site and histology. Post biopsy mammograms showed a he-
matoma larger than 20mm in 79 cases (17.6%). The average hematoma size in our population was 2.5cm\(^2\) (range: 0 to 40cm\(^2\)). There was a significant correlation between the presence of a post biopsy hematoma larger than 20mm and clip migration over 10 mm (31.5% of clips, or 141 cases) with \(p < 0.001\) on the \(\chi^2\) test. In addition, table I also demonstrates that clip migration was more frequent with CC compression (52/313=16.6%) compared to mediolateral compression (8/134=5.9%). This difference was statistically significant (\(p<0.003\) with \(\chi^2\) test and \(p<0.005\) with \(\chi^2\) test with Yates correction).

Clip migration over 20 mm on follow-up mammograms is summarized on table III: this was noted in 60 patients (13.4%) with clip migration over 40 mm in 40 cases (8.9%). When CC compression was used (52 procedures), clip migration was visualized on the follow-up lateral projection in all cases. When mediolateral compression was used (8 procedures), clip migration was visualized in all but one cases on the follow-up CC projection.

**Discussion**

Clips are routinely used during interventional breast procedures. They are placed when the initial target lesion has been completely removed or becomes less conspicuous during the procedure, for potential future surgical intervention, for malignant (DCIS or invasive ductal carcinoma) or borderline (atypical ductal hyperplasia, lobular neoplasm, flat epithelial atypia) lesions. This clip must be visible on future mammograms for eventual localization. To be clinically useful, it must remain at or near the biopsy site in the event of surgery or for optimal follow-up.

Unfortunately, clip placement is not always reliable. Clip migration from a few millimeters to several centimeters has been reported in the literature. Previous publications have shown that clips tended to migrate along the Z axis (compression axis) at the time of compression release and during follow-up. This is referred to as the accordion effect (fig. 4). Migration occurs when the clip is not anchored to the wall of the biopsy cavity but to the adjacent tissues at the time of breast compression. This distance is minimal in the compressed breast; however, this distance is increased during decompression. This effect is unpredictable and clip migration may be superficial or deep to the biopsy site. It may also be delayed, as reported by several authors (10-15).

In our population, the accordion effect was the main cause of clip migration: 59 of 60 procedures. All procedures were performed from a lateral approach. Unlike with the CC approach, the accordion effect cannot be further increased by clip migration along the needle tract since during a lateral approach, the compression axis and needle tract are parallel. As such, during decompression, the axis of clip migration is perpendicular to the needle tract.

In addition, we observed that clip migration occurred more frequently with CC compression (52/313=16.6%) compared to mediolateral compression (8/134=5.9%). This difference was statistically significant (\(p<0.003\) with \(\chi^2\) test and \(p<0.005\) with \(\chi^2\) test with Yates correction). The reasons for this remain uncertain: breast ptosis, gravity effect?

We suggest that a mediolateral compression axis should be used, especially when
the cluster is located in the inferior half of the breast, with an inferior approach being more esthetic. Also, in the event of presurgical stereotactic localization, the patients will be in the same position and accurate lesion localization will be facilitated.

At the time of presurgical localization, the patient is placed in a true lateral position, medial or lateral, based on the site of the target lesion (fig. 5). The images are compared to the post-biopsy films in order to confirm the exact site of the clip and the degree of clip migration. Stereotactic images are obtained centered on the clip. Calculation of the X and Y coordinates is accurate, only the depth or Z axis will be erroneous. In such case, depth is modified according to clip migration (fig. 6), and also based on breast thickness and density since the distance on the frontal image is increased due to breast compression. On average, about 1/3 of the distance from the frontal image is considered. For example, if the frontal film shows a clip migration of 3 cm, only 10 mm of depth will be added or subtracted.
along the Z axis according to superficial or deep clip migration. Blue dye or a harpoon is then used for lesion localization. Post localization mammograms are then obtained, with radiopaque skin marker when blue dye is used. The surgeon is informed that localization was performed at the site of biopsy and not at the clip location.

In order to improve the reliability of clip positioning, several clips have been designed, including the addition of a material visible on US that fills the cavity created by the biopsy procedure. Rosen (16) compared the accuracy of a collagen-plug biopsy site marking device to a conventional clip and showed significant differences: clip migration over 10mm: 16% for the collagen-plug marker and 44% for the clip alone.

**Conclusion**

Clip migration continues to occur despite technical improvements and clip characteristics, with or without collagen. For quality purposes, it is mandatory to know the relationship between clip position and target lesion, and to document it as accurately as possible: CC and true lateral mammograms and detailed report. There seems to be a reduction in the degree of accordion effect when using mediolateral compression and a lateral approach. Mediolateral compression with lateral approach is optimal for future pre-surgical localization procedures. The correlation with histological findings will confirm the quality of the localization and surgical procedure.

**References**