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Case Report

SAVI SCOUT® Radar Localization of Breast Lesions as a Practical Alternative to Wires in Breast Cancer and Macromastia. Description of Our Experience with the Use of Radar Localization System

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Abstract

Breast cancer is a leading cause of cancer-related deaths among females in the world. Image-guided wire localization (WL) of non-palpable breast lesions has traditionally been used to help surgeons localize these tumours. WL is normally carried out the same day as the surgical procedure, which can lead to programming conflicts between the radiological and surgical teams. New devices have been developed to help overcome the disadvantages related to WL. One of them is the SAVI SCOUT® system (SS), a surgical guidance system, nonradioactive infrared activated electromagnetic wave reflector that can be implanted into the breast under imaging guidance the same day as the biopsy and remain until the day of surgery, even if the patient initially undergoes neoadjuvant therapy. Very little training is required for the radiologist. We report the case of a 75-year-old woman with breast cancer and macromastia. The ultrasound and mammography described two lesions in the left breast associated with a wide area of micro calcifications between both lesions (about 4cm). Two SS reflectors were placed identifying both lesions and delimiting the suspicious area of micro calcifications. Bilateral oncoplastic reduction mammoplasty was performed. In addition, a descriptive review of the results obtained in breast conservation surgery using SS from August to December 2022 was also performed. SS was used in 40 patients of the 130 patients (43%) who underwent breast cancer surgery. All SS reflectors were detected and removed. In 2 cases, the radar localization system stopped working after direct contact of the SS reflector with the electric scalpel.

Keywords: Breast Cancer; Radar Localization; Macromastia; Oncoplastic Surgery

Introduction

Since the implementation of screening mammography and improvements in imaging, breast conservation surgery has increased due to the detection of breast cancer at an early stage [1,2]. In patients with non-palpable breast cancer, several studies showed that breast conserving surgery (BCS) is the best choice [3]. Nowadays, wire-guided localization (WL) is the most commonly used method for the localization of non-palpable breast lesions. WL has been a reliable and cost-effective procedure for over 40 years [4]. The limitations of WL have led to the development of alternative approaches, such as SAVI SCOUT® (SS), a non-radioactive radar localization system. These techniques are more comfortable, eliminate protruding wires, risk of dislodging, and allow the incision site to be independent from the skin entry site [5]. In addition, SS not interfering with the surgical instruments used, so there is no need to replace it. Another advantage is that the SS reflector does not produce significant magnetic susceptibility artifact. Despite the fact that BCS is currently the best option of surgical approach, this procedure in some cases, such as macromastia, is associated with certain oncological and cosmetic challenges. In these cases, the oncoplastic surgery approach should be the first choice. We present a case of breast cancer and macromastia in which SS was used for the localization and delimitation of the tumour area. A bilateral oncoplastic reduction mammoplasty (ORM) was performed. In addition, we described our experience with the first 40 cases who underwent breast conservation surgery using SS.

Case Presentation

75-year-old female patient who consulted for self-palpation of a nodule in the upper external quadrant of the left breast. Clinical examination revealed macromastia and palpation of a nodule in the upper external quadrant of the left breast of about 2 cm (Figure 1).

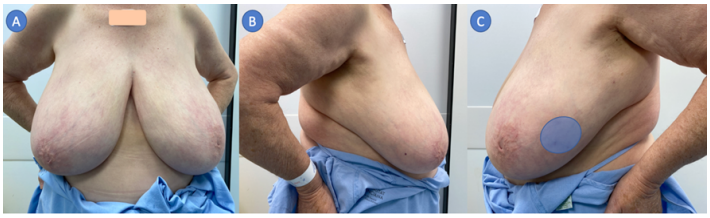

Figure 1: A: Patient front view showing macromastia. B: Right side view. C: Left side view showing tumour area with blue circle.

Initially, an ultrasound was performed which described a hypo echogenic nodule of irregular borders with a hyper echogenic halo of 14 mm. Subsequently, the study was completed with a mammography in which the lesion described in the ultrasound was observed in the left upper external quadrant, and approximately 2 cm caudal, medial and superficial, a second nodule of similar characteristics, measuring 1 cm, was observed. Between both lesions and in depth an area of about 4cm of suspicious micro calcification clusters with a malignant morphology was also described (Figure 2). A core needle biopsy of both nodules was performed and two SS reflectors were placed identifying both and delimiting the area of micro calcifications (Figure 3). The reflectors were deployed into the target using ultrasound guidance. These reflectors provide the exact location of the target allowing for better planning and excision of less uninvolved tissue. The FDA has approved implantation of the reflector for an indefinite time [6], so it can be placed on the same day as the biopsy. The system consists of an implantable 12 mm reflector preloaded in a 16G-delivery needle, a hand piece and a console (Figure 4). The hand piece and console system emit pulses of infrared light and radar wave signals, and receives signals back from the reflector to provide real-time localization and target proximity information to the surgeon [7]. The histologic study of both nodules was compatible with infiltrating ductal carcinoma. In addition, the tumour was estrogen receptor-positive and HER2-negative, and had high Ki-67 score, so it was classified as luminal B breast cancer.

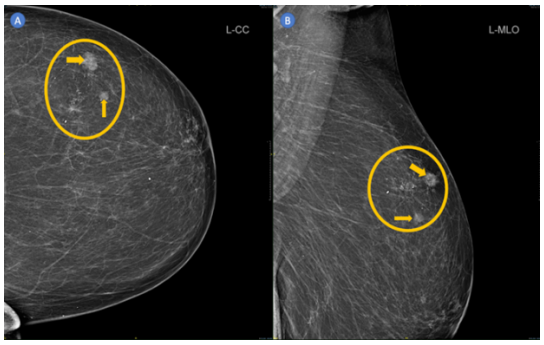

Figure 2: A: Cranio-caudal mammography. B: Latero-oblique mammography. The yellow arrows show the nodules and the yellow circles delineate the micro calcification area.

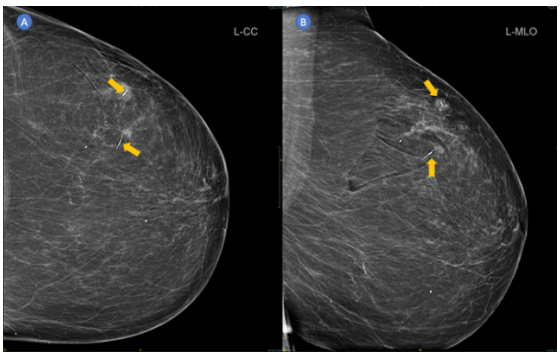

Figure 3: A: Cranio-caudal mammography. B: Latero-oblique mammography. The yellow arrows show the two SAVI SCOUT® reflectors.

Figure 4: SAVI SCOUT® surgical guidance system. A: Console system B: Hand piece C: Hand piece macro front view. Infrared lights can be seen C: Delivery needle (16G) E: Reflector (12mm). Images provided by courtesy of MERITMEDICAL.

The patient was presented to the multidisciplinary breast cancer committee and surgical approach was determined. After explaining the different surgical options, due to the tumour area and the presence of macromastia, it was decided that an oncoplastic surgery should be performed. A bilateral ORM was proposed as the first choice. On the day of surgery, with the patient standing, the pattern was drawn. First, the sternal fork was marked and then 5 cm lateral to the clavicle were measured. Subsequently, the medial mammary line was traced and the projection of the inferior mammary sulcus was made on it to define the upper limit of the new location of the nipple areola complex (NAC). Then, the vertical and horizontal branches were made. Once the pattern of the affected breast was finished, we proceeded to draw the pattern on the contralateral breast to achieve adequate symmetry (Figure 5). The surgical procedure was performed under general anaesthesia. Before surgery began, the area to be removed and the presence of the SS reflectors were checked with the use of hand piece system (Figure 6). The incisions were performed following the previously drawn pattern. After tumour excision, the specimen was sent to radiology where the presence of both SS reflectors in the specimen was verified (Figure 7). Subsequently, the incision was closed. No drains were placed. The surgery was performed as an outpatient procedure (Major Outpatient Surgery).

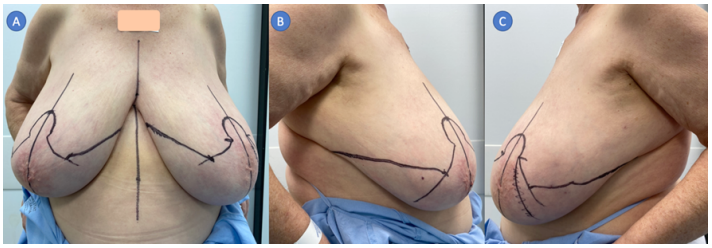

Figure 5: Incision lines and new NAC localization A: Front view. B: Right side view. C: Left side view.

Figure 6: SAVI SCOUT® reflectors were checked with the use of a hand piece system before surgery. The green circles indicate the location of these two reflectors.

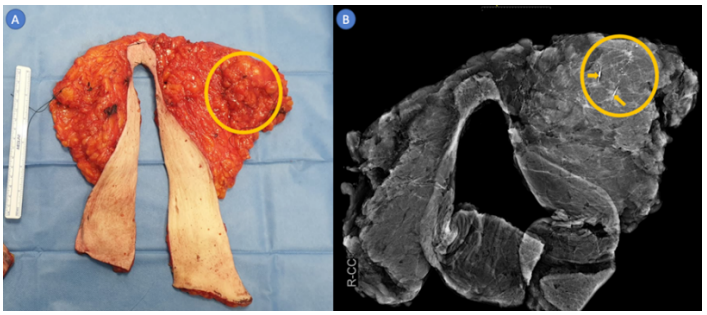

Figure 7: A: Surgical specimen. B: Mammography showing the presence of the two SAVI SCOUT® reflectors (yellow arrows) and the area of micro calcifications (yellow circle).

Results

The patient did not present any complications in the immediate postoperative period and was discharged the same day of surgery. She was followed in an outpatient clinic and progressed without complications. The histological study of the excised specimen confirmed tumour excision with clear margins. The patient is currently very satisfied with the result (Figure 8). Regarding our experience with the use of the SS, we can summarize that since we started using radar localization in August 2022, a total of 130 surgeries for breast cancer have been performed in our centre, of which 92 (71%) underwent BCS and the remaining 38 (29%) underwent mastectomy. Of the 92 patients in whom conservative surgery was performed, radar localization system with SS was used in 40 cases (43%), while in the remaining 52 cases (57%), WL was used. In 4 of the 40 cases (10%) in which SS was used, margins were positive and re-intervention was necessary. In all of cases the SS reflectors were detected and removed with subsequent radiological confirmation. It should be noted that in 2 cases, at the beginning, the radar localization system stopped working after direct contact of the SS reflector with the electric scalpel while the lumpectomy was being performed.

Figure 8: Patient 1 week after surgery.

Discussion

The implementation of a screening mammography program has allowed the detection of breast cancer to be done at an early stage, which in turn has made BCS the best choice for surgical treatment, provided that the necessary conditions are present to carry it out. Consequently, the detection of breast cancer at an early stage usually requires preoperative localization. This procedure is performed by the radiologist to demarcate as precisely as possible the coordinates of a malignant lesion to aid the surgeon in achieving clear margins during BCS [8]. Currently, WL is the most widely used method for localization of non-palpable breast lesions. The limitations of WL include patient discomfort, the need to perform localization on the day of surgery, which can create logistic challenges that limit operating room (OR) efficiency, possible wire migration and transection, lack of a point source for reorientation during surgery and suboptimal cosmetic outcome [9]. For these reasons, new localization techniques have been developed that do not have these disadvantages, such as non-radioactive radar localization (SAVI SCOUT®). An advantage of SS is reflector placement prior to surgery, even on the day of biopsy, enabling scheduling flexibility. The lack of an external component limits possible displacement. The reflector provides a continuous point of source allowing surgical reorientation and offers real time distance measurement with accuracy within 1 mm shown on the console display. Surgeons determine the ideal skin incision site which can potentially improve cosmesis [7]. Additionally, with long-term implant clearance from the FDA, the reflector could potentially be placed at the time of biopsy if a lesion is highly likely to need excision, potentially skipping the preoperative localization procedure completely [9]. Limitations of SS include limited repositioning once deployed, which could damage the reflector and potential reflector migration, particularly in the setting of a hematoma [7].Placement of the reflector deeper than 6 cm may interfere with detection. The ultrasound and the mammography guidance are the only ways that the reflector can be placed. The reflector itself is MRI conditional and patients can be scanned safely (at 3T or less) after reflector placement with no significant magnetic susceptibility artifact [7].

The objective of BCS is to achieve a complete tumour resection with clear margins. However, this procedure may be associated with certain oncological and cosmetic problems, such as large breast size, affected margins, breast/tumour ratio, radiotherapy (RT)-related problems and patient dissatisfaction. The frequency of macromastia in breast cancer patients undergoing BCS is 40% [10]. In some meta-analyses [11], the rate of positive margins after BCS was 20.6%. Some problems have been reported with RT dose homogeneity in post-BCS patients with large breasts [12], and aesthetic concerns in post-BCS patients have reached 30% [13]. Currently, due to the development of oncoplastic procedures like ORM, which combines lumpectomy and bilateral breast reduction techniques, we can obtain better results and therefore should consider them in these cases. This approach (ORM) removes the tumour with wider margins and increases RT effectiveness on a reduced breast [14]. In cases of breast cancer and macromastia, ORM allows wide resections and improves quality of life [15]. In terms of our experience with the use of the SS, we have had a re-intervention rate of 10%, which is below that described in the available literature, which is up to 20% [11], without the disadvantages of WL. In addition, the SS reflector was excised in all cases, which in our experience is not always achieved with the WL. In the two cases in which the SS reflector stopped working because it was in direct contact with the electric scalpel, it is worth mentioning that this occurred in the first cases, and we consider it as part of the learning curve. Despite what happened, in both cases the reflector was removed and the tumour was excised with clear margins. Having a good exposure of the lumpectomy area as well as the use of the hand piece to detect the SS reflector before deciding and sectioning the margins prevented this from happening again in successive cases.

Conclusion

The new technologies for the detection of non-palpable breast lesions have allowed us to have better alternatives than WL, avoiding the disadvantages of this technique, enabling scheduling flexibility between surgical and radiology teams, preventing delays on the day of surgery and increasing the patients' comfort. In this context, and in our experience, the use of the SS has proven to be a safe technique with a very small learning curve, which has allowed us to correctly identify the lesions in all cases and the rate of re-intervention due to affected margins was equal to or even lower than those described with other techniques, although we believe that more studies are needed in this field. On the other hand, the association between the diagnosis of breast cancer and macromastia generates a challenge in the surgical approach, and surgeons must know the oncoplastic techniques that are often the best choice in these cases. In our case, the combination of the SS with oncoplastic techniques has allowed us to have a favourable result with a high degree of patient satisfaction.

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