MRI-guided breast biopsies, preliminary experience


1. Clínica Alemana de Santiago, School of Medicine Clínica Alemana, Universidad del Desarrollo, Santiago, Chile
2. Medical technologist, Clínica Alemana de Santiago, School of Medicine Clínica Alemana, Universidad del Desarrollo, Santiago, Chile

Abstract. Breast MRI is becoming a frequently used working tool in our environment. A group of lesions exist that can only be identified by this technique, “MRI only”. Between 14-20 % of these will be malignant, according to various published series. Such lesions require an MRI-guided biopsy.

Patients and Methods: A descriptive retrospective review of vacuum-assisted biopsies was performed at our institution (period between August 2008 and June 2013).

Results: 0.3 % (11) of the biopsies performed at our institution were MRI-guided, in 9 women. In 55% of the cases the resonance indication in which the biopsied lesion was detected, was newly diagnosed staging of breast cancer; in 100% of the cases a second-look ultrasound was performed, the lesions had an average size of 15 mm (4-29), 63.6% were nodules and the remainder other non-mass type deposits. The duration of the biopsy varied between 40 and 130 min, 27.2% were malignant lesions, 36.4 % high-risk lesions, and 36.4 % benign. In 45.5% the result of the MRI-guided biopsy changed the surgical procedure. Of the 7 operated lesions there was an underestimation in one case of ductal carcinoma in situ, which resulted being invasive ductal carcinoma. In the remainder, the surgical histology was identical to that of the MRI-guided biopsy. Conclusion: MRI-guided biopsies are infrequent, they take considerable time, their histological correlation is very reliable and it changes the surgical procedure in almost half of the cases, which has implications in the prognosis of the patient.

Keywords: Breast cancer, Breast MRI, MRI only, Vacuum-assisted biopsy.

Resumen. La resonancia magnética (RM) mamaria se está convirtiendo en una herramienta de trabajo frecuentemente utilizada en nuestro medio. Existe un grupo de lesiones que sólo pueden ser identificadas por esta técnica, RMI only. Entre 14 a 20% de ellas serán malignas, según las diferentes series publicadas. Este tipo de lesiones requieren de biopsia guiada bajo RM. Pacientes y Métodos: se realizó revisión retrospectiva descriptiva de las biopsias asistidas por vacío realizadas en nuestra institución (periodo entre agosto de 2008 y junio de 2013). Resultados: El 0,3% (11) de las biopsias realizadas en nuestra institución fueron realizadas bajo RM, en 9 mujeres. En el 55% de los casos la indicación de la resonancia en la que se detectó la lesión biopsiada, fue etapificación de cáncer mamario recientemente diagnosticado; en el 100% de los casos se realizó ultrasonido de segunda mirada, las lesiones tenían un tamaño promedio de 15 mm (4-29), un 63,6% fueron nódulos y el resto captaciones tipo no masa. La duración de la biopsia varió entre 40 y 130 minutos, un 27,2% resultaron lesiones malignas; 36,4% lesiones de alto riesgo; y 36,4% benignas. En el 45,5% el resultado de la biopsia bajo resonancia cambió la conducta quirúrgica. De las 7 lesiones operadas hubo subestimación en un caso de cáncer ductal in situ, que resultó cáncer ductal infiltrante. En el resto la histología quirúrgica fue idéntica a la de la biopsia bajo resonancia. Conclusión: Las biopsias bajo resonancia son infrecuentes, consumen un tiempo considerable, su correlación histológica es muy confiable y cambia la conducta quirúrgica casi en la mitad de los casos, lo cual tiene implicancias en el pronóstico de la paciente. Palabras clave: Biopsia asistida por vacío, Cáncer de mama, Resonancia mamaria, MRI only.


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Introduction
Breast MRI has become an ever increasingly used examination in our country, despite its high cost and its limited availability. It is a method that complements conventional techniques and the clinical examination. It enables the detection, diagnosis, staging and treatment monitoring of breast cancer(1).
Despite its high sensitivity 90-99 % its specificity is relatively low 37-72%\(^{(2)}\) which means that similar kinetics and morphological characteristics overlap in both benign and malignant lesions\(^{(1,7)}\), due to this suspicious findings require histological verification.

It is known that some lesions visible at first only in MRI, can be seen on second look sonography. This varies between 20 to 46% and according to the different sets of these, it has been reported that up to 43% may correspond to malignant lesions\(^{(3,4)}\).

There is also a non-negligible percentage of lesions that are only evident in MRI, known in the literature as “MRI only” and in these from 14 to 20% have been reported as malignant\(^{(1,4)}\) therefore they require a method of MRI-guided biopsy to determine their exact nature and thus take an appropriate therapeutic approach toward the patient.

There is the MRI-guided needle localization and subsequent surgical biopsy\(^{(1,8)}\) which has the disadvantage of the greater amount of resected tissue, increased associated morbidity and higher costs, but there is also the MRI-guided percutaneous biopsy whose advantages include being a rapid procedure, of low morbidity and reduced costs compared to excisional biopsy. This type of biopsy has been conducted since the late eighties and there are extensive published experiences\(^{(6)}\).

In our center we have since 2007 a vacuum-assisted biopsy system, compatible with MRI and we consider as the objective of this paper to undertake a review of our casuistry and technique of MRI-guided breast biopsies performed in our department.

**Materials and methods**

**Patients:**

A retrospective review was made of MRI-guided breast biopsies performed, taken from the records stored in the database of the Breast Imaging Service (FileMaker Pro 7.5) between August 2008 and June 2013. Demographic characteristics, personal and family breast cancer history and indication of the biopsy were evaluated. Images of the MRI-guided biopsy, available in PACS and CAD (Computer Aided Detection) were reviewed. In all cases the biopsies were performed after signing an informed consent.

**Lesions**

The interpretation of the MR was made based on the criteria of the American College of Radiology and all biopsied lesions were categorized as BI-RADS 4 or 5.

The number, size, location and type of lesion (focus, nodule or no mass uptake), along with its curve of contrast enhancement (persistent, plateau or washout), were evaluated.

Before deciding to perform a MRI-guided biopsy, mammography and ultrasound were reassessed, taking additional plates if necessary and always performing “second look” ultrasonography.

**Procedure**

All patients went personally to schedule their biopsy time with a medical technologist from our center, in order to have explained to them what the procedure consisted of, to evaluate history of allergic reaction to gadolinium, etc. On that occasion they were asked to discontinue aspirin seven days before the date of the procedure and anticoagulants three days before, as well as to ask them to fast for two hours prior to the procedure.

The biopsies were performed by five breast imaging radiologists with experience of 8 to 15 years in percutaneous biopsies.

All biopsies were performed with 9 Gauge needle, a vacuum-assisted system, compatible with MRI, Suros Surgical System ATEC (Automated Tissue Excision and Collection) and breast coil GE 1.5 T DST resonator (8 channel HD breast) and grid localization (Figure 1 and 2). In all biopsies performed a clip marker was left (MamoMark Biopsy site marker) and gadolinium was used in a dosage of 0.1 mmol/Kg.
An antebrachial i.v. line is installed, then placed in the prone position in the magnet (Figure 3).

**Figure 3. Patient entering the resonator.**

The breast is introduced into the coil and compressed gently with the grid, a capsule of vitamin E is adhered to the skin, which serves as a reference, obtaining only with the grid the X-Y coordinates, of the lesion to be biopsied.

A localization sequence is taken and then another in the sagittal plane with gadolinium and CAD (Computer Aided Detection), and having as a reference the capsule of vitamin E, the depth or Z axis (Figures 4 and 5) is calculated.

The patient is removed from the magnet, the skin is disinfected with povidone iodine and the skin and subcutaneous planes are anaesthetized with lidocaine 2%, and the path of the needle with lidocaine association to epinephrine in a 1:100,000 dilution, then a small incision is made with a scalpel and the needle guide is put in the grid, according to the calculated depth, the centimeters are marked on the cannula and then the stylet with the cannula is inserted into the breast. Once at the required depth, the stylet is removed and a plastic plug/seal (Figures 6, 7 and 8) is inserted.

The patient is placed again inside the magnet and a sequence is taken to assess whether we are in the right location (Figure 9), if so, the patient is taken out again, the plastic seal is removed and the biopsy device is inserted and samples are taken, rotating 360°. After that a new sequence is taken to assess if any lesion remains or if it was removed and a decision is made to continue or end the procedure, but not before putting the marker clip in the biopsy site (Figure 10).

All elements are removed from the breast and the biopsy site is compressed, then the incision is covered and a compress dressing with ice applied.

**Figure 4 and 5. Calculating X and Y axes in CAD and with vitamin E. capsule**

**Figure 6. Installing plastic needle guide.**

**Figure 7. Positioning guide for clip.**
The patient leaves with instructions for relative rest for 48 hours and analgesics, if necessary.

All images of the procedure are saved in the PACS system.

The duration of the procedure was registered for each case.

**Histological Analysis**

The samples were fixed in formalin and analyzed the standard way.

Of the eleven biopsies performed, 10 were informed by the same pathologist of the institution and one was referred to another center, at the request of the patient.

The results were categorized as benign, high-risk lesions (atypical ductal hyperplasia - ADH, flat epithelial atypia - FEA, lobular neoplasia - LN 1 and 2) and malignant (ductal carcinoma or invasive lobular and ductal carcinoma in situ).

The concordance or discordance between the histology obtained and the appearance of the lesion was always recorded.

**Results**

In the 58 month period 3,480 breast biopsies were performed at our center. Only 11 (0.3%) were performed under magnetic resonance, in 9 women, whose average age was 47.6 years with a range of 37-58 years. Only one patient had a family history of breast cancer (mother and sister).

In five women (55%) the indication of the resonance in which the biopsied lesion was detected, was staging of newly diagnosed breast cancer; in two patients the biopsies were double (1 bilateral and the other in the same breast), the lesions had an average size of 15 mm with a range from 4 to 29 mm; 64% of the biopsied lesions were nodules; and the remainder non-mass type deposits. In each procedure between 12 and 30 samples were taken and the length of the procedures varied between 40 and 130 minutes.

Biopsies showed the following histologic findings: 36.4% (n = 4) were benign lesions; 36.4% (n= 4) were high-risk lesions; and 27.2% (n= 3) were malignant lesions (Table I).

All malignant and high-risk lesions were operated, encountering underestimation in one case of ductal carcinoma in situ, which resulted being invasive ductal cancer in the excisional biopsy. In the remainder, the surgical histology was identical to that of the MRI-guided biopsy.

From August 2008 to the present the patients are being monitored and we have found no false negatives.

In 45.5% the result of the MRI-guided biopsy changed the surgical procedure, in 4 cases from a partial mastectomy to a total mastectomy and in another patient a control to a partial mastectomy.

In no case did we have early or late complications from the procedure.

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**Figure 8.** Plastic introduction cannula. 2. Plug/seal. 3. Stylet. 4. Needle guide.

**Figure 9.** Axial T1 with Gd, confirms correct position of the needle.

**Figure 10.** Sagittal T1image post procedure (metal clip)
Discussion

MRI-guided vacuum-assisted biopsy is a method that is currently part of the diagnostic algorithm for suspicious breast lesions, it is a safe and high accuracy diagnostic procedure\(^9,10\). It is the method of choice in those “MRI only” suspicious lesions, however, a thorough analysis of the images is essential, even to take new mammographic projections and always perform second look ultrasound, as many of them may be visible with ultrasound\(^4,11\). In our center this number reaches 75% (data not yet published) and the fact of having ultrasound correlation implies that in addition to being able to take the sample using this method (which is much cheaper, convenient and fast), it also has an important biological significance, which is that there is greater likelihood of malignancy in lesions that correlate to ultrasound\(^11,12,4,1\). Once we have analyzed the case, the decision to perform a MRI-guided biopsy should be made by a multidisciplinary team.

Although our sample is small, the results obtained are consistent with those in literature: we obtained a 27.2% of cancers, where the ranges are described between 18% to 61%\(^{14,15}\); we had low histological underestimation \(n = 1\) (9%) case of ductal carcinoma in situ, whose surgical biopsy revealed an infiltrating ductal carcinoma, being described in the different series between a 7 to 25%\(^{6,15-18}\). It is noteworthy that in almost half of the cases the therapeutic approach changed, which probably has to do with the type of patient, since in 55% the MRI was requested for already diagnosed staging cancer.

Even though comparatively with biopsies performed with ultrasound or stereotactic guidance, that which is MRI-guided takes more time, we believe that this could be improved on gaining more experience.

Conclusion

Chile’s first series of MRI-guided biopsies is presented, showing that it is an efficient and safe procedure for patients, although not a frequent one.

Even though it takes considerable time, its histological correlation is excellent and changes the surgical procedure in almost half of the cases, which has implications for the prognosis of the patient.

We hope in the future to present a higher casuistry and that the method can be performed in other centers of our country.

Bibliography