RM: Dinàmica, difusió, espectroscòpia, noves perspectives.

Melcior Sentís
Hospital CIMA

msentis@telefonica.net

Parte Árida

pero

fundamental

Intentaremos no hacernos daño

Nov 2016

Search NCBI databases

Breast MR

Results found in 26 databases for "Breast MR"

Literature

Books	1,484	books and reports
MeSH	0	ontology used for PubMed indexing
NLM Catalog	65	books, journals and more in the NLM Collections
PubMed	3,482	scientific & medical abstracts/citations
PubMed Central	47,904	full-text journal articles

Febrer 2019

Search NCBI Breast MR

NCBI Databases

Results found in 25 databases for: **Breast MR**

Literature

Bookshelf	1,697
MeSH	0
NLM Catalog	65
PubMed	4,272
PubMed Central	64,598

http://www.ncbi.nlm.nih.gov/gquery/?term=Breast+MR

Table 1 Indications for breast MRI

Screening of women at high risk of breast cancer
Preoperative staging of newly diagnosed breast cancer (ipsilateral and contralateral)
Evaluation of the effect of neoadjuvant chemotherapy
Evaluation of women with breast implants
Occult primary breast carcinoma (search for breast cancer in patients with metastases and negative mammography and ultrasound)
Suspected local recurrence*
Problem solving (equivocal findings at mammography/ultrasound)*

*When needle biopsy cannot be performed

Other new indications were recently proposed, such as nipple discharge [8] and evaluation of lesions with uncertain malignant potential (so-called high-risk or B3 lesions) detected at mammography or ultrasound, and needle-biopsied under their guidance [9]

Mann, Ritse M., Corinne Balleyguier, Pascal A. Baltzer, Ulrich Bick, Catherine Colin, Eleanor Cornford, Andrew Evans, et al. “Breast MRI: EUSOBI Recommendations for Women’s Information.” European Radiology, May 23, 2015. doi:10.1007/s00330-015-3807-z.

Aproximaciones y secuéncias

Fortschr. Röntgenstr. 145, 5 (1986) 565–571
© Georg Thieme Verlag Stuttgart · New York

Anwendung von Gd-DTPA bei der kernspintomographischen Untersuchung der Mamma*

Von S. H. Heywang, G. Fenzl, R. Beck, D. Hahn, W. Eiermann, W. Permanetter und J. Lissner

4 Abbildungen

Radiologische Klinik (Direktor: Prof. Dr. J. Lissner), Gynäkologie (Direktor: Prof. Dr. H. Heppt) und Pathologisches Institut (Direktor: Prof. Dr. M. Eder) Klinikum Großhadern, Universität München

55 Patientinnen mit insgesamt 60 Mammaveränderungen wurden an unserem Institut kernspintomographisch mit und ohne Gd-DTPA sowie mammographisch präoperativ untersucht. Mammakarzinome und Fibroadenome nahmen das Kontrastmittel signifikant, hingegen nicht-proliferierende Mastopathien, normales Mammagewebe und Narbengewebe nicht signifikant auf. Grenzwertige Kontrastmittelaufnahme wurde bei proliferierenden Mastopathien beobachtet. Die diagnostische Treffsicherheit konnte durch Kernspintomographie mit Gd-DTPA verbessert werden. Vorteile ergaben sich vor allem bei der Erkennung von Tumoren in dichten Brüsten, bei der Differenzierung zwischen unregelmäßiger Mastopathie und Karzinom sowie bei der Differenzierung zwischen posttherapeutischen Veränderungen (nach Bestrahlung, Operation oder Prothese) und Narbenkarzinom. Derzeit sind jedoch noch technische Verbesserungen und klinische Erfahrungen notwendig.

The use of Gd-DTPA for magnetic resonance of the breast

55 patients with altogether 60 breast masses have been examined post-operatively by plain MR, MR with Gd-DTPA and mammography at our institution. All breast carcinomas and fibroadenomas did enhance significantly. Non-proliferative dysplasia, normal breast tissue and scar tissue did not enhance significantly. Borderline enhancement has been found in cases of proliferative dysplasia. The diagnostic accuracy has been improved by MR with Gd-DTPA. Advantages have been an improved visualization of tumors in dense breasts, an improved differentiation between irregular dysplasia and carcinoma and an improved differentiation between posttherapeutic changes (after radiation, surgery or silicon implants) and carcinoma. Nevertheless both technical improvements and further clinical experience is necessary.

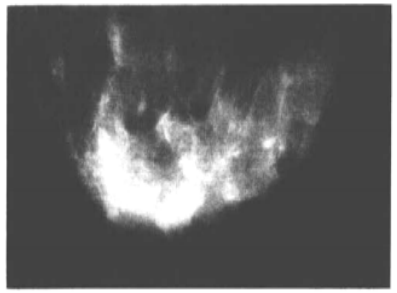


Abb. 1a Mammographisch dichte Brust ohne Hinweis auf Karzinom.

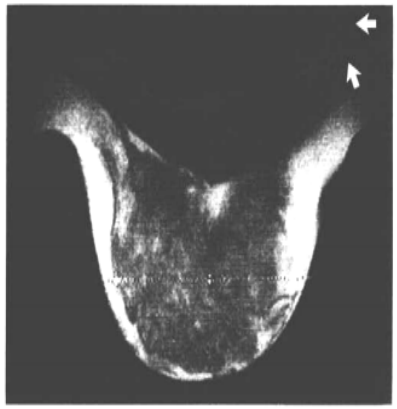


Abb. 1b Kernspintomographischer transversaler Schnitt auf Höhe des Palpationsbefundes, T_2-gewichtetes Bild: unruhiger dichter Drüsenkörper mit signalintensiveren und signalärmeren Arealen. Es ließ sich kein sicherer Tumorknoten unterscheiden. Es fallen jedoch Lymphknoten axillär auf (◆).

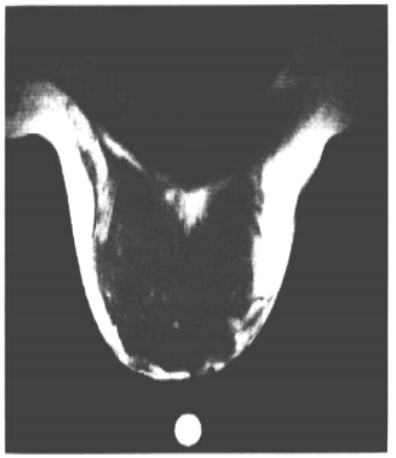


Abb. 1c Kernspintomographischer transversaler Schnitt, T_1-gewichtetes Bild: dichter, signalarmer Drüsenkörper.

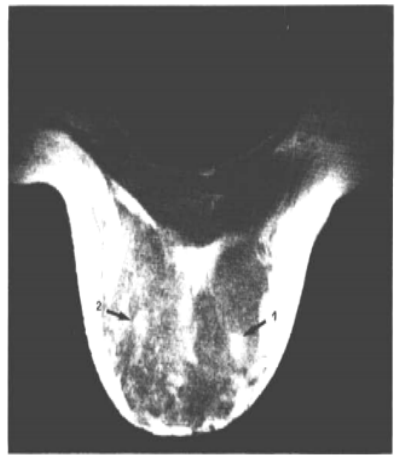


Abb. 1d Kernspintomographischer transversaler Schnitt, T_1-gewichtetes Bild nach Gabe von Gd-DTPA. Im Vergleich zu 1c erhöhte Signalintensität im gesamten Drüsengewebe. Außerdem 2 Areale (1 und 2) mit noch stärkerer KM-Anreicherung.

Abb. 1 Palpabler Knoten im äußeren Quadranten der rechten Brust. Histologisch wurden ein Karzinom (1) und ein Fibroadenom (2) gefunden. Der gesamte Drüsenkörper zeigte eine ausgeprägte proliferierende Mastopathie mit Atypien.

Heywang, S. H., G. Fenzl, R. Beck, D. Hahn, W. Eiermann, W. Permanetter, i J. Lissner. «[Use of Gd-DTPA in the nuclear magnetic resonance study of the breast]». RöFo: Fortschritte Auf Dem Gebiete Der Röntgenstrahlen Und Der Nuklearmedizin 145, núm. 5 (novembre 1986): 565-71. https://doi.org/10.1055/s-2008-1048990.

Guidelines

Revised 2018 (Resolution 34)*

ACR PRACTICE PARAMETER FOR THE PERFORMANCE OF CONTRAST-ENHANCED MAGNETIC RESONANCE IMAGING (MRI) OF THE BREAST

Revised 2017 (Resolution 10)*

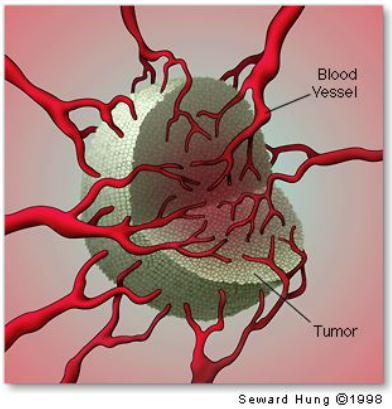
ACR PRACTICE PARAMETER FOR PERFORMING AND INTERPRETING MAGNETIC RESONANCE IMAGING (MRI)

CAR PRACTICE GUIDELINES AND TECHNICAL STANDARDS FOR

BREAST IMAGING AND INTERVENTION

Criterios : Indicación , profesionales y certificación , calidad equipos, auditoría, etc

Angiogénesis tumoral



Methods Title

Estándares

Poco y repetitivo

- técnicamente NO al día
- La literatura va más rápido que la Práctica Clínica
- A menudo la radiología no responde a las preguntas clínicas
-
-

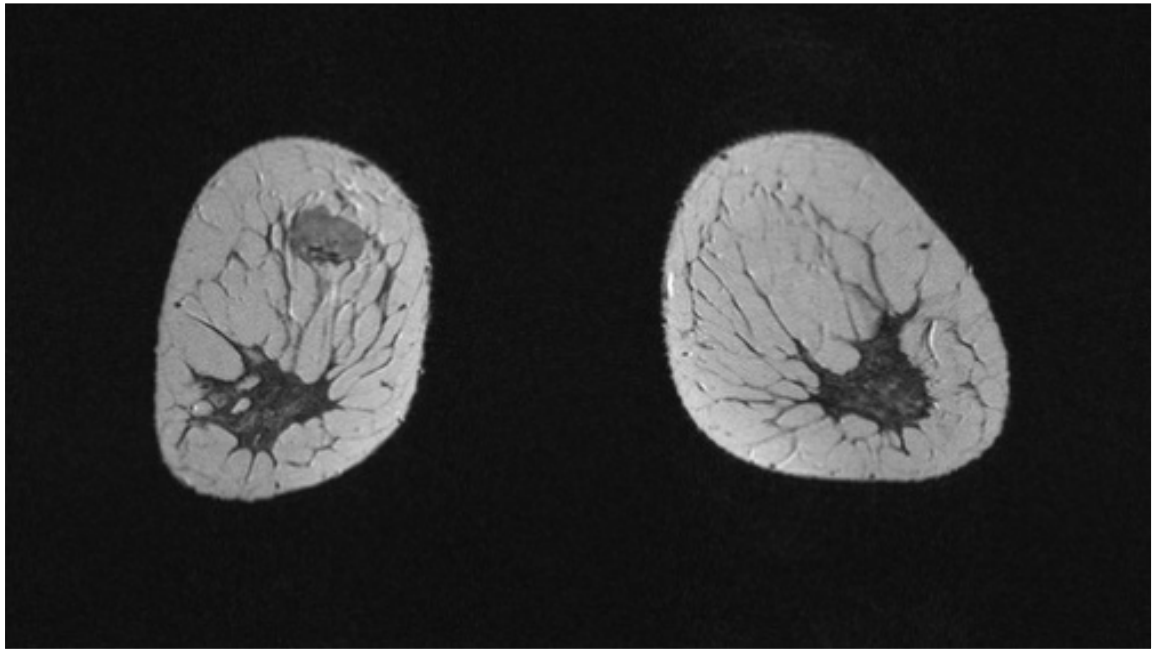
THE ACR BI-RADS

SECTION I: Clinical Information and Acquisition Parameters

C. ACQUISITION REPORTING RECOMMENDATIONS

Sequence	Criteria
T2-Weighted/Bright Fluid Series	• Adequate SNR/not too grainy • Sufficient bright fluid contrast
Multi-Phase T1-Weighted Series:	
Pre-Contrast T1	• Adequate SNR/not too grainy
Early Phase (first) Post-Contrast T1	• Adequate SNR/not too grainy • Completed within 4 minutes of completion of injection • Technical factors match pre-contrast T1
Delayed Phase (last) Post-Contrast T1	• Adequate SNR/not too grainy • Technical factors match pre-contrast T1

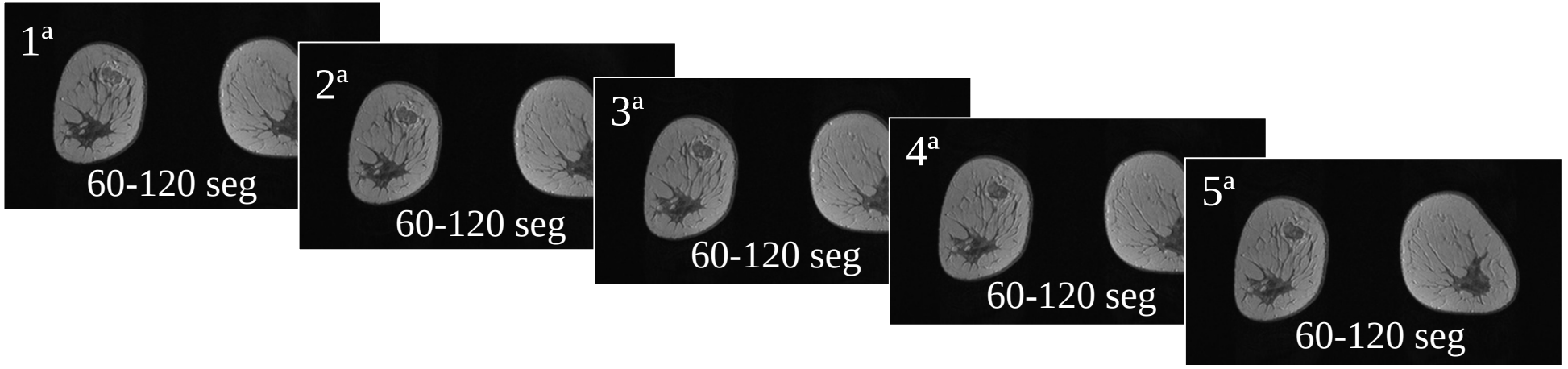
Sequence	Criteria
T2-Weighted/Bright Fluid Series	• Adequate SNR/not too grainy • Sufficient bright fluid contrast



¿Para qué sirve?

- Quistes
- Señal de lesiones sólidas

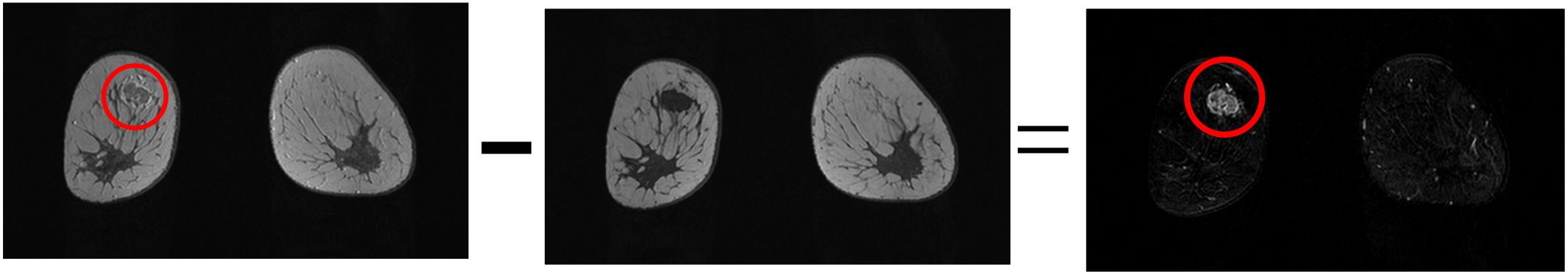
Multi-Phase T1-Weighted Series:	
Pre-Contrast T1	• Adequate SNR/not too grainy
Early Phase (first) Post-Contrast T1	• Adequate SNR/not too grainy • Completed within 4 minutes of completion of injection • Technical factors match pre-contrast T1
Delayed Phase (last) Post-Contrast T1	• Adequate SNR/not too grainy • Technical factors match pre-contrast T1



- Repetición de la misma secuencia varias veces después de administrar el contraste con un intervalo de 60-120 segundos = ESTUDIO DINÁMICO

Eliminación de la señal de la grasa

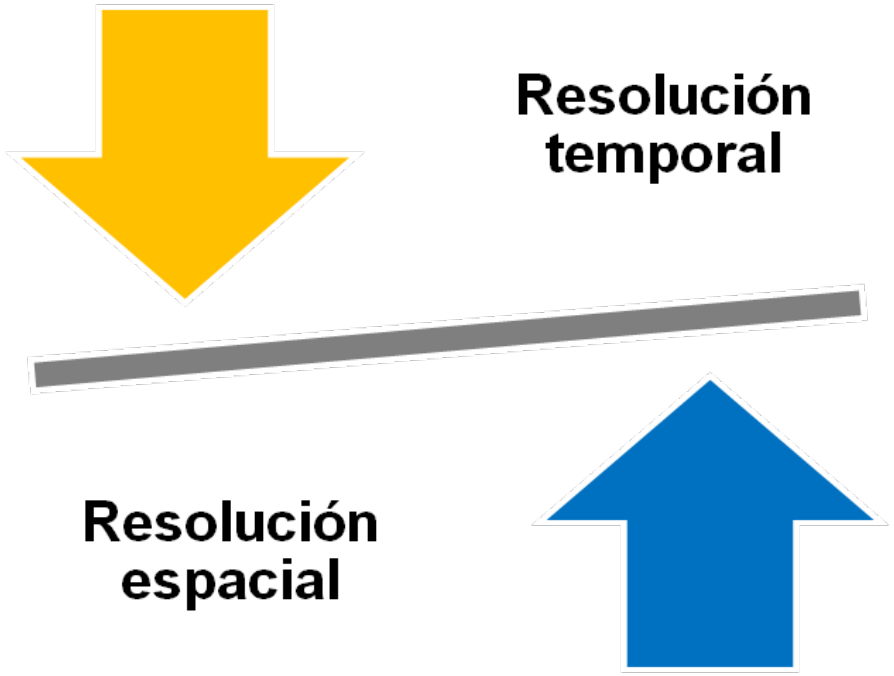
- Substracción (postprocesado)
- Secuencias de supresión grasa



T1 con contraste − T1 sin contraste = SUBSTRACCIÓN

Alta resolución temporal (<120 seg) = características dinámicas

Alta resolución espacial = características morfológicas

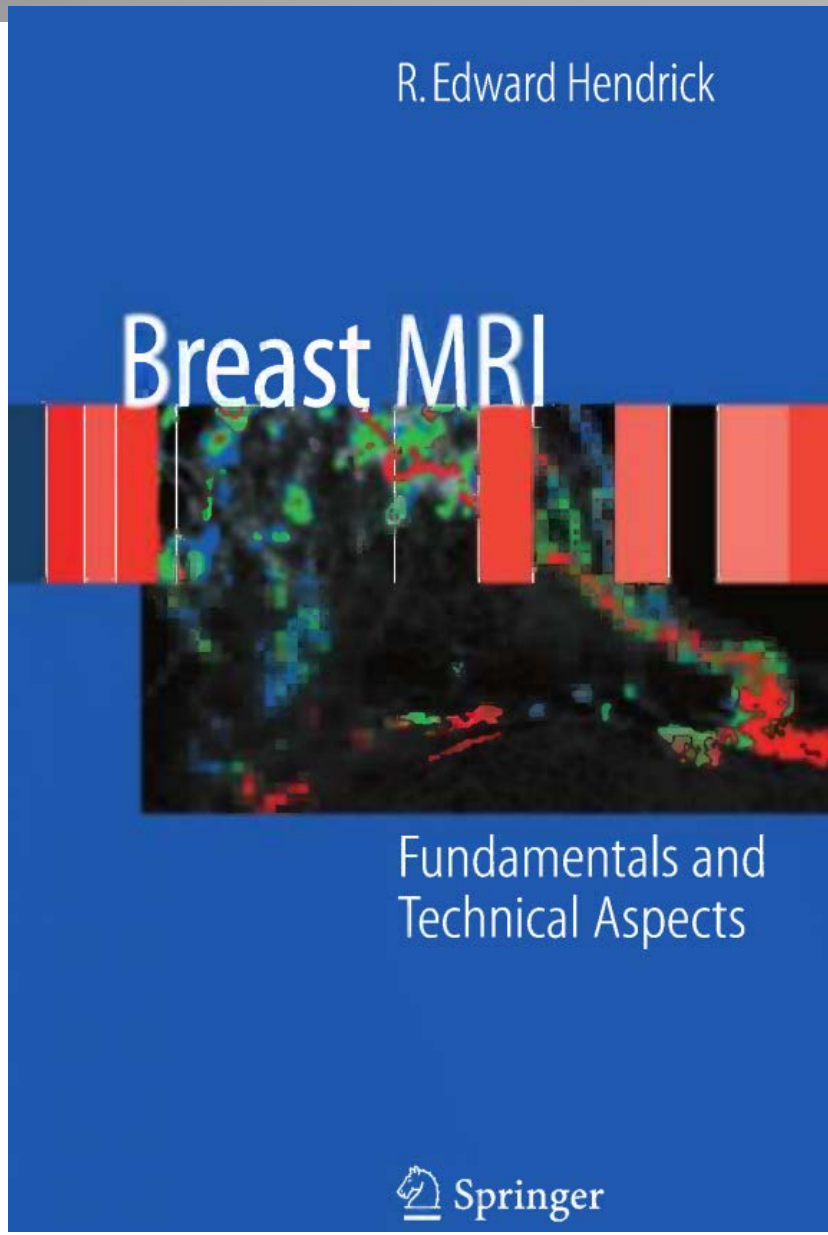


¿Cómo me lo he planteado?

- **Esta sesión se puede plantear como un «recetario físico»**
  - Física
  - Secuencias y parámetros
  - Fashion MRI

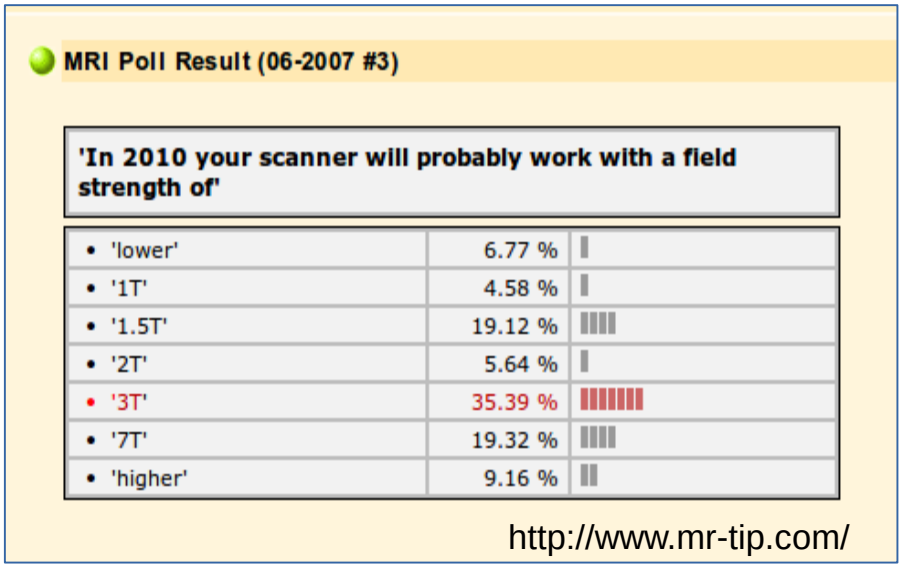
- **Tambien como una guia de supervivéncia**
  - Critérios de calidad
  - Usuario final

- Criterios de realización
- Guidelines
- Máquinas y maquinistas
- Que puedo esperar
- Que les digo a las pacientes



La moto o el motorista?

- **0.3**
- **0.5**
- **1**
- **1.5**
- **2**
- **3**
- **7**
- **mayor**



MRI Poll Result (06-2007 #3)

'In 2010 your scanner will probably work with a field strength of'

'lower'	6.77 %
'1T'	4.58 %
'1.5T'	19.12 %
'2T'	5.64 %
'3T'	35.39 %
'7T'	19.32 %
'higher'	9.16 %

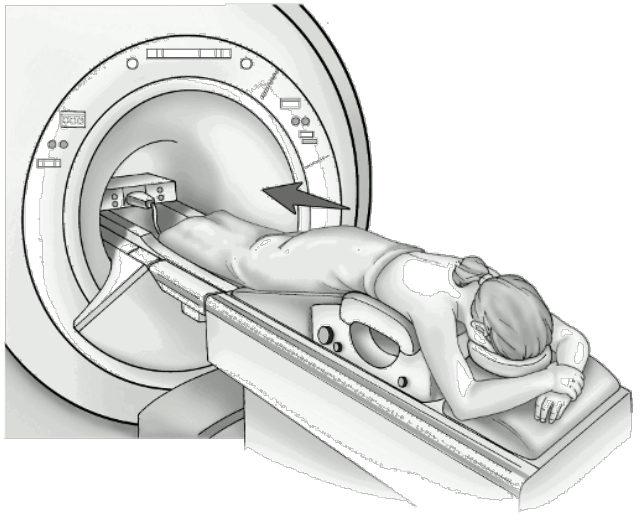
http://www.mr-tip.com/

- **Competencia**
- **Formación**
- **Correlación**
- **Interdependencia**
- **Multidisciplinar**
  - Radiologos
  - Otros prof.
    - Médicos
    - NO médicos

¿Que les digo a las pacientes?

- **Webs útiles**
- **Radiology info**
  - https://www.radiologyinfo.org/en/info.cfm?pg=breastmr
- **American Cancer Society**
  - https://www.cancer.org/cancer/breast-cancer/screening-tests-and-early-detection/breast-mri-scans.html

Courtesy of Cindy Henke



Breast MRI

la visión externa también se transmite a la paciente

ARTICLE IN PRESS

How Does MR Imaging Help Care for the Breast Cancer Patient? Perspective of a Medical Oncologist

Akshara S. Raghavendra, MD, MS, Debu Tripathy, MD*

KEYWORDS

• MR imaging • Staging • Breast cancer • Neoadjuvant chemotherapy • Metastatic

KEY POINTS

- MR imaging can detect occult breast cancers and nodes that are not apparent during mammographic, ultrasound, or clinical workup, which may affect treatment outcome.
- MR imaging is often used to characterize extent of disease and monitor clinical response to neoadjuvant systemic therapy, to guide surgical planning; it holds the potential to predict pathologic response.
- MR imaging assists in early staging for treatment planning, as well as staging in (advanced) metastatic disease.

- Confianza
- Credibilidad
- Calidad en la atención

1. Raghavendra AS, Tripathy D. How Does MR Imaging Help Care for the Breast Cancer Patient? Perspective of a Medical Oncologist. Magnetic Resonance Imaging Clinics of North America. 2018 May 1;26(2):289–93.

Check list

UVA Imaging
Outpatient Diagnostic Imaging Centers

Scheduled Exam Time _____ Ready _____

Patient Name:

MR #

Addressograph

MR SCREENING FORM
Before beginning your study, it is necessary that you answer the following questions:

Patient name: _____ Height: _____ Weight: _____ Age: _____

Date: _____ Procedure being performed: _____ Ambulatory ____ Wheelchair ____ Gurney ____

Have you ever had an MRI?	☐YES ☐NO	Have you had an injury to the eye involving a metallic object or fragment (e.g. metallic slivers, shavings, foreign body, etc)?	☐YES ☐NO
Have you experienced any problem related to a previous MRI? *If Yes, Describe:*	☐YES ☐NO	Have you had any other injuries by a metallic object or foreign body (e.g. BB, bullet, shrapnel, etc)?	☐YES ☐NO
Are you claustrophobic or do you have a breathing or motion disorder?	☐YES ☐NO		
Did you bring sedation medications with you today?	☐YES ☐NO		
Following to be completed by clinical staff only:			
Type of sedation: _____			
Amount of sedation: _____			
Time sedation taken: _____			
Sedation administered by: _____			
Have you ever had contrast material (dye) for a kidney x-ray, CT, MRI, or other imaging test/study?	☐YES ☐NO	Have you had any surgeries? *If Yes, Describe:* _____	☐YES ☐NO
If yes, did you have any discomfort, ill effects, or allergic reaction? *If Yes, Describe:*	☐YES ☐NO	Have you had an endoscopic procedure in the past 2 months? *If Yes, Describe:*	☐YES ☐NO
Do you have a history of asthma, seasonal/environmental allergies, or respiratory disease?	☐YES ☐NO	Were clips placed in the procedure?	☐YES ☐NO ☐UNCERTAIN
Are you allergic to any medications? *Please List:* _____	☐YES ☐NO	At which Facility was it performed? _____	
Do you have diabetes?	☐YES ☐NO	**For Male Patients:** Do you have a penile prosthesis?	☐YES ☐NO
Do you now have or have you had kidney disease or any history of kidney problems? *If Yes, Describe:*	☐YES ☐NO	**For Female Patients:** Are you pregnant or experiencing a late menstrual period?	☐YES ☐NO
Do you have anemia or any disease that affects your blood?	☐YES ☐NO	Are you currently breastfeeding?	☐YES ☐NO
Do you have a history of seizures?	☐YES ☐NO		
Were you hospitalized in the past 2 weeks?	☐YES ☐NO	Do you have an IUD, diaphragm, pessary?	☐YES ☐NO

TECHNOLOGIST OR NURSE USE ONLY

VENIPUNCTURE SITE: _____ TYPE NEEDLE/CATH: _____ # STICKS: _____

PERFORMED BY: _____ INJECTED BY: _____ INJECTION TIME: _____

CONTRAST TYPE/AMT: _____ CONTRAST LOT #: _____ I.V. DISCONTINUED BY: _____

Creatinine: _____mg/dl **Date:** _____ **Source:** _____ **Weight:** _____ **GFR** _____ mL/min/1.73 m^2

Reference Ranges: GFR = >60 mL/min/1.73 m^2

(Rev. 08/12) **NOT A CHART DOCUMENT** Next Page ➡

WARNINGS AND IMPORTANT INSTRUCTIONS **!!MAGNET IS ALWAYS ON!!**

Certain implants and devices may be hazardous to you and/or may interfere with the MR procedure. Do not enter the MR system room if you have any questions regarding an implant, device, or object. Before entering the MR environment you must remove all metallic objects including hearing aids, dentures, partial plates, keys, pager, cell phone, hairpins, jewelry, body piercing jewelry, watch, safety pins, credit cards, (any card with a magnetic strip), pocket knife, nail clippers, and tools. Consult the MR technologist BEFORE entering the MR system room!

_____	☐Yes	☐No	Swan-Ganz or thermodilution catheter***
_____	☐Yes	☐No	Cardiac Pacemaker***
_____	☐Yes	☐No	Implanted Cardioverter defibrillator (ICD) ***
_____	☐Yes	☐No	Aneurysm Clip(s) **
_____	☐Yes	☐No	ICP Bolt**
_____	☐Yes	☐No	Electronic implant or device**
_____	☐Yes	☐No	Magnetically –activated implant or device**
_____	☐Yes	☐No	Neurostimulation system (Deep Brain Stimulator, Vagus Nerve Stimulator) **
_____	☐Yes	☐No	Spinal Cord Stimulator**
_____	☐Yes	☐No	Internal electrodes or wires**
_____	☐Yes	☐No	Bone growth/Bone fusion stimulator**
_____	☐Yes	☐No	Cochlear, otologic, or other ear implant**
_____	☐Yes	☐No	Insulin or other infusion pump**
_____	☐Yes	☐No	Implanted drug infusion device**
_____	☐Yes	☐No	Shunt (spinal or ventricular) **
_____	☐Yes	☐No	Tissue expander (e.g. breast) **
_____	☐Yes	☐No	Endoscopic clip **
_____	☐Yes	☐No	Any type of prosthesis (eye, penile, etc.)*
_____	☐Yes	☐No	Eyelid spring or wire*
_____	☐Yes	☐No	Any metallic fragment or foreign body*
_____	☐Yes	☐No	Metallic stent, filter, or coil*
_____	☐Yes	☐No	Heart valve prosthesis
_____	☐Yes	☐No	Artificial or prosthetic limb
_____	☐Yes	☐No	IUD, diaphragm, or pessary
_____	☐Yes	☐No	Radiation seeds or implants
_____	☐Yes	☐No	Medication Patch (Nicotine, Nitroglycerine)
_____	☐Yes	☐No	Wire mesh implant
_____	☐Yes	☐No	Surgical staples, clips, or metallic sutures
_____	☐Yes	☐No	Joint replacement (hip, knee, etc.)
_____	☐Yes	☐No	Bone/joint pin, screw, nail, wire, plate, etc.)
_____	☐Yes	☐No	Vascular access port, PICC line or catheter – Type _____
_____	☐Yes	☐No	Dentures or partial plates
_____	☐Yes	☐No	Tattoo or permanent makeup
_____	☐Yes	☐No	Body piercing jewelry
_____	☐Yes	☐No	Hearing aid (**Remove Hearing aid(s) before entering MR system room**)
_____	☐Yes	☐No	Other implant: _____
_____	☐Yes	☐No	Breathing difficulties or motion disorder
_____	☐Yes	☐No	Claustrophobia

*** **These items are contraindicated for MRI. The MR exam will be cancelled until/unless these items are removed from the patient.**

** **These items may or may not be MR conditional. Information on the make, model, and date of implant must be supplied. These items are addressed on a case by case basis and a determination made as to the safety of proceeding with the exam. In some instances it may be safe to proceed with the exam. In some instances it may be safe to proceed with limitations as to the body part scanned, and type of scan parameters used. The presence of these items may compromise the diagnostic quality of the exam if within the region of interest.**

* **MR scan can most likely be performed with these objects. additional information may be requested regarding location in the body, type of implant/foreign body, and date acquired.**

Please list make, model, and date of implantation for all objects marked ** **here**:

_____

_____

NOTE: You may be advised or required to wear earplugs or other hearing protection during the MR procedure to prevent possible problems or hazards related to acoustic noise.

I attest that the above information is correct to the best of my knowledge. I have read and understand the contents of this form and have been given the opportunity to ask questions regarding the information on this form and regarding the MR procedure I am about to undergo.

Signature of Person Completing Form _____ Date _____/_____/_____

Form Completed By: Patient Relative UVAI Staff _____ (Print Name) _____ (Relationship to Patient)

Cyracom Unit Used By: _____ (Employee Signature) Cyracom Translator# _____

Form Information Reviewed By: _____ (Scanning MRI Technologist's Name) _____ (Signature)

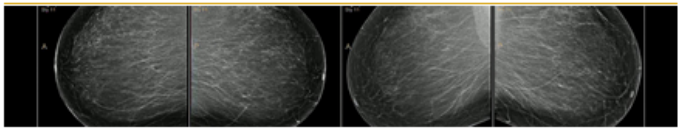
Concordáncia de la Inf. y los mensajes

- **Presencial**
  - En el acto médico prévio
  - Los tècnicos Mx
  - Los tècnicos de la RM
- NO presencial
  - Citación telefónica
  - Carta citación
  - Recursos web
- Elaboración de un argumentario del área que se mantiene en los diferentes momentos
- La información es el mejor colaborador
- SIEMPRE se personaliza el trato.

Unitat de Radiologia Mamària

Presentació
Qui som
Dispositius d'atenció i ubicació
Catàleg de proves
Informació per a usuàries
Informació per a professionals
Activitat
Contacte

Presentació



L'Àrea de Radiologia Mamària i Ginecològica és un departament específic per al diagnòstic de la patologia de la dona. Incorpora professionals especialistes en aquest camp: radiòlegs, infermeres, tècnics en radiologia i una estructura administrativa de suport amb una clara orientació a les pacients basada en el treball multidisciplinari. L'àrea forma part de la Unitat de Patologia Mamària, que engloba les diferents agrupacions clíniques

Responsable de la Unitat de Radiologia Mamària i Ginecològica

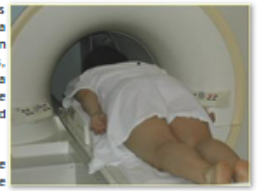
Melcior Sentís i

Enllaços d'interès

Presentació
Qui som
Dispositius d'atenció i ubicació
Catàleg de proves
Ressonància magnètica
Mamografies
Ecografies
TAC
Radiologia
Informació per a usuàries
Informació per a professionals
Activitat
Contacte

Ressonància magnètica de mama

Definició



La ressonància magnètica (RM) és un fenòmen físic pel qual certes partícules absorbeixen energia electromagnètica de radiofreqüència en ser col·locades sota un camp magnètic. Per entendre'ns millor, nosaltres col·loquem a la pacient en un imant gegant (camp magnètic) i mitjançant l'emissió de diferents sorolls, obtenim les imatges corresponents de la zona a estudiar: en aquest cas, la mama. Per a això, necessitem un accessori (bobina) que es col·loca al voltant de la mama, i que és l'encarregada d'emetre i rebre el senyal (soroll) que més tard serà convertida en imatge mitjançant un ordinador.

Tot l'equip de RM està instal·lat en una sala, des de la qual estem en contacte amb la pacient mitjançant una càmera de vídeo i un sistema de intercomunicador.

Contraindicacions

Com hem dit anteriorment, l'exploració es porta a terme sota un camp magnètic (imant gegant), pel que hi ha pacients que estan contraindicats; és a dir, hi ha una sèrie de pacients que NO poden ser sotmesos aquesta exploració sota cap concepte:

- Pacients portadors de marcapassos.
- Pacients portadors de clips vasculars cerebrals o vàlvules cardíaques o implants coclears (depenent del material).

Quan està indicada la prova?

Aquest estudi serveix principalment per valorar l'extensió del càncer de mama.

Es realitza a:

- Pacients diagnosticades de càncer de mama: valorem l'extensió del càncer, i d'aquesta manera es pot arribar a un tractament adequat de forma ràpida.
- Pacients tractades de càncer de mama: valorem la resposta al tractament i d'aquesta manera comprovar si és eficaç.
- Pacients que per factors hereditaris tenen un major risc a patir càncer de mama.

Com s'ha de preparar?

Per realitzar aquest estudi és necessari l'administració d'un contrast endovenós, anomenat Gadolini, pel qual ha de romandre en dejú durant les 4 - 6 hores prèvies a l'estudi.

Si vostè està en període de lactància no pot donar de mamar fins 72h després de ser realitzada l'exploració, per evitar que aquest contrast passi al nadó mitjançant la llet materna.

El contrast s'elimina de l'organisme per via renal (per l'orina) i no s'han descrit efectes secundaris, excepte en casos molt especials.

Com realitzarem la prova?

En primer lloc li realitzarem una breu enquesta per obtenir informació sobre les seves dades personals, estat general, si és portador d'algun implant quirúrgic,...

Un cop completada tota aquesta informació, l'acompanyarem a una cabina dins l'àrea de preparació, perquè dipositi els seus objectes o robes que puguin ser ferromagnètics, és a dir, objectes que no poden entrar dintre de la sala d'exploració, com són: les joies, rellotge, targetes de crèdit, cinturó, etc. I se li col·locarà una bata oberta per davant per realitzar l'estudi.

Una vegada dins la sala de RM procedirem a la col·locació d'una via, per a l'administració del contrast endovenós. S'haurà de col·locar en decúbit pron (boca terrosa) en la llitera d'exploració, obrint-se la bata per a situar un pit a cada costat dels forats que consta la bobina de mama.

Enllaços d'interès

Asociación española contra el cáncer (www.aecc.es)
C/ Amador de los Ríos, 5
28010 Madrid
Tel. 91 319 41 38
Fax. 91 319 09 66

ACTEDI - Associació Catalana de Tècnics en Imatge per al Diagnòstic (www.actedi.cat)
C/ Ausiàs Marc, 60
08010 Barcelona
Tel. 630 380 886

GEICAM - Grupo Español de Investigación en Cáncer de Mama (www.geicam.org)
Avda. de los Pirineos, 7, ofc. 1-14
28700 San Sebastián de los Reyes (Madrid)
Tel. 91 659 28 70
Fax. 91 651 04 06
E-mail: geicam@geicam.org

Grup Ágata - Associació catalana de dones afectades de càncer de pit (www.grupagata.org)
C/ Enric Granados 137, pral. 1a
08008 Barcelona
Tel. 93 415 93 94
Fax. 93 415 65 34
E-mail: agatas@suport.org

Oncolliga - Fundació Lliga catalana d'ajuda oncològica (www.oncolliga.org)
C/ Rector Ubach 5
08021 Barcelona
Tel. Veure Web, diferents telèfons segons seus comarcals.

Corporació Sanitària Parc Taulí
Accessibilitat
Parc Taulí Hospital Universitari
UDIAT Centre Diagnòstic
Seu electrònica
Contacte
Com arribar-hi
Català
Cercar...
Serveis i Unitats
Usuaris
Professionals
Docència
R+D+I
Informació del centre
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Unitat de Radiologia Mamària

Presentació
Qui som
Dispositius d'atenció i ubicació
Catàleg de proves
Informació per a usuàries
Informació per a professionals
Activitat
Contacte

Informació per a les usuàries

Introducció | Autoexploració | Tipus de proves | Tipus de punccions | Consulta d'infermeria
Per què em reciten? | Per fer-se una exploració privada

Tipus de proves

- Mamografia
- Ecografia de mama
- Galactografia
- Ressonància Magnètica (RM)
- Tomosíntesi

Responsable de la informació: Melcior Sentís i Crivellé, cap de Diagnòstic per la Imatge
Darrera actualització el 17 Març 2016
Categoria: Unitat de Radiologia Mamària

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08010 Barcelona
Tel. 630 380 886

- **Deberan desnudarse – bata**
- **Como guardan sus objetos personales**
- **Les harán un cuestionario**
- **Les administrarán contraste endovenoso**
  - Salvo estudios de prótesis
- **El circuito de los resultados**
  - Con su médico referente
  - Con los radiólogos
- **Recabar toda la información que consideren sobre la prueba**

A tener en cuenta

Técnica

- No todo vale.
- Las secuencias «fantásticas»suelen tener problemas
- Hay criterios ligados a la física que no se pueden eludir
- La técnica también exige
- Hay que estar a pie de máquina hasta tener un protocolo sólido
- **Las RM de mama no se hacen desde casa**

Que debe contener un estudio

- **Estudio dinámico T1w**
- **Estudio T2w**
- **Estudio sustraido**
  - Evaluación de cinética y morfología
  - Reconstrucción multiplanar de la lesión.
- **Estudio de difusión DWI**
  - Mínimo dos valores de b (0 - 1000)
  - ADC
- **Informe radiologico**
  - BI-RADS

Estudio Dinámico GRE T1w

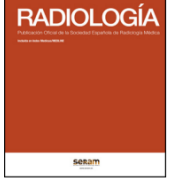
- **Antena dedicada , específica de mama**
- **Dosis : 0,15 mmol/kg** *
- **Resolución 1-3 min**
  - Idealmente 60 – 90 seg.
- **Estudio dinámico**
  - 1 preC y al menos 2 postC
  - Primer estudio antes de 180 seg postC
  - Último estudio no antes de 6-8 min. Po

Contraste

seram
Sociedad Española de Radiología Médica

RADIOLOGÍA

www.elsevier.es/rx



ORIGINAL

Resonancia magnética dinámica de mama: estudio comparativo de gadobutrol y Gd-DTPA

F. Escribano[a,*], M. Sentís[a], J.C. Oliva[b], L. Tortajada[a], M. Villajos[a], A. Martín[a] y S. Ganau[a]

[a] *Área de Radiología Mamaria y Ginecológica, Hospital Universitari Parc Taulí, UDIAT, Institut Universitari Parc Taulí-UAB, Sabadell, Barcelona, España*
[b] *MPharm, MStat, Institut d'Investigació i Innovació Parc Taulí (I3PT), Sabadell, Barcelona, España*

Tabla 2 Realce relativo de intensidad de señal para el gadobutrol y el Gd-DTPA

Tiempo de medición	Contraste	Realce relativo de intensidad de señal (%)	IC95%	p[a]
T1	Gadobutrol	289,84	259,64-320,03	0,081
	Gd-DTPA	260,1	246,02-274,19	
T2	Gadobutrol	311,21	281,31-341,11	0,029
	Gd-DTPA	274,42	260,55-288,02	
Pico IS	Gadobutrol	337,9	308,07-367,74	0,001
	Gd-DTPA	295,36	281,24-309,48	

IC95%: intervalo de confianza del 95%.
[a] Prueba t de Student.

No todos los Gd son iguales, aunque si hay equivaléncias

Contrast e

Breast Lesion Detection and Characterization With Contrast-Enhanced Magnetic Resonance Imaging: Prospective Randomized Intraindividual Comparison of Gadoterate Meglumine (0.15 mmol/kg) and Gadobenate Dimeglumine (0.075 mmol/kg) at 3T

Statistical Tests: Lesion detection, sensitivity, specificity, and diagnostic accuracy were calculated per-lesion and per-region, and compared by univariate and multivariate analysis (Generalized Estimating Equations, GEE).
Results: Five patients were excluded, leaving 104 women with 142 histologically verified breast lesions (109 malignant, 33 benign) available for evaluation. Lesion detection with gadobenate (84.5-88.7%) was not inferior to gadoterate (84.5–90.8%) ($P \geq 0.165$). At per-region analysis, gadobenate demonstrated higher specificity (96.4–98.7% vs. 92.6–97.3%, $P \leq 0.007$) and accuracy (96.3–97.8% vs. 93.6–96.1%, $P \leq 0.001$) compared with gadoterate. Multivariate analysis demonstrated superior, reader-independent diagnostic accuracy with gadobenate (odds ratio = 1.7, $P < 0.001$ using GEE).

Dosis en función del campo

Clauser, Paola, Thomas H. Helbich, Panagiotis Kapetas, Katja Pinker, Maria Bernathova, Ramona Woitek, Andreas Kaneider, i Pascal A.T. Baltzer. «Breast Lesion Detection and Characterization with Contrast-enhanced Magnetic Resonance Imaging: Prospective Randomized Intraindividual Comparison of Gadoterate Meglumine (0.15 Mmol/Kg) and Gadobenate Dimeglumine (0.075 Mmol/Kg) at 3T». Journal of Magnetic Resonance Imaging, 15 desembre 2018. https://doi.org/10.1002/jmri.26335.

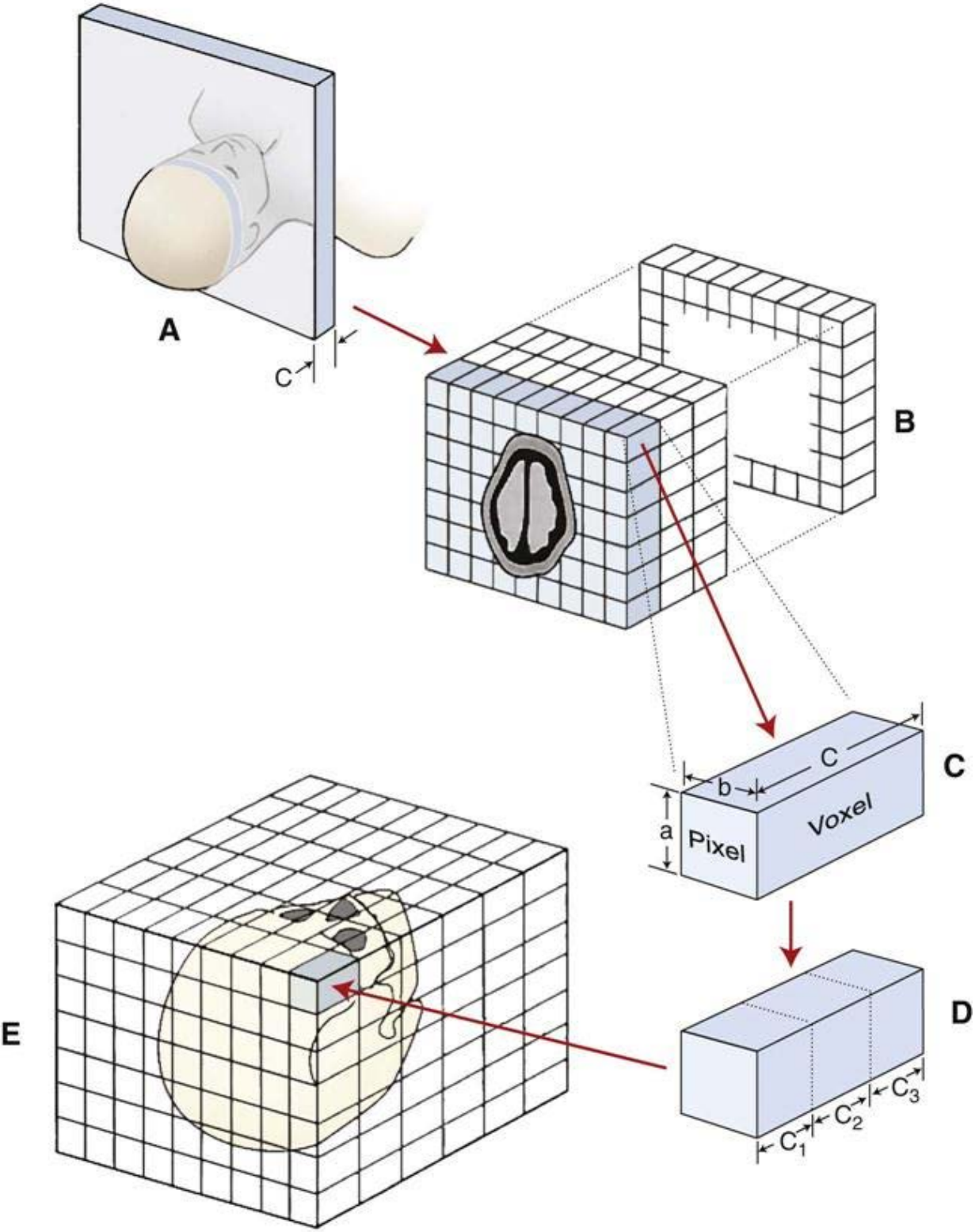
Challenges in Dynamic Contrast Enhanced Breast Imaging

1) Enhancing lesions result from Gd contrast agent "leaking" from poorly formed blood vessels within and around the malignant tumor.
2) The contrast agent shortens the T1 of the lesion relative to the surrounding normal tissues and thus may be detected as bright regions on *T1-weighted* images, provided there is adequate signal-to-noise (*SNR*).
3) The breast has significant adipose (fatty) tissues, also with short T1, thus create a significant background, *fat-suppression* is very important.
4) High *3D spatial resolution* for small-lesion detection and shape assessment.
5) Enhancement patterns are critical to differentiation of benign and malignant masses, *high temporal resolution* is essential.
6) Full *simultaneous coverage* of both breasts is needed for comparison.
7) Image *artifacts* must be minimized: motion (cardiac and breathing), out-of-volume wrap and non-uniform fat-suppression.

Unfortunately: SNR, spatial resolution, volume coverage and imaging time all compete with one other and artifact free images may be difficult to obtain.

An MR pulse sequence that can meet all of these technical requirements is a significant challenge.

- **Resolución espacial**
  - Máxima matriz possible
  - Pixel size 1-3 mm (0,5 x 0,5 o 1 x 1 mm.)
- **Adquisición en T1 en fase**
    - GRE (2D o 3D)
      - 3D: mayor contrste T1, TR corto, mayor SNR, cortes más finos
      - Angulo 25-50 (3D)
      - Imagen paralela
    - Imagen isotrópica - reconstrucción multiplanar -



Isotropia

What is the appropriate spatial resolution and SNR?

Basically, the answer is the best you can get and still maintain the necessary SNR and temporal sampling.

The ACR guidelines have stated:

1) < 1.0mm X 1.0mm in-plane pixel size
2) < 3 mm slice thickness (with no slice-gap)
3) "not too grainy"

Dynamic Bilateral Contrast-enhanced MR Imaging of the Breast: Trade-off between Spatial and Temporal Resolution[1]

Comparison: 1.25 X 1.25 mm pixel vs 0.6 X 0.8 pixels

1) Correctly upgraded BIRADS scores in 13 of 26 cancers
2) Correctly down-graded 10 of 28 benign lesions

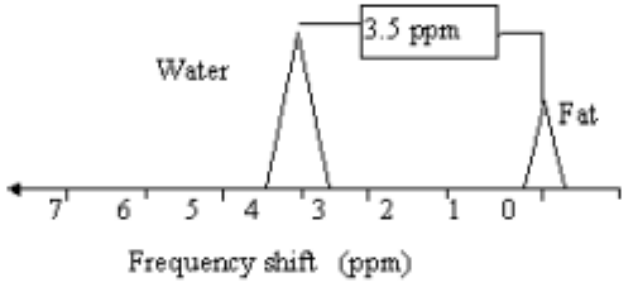
- **Estudio bilateral**
- **Supresión grasa**
  - NO comprometa Res Esp. ni Res temp
  - Sustracción matemática

. Reconstrucciones MPR

» **Siguiendo el lóbulo**

Frequency Selective Fat Suppression

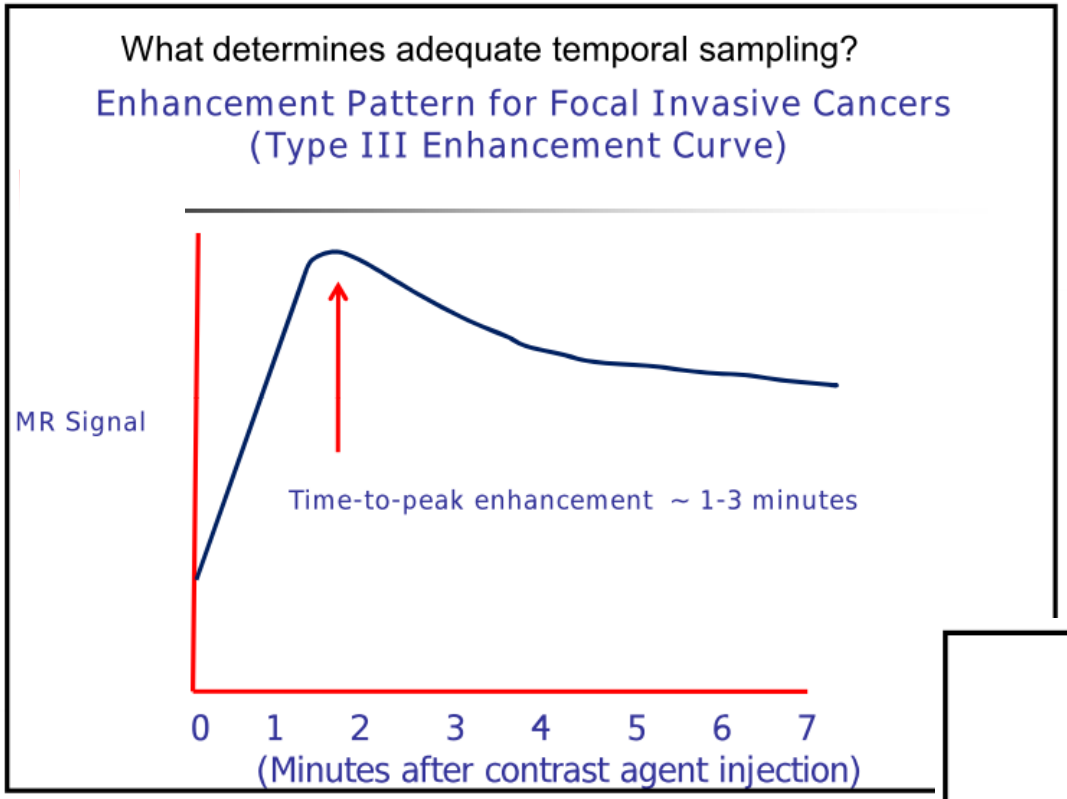
1) Pre-pulse centered at fat resonant frequency with RF-pulse bandwidth set for appropriate volume coverage
2) Nominal fat frequency located at 3.5 ppm below water frequency
3) Important to have homogeneous B0 field
4) B0 field will by affected by magnetic susceptibility of patient: Importance of good auto-shimming.

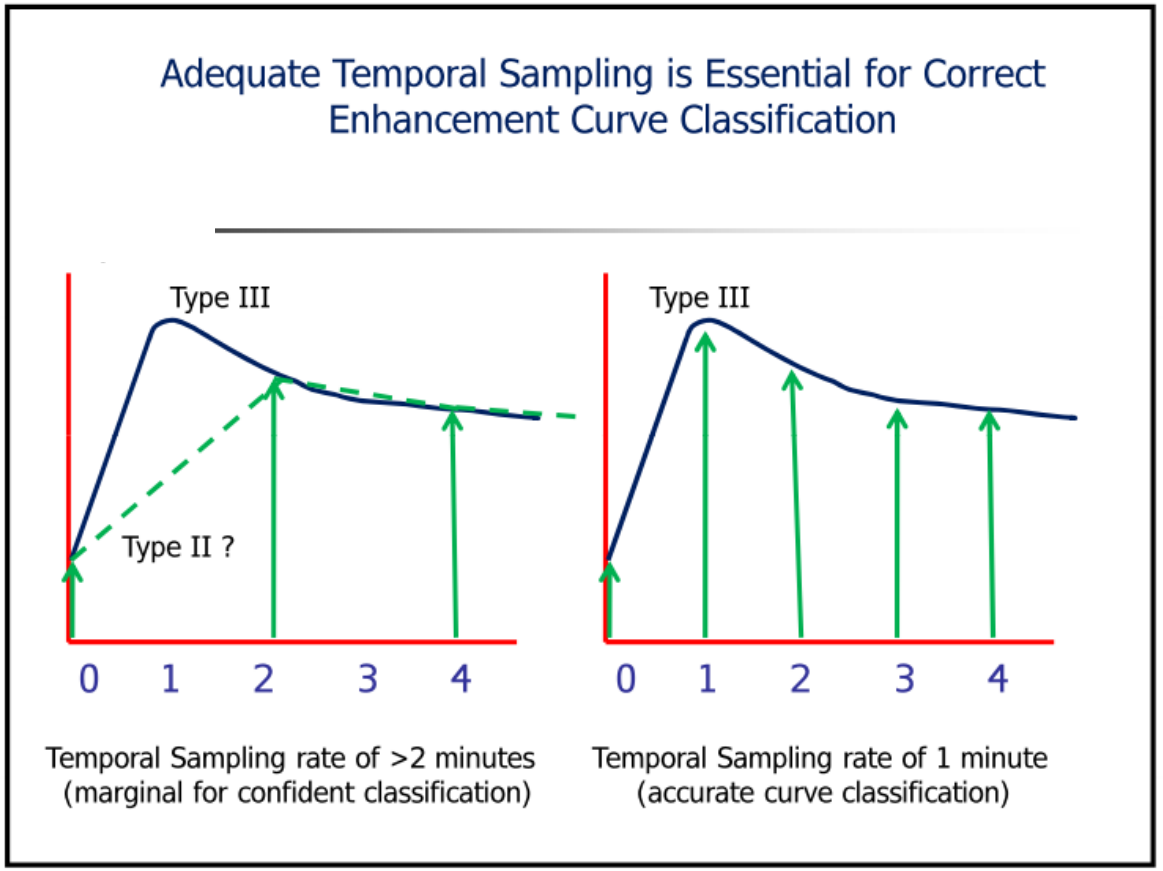


For: 1.5T = (64 X 10^6 Hz) X 3.5 pp/10^6

~ 220 Hz

For: 3T ~ 440 Hz





Ron Price Vanderbilt University Medical Center Vanderbilt University Medical Center Nashville, TN 37232

3D Fat-suppressed T1-weighted Gradient Echo Sequences
(Most 3D sequences will use centric k-space filling.)

General Electric	VIBRANT (Volume Image Breast Assessment)
Philips	THRIVE (T1 High-Res Isotropic Vol Excitation)
Siemens	VIEWS (fl3d, 3D-FLASH)
Aurora	RODEO (1993, Harms and Flamig)
Hitachi	TIGRE
Toshiba	RADIANCE

Typical Sequence Timing Parameters for T1-weighting:

TE/TR/ϕ	1-3 ms/4-6 ms/10^0-15^0
Acquisition time:	1-3 minutes

Accurate temporal sampling requires specific knowledge of the 3D pulse sequence being used.

1) Time of 3D gradient-echo volume acquisition (16-channel coil)
2) Method of k-space (spatial frequency) filling, e.g. sequential or centric.

Note: May need to contact vendor representative for some of this information.

$$\text{Acquistiton time} = \frac{\text{TR X slice phase matrix X in-plane phase matrix X NSA}}{\text{Parallel Imaging Undersampling (Acceleration) Factors}}$$

(SENSE, SMASH, GRAPPA ...)

Example: FOV = 250 mm, Matrix = 356 X 512 X 200 (SENSE)
TE/TR/ϕ = 3.2 ms/6.5 ms/10^0
In-plane phase matrix = 356 (0.7mm X 0.7mm)
Slice phase matrix = 200 (1-2 mm)
SPAIR (Spectrally selective Adiabatic IR) Fat-suppression

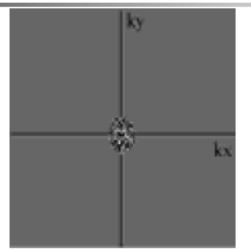
$$\text{Acq. Time} = \frac{0.0065 \text{ sec X } 200 \text{ X } 356}{2.8 \text{ (phase) X } 2.0 \text{ (slice)}} = 83 \text{ sec}$$

Ron Price Vanderbilt University Medical Center Vanderbilt University Medical Center Nashville, TN 37232

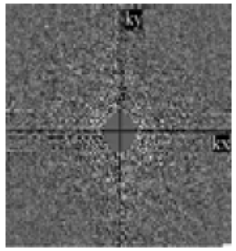
How k-space determines image content

Significance: Acquire center of k-space as contrast agent arrives to ensure maximum contrast enhancement.

Center - contrast



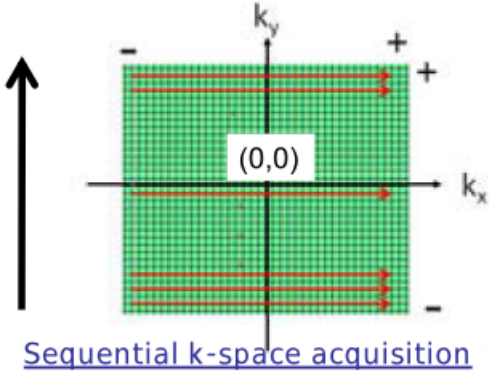
Periphery - resolution



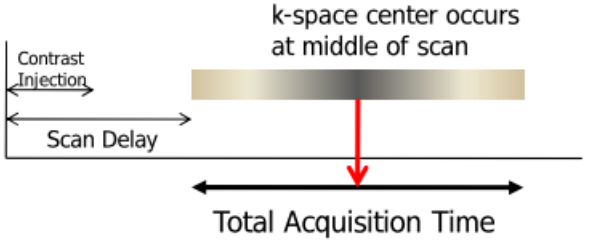
Mezrich R, A Perspective on k-Space: Radiology 1995; 195:297-315

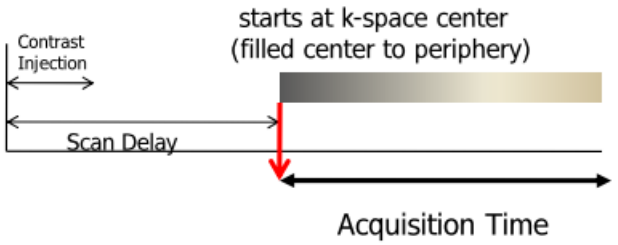
Paschal CB and Morris HD: k-space in the Clinic, JMRI 19(2) 145-159(2004)

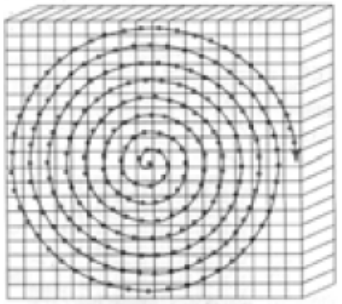
The center of k-space occurs when the zero-strength phase-encoding gradients are applied. For 3D phase encoding is applied in two directions: slice and in-plane phase.



Sequential k-space acquisition







Spiral or centric-elliptical (phase and slice) center-out for 3D k-space acquisition

Ron Price Vanderbilt University Medical Center Vanderbilt University Medical Center Nashville, TN 37232

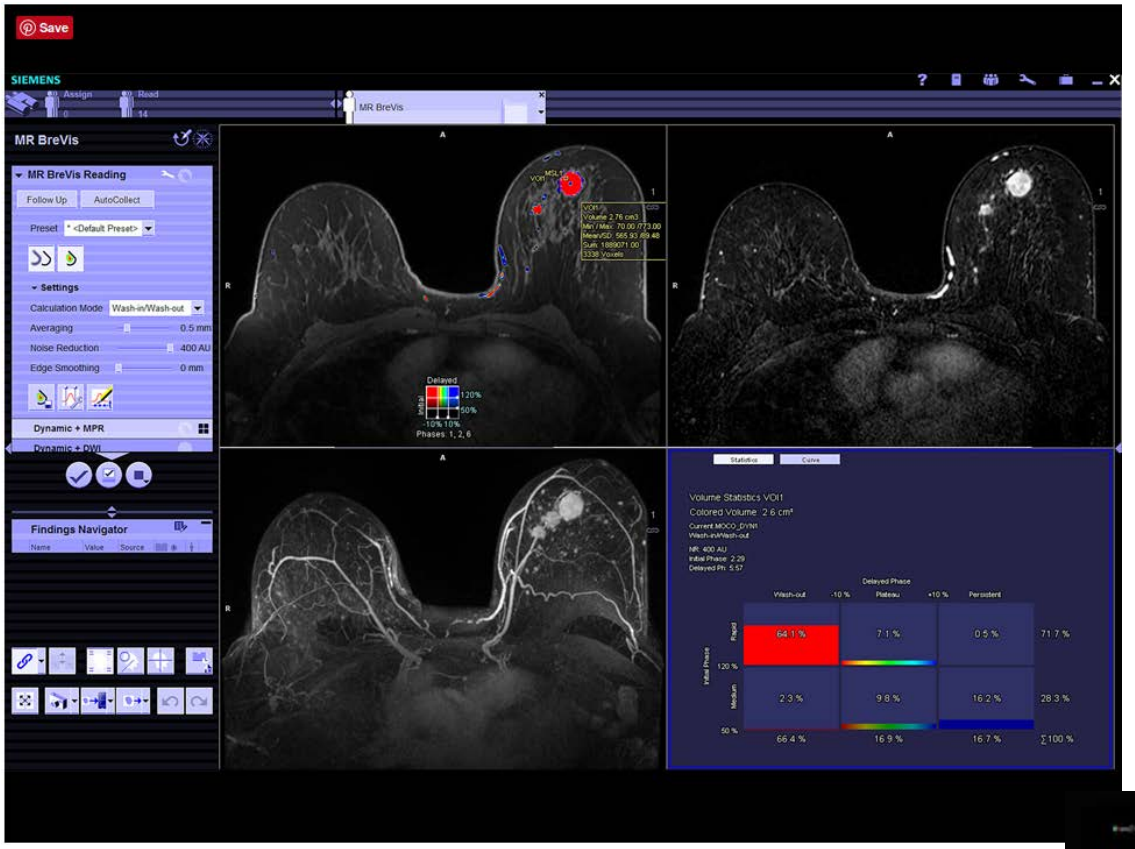
1. T1-sensitive pulse sequences and simultaneous bi-lateral breast coverage(3D Gradient Echo with shortest TE/TR)
2. High signal-to-noise coils (sensitivity)
3. High isotropic spatial resolution (less partial-volume/lesion detectability)
4. Fat suppression (background suppression/image contrast)
5. High temporal resolution (dynamic pattern definition)

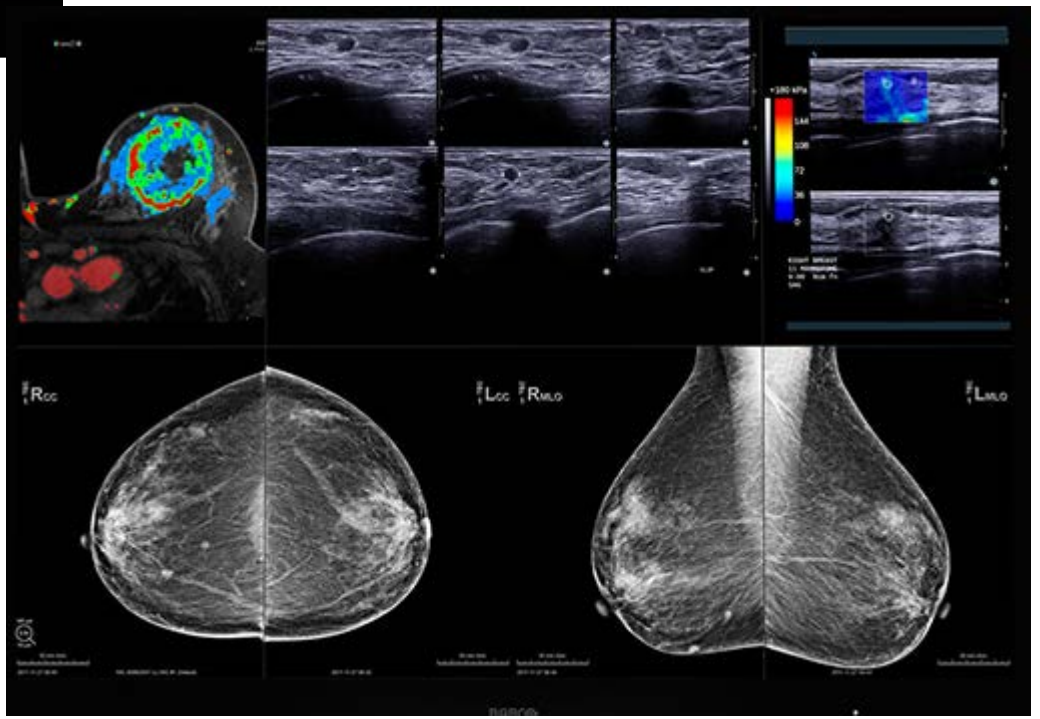
ACR Accreditation Pulse Sequence Requirements
www.acr.org

Sequence	Criteria
T2-Weighted/Bright Fluid Series	• Adequate SNR/not too grainy • Sufficient bright fluid contrast
Multi-Phase T1-Weighted Series:	
Pre-Contrast T1	• Adequate SNR/not too grainy
Early Phase (first) Post-Contrast T1	• Adequate SNR/not too grainy • Completed within 4 minutes of completion of injection • Technical factors match pre-contrast T1
Delayed Phase (last) Post-Contrast T1	• Adequate SNR/not too grainy • Technical factors match pre-contrast T1

For the pre-contrast and post-contrast T1-weighted series, the following parameters ***must*** be met:

Sequence	Slice Thickness	Gap	Maximum Recommended In Plane Pixel Dimension for Phase and Frequency
Sagittal, Axial and/or Coronal	≤3 mm	0 mm	≤1 mm





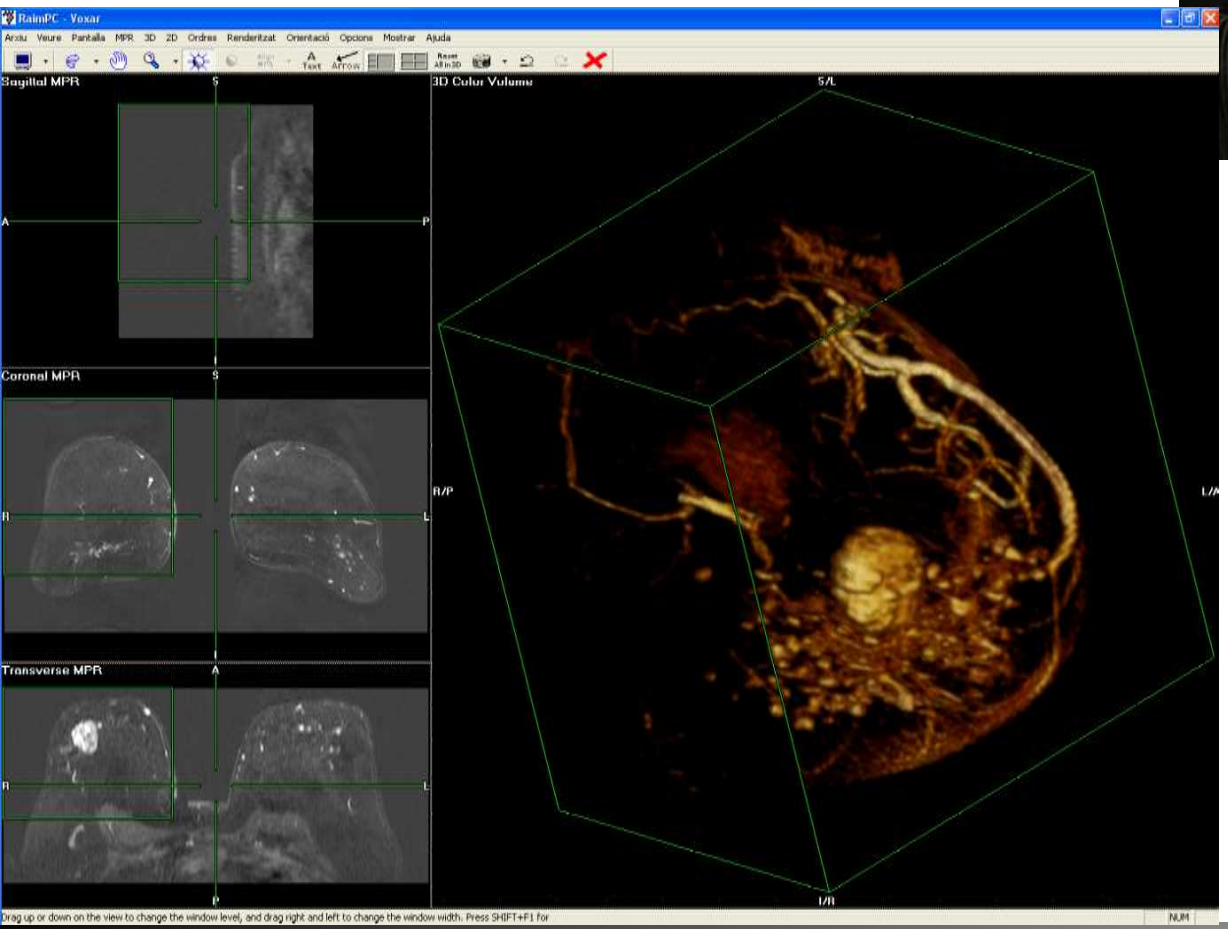
Correlación

Conclusions

Current imaging protocols for breast cancer assessment rely upon dynamic contrast enhanced (DCE) MRI to provide clearly detectable lesion enhancement as well as an accurate characterization of the lesion enhancement pattern.

To meet these clinical requirements, the technical elements for breast MRI are:

1)A dedicated breast-coil array to provide high SNR images and simultaneous coverage of both breasts.
2)Fat-suppressed, T1-weighted 3D multi-phase gradient echo sequences with high in-plane spatial resolution (< 1mm X 1mm), thin slices (< 3mm) and good temporal resolution (~ 60sec) made possible by using parallel imaging.
3)Post-processing capability should provide post-contrast injection subtraction images, multi-phase time-intensity curves and maximum intensity projection (MIP) for 3D viewing and vascular maps.


RainPC - Voxar
Arxiu Veure Pantalla MPR 3D 2D Ordres Renderitzat Orientació Opcions Mostrar Ajuda
Sagittal MPR
Coronal MPR
Transverse MPR
3D Color Volume
Drag up or down on the view to change the window level, and drag right and left to change the window width. Press SHIFT+F1 for
NUM

Pacientes que tengan cáncer

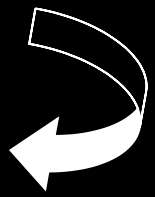
- Estudio de extensión locorregional

Componente *in situ* extenso

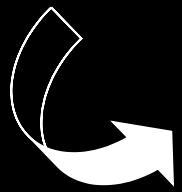
Determina la tasa de reexcisiones

Sensibilidad:
RM 98 % vs Mamografía 56%

n=167



"Los casos no detectados por RM, lo fueron por Mx"



"Todos los CDIS de alto grado que la Mx no identificó, se detectaron por RM"

Kuhl CK, Schrading S, Bieling HB et al. MRI for diagnosis of pure ductal carcinoma in situ: a prospective observational study. Lancet 2007;370(9586):485-92

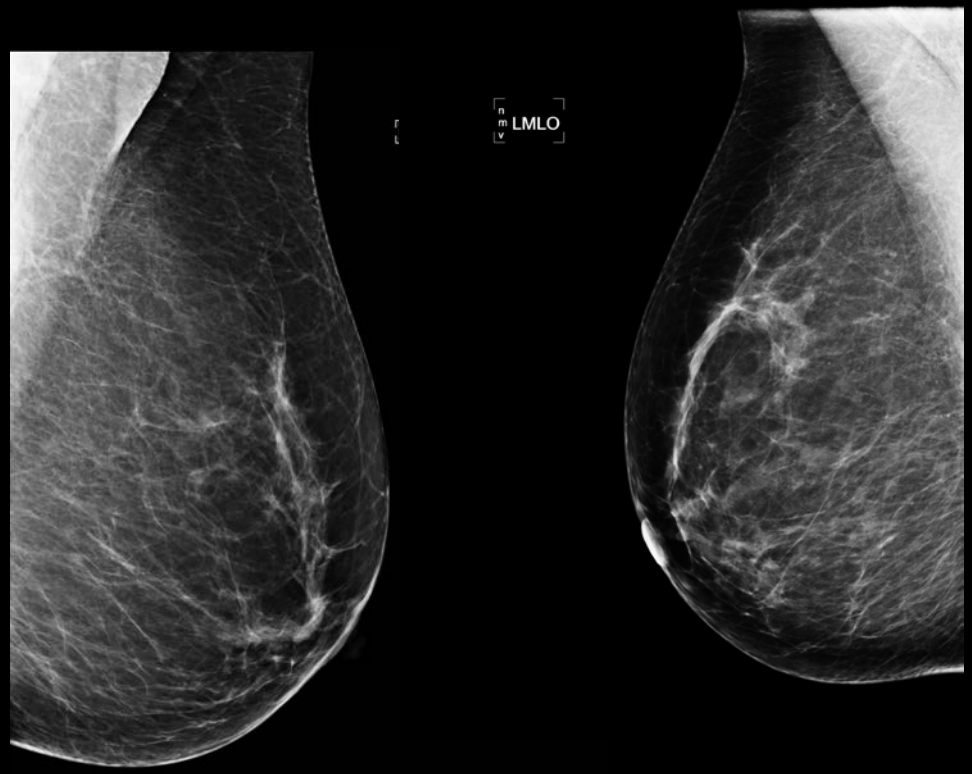
Oct 2008

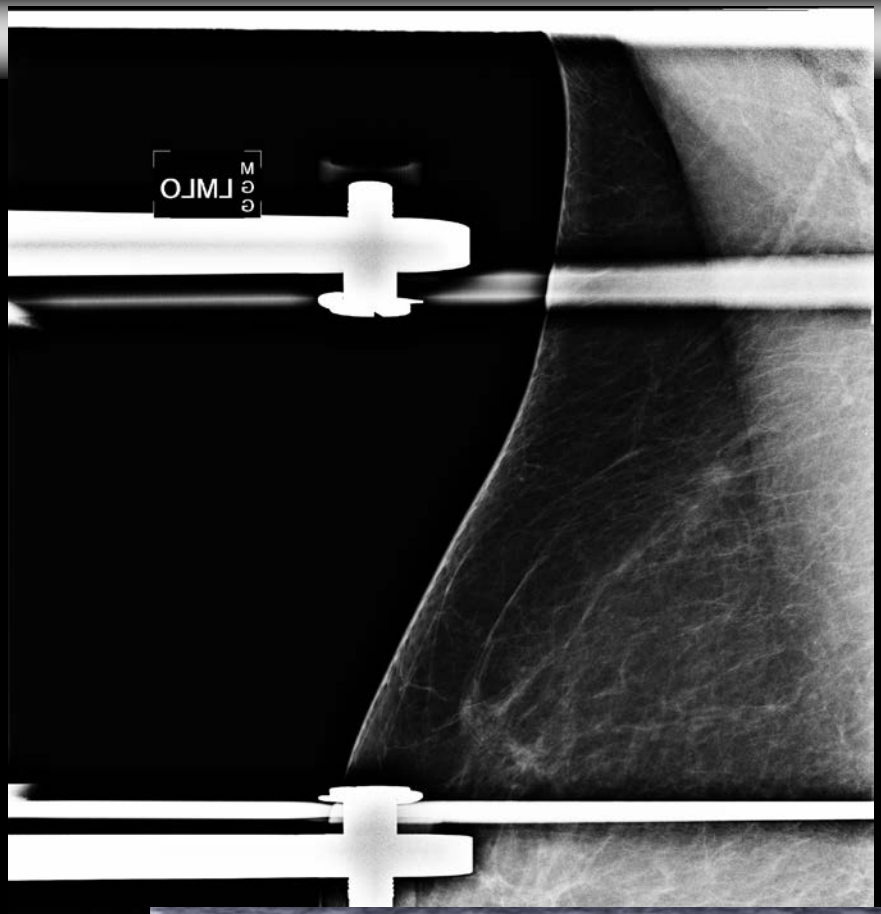
Oct 2012

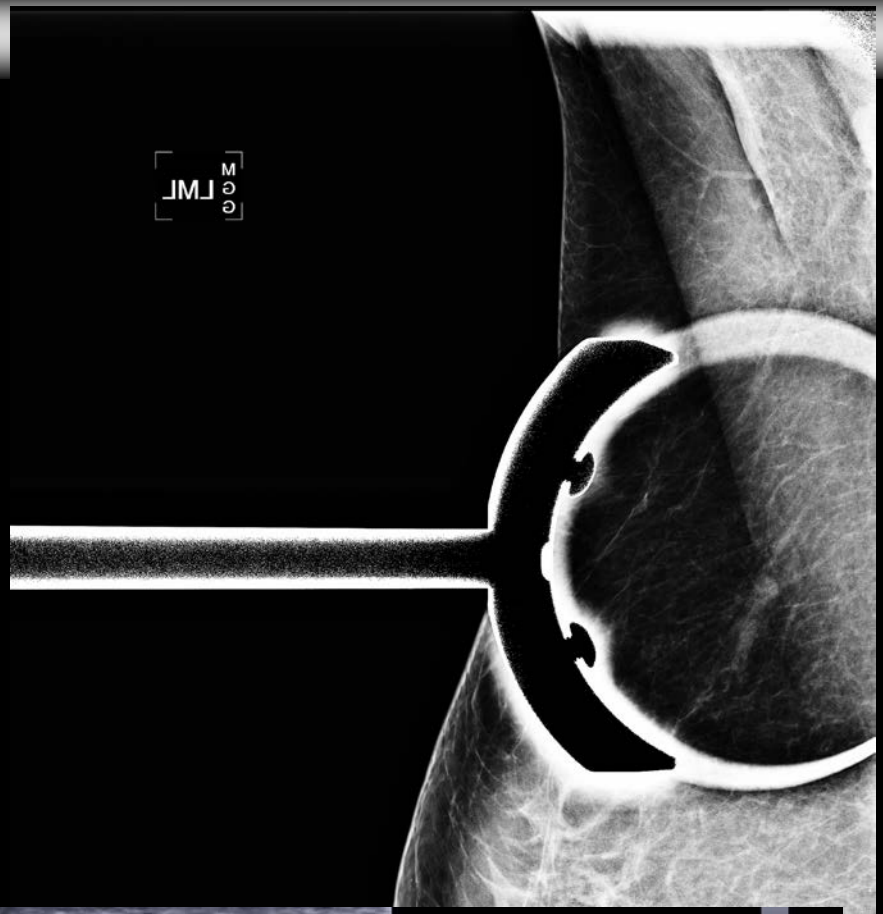
CASO

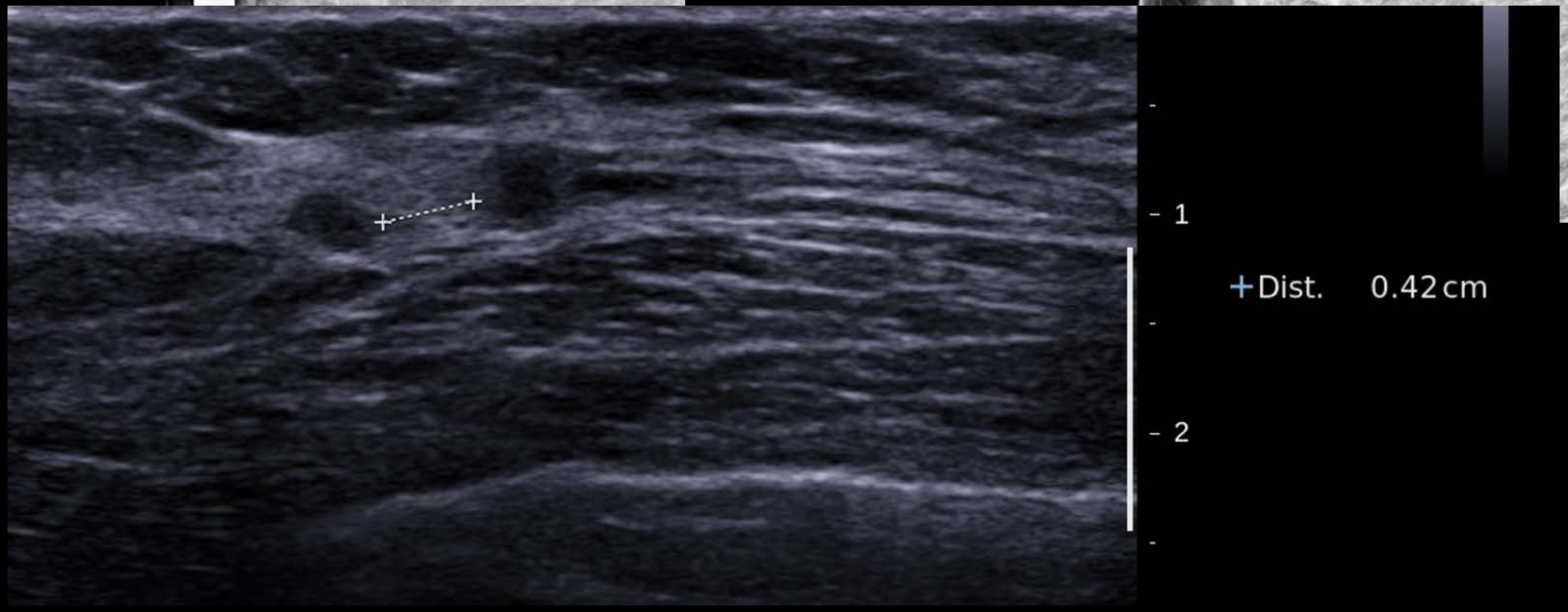
55 años.

Asintomática








1
2
Dist. 0.42 cm

ESTADIFICACIÓN

Resonancia Magnética (RM)

- Multifocalidad, Multicentricidad, Bilateralidad (Second-look ecográfico)

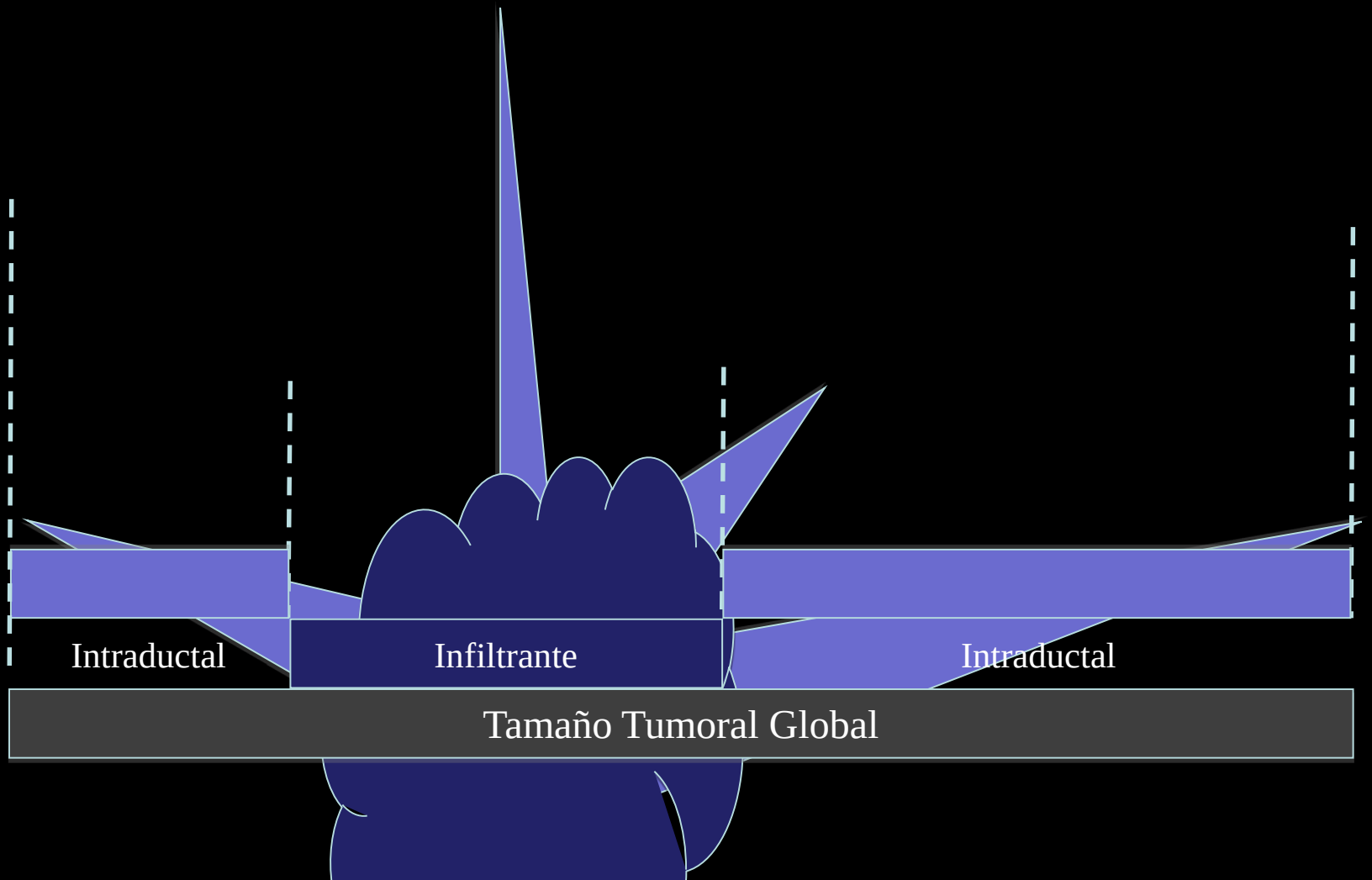
	Mx	Eco	RM
Multifocal	37%	41%	96%
Multicéntrico	18 %	9%	95%

- Técnica con mejor correlación radio-patológica para la determinación del tamaño (T). *La Mx y la Eco infraestiman el tamaño tumoral entre un 14-37% y 18-40% respectivamente.*
- Componente intraductal extenso no asociado a microcalcificaciones
- Adenopatías en cadena mamaria interna
- Muy sensible y poco específica (Biopsia!!!!)

ESTADIFICACIÓN

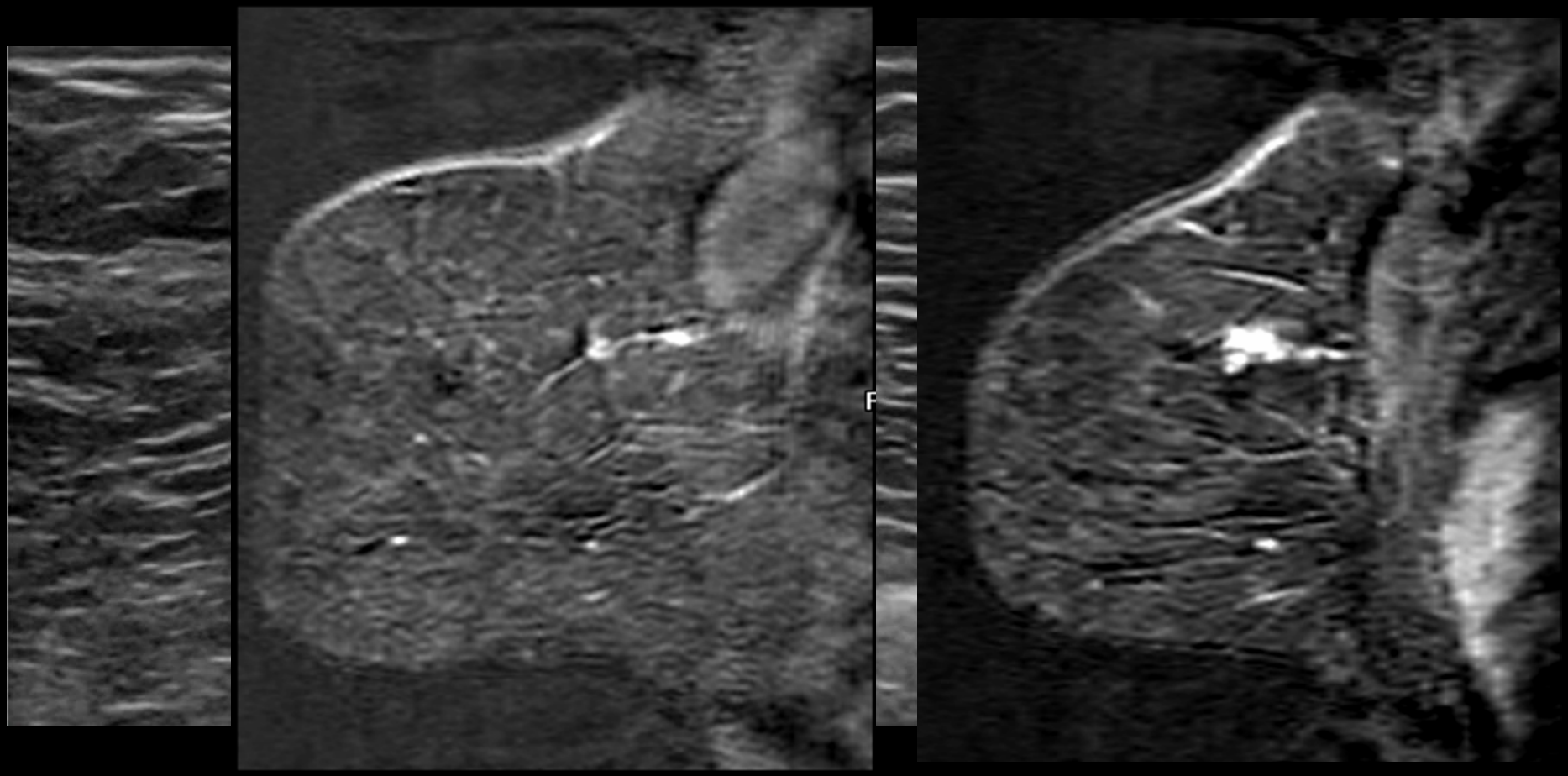
Componente intraductal extenso

- Es el componente “in situ” asociado al componente infiltrante.



CASO

55 años. Asintomática



Informe RM

En la prolongación axilar I se visualiza focos de captación diferenciada de morfologia nodular y bordes irregulares que se continua con una captación lineal anterior interna. Así mismo se evidencia otra área de captación de morfología lineal irregular que podría correspoder a componente intraductal discontinuo, midiendo globalmente 33x11x17mm (APxCCxLL).

CASO

55 años. Asintomática

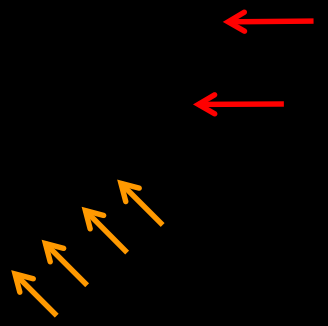
ROLL : Localicación del tumor + GC

CASO

55 años. Asintomática

Tratamiento Quirúrgico

Conservador: Tumorectomia + exceresis de GC



Estudio de Difusión - DWI

Probablemente el futuro

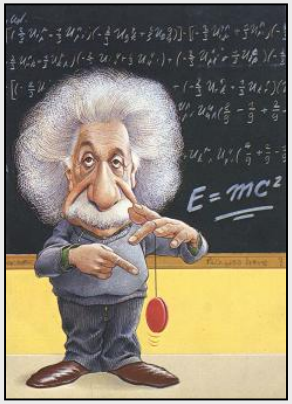
- Caracterización.
- Valoración respuesta
- Screening

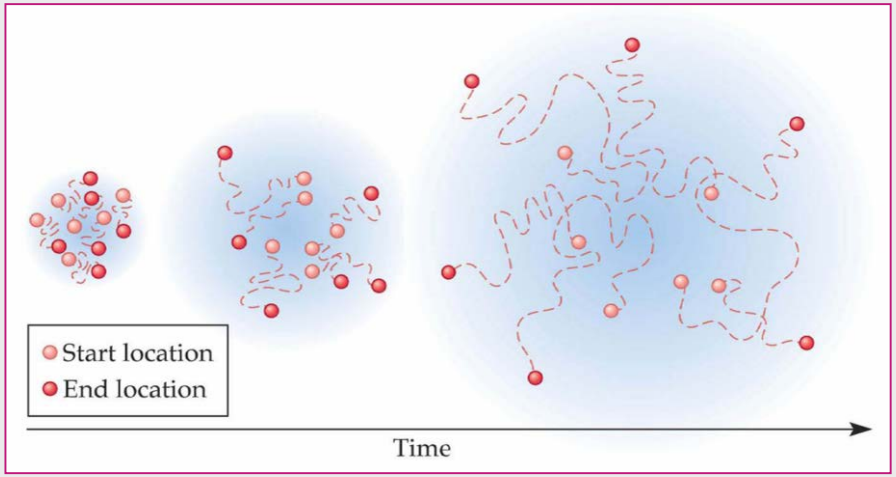
Estudio de Difusión - DWI

- **Difusión:**

Movimiento aleatorio, o **browniano,** de las moléculas en estado líquido. Dicho movimiento nace de la energía térmica de las moléculas que se disipa en forma de energía cinética. **Difusión libre**

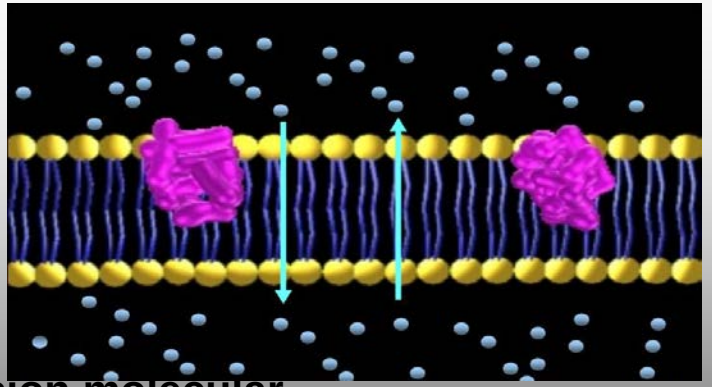
$$r^2=6Dt$$





- **Difusión por RM**

Detección del movimiento aleatorio de las moléculas de agua en los tejidos: **Difusión restringida**



La RM es el único método capaz de detectar y medir la difusión molecular in vivo, esto es, la traslación de las moléculas. ADC

BASES FÍSICAS

• Las técnicas de RM adaptadas a la difusión resultan sensibles a cualquier desplazamiento translacional:

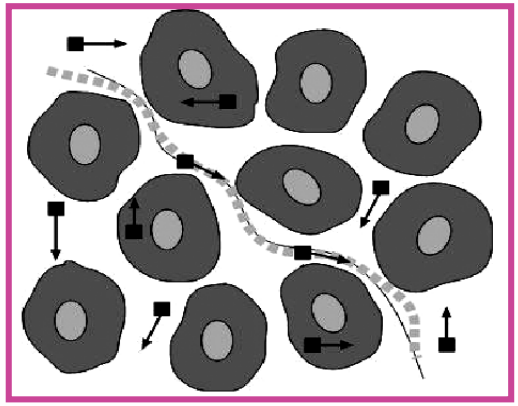
- Difusión libre **(D)**
- Otros mecanismos: perfusión tisular, transporte celular….

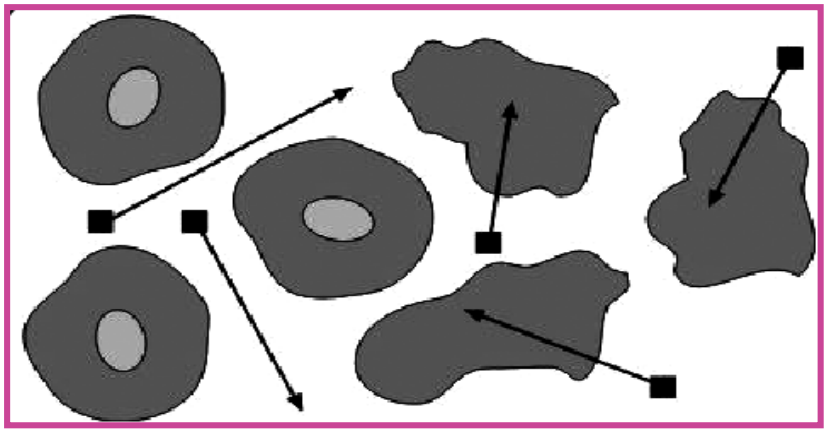
$$r^2 = 6Dt$$

• Señal de difusión de los tejidos:

- espacio extracelular
- espacio intracelular
- espacio intravascular

ADC





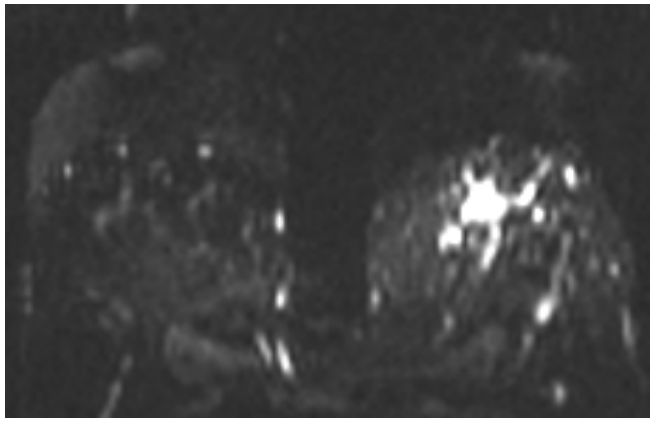
• La difusión RM es capaz de diferenciar el movimiento del agua intracel. del extracel.

BASES FÍSICAS

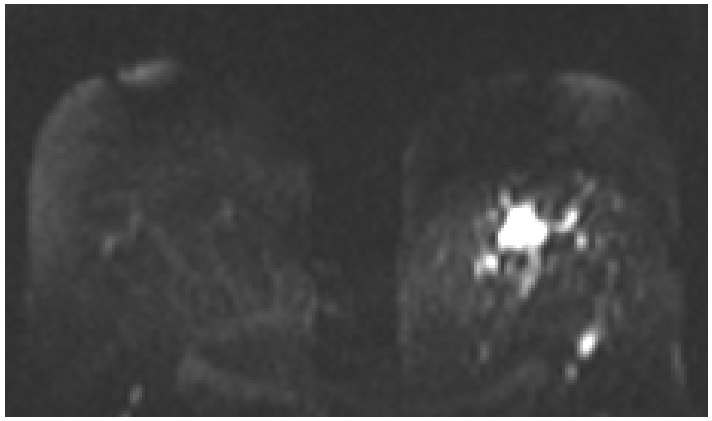
- **Análisis cualitativo:**

nolo

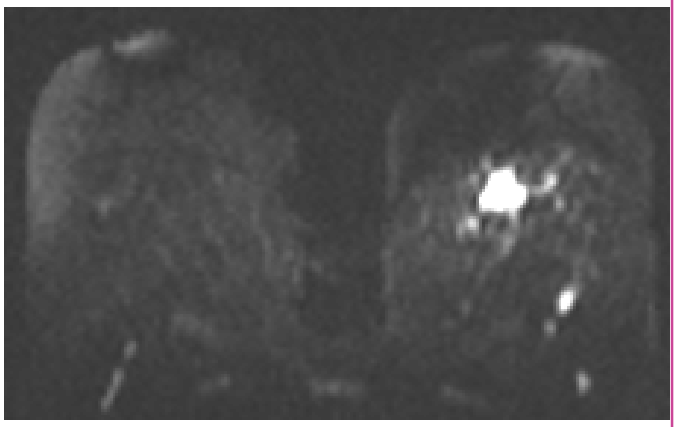
- Valor b bajo: buena relación S/R pero escasa ponderación en difusión (sensible)
- Valor b alto: menos relación S/R y más incremento de los efectos de discriminación de la difusión



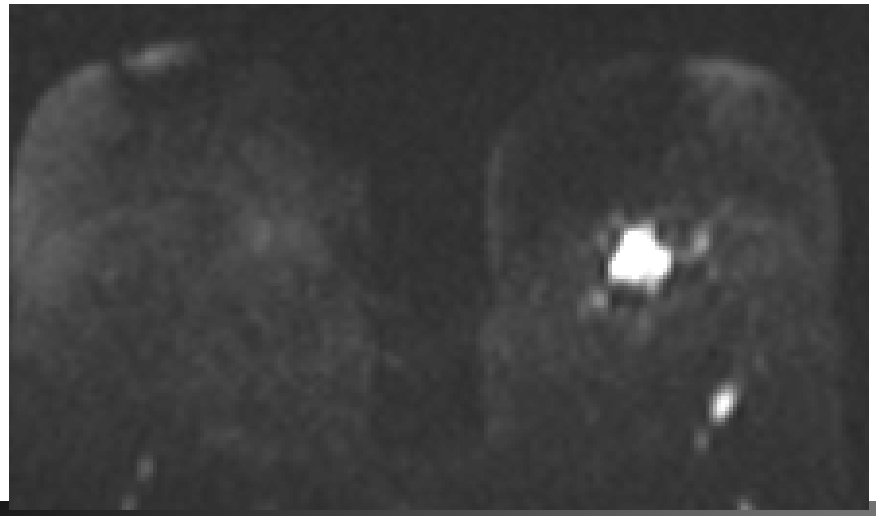
b0



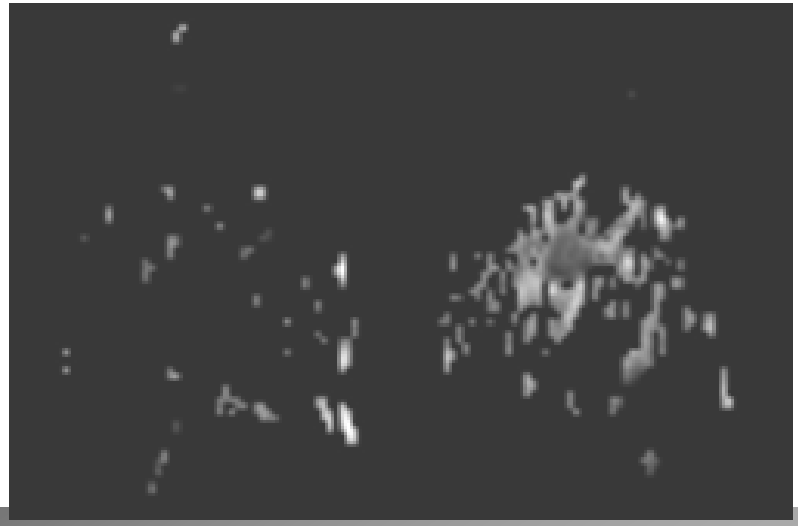
b400



b700



b1000



ADC

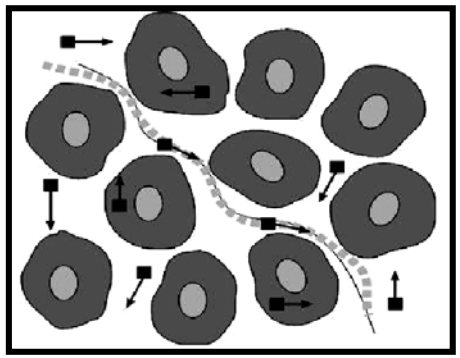
APLICACIONES CLÍNICAS: ¿CUÁNDO?

Seguimiento mama tratada: Predictor de respuesta precoz en QP

- ↑ precoz del ADC postratamiento **MEJOR RESPUESTA A QP**:

↑ movilidad de molec de agua

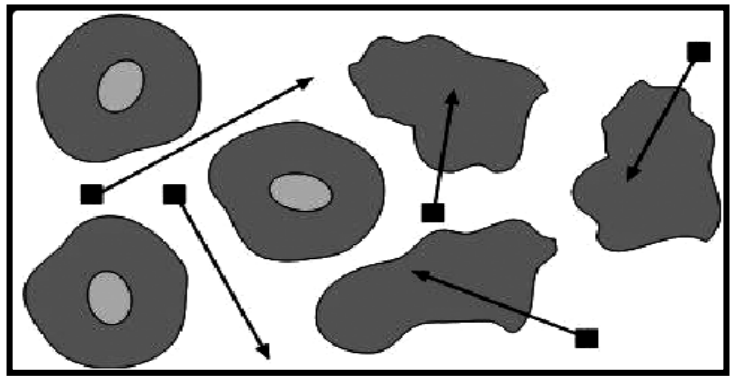
- aumento del fluido extracel. (por ↓ cel. lesión)
- pérdida integridad membranas (apoptosis/necr)



ADC ↓

Respuesta

Progresión



ADC ↑↑↑

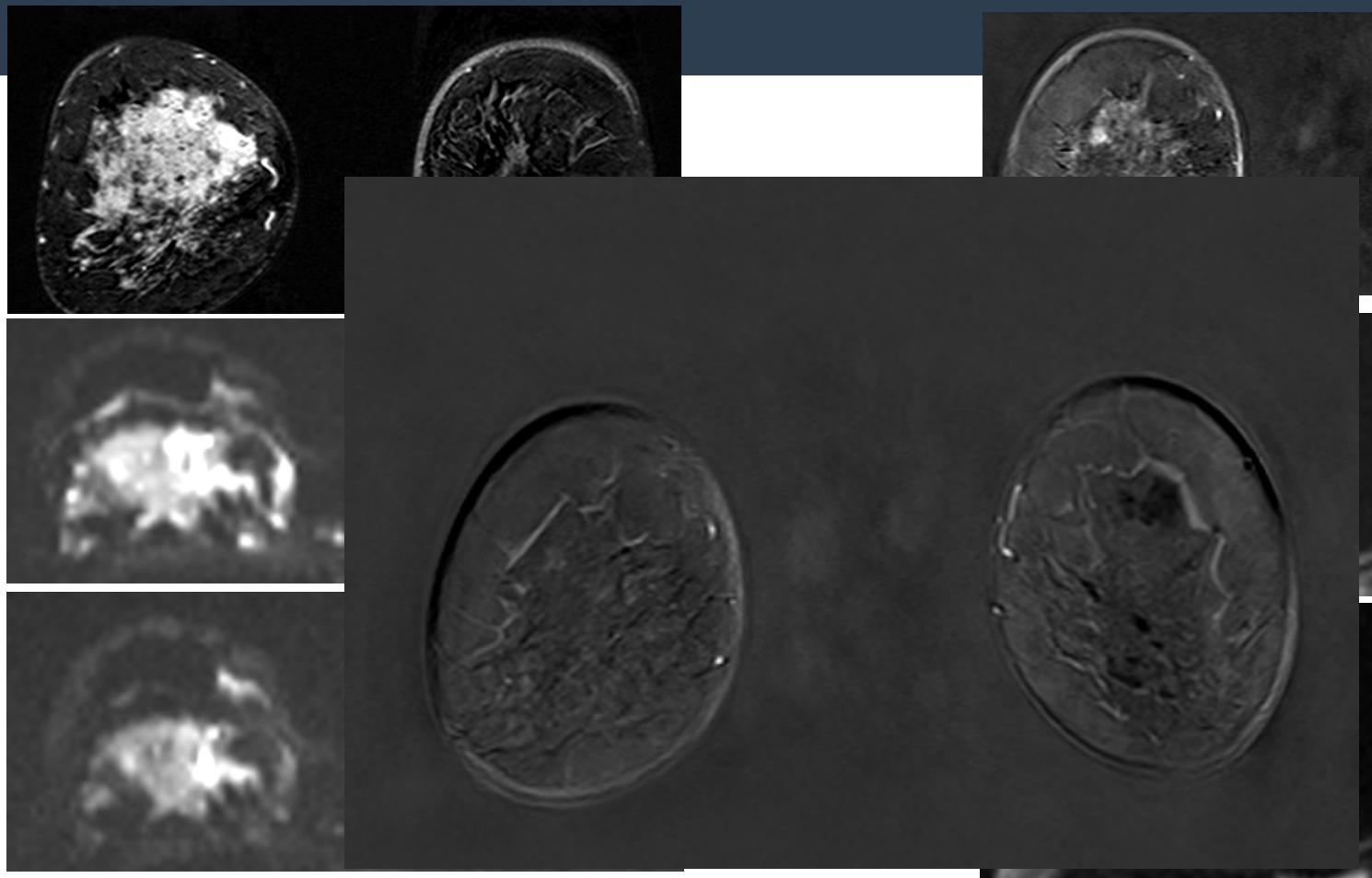
- ↓ del ADC postratamiento **PROGRESIÓN, EDEMA O FIBROSIS:**

↓ espacio extraceular por ↑ tamaño o número de las células

CAMBIOS PRECOCES **DIFUSIÓN BIOMARCADOR DE RESPUESTA**

APLICACIONES CLÍNICAS: ¿CUÁNDO?

Seguimiento mama tratada: Predictor de respuesta precoz en QP



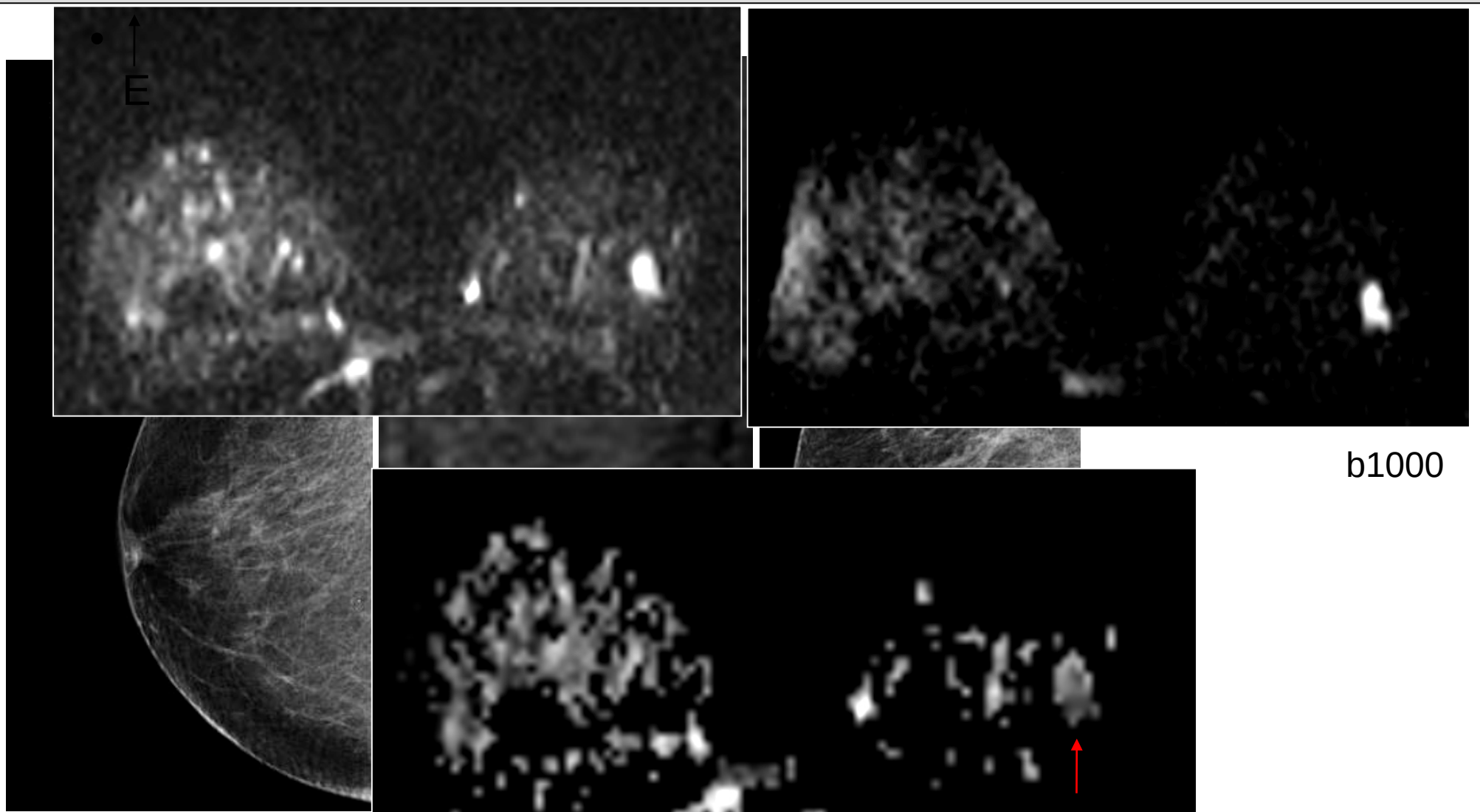
ADC

(0.69 x 10^{-3} mm2/s)

(2.1 x 10^{-3} mm2/s)

APLICACIONES CLÍNICAS: ¿CUÁNDO?

Seguimiento mama tratada: Diferenciación cambios postratamiento/recidiva



b1000

ADC (0.6 x 10^{-3} mm2/s)

Radiology

Neoadjuvant Systemic Therapy in Breast Cancer: Association of Contrast-enhanced MR Imaging Findings, Diffusion-weighted Imaging Findings, and Tumor Subtype with Tumor Response[1]

Gorane Santamaría, MD, PhD
Xavier Bargalló, MD, PhD
Pedro Luis Fernández, MD, PhD
Blanca Farrús, MD, PhD
Xavier Caparrós, MD
Martin Velasco, MD, PhD

Purpose: To investigate the performance of tumor subtype and various magnetic resonance (MR) imaging parameters in the assessment of tumor response to neoadjuvant systemic therapy (NST) in patients with breast cancer and to outline a model of pathologic response, considering pathologic complete response (pCR) as the complete absence of any residual invasive cancer or ductal carcinoma in situ (DCIS).

Advances in Knowledge

- Absence of late enhancement at MR imaging in breast tumors after neoadjuvant systemic therapy is significantly associated with pathologic complete response (pCR) in comparison to presence of this finding ($P < .001$).
- Apparent diffusion coefficient (ADC) ratio, a variable calculated by dividing posttreatment ADC and pretreatment ADC, was significantly higher in the pCR group (1.788) than in the nonresponders (1.487) ($P = .009$).
- A significant progressive increase in mean ADC ratio was observed depending on persistence of residual invasive carcinoma, residual ductal carcinoma in situ, or pCR (1.440, 1.743, 1.788, respectively) ($P < .001$).
- A model combining tumor subtype, late enhancement, and ADC ratio had the highest association with pathologic response, achieving an area under the curve of 92%.

Implication for Patient Care

- In the long term, a model combining tumor subtype, late enhancement, and ADC ratio might help identify patients in whom surgical therapy could be avoided.

Table 3

DW Imaging and ADC Findings according to Response

Finding	Non–Complete Responders ($n = 90$)	Complete Responders ($n = 21$)	*P* Value
Pretreatment ADC ($\times 10^{-3}$ mm²/sec)*	1.072 ± 0.231	1.025 ± 0.153	.549
Posttreatment ADC ($\times 10^{-3}$ mm²/sec)*	1.563 ± 0.471	1.812 ± 0.294	.011
ADC ratio	1.487 ± 0.473	1.788 ± 0.299	.009

Note.—Data are means ± standard deviations.

*ADCs were obtained by using the mean-value method.

Results Title

Velocidad

Inicialmente la accesibilidad era una limitante para el uso sistemático de la RM . Hoy solo el tiempo y el contraste son los retos

Radiomics

ORIGINAL ARTICLE HEALTH SERVICES RESEARCH AND POLICY

Fast MR

n = 568

An Abbreviated Protocol for High-Risk Screening Breast MRI Saves Time and Resources

Susan C. Harvey, MD[a], Phillip A. Di Carlo, MD[a], Bonmyong Lee, MD[a], Eniola Obadina, MD[a], Dorothy Sippo, MD[b], Lisa Mullen, MD[a]

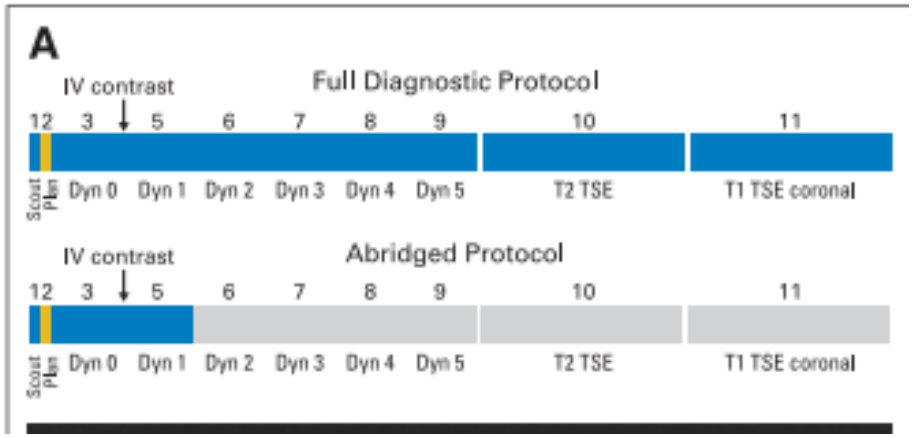
Full Diagnostic Protocol

Abreviated Protocol

- T1w FS pre and post CM
- Subtraction
- MIP

Abbrevia[redacted] is as effective as full-protocol MRI for demonstration of cancers in the high-risk screenin[redacted] with **only 12 (2.1 %) cases recommended for additional MRI evaluation**. The efficienc[redacted]ource savings of an abbreviated protocol would be significant, and would allow for opportunities to provide MRI for additional patients, as well as improved radiologist time management and workflow, with the potential to add real-time MRI interpretation or double reading.

Harvey, Susan C., Phillip A. Di Carlo, Bonmyong Lee, Eniola Obadina, Dorothy Sippo, and Lisa Mullen. “An Abbreviated Protocol for High-Risk Screening Breast MRI Saves Time and Resources.” Journal of the American College of Radiology 13, no. 11 (November 2016): R74–80. doi:10.1016/j.jacr.2016.09.031.



Abbreviated Breast Magnetic Resonance Imaging (MRI): First Postcontrast Subtracted Images and Maximum-Intensity Projection—A Novel Approach to Breast Cancer Screening With MRI

Christiane K. Kuhl, Simone Schrading, Kevin Strobel, Hans H. Schild, Ralf-Dieter Hilgers, and Heribert B. Bieling

Table 3. Diagnostic Indices

Index	MIP Images*		FAST Images		FDP	
	%	95% CI	%	95% CI	%	95% CI
First screening round (n = 443)						
Sensitivity	90.9	58.7 to 99.7	100.0	71.5 to 100.0	100.0	71.5 to 100.0
Specificity	NA	NA	94.4	91.8 to 96.4	94.9	92.4 to 96.8
PPV	NA	NA	31.4	16.9 to 49.3	33.3	18.0 to 51.8
NPV	99.7	98.2 to 100.0	100.0	99.1 to 100.0	100.0	99.1 to 100.0
Entire screening period (n = 606)						
Sensitivity	90.9	58.7 to 99.7	100.0	71.5 to 100.0	100.0	71.5 to 100.0
Specificity	NA	NA	94.3	92.1 to 96.0	93.9	91.7 to 95.7
PPV	NA	NA	24.4	12.9 to 39.5	23.4	12.3 to 38.0
NPV	99.8	98.7 to 100.0	100.0	99.3 to 100.0	100.0	99.3 to 100.0

Abbreviations: FAST, first postcontrast subtracted; FDP, full diagnostic protocol; MIP, maximum-intensity projection; NA, not applicable; NPV, negative predictive value; PPV, positive predictive value.

*MIP images were read as positive or negative depending on whether significant enhancement was observed; no actual differential diagnosis was attempted based on MIP images.

Kuhl, Christiane K., Simone Schrading, Kevin Strobel, Hans H. Schild, Ralf-Dieter Hilgers, and Heribert B. Bieling. “Abbreviated Breast Magnetic Resonance Imaging (MRI): First Postcontrast Subtracted Images and Maximum-Intensity Projection—A Novel Approach to Breast Cancer Screening With MRI.” Journal of Clinical Oncology 32, no. 22 (August 1, 2014): 2304–10. doi:10.1200/JCO.2013.52.5386.

Estudios Fast

Japanese Journal of Radiology
https://doi.org/10.1007/s11604-018-0731-6

ORIGINAL ARTICLE

Comparison of detectability of breast cancer by abbreviated breast MRI based on diffusion-weighted images and postcontrast MRI

Takayuki Yamada[1] · Yoshihide Kanemaki[2] · Satoko Okamoto[2] · Yasuo Nakajima[3]

Received: 12 January 2018 / Accepted: 21 March 2018

Abstract

Purpose To compare the detectability of unenhanced abbreviated magnetic resonance imaging (MRI) based on diffusion-weighted imaging (DWI) and abbreviated postcontrast MRI for breast cancer.

Methods The study population consisted of 87 patients undergoing breast MRI between December 2016 and March 2017 in a clinical setting. All breast MRIs were performed using a 1.5-T MRI scanner with a 16-channel breast radiofrequency coil. The abbreviated protocols based on DWI (AP1) and postcontrast MRI (AP2) were assessed independently by two radiologists. Sensitivity and specificity were calculated. Receiver operating characteristic analysis was performed and the areas under the curves (AUCs) were compared between AP1 and AP2.

Results The study included 87 patients with 89 breast cancer lesions ≤2 cm in diameter. The sensitivity/specificity for AP1 and AP2 for reader 1 was 89.9/97.6% and 95.5/90.6%, respectively, and those for reader 2 was 95.5/94.1% and 98.9/94.1%, respectively. The AUCs for AP1 and AP2 for reader 1 were 0.9629 and 0.9640 ($p = 0.95$), respectively, and those for reader 2 were 0.9755 and 0.9843 ($p = 0.46$), respectively.

Conclusions The detectability of the unenhanced abbreviated protocol based on DWI would be comparable to that of abbreviated postcontrast MRI for breast cancer.

Clinical Imaging 53 (2019) 169–173

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journal homepage: www.elsevier.com/locate/clinimag

Breast Imaging

Abbreviated protocol breast MRI: The past, present, and future

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ARTICLE INFO

ABSTRACT

Breast MRI has been shown to be the most sensitive examination in the detection of breast cancer. However, given the high associated costs, its use in the screening setting has traditionally been limited to those who are at high-risk for breast cancer. Abbreviated protocol breast MRI is capable of reducing the traditional costs associated with breast MRI, while maintaining diagnostic accuracy and cancer detection, and therefore a potential future screening tool for breast cancer in a broader population of women than just those at high-risk. New techniques, such as Ultrafast breast MRI, are able to not only shorten the traditional breast MRI acquisition and interpretation time, but also provide kinetic information.

Sensitivity and Specificity of FDP vs. AP.

	Sensitivity (%)		Specificity (%)	
	FDP	AP	FDP	AP
Kuhl et al. [20]	100	100, 90.9[a]	93.9	94.3
Mango et al. [21]	n/a	96, 93[a]	n/a	n/a
Heacock et al. [22]	n/a	97.8[b], 99.4[c],99.4[d]	n/a	n/a
Grimm et al. [23]	95	86[b], 89[c]	52	52[b], 45[c]
Harvey et al. [24]	n/a	100	n/a	n/a
Moschetta et al. [25]	92	89	92	91
Oldrini et al. [26]	100[e], 100[f]	100[e], 100[f]	91.5[e], 94.4[f]	91.5[e], 95.1[f]
Choi et al. [27]	n/a	100	n/a	89.2

Select patient and pathology information.

Study	Number of patients	Number of MRI examinations	Cancer detection rate (/1000)	Number of invasive carcinomas	Number of DCIS
Kuhl et al. [20]	443	606	18.2	7	4
Mango et al. [21]	100	100	n/a	79	21
Heacock et al. [22]	107	107	n/a	94	13
Grimm et al. [23]	48	48	n/a	9	3
Harvey et al. [24]	505	568	12.3	5	2
Moschetta et al. [25]	470	470	n/a	69	0
Oldrini et al. [26]	90	90	n.a	25	1
Choi et al. [27]	725	799	15.0	7	5

Table 1
Fast abbreviated breast MRI protocols.

Study	Tesla	Protocol 1	Protocol 2	Protocol 3
Kuhl et al. [20]	1.5 T	Subtraction MIP	Protocol 1 PLUS Axial T1W gradient echo pre-contrast Axial T1W gradient echo post-contrast First post-contrast subtracted (FAST) images	
Mango et al. [21]	1.5 T, 3.0 T	Sagittal fat-suppressed T1W Sagittal fat-suppressed 1st T1W post-contrast Sagittal fat-suppressed 1st T1W post-contrast Subtraction Subtraction MIP		
Heacock et al. [22]	3.0 T	Sagittal non-contrast T1W Sagittal 1st post-contrast T1W Sagittal 1st post-contrast T1W Subtraction	Protocol 1 PLUS Clinical history provided Prior imaging	Protocol 2 PLUS Pre-contrast T2W fat-suppressed non-contrast
Grimm et al. [23]	1.5 T, 3.0 T	Fat-saturated pre-contrast T2W Pre-contrast T1W 1st fat-saturated T1 post-contrast	Protocol 1 PLUS 2nd T1W post-contrast	
Harvey et al. [24]		Axial pre-contrast fat-saturated T1W Axial post-contrast fat-saturated T1W Axial post-contrast fat-saturated T1W Subtraction Axial post-contrast fat-saturated T1W Subtraction MIP		
Moschetta et al. [25]	1.5 T	Short T1 inversion recovery (STIR) Turbo-spin-echo (TSE)-T2W Pre-contrast T1-weighted high-resolution isotropic volume (THRIVE) 1st Post-contrast THRIVE		
Oldrini et al. [26]	3.0 T	Sagittal three-dimensional Gradient Echo T1W dynamic VIBRANT pre-contrast 1st Sagittal three-dimensional Gradient Echo T1W dynamic VIBRANT post-contrast Subtraction		
Choi et al. [27]	1.5 T, 3.0 T	Sagittal fat-suppressed T2W fast spin-echo Sagittal T1W fat-suppressed fast spoiled gradient echo pre-contrast Sagittal T1W fat-suppressed fast spoiled gradient echo post-contrast Subtraction images MIP		

EA1141 Trial

Abbreviated Breast MRI and Digital Tomosynthesis Mammography in Screening Women With Dense Breasts

Experimental: Arm A (DBT, AB-MR)
Participants undergo DBT followed by AB-MR for under 10 minutes on the same day or within 24 hours at baseline and then after 1 year.

Experimental: Arm B (AB-MR, DBT)
Participants undergo AB-MR for under 10 minutes followed by DBT on the same day or within 24 hours at baseline and then after 1year.

After this they will return to
regular mammography screening for 3 years

Supplemental Breast MR Imaging Screening of Women with Average Risk of Breast Cancer[1]

Christiane K. Kuhl, MD, PhD
Kevin Strobel, MD
Heribert Bieling, MSc
Claudia Leutner, MD
Hans H. Schild, MD, PhD
Simone Schrading, MD, PhD

Purpose: To investigate the utility and accuracy of breast magnetic resonance (MR) imaging as a supplemental screening tool in women at average risk for breast cancer and to investigate the types of cancer detected with MR imaging screening.

Materials and Methods: This prospective observational study was conducted at two academic breast centers in women aged 40–70 years without breast cancer–associated risk factors (lifetime risk <15%). Between January 2005 and December 2013, women with at least minimal residual breast tissue (American College of Radiology categories A–D) and normal conventional imaging findings (screening mammography with or without screening ultrasonography [US]) were invited to undergo supplemental MR imaging screening. Outcome measures were supplemental cancer detection rates, interval cancer rates, and biologic profiles of MR imaging–detected additional cancers, as well as specificity and positive predictive value (PPV) of MR imaging screening. Tissue diagnoses or 2 years of follow-up were used to establish the reference standard.

Since we aimed to investigate the supplemental cancer yield of MR imaging, the first screening round included only women with negative screening mammograms and US studies. However, also during the 1741 subsequent screening rounds, 12 of the total 13 incidence screening cancers were detected with MR imaging alone; none were detected with mammography only or US only.

2120 dones = 3861 estudis MR

60 cáncers

DCIS= 20

Infiltrants = 40

CDR: 15.5 / 1000 (95% CI CI: 11,9 , 20)

ronda prevalent — 48 screening inicial

CDR: 22,6 /1000

ronda incident — 12 de 13 **MR alone**

CDR: 6,9 /1000

***1 Ca amb 3 modalitats

CAP -0- es va diagnosticar amb MX o US solsament

Mediana mida : 8 mm

G- 93,4 %

Alt grau

ronda prevalent :

41,7%

ronda incident :

46%

NO INTERVAL CANCER

Screening amb RM

Especificitat: **97,1** % 95% CI: 96.5 , 97.6

VPP : **35,7** % 95% CI: 28.9 . 43.1

Conclusion:	In women at average risk for breast cancer, MR imaging screening improves early diagnosis of prognostically relevant breast cancer.

DWI avanzada

Progresos en las técnicas de difusión que se basab en refinar la adquisición y el procesado matemático de los datos obtenidos.

- IVIM
- Kurtosis

DCE-MRI: Sens 90 % Esp 78 %
DWI: Sens 92.8 % Esp 96.7 %

El movimiento «in vivo» de las moléculas de agua se influencia por:

- Estructura del tejido.
- Difusión de las moléculas de agua.
- Microcirculación de la sangre en la red microcapilar.

IVIM **I**ntra**V**oxel **I**ncoherent **M**otion.

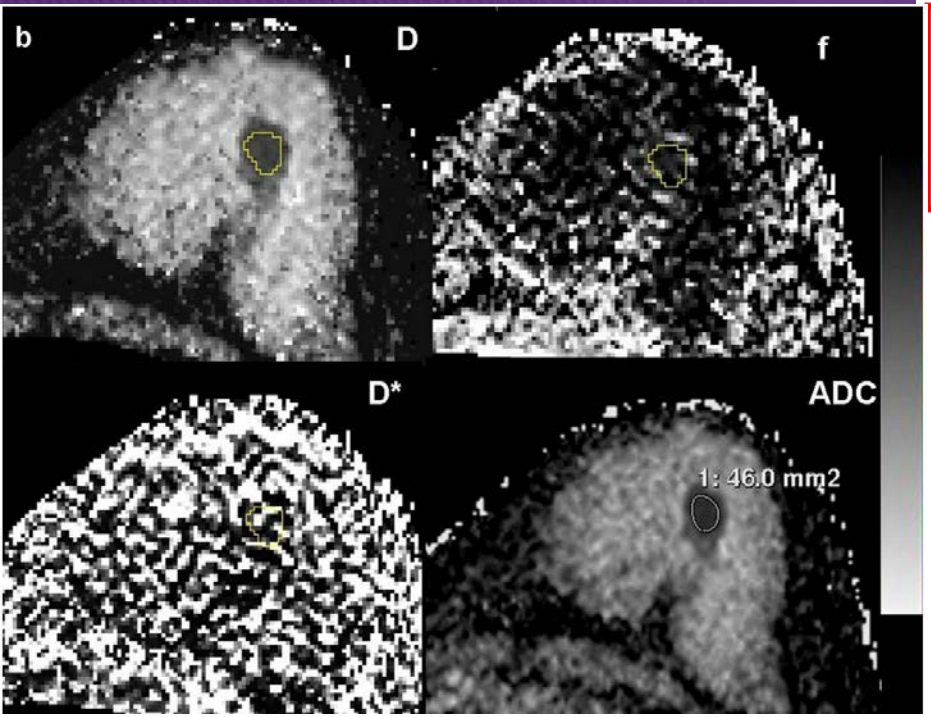
Tecnica de DWI que valora separadamente:

- Perfusión tisular
- Difusividad

Se obtienen:

- Coeficiente de difusión puro (**D**)
- Perfusión relacionada con la microcirculacion incoherente (**D***)
- Volumen de la fracción microvascular (**f**)

Liu, Chunling, Changhong Liang, Zaiyi Liu, Shuixing Zhang, and Biao Huang. “Intravoxel Incoherent Motion (IVIM) in Evaluation of Breast Lesions: Comparison with Conventional DWI.” European Journal of Radiology 82, no. 12 (desembre 2013): e782–89. doi:10.1016/j.ejrad.2013.08.006.



$$\frac{S_b}{S_0} = (1-f)\exp(-bD) + f\exp[-b(D*+D)]$$

S_b : Intensidad de señal en el pixel con un gradiente de difisión b

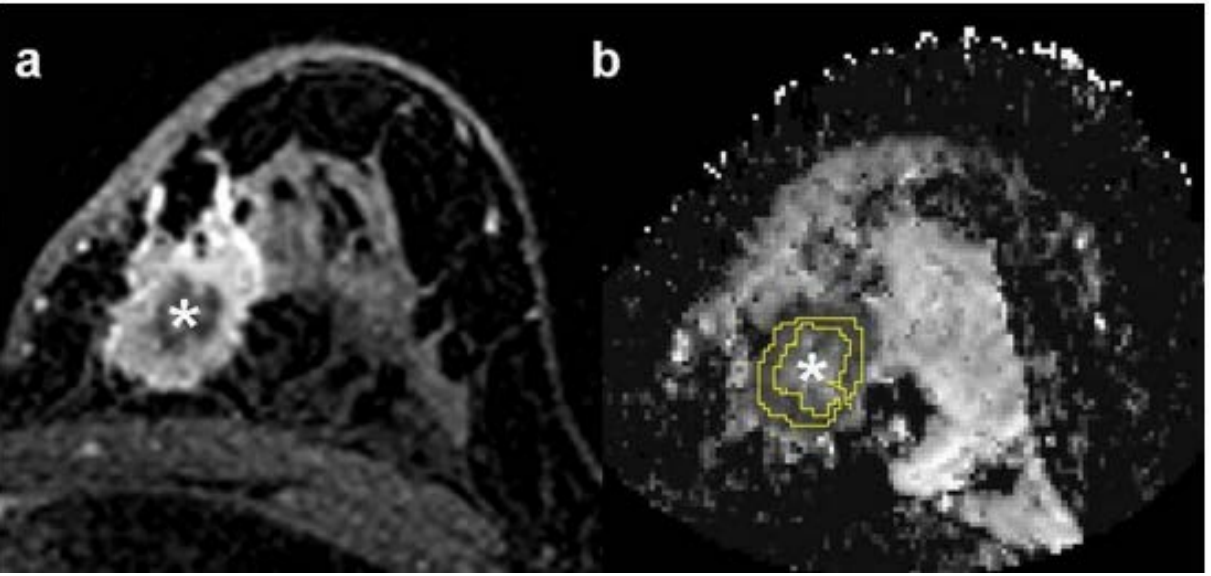
S_0 : Intensidad de señal en el pixel sin gradiente de difusión

D : difusión pura

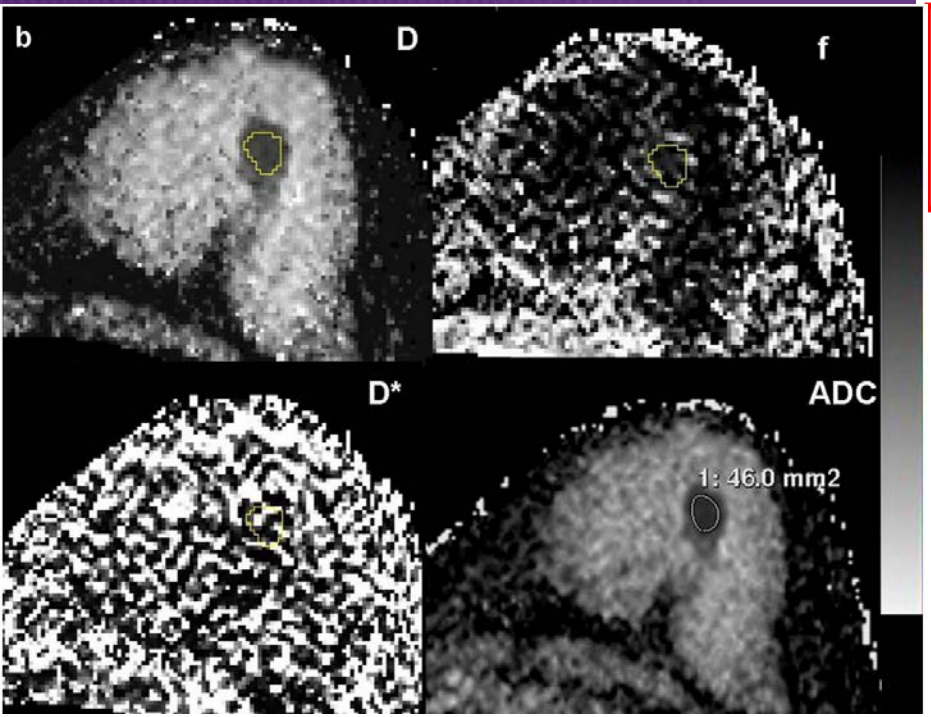
D* : coeficiente de pseudodifusión -perfusión relacionada con la difusión o microcirculación incoherente.

Diagnostic abilities of IVIM parameters and ADC values.

	Sensitivity (%)	95% CI	Specificity (%)	95% CI
$D \leq 1.06$ ($\times 10^{-3}$ mm^2/s)	90	76.3–97.2	92.68	80.1–98.5
$f \geq 6.93$ (%)	87.50	73.2–95.8	53.66	37.4–69.3
$D^* \leq 119.14$ ($\times 10^{-3}$ mm^2/s)	85.00	70.2–94.3	41.46	26.3–57.9
ADC ≤ 1.18 ($\times 10^{-3}$ mm^2/s)	92.50	79.6–98.4	90.24	76.9–97.3



Liu, Chunling, Changhong Liang, Zaiyi Liu, Shuixing Zhang, and Biao Huang. “Intravoxel Incoherent Motion (IVIM) in Evaluation of Breast Lesions: Comparison with Conventional DWI.” European Journal of Radiology 82, no. 12 (desembre 2013): e782–89. doi:10.1016/j.ejrad.2013.08.006.



$$\frac{S_b}{S_0} = (1-f)\exp(-bD) + f\exp[-b(D*+D)]$$

S_b : Intensidad de señal en el pixel con un gradiente de difisión b

S_0 : Intensidad de señal en el pixel sin gradiente de difusión

D : difusión pura

D* : coeficiente de pseudodifusión -perfusión relacionada con la difusión o microcirculación incoherente.

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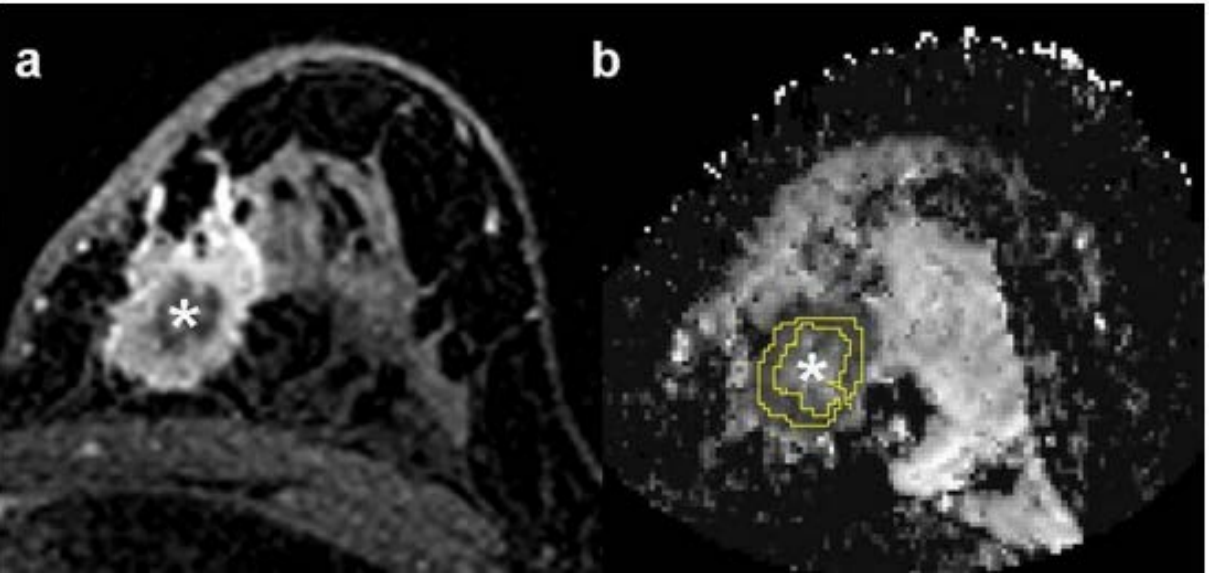

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ORIGINAL RESEARCH

Intravoxel Incoherent Motion MRI for the Differentiation of Benign, Intermediate, and Malignant Solid Soft-Tissue Tumors

Haijun Wu, MD,[1]* Shuixing Zhang, MD,[1] Changhong Liang, MD,[1] Hui Liu, MD,[1] Yanhui Liu, MD,[2] Yingjie Mei, MS,[3] Hongjun Liu, MD,[1] Zaiyi Liu, MD,[1] and Fangping Xu, MD[2]

Int J Clin Exp Med 2017;10(1):1705-1714
www.ijcem.com /ISSN:1940-5901/IJCEM0041238

Original Article

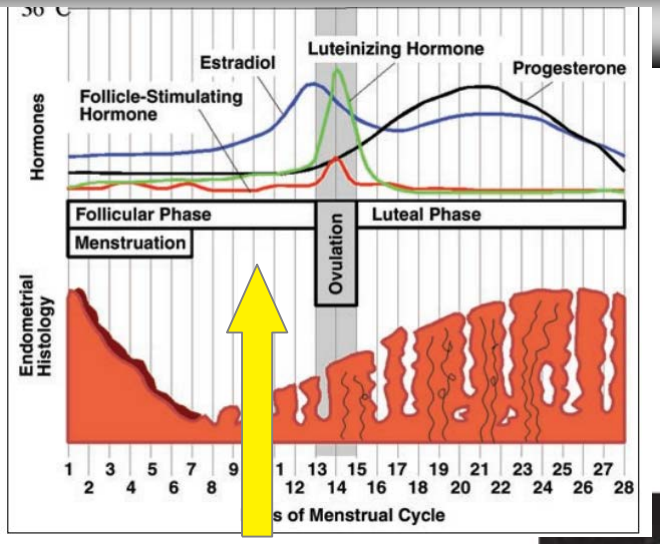
Intravoxel incoherent motion MR imaging in breast cancer: quantitative analysis for characterizing lesions

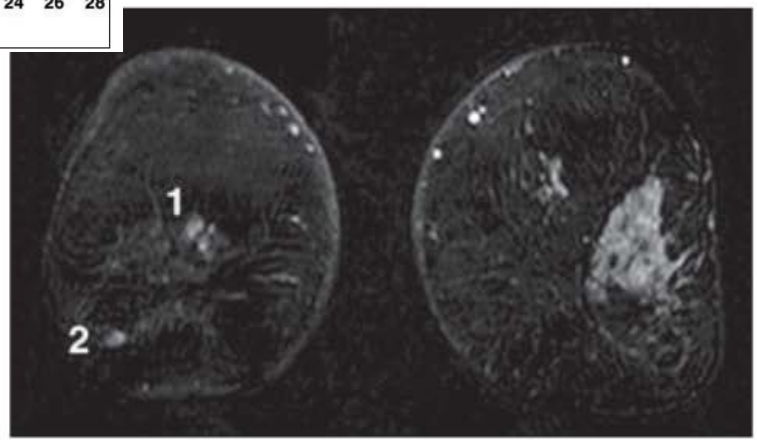
Naier Lin[1], Junyan Chen[2], Jia Hua[3], Jinhua Zhao[1], Jun Zhao[4], Jinsong Lu[5]

Lin, Naier, Junyan Chen, Jia Hua, Jinhua Zhao, Jun Zhao, i Jinsong Lu. «Intravoxel incoherent motion MR imaging in breast cancer: quantitative analysis for characterizing lesions». Int J Clin Exp Med 10, núm. 1 (2017): 1705–1714.

Wu, Haijun, Shuixing Zhang, Changhong Liang, Hui Liu, Yanhui Liu, Yingjie Mei, Hongjun Liu, Zaiyi Liu, i Fangping Xu. «Intravoxel Incoherent Motion MRI for the Differentiation of Benign, Intermediate, and Malignant Solid Soft-Tissue Tumors: IVIM for Solid Soft-Tissue Tumors». Journal of Magnetic Resonance Imaging, abril 2017. https://doi.org/10.1002/jmri.25733.

Use of Serum Progesterone Concentration for Timing Breast MRI Examinations and Avoiding False-Negative Findings





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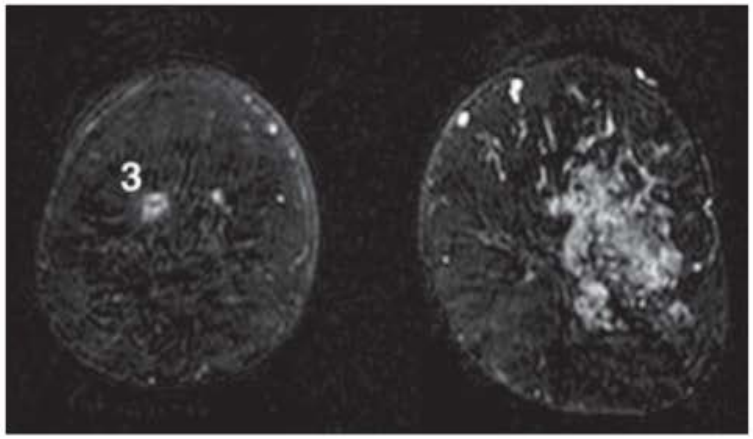

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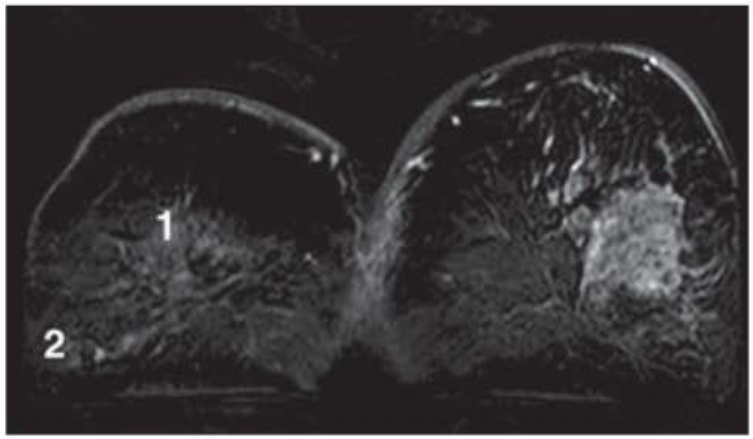
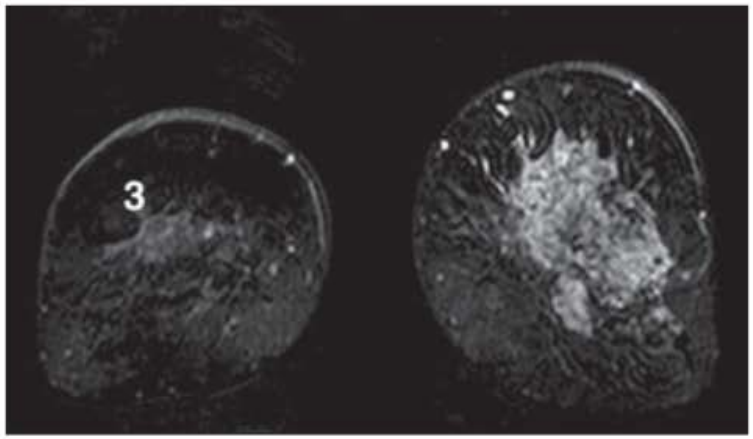


0.53 ng/mL

C

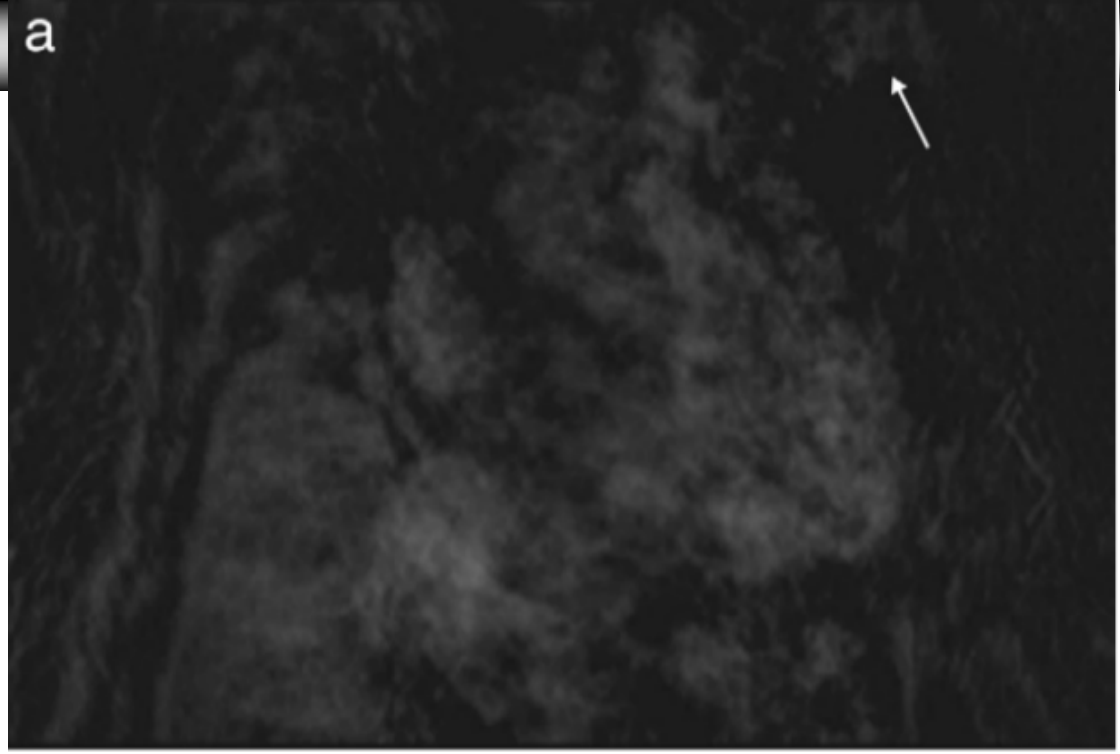


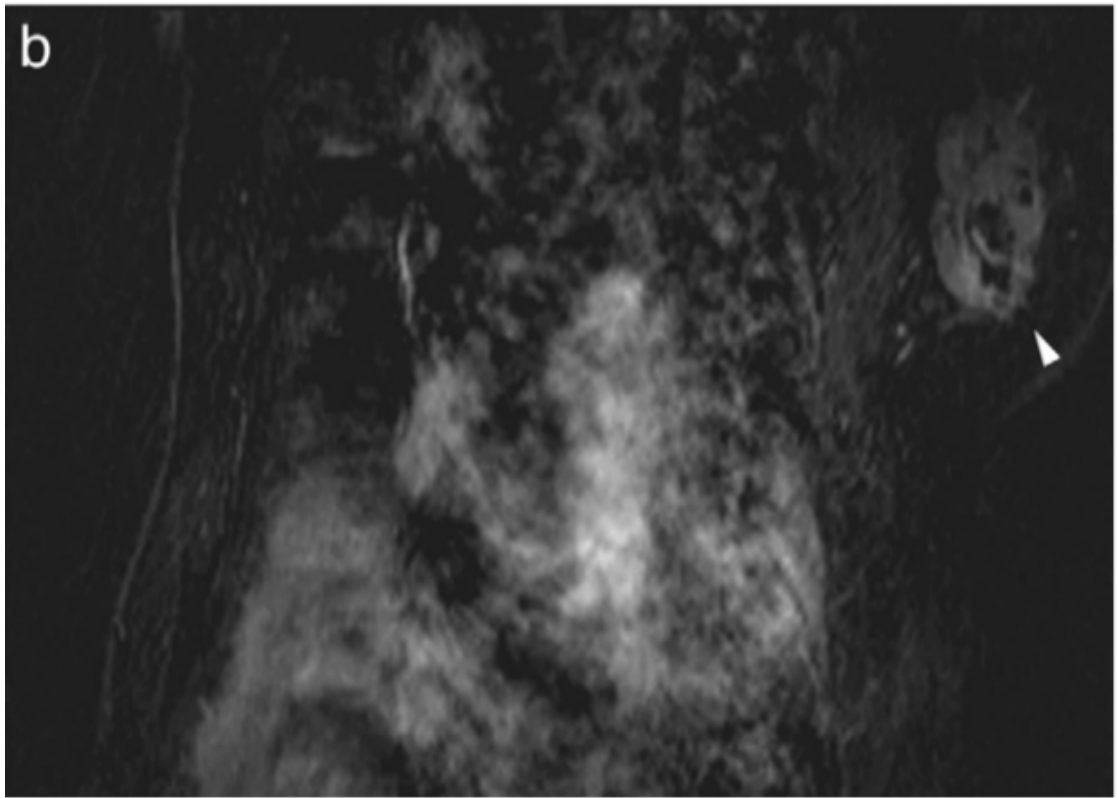
D

Tabla 1 Clasificación de los diferentes artefactos y *pitfalls* según los factores implicados

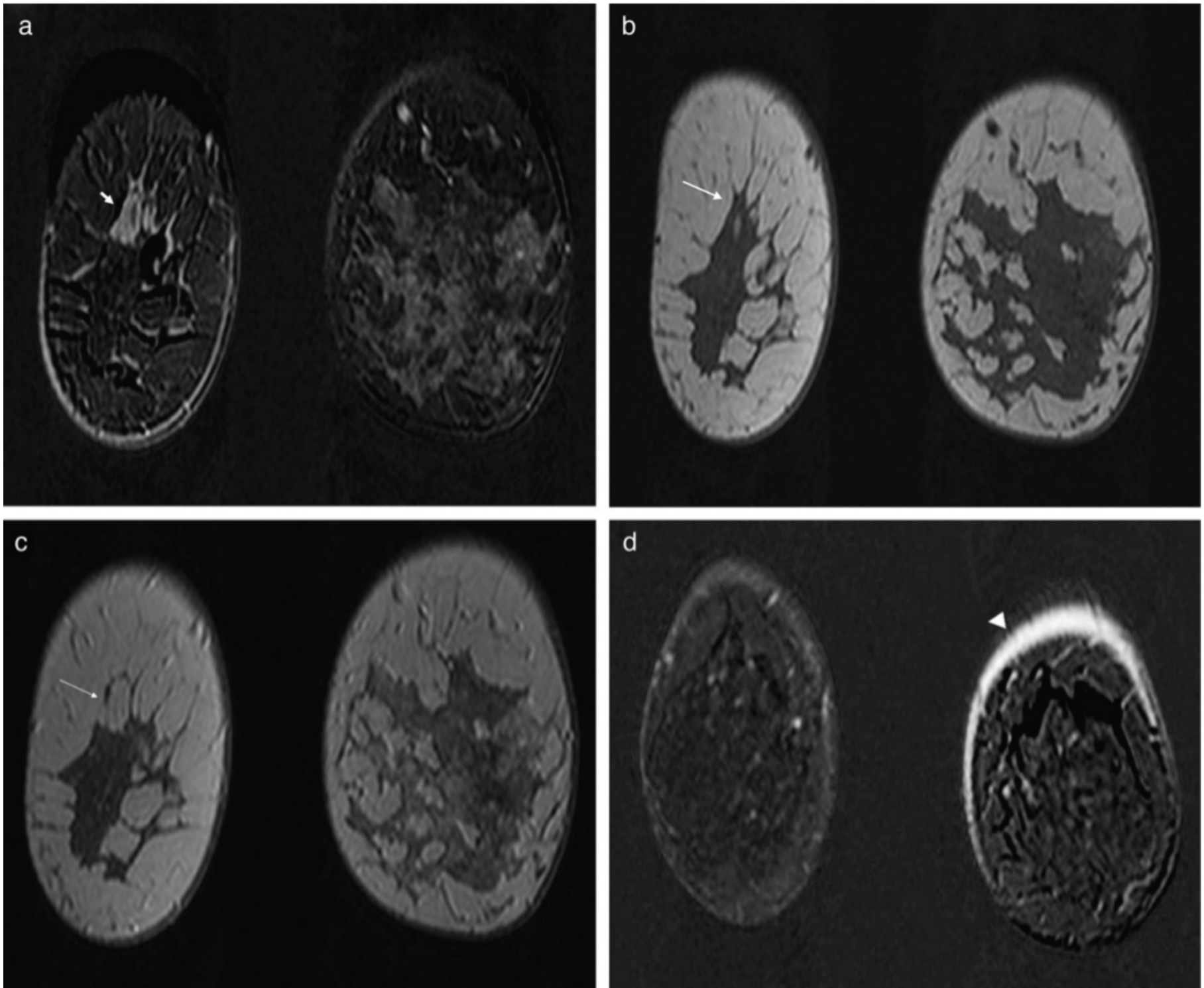
Factores técnicos
- Posición del paciente y compresión mamaria
- Inyección del contraste intravenoso
- Movimiento
- *Aliasing*
- Susceptibilidad magnética
- Supresión no homogénea de la grasa
Factores anatómicos y fisiológicos
- Hábito corporal
- Complejo areola-pezón
- Estructuras vasculares
- Ganglios intramamarios
- Estimulación hormonal
Factores patológicos
- Lesiones cutáneas
- Carcinoma mucinoso y carcinoma medular
- Cambios iatrogénicos
Factores operador-dependiente
- Historia clínica
- Multimodalidad

Posicionamiento

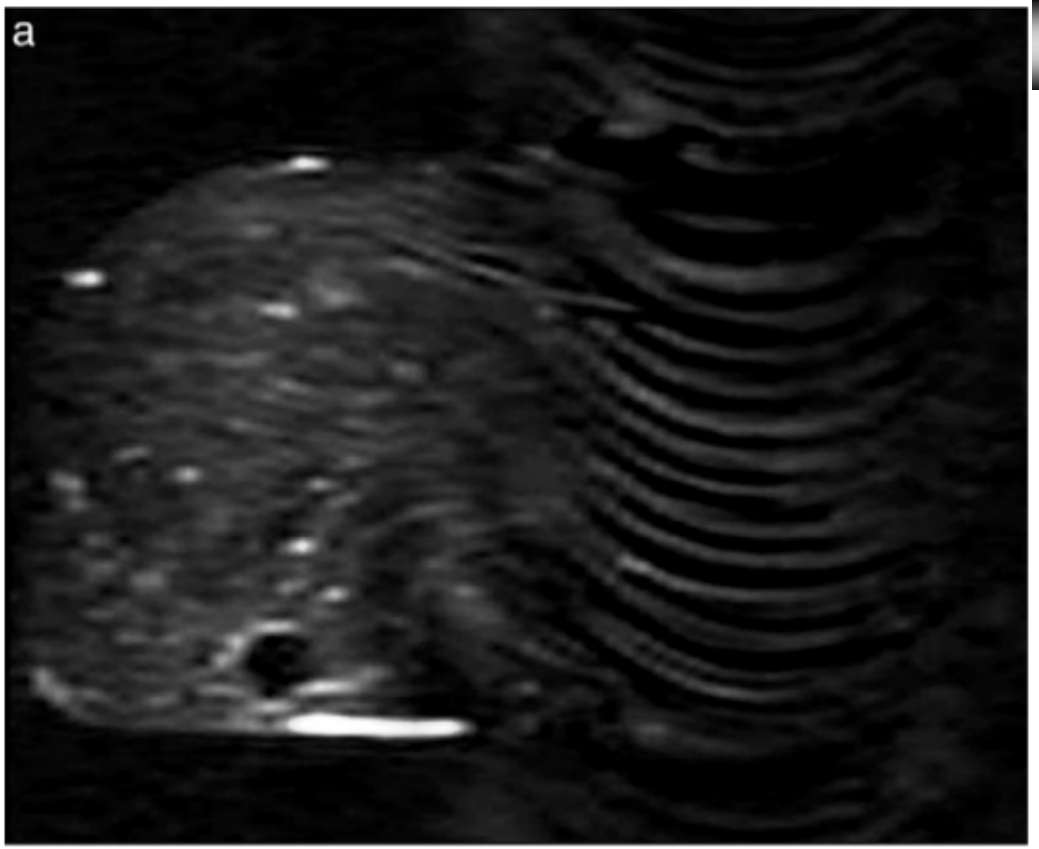


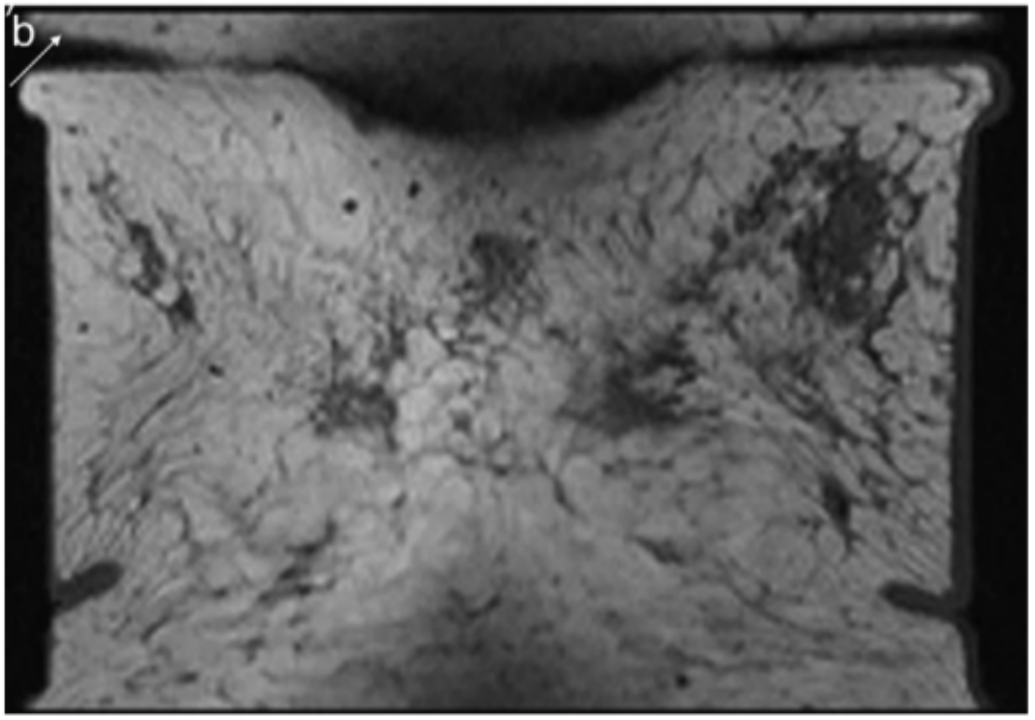


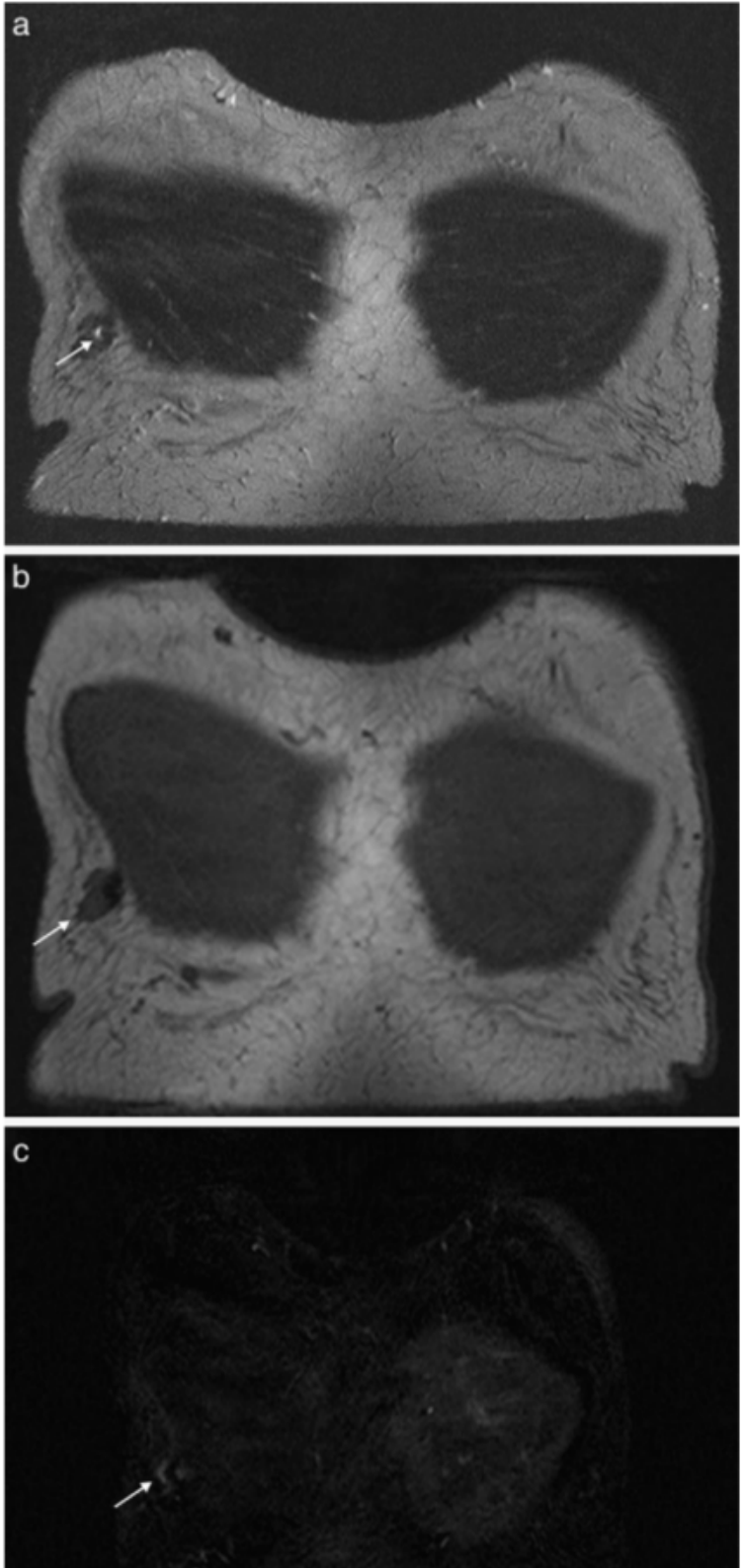
movimiento



Fase



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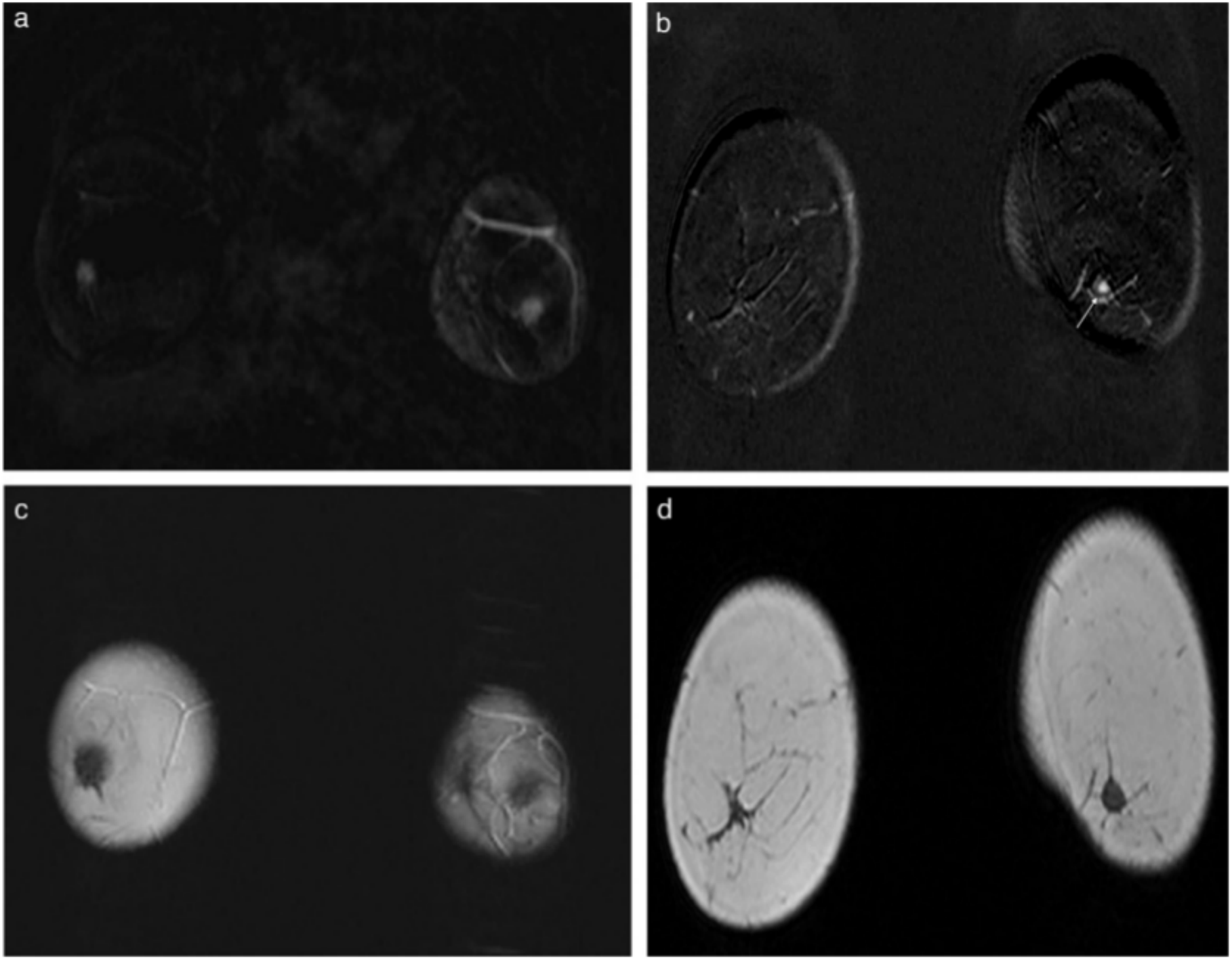
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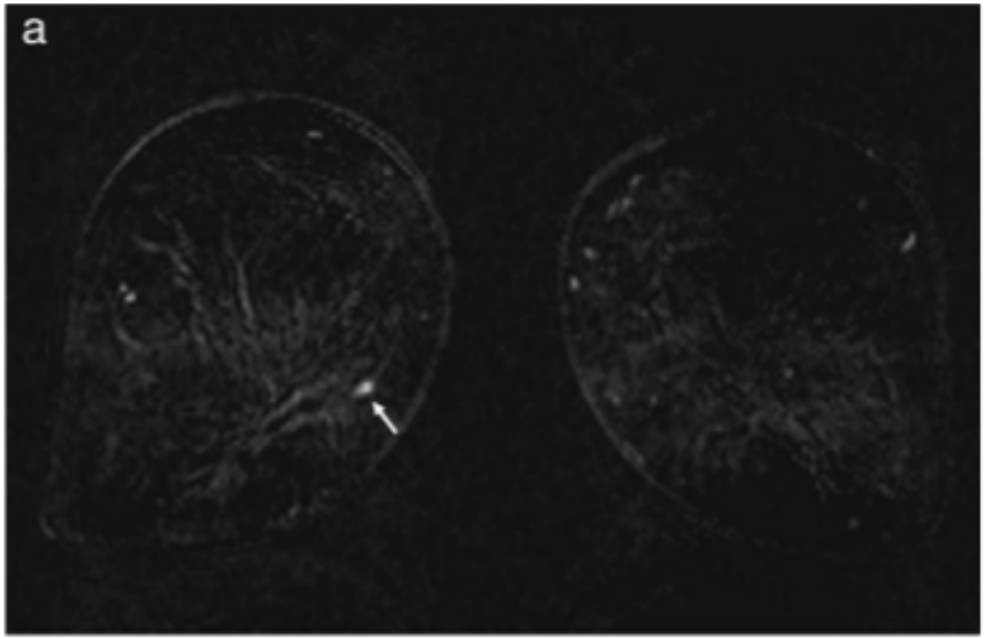
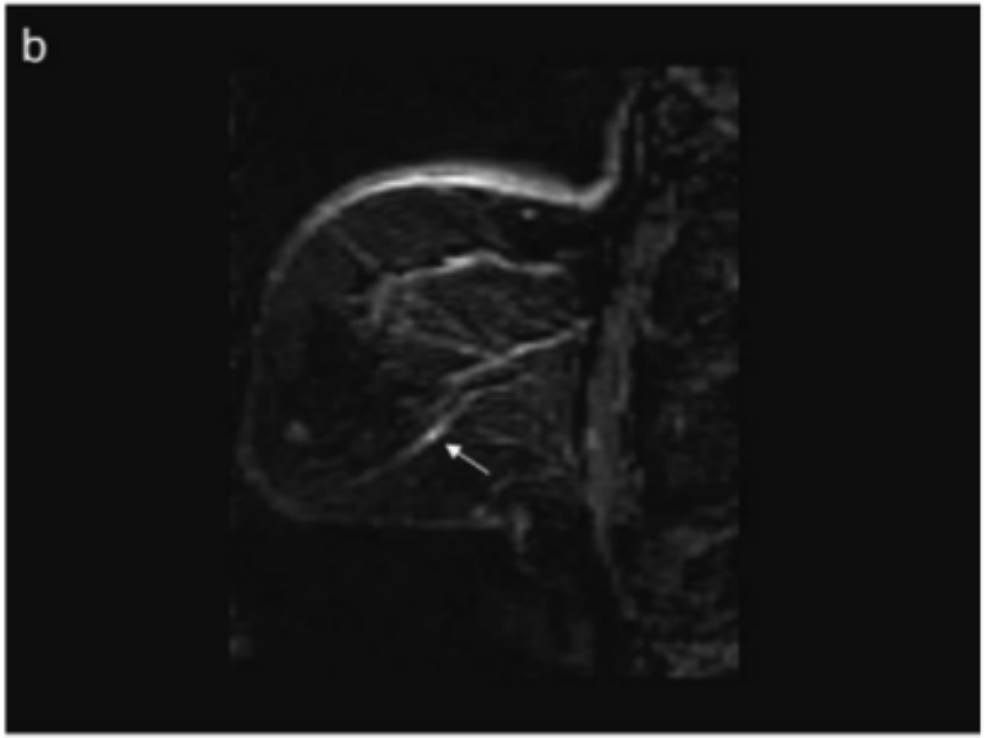
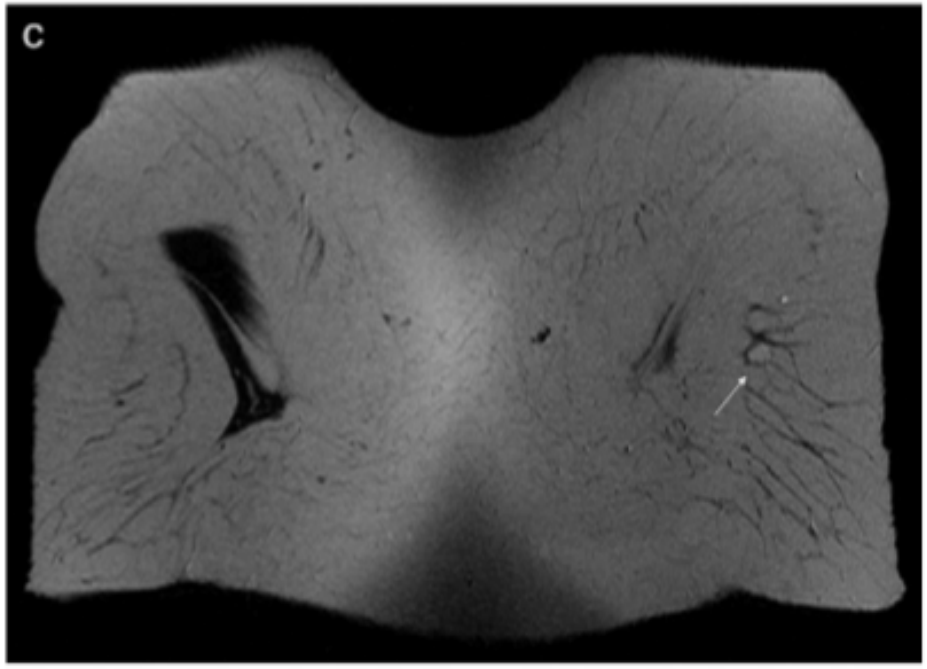
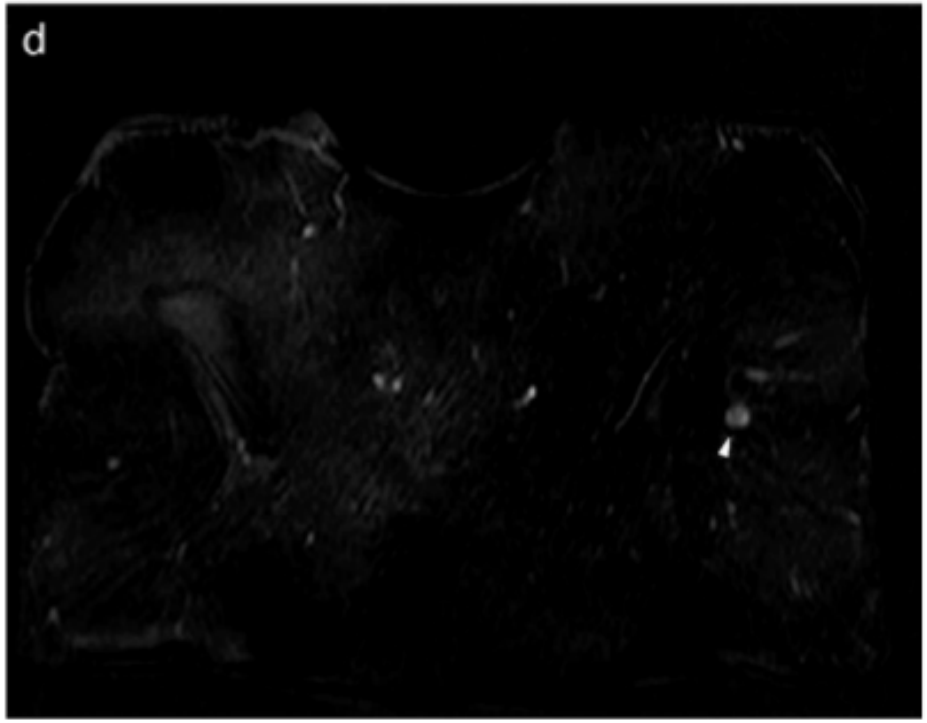
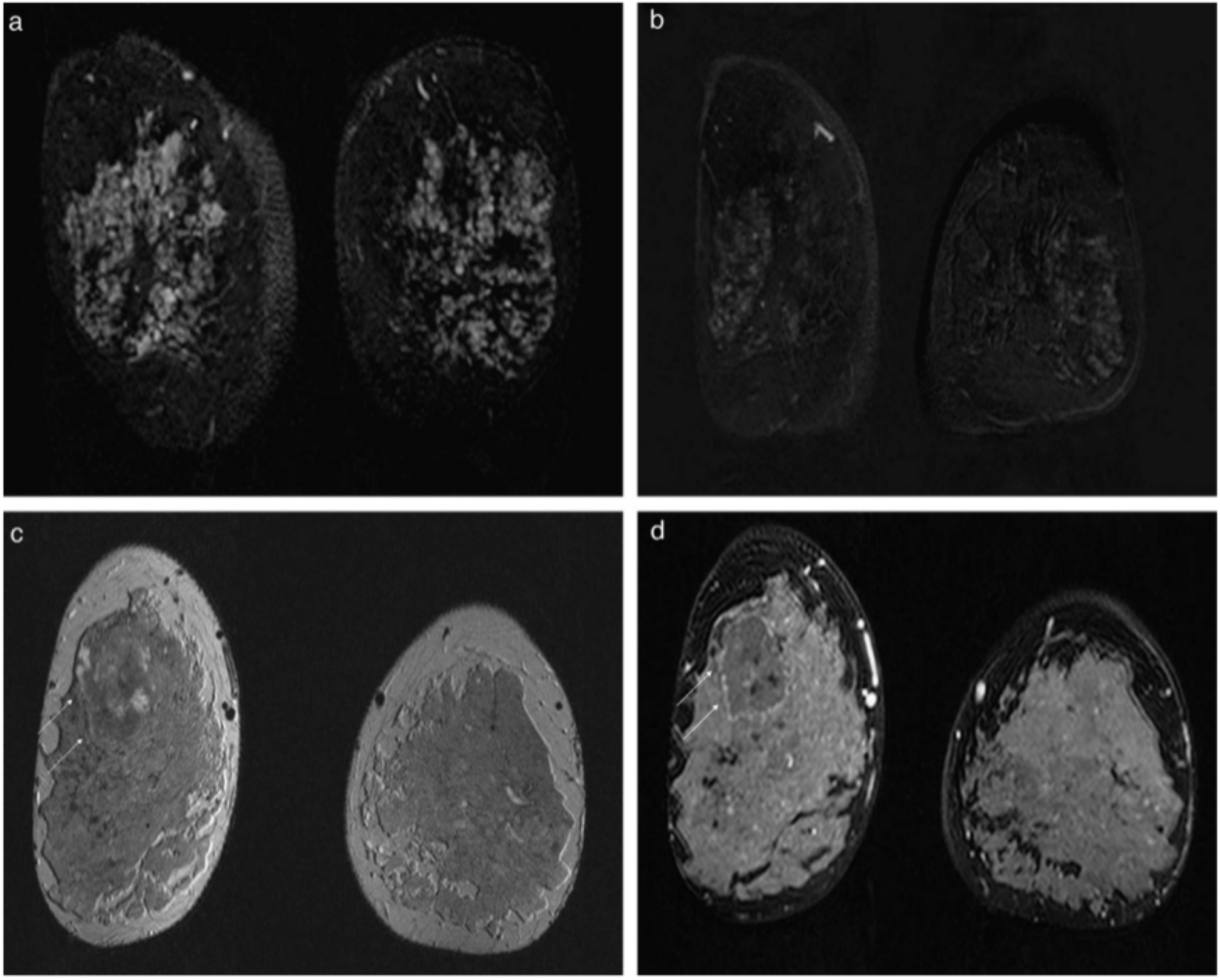
Estructuras normales







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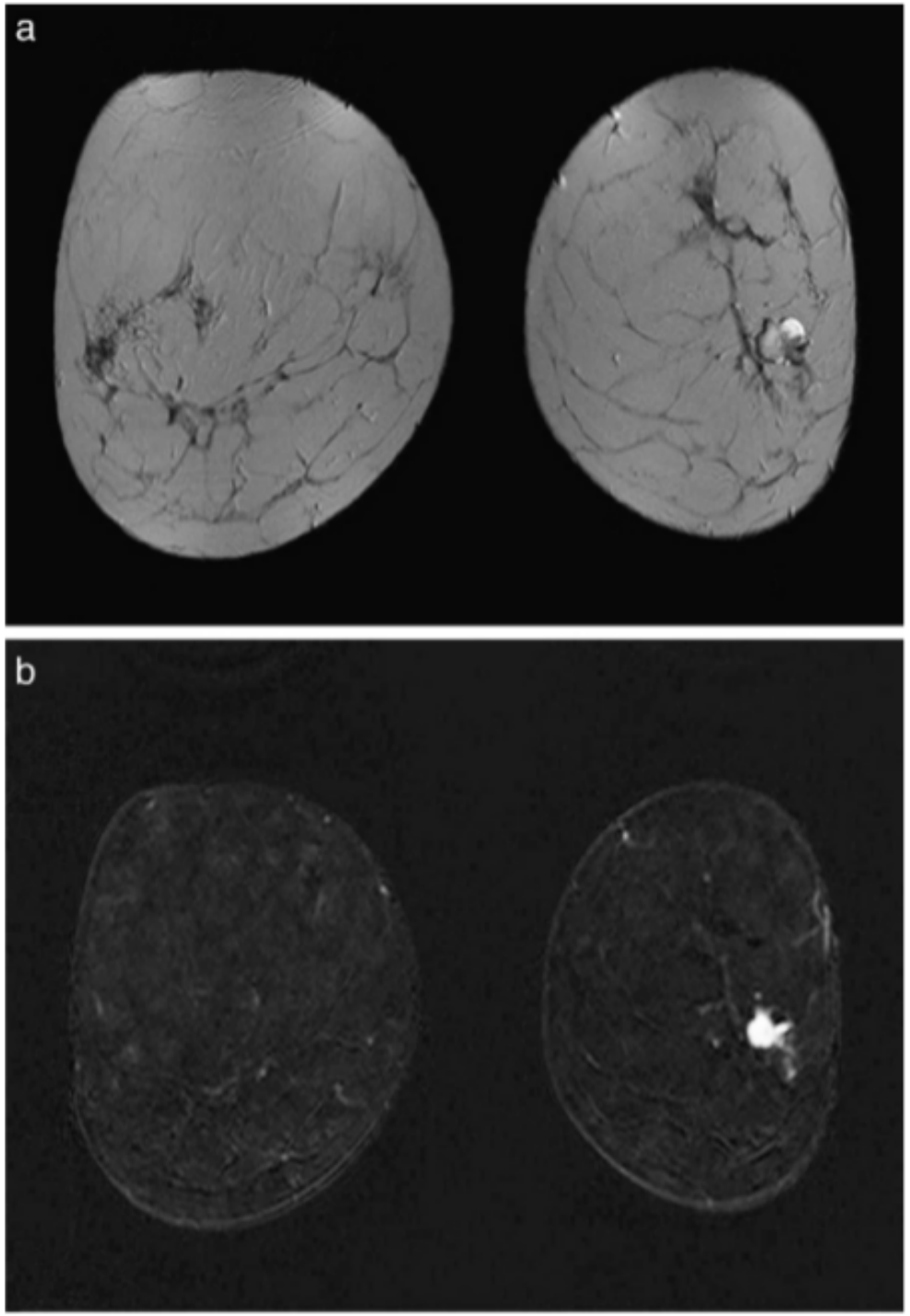
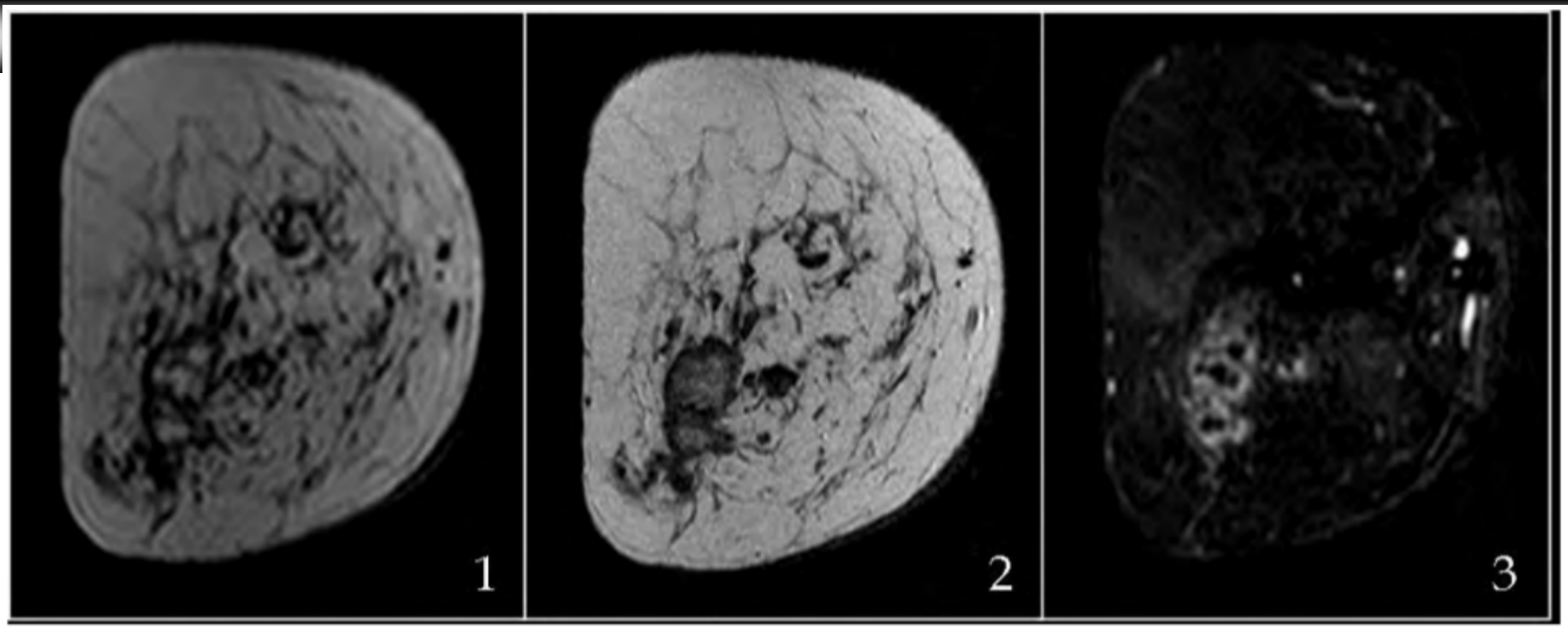
No todo lo blanco es bueno

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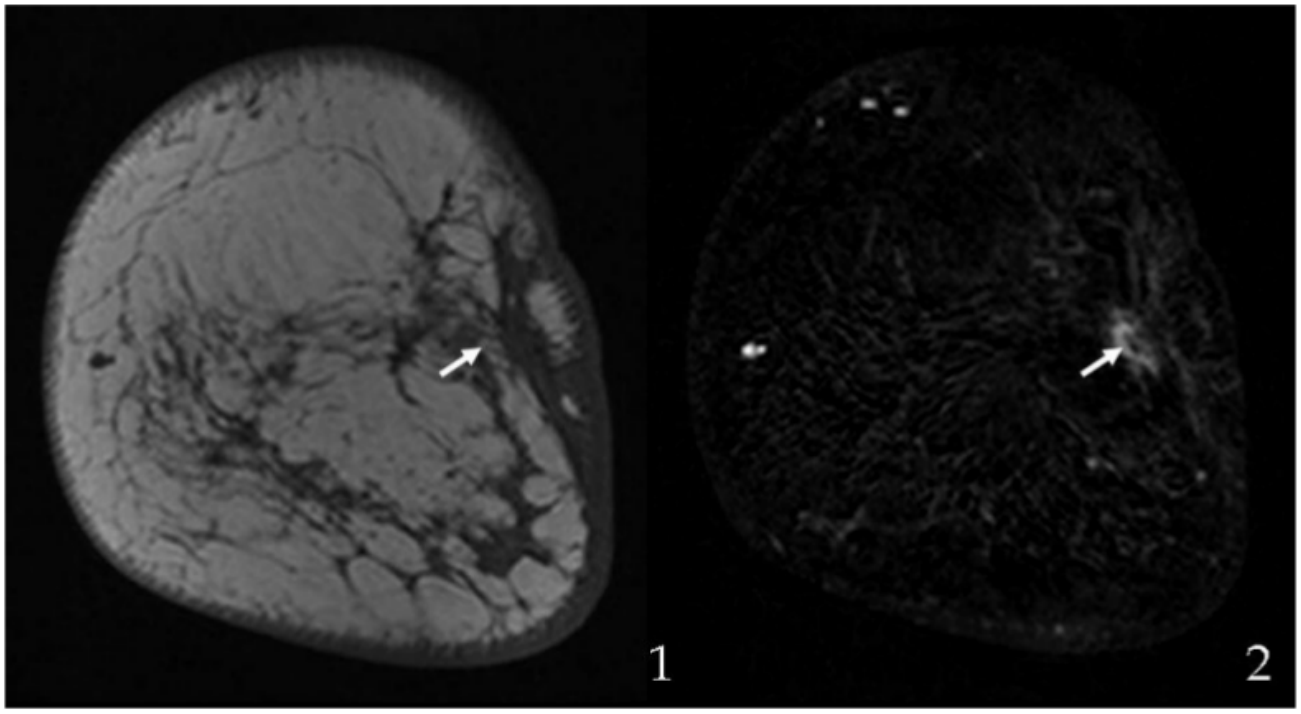
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Sergi Ganau, Lidia Tortajada, Fernanda Escribano,
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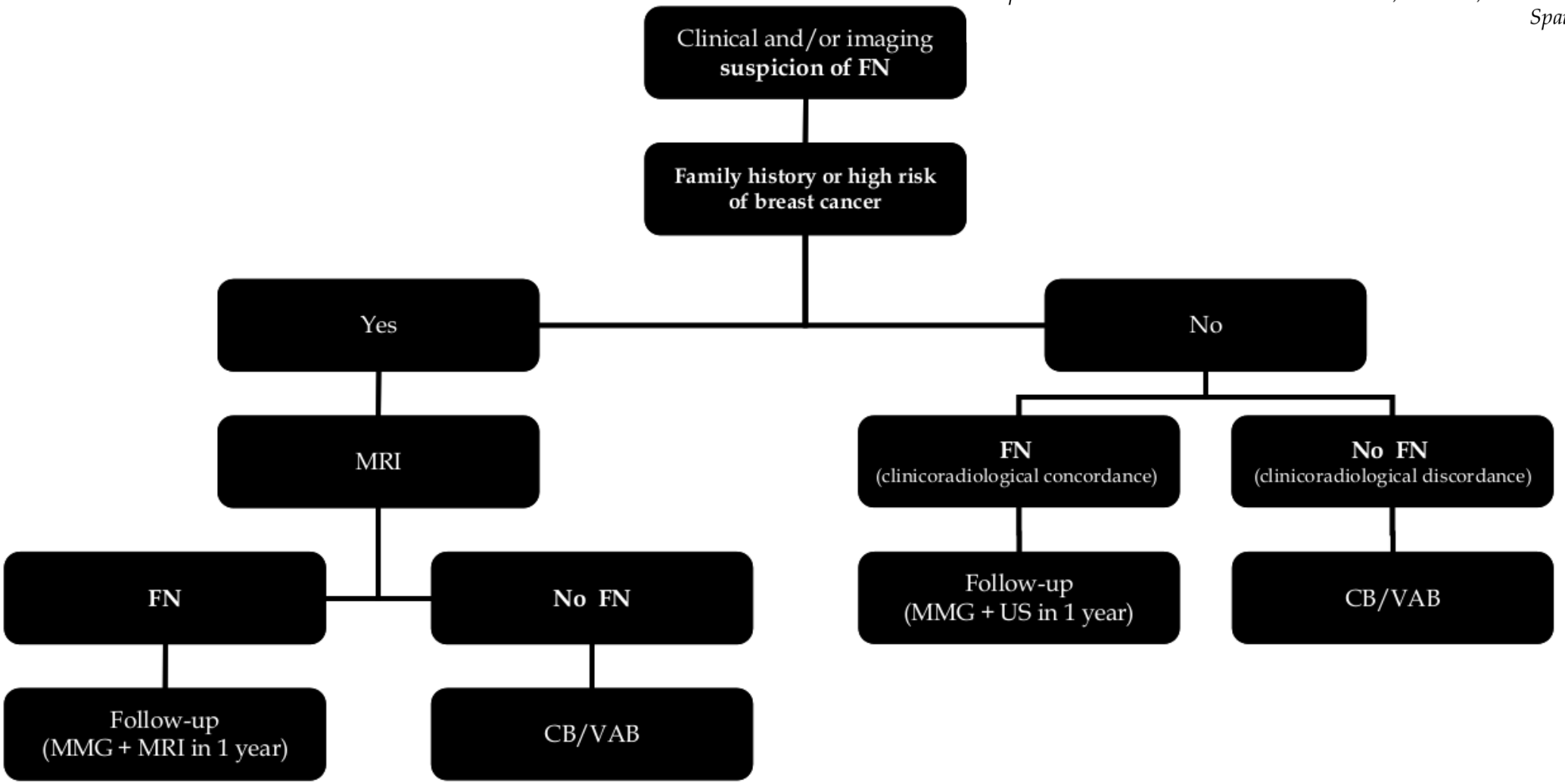
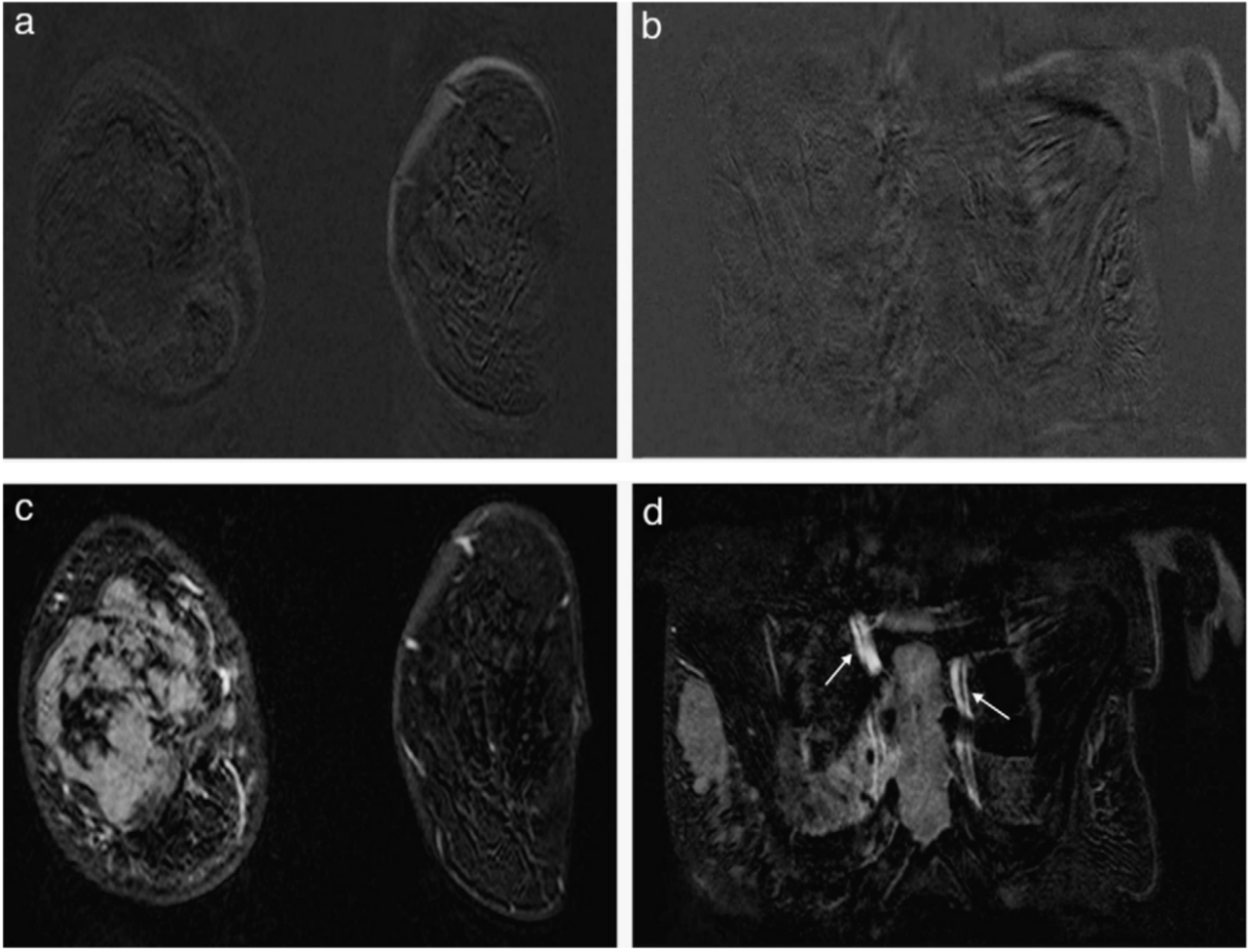
Women´s Imaging Department, UDIAT-CD,
Corporació Sanitària i Universitària Parc Taulí, Sabadell, Barcelona, Spain



CB = core biopsy; FN = fat necrosis; MMG = mammography; MRI = magnetic resonance imaging; US = ultrasound; VAB = vacuum-assisted biopsy.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Resumen

Marbella 19 al 21 de Mayo 2011 — XII Congreso de la Sociedad Española de Diagnóstico por Imagen de la Mama — SEDIM

LA IMAGEN MAMARIA COMO SUBESPECIALIDAD

Marina Álvarez Benito, Melchor Sentís Crivellé

En los últimos años se han producido cambios importantes en el abordaje de la patología mamaria y en concreto en el cáncer de mama.

Estos cambios en parte son debidos a un conocimiento más profundo de la enfermedad; al desarrollo de nuevos tratamientos sistémicos, quirúrgicos y radioterápicos; a la aparición de métodos diagnósticos más precisos, y a la extensión de los programas de screening para el diagnóstico precoz de la enfermedad.

!La imagen mamaria como subespecialidad !!!!

Introduction Title

Introduction

Methods

Results

Discussion

Results Title

Introduction

Methods

Results

Discussion

Discussion Title

Introduction

Methods

Results

Discussion

Acknowledgements

References

- Author1. (Year). *Title*. Journal.
- Author2. (Year). *Title*. Journal.
- Author3. (Year). *Title*. Journal.