Implants, Explantation and Explantation

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Objectives

- Recognize normal imaging appearance of commonly used implants
- Identify imaging findings associated with intra and extracapsular rupture
- Recognize imaging features of reduction and explantation
- Review complications associated with reconstruction
- Recognize imaging appearances of the most common AMFs

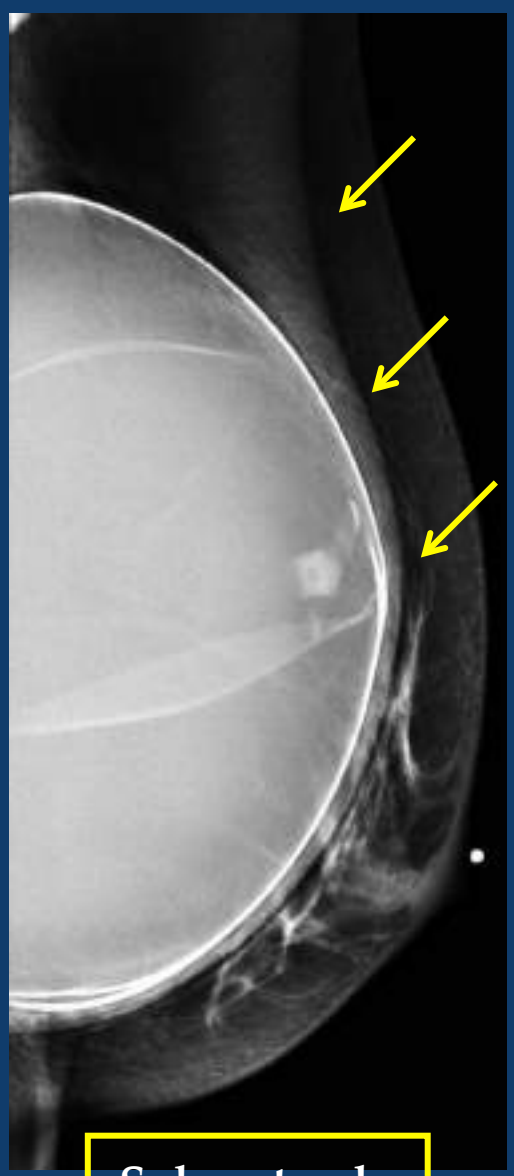
Implants

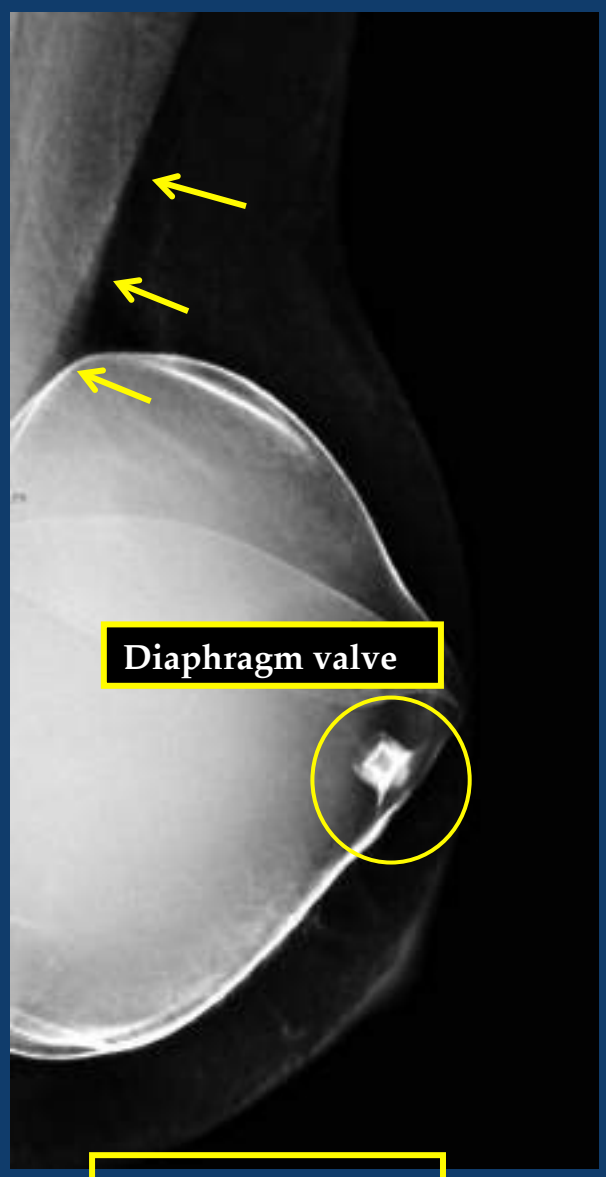
2 Main Categories:

- Saline (elastomer silicone shell containing 0.90% NaCl sterile solution)
- Silicone (elastomer silicone shell containing silicone)
  - Single lumen
  - Double lumen
  - Single lumen with semi-solid cohesive silicone gel

Saline Implants

- Smaller incisions for insertion
- Flexibility with sizing
- Cosmetic problems more likely (“rippling” or “wrinkling”)





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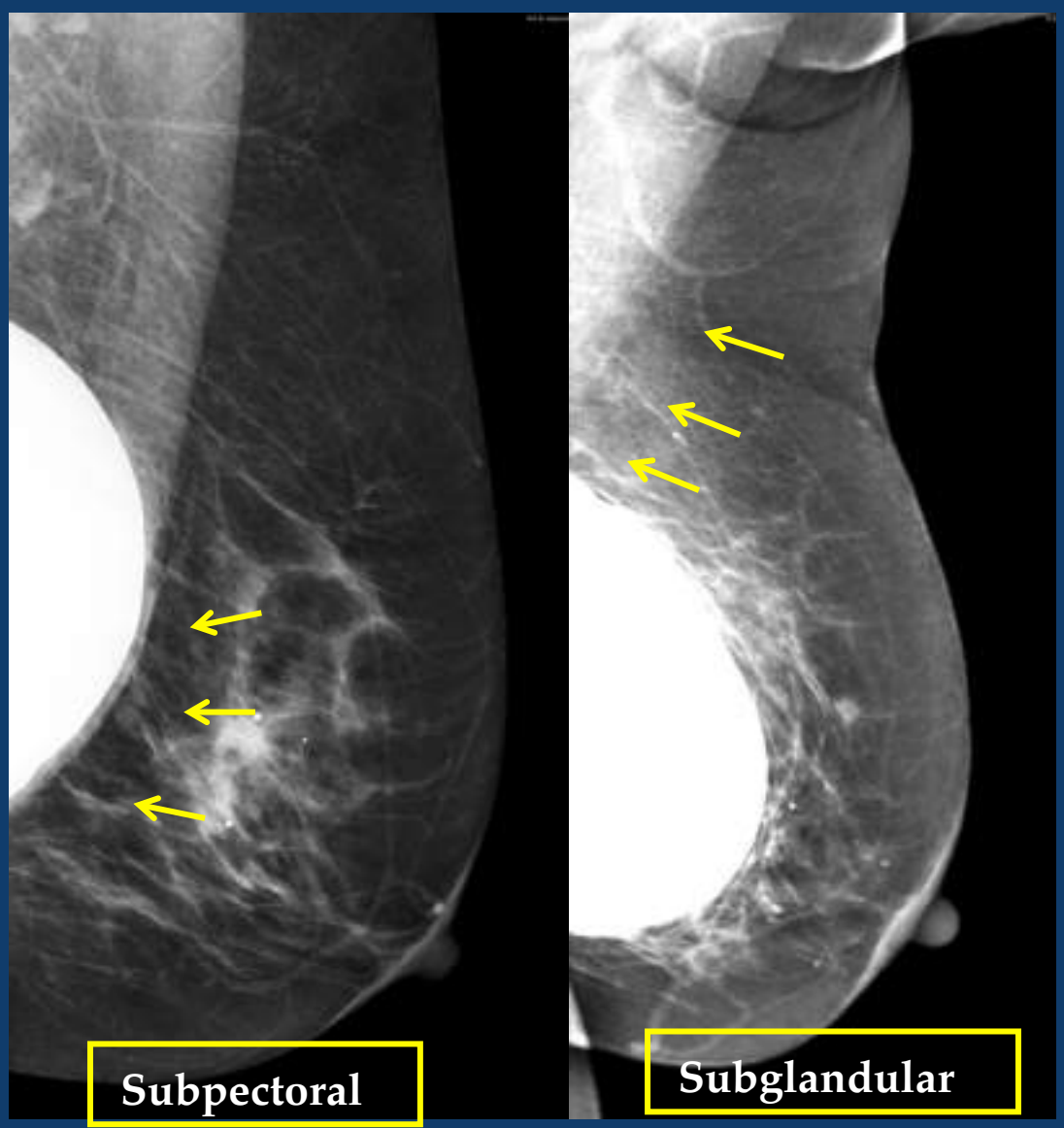
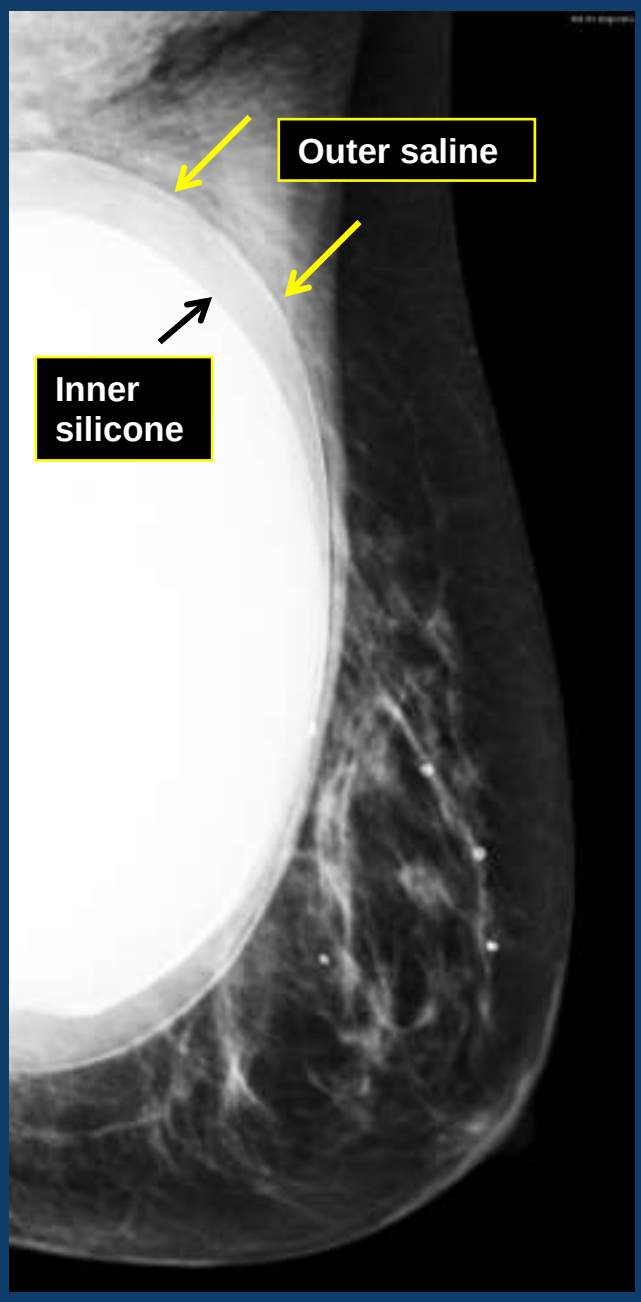
Silicone Implants

- Most common: thin shell, low cohesion silicone gel filler
- Risk of “gel bleed”



Double Lumen Implants

- Not commonly used
- Most are outer saline envelope, inner viscous silicone
- Several different combinations



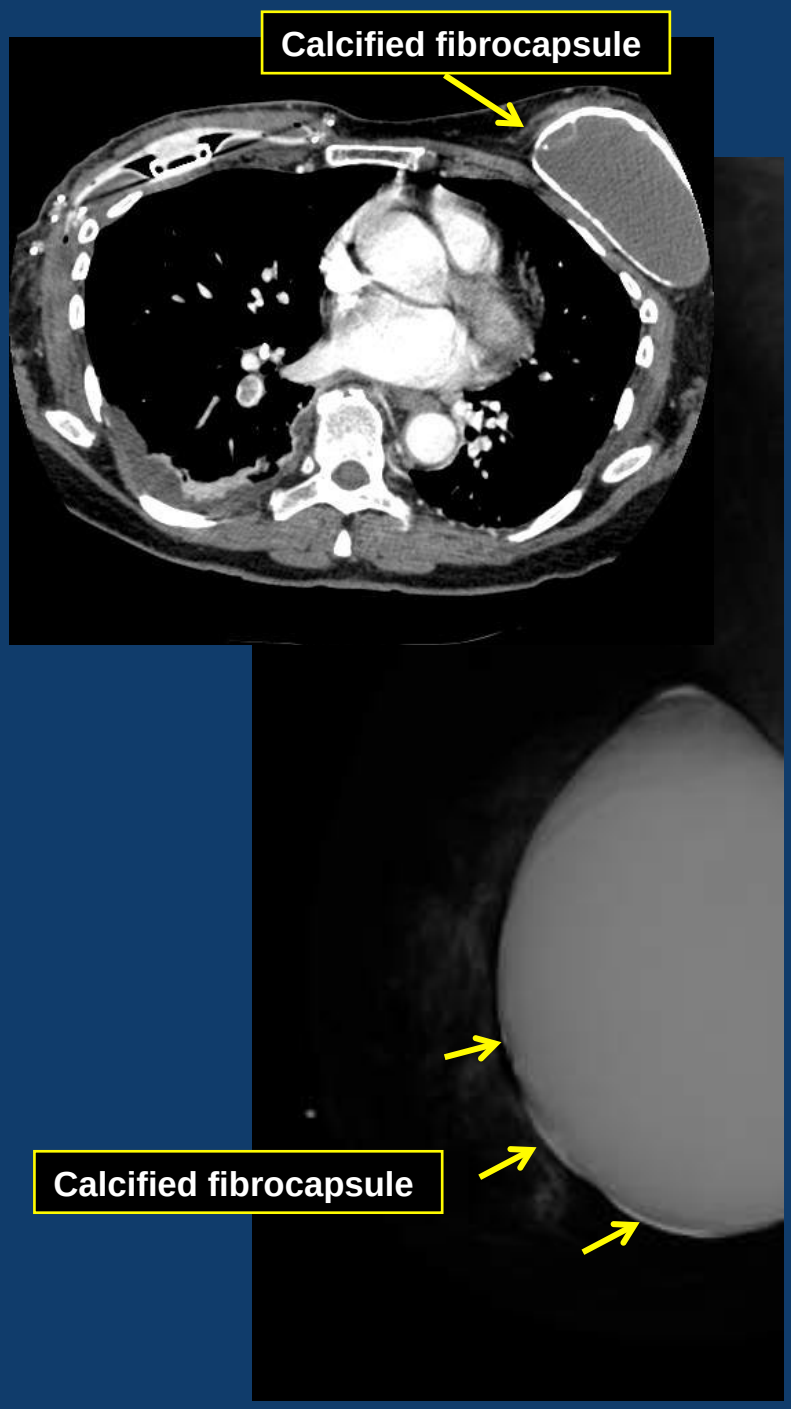
Cohesive Gel Implants

- “Gummy Bear” implants
- Single lumen
- Semi-solid, cohesive gel
- Less risk of “gel bleed”
- Less risk of capsular contracture

Cohesive Gel Implants

Implants

- Collagen fiber capsule, normal around all implants
- Some may calcify
- Implant may feel “firm” with calcifications



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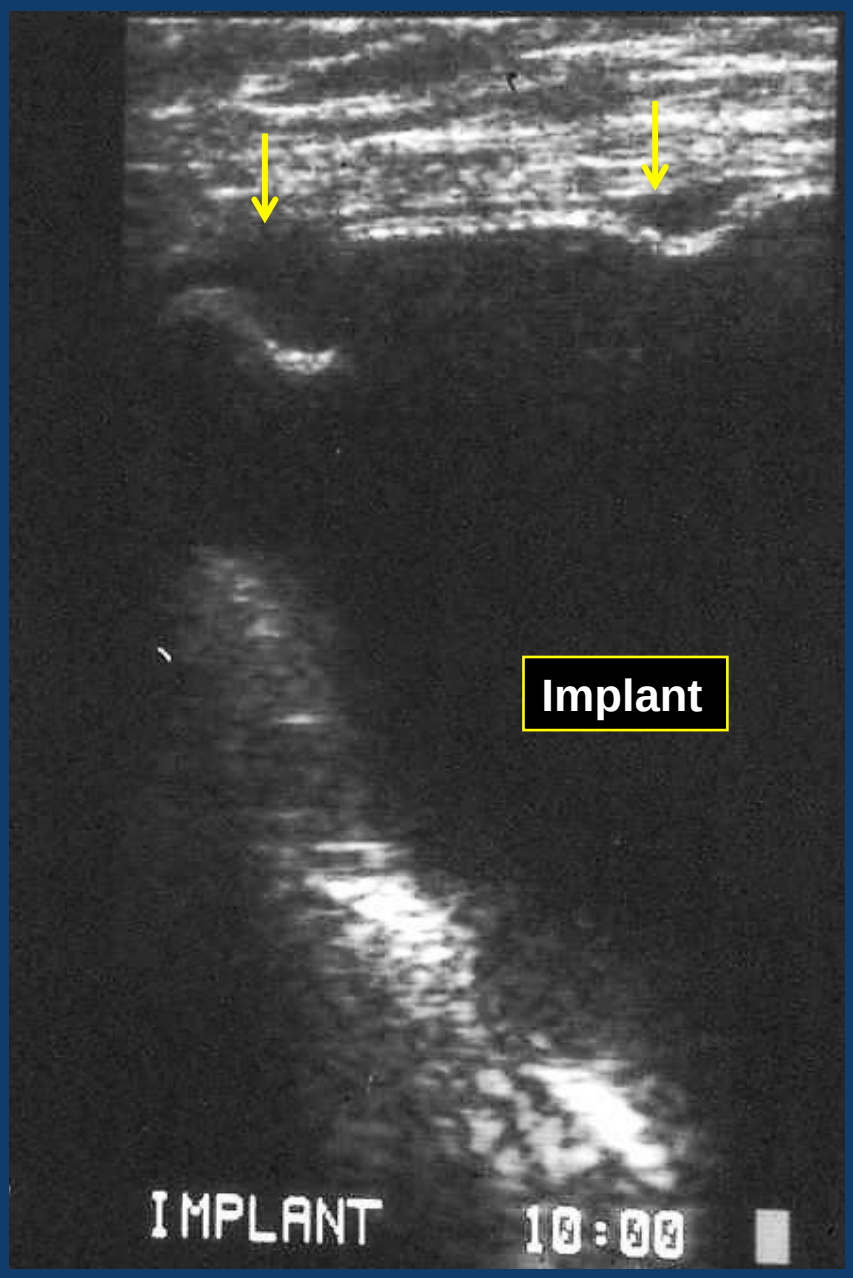
Implants Complications

- Immediate
  - *Seroma*
  - *Hematoma*
  - *Infection (1.2%)*
  - *Deflation (1.8%)*
- Delayed
  - Capsular contracture
  - Rupture

Implants Complications

Seroma

- Serous fluid from disruption of lymphatics
- Small collection normal post-op
- Resolves in a few weeks



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Implant Complications

Seroma

- Aspiration recommended of larger seromas (infection risk)

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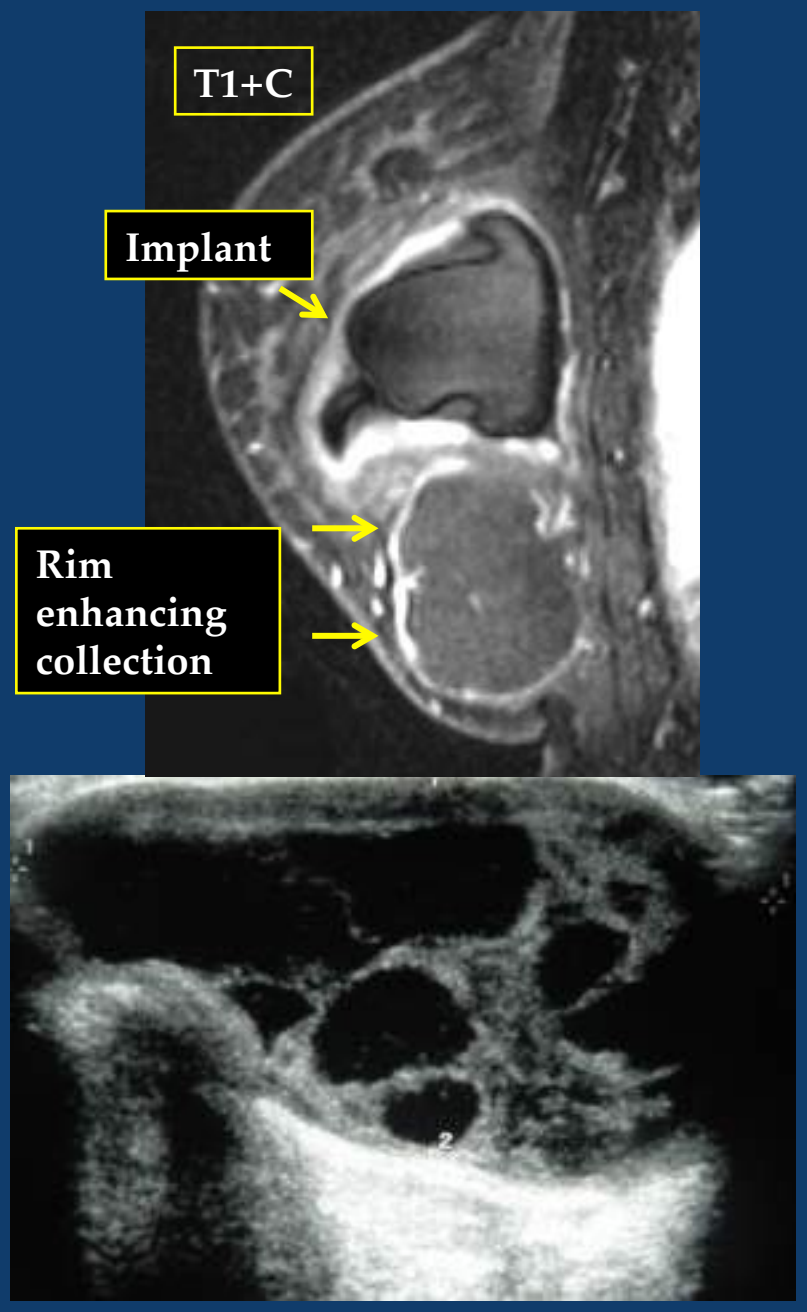
Implant Complications

Infection/abscess

- Usually occur within a month post-op
- Organisms: staph aureus, staph epidermis, (rarely, anerobes or mycobacterium)



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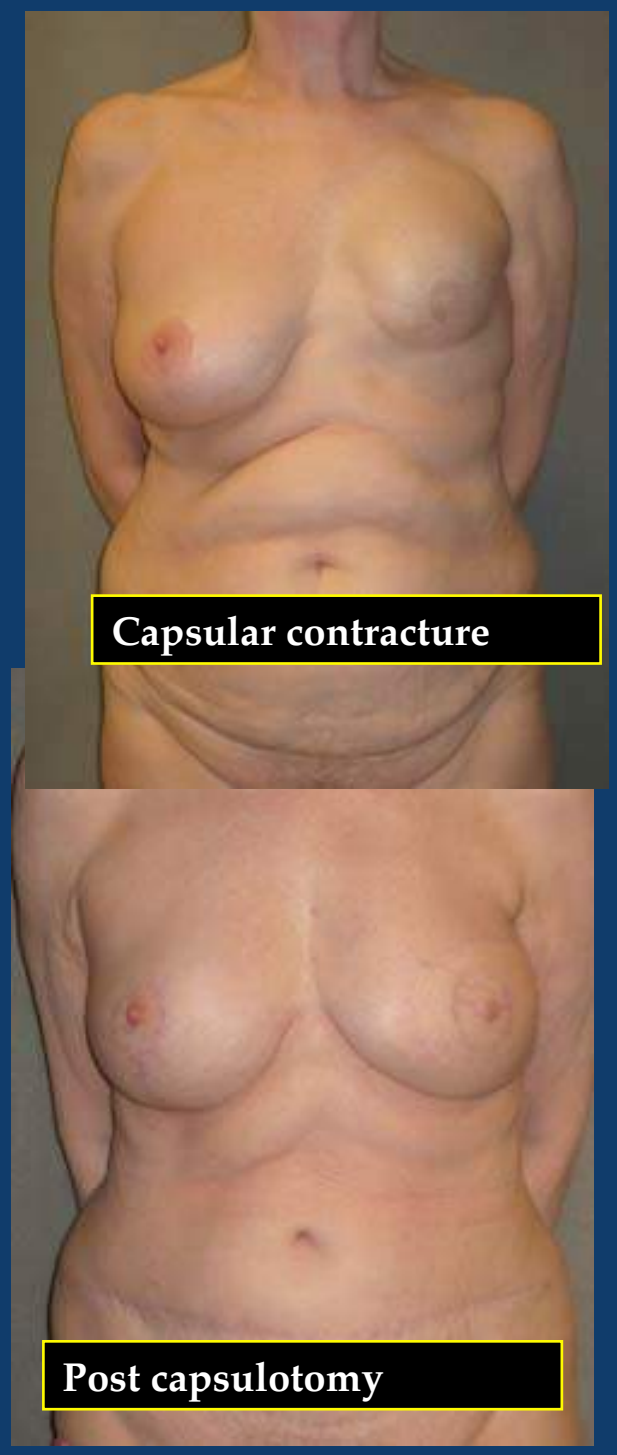
Implant Complications

- Immediate
  - Seroma
  - Hematoma
  - Infection (1.2%)
  - Deflation (1.8%)
- Delayed
  - *Capsular Contracture*
  - *Rupture*

Implant Complications

Capsular contracture (CC

- Collagen fiber capsule thickens and compresses implant
- May be painful
- May distort breast or implant
- Etiology—inflammation, bacterial contamination, implant leak
- More common with subglandular placement

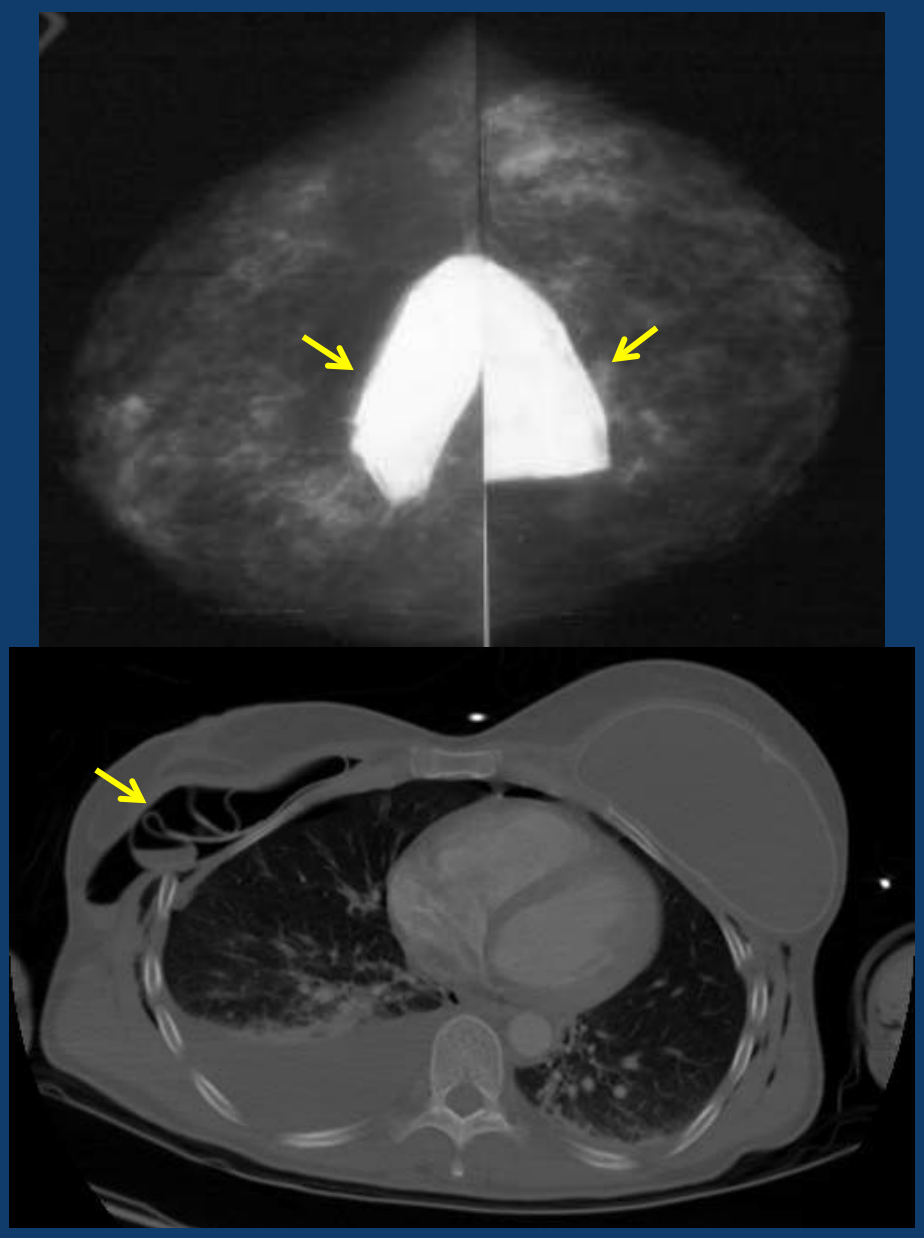


Implant Complications

Rupture

Saline:

- Most common delayed compl.
- Clinically diagnosed
- Mammo—collapsed implant shells

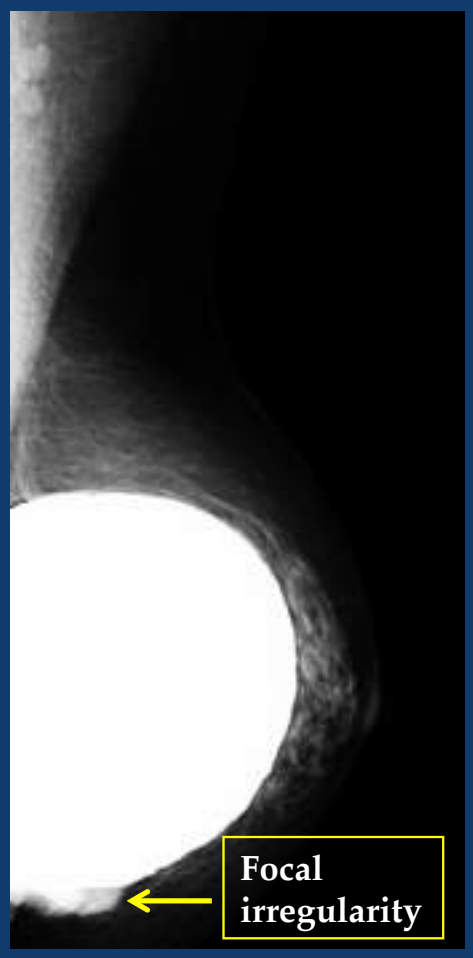


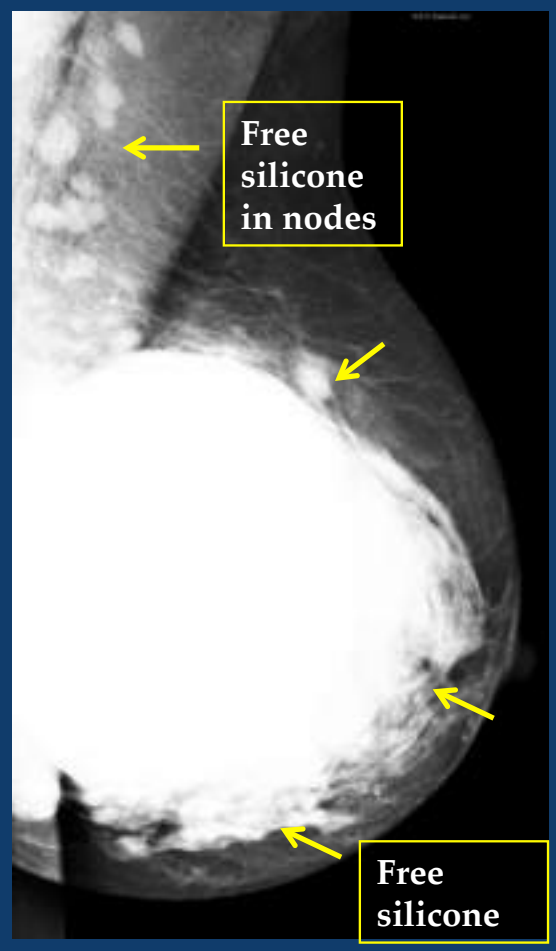
Implant Complications

Silicone Implant Rupture

- Lifespan about 12 yrs
- Extracapsular rupture
  - Free silicone extrudes beyond capsule into breast tissue or axillary nodes
  - Dx: mammography, US, MRI
- Intracapsular rupture
  - Implant ruptures but fibrous capsule remains intact
  - Dx: US, MRI (gold standard)

Implant Complications





- Caveat: Not all free silicone=current rupture

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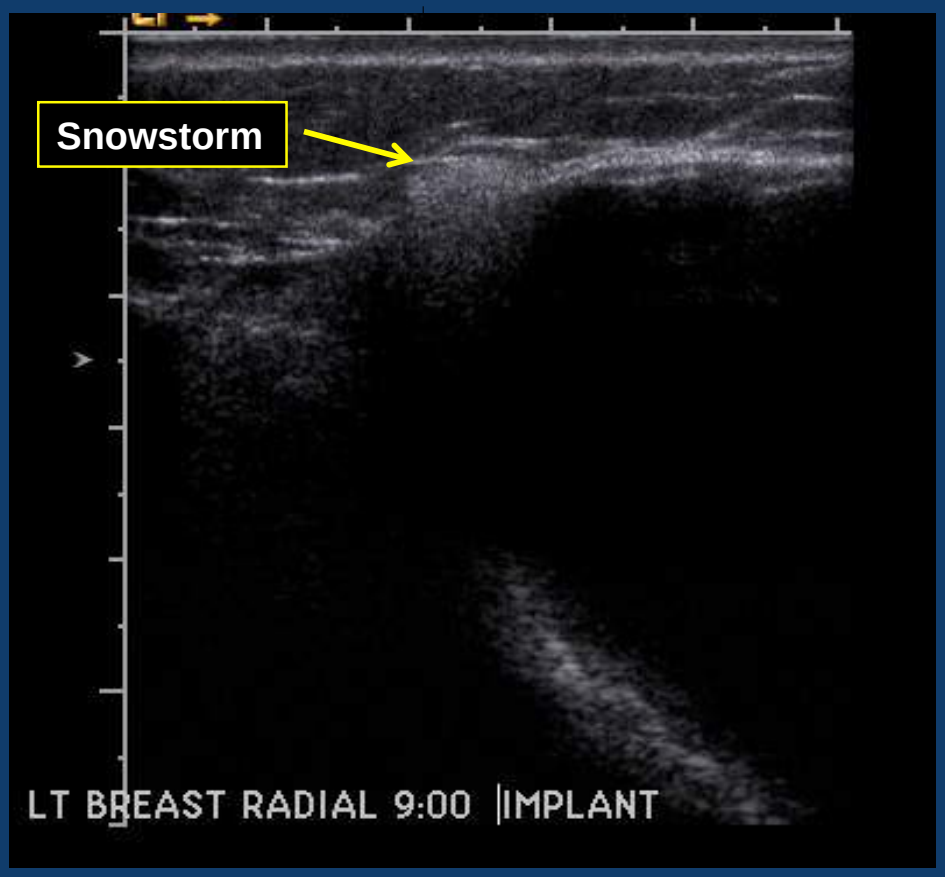
Implant Complications

Extracapsular Rupture

- Ultrasound
  - "Snowstorm" sign
    - Echogenic noise caused by large # of reflecting surfaces within silicone microglobules resulting in scattering and reverberation of sound
    - Very reliable and diagnostic sign of rupture
    - Caveat: Rupture of previous implants with residual free silicone (hx is important!)

Implant Complications

52 y/o with silicone implants, ? focal bulge laterally on screening mammo



Dx: Extracapsular Rupture

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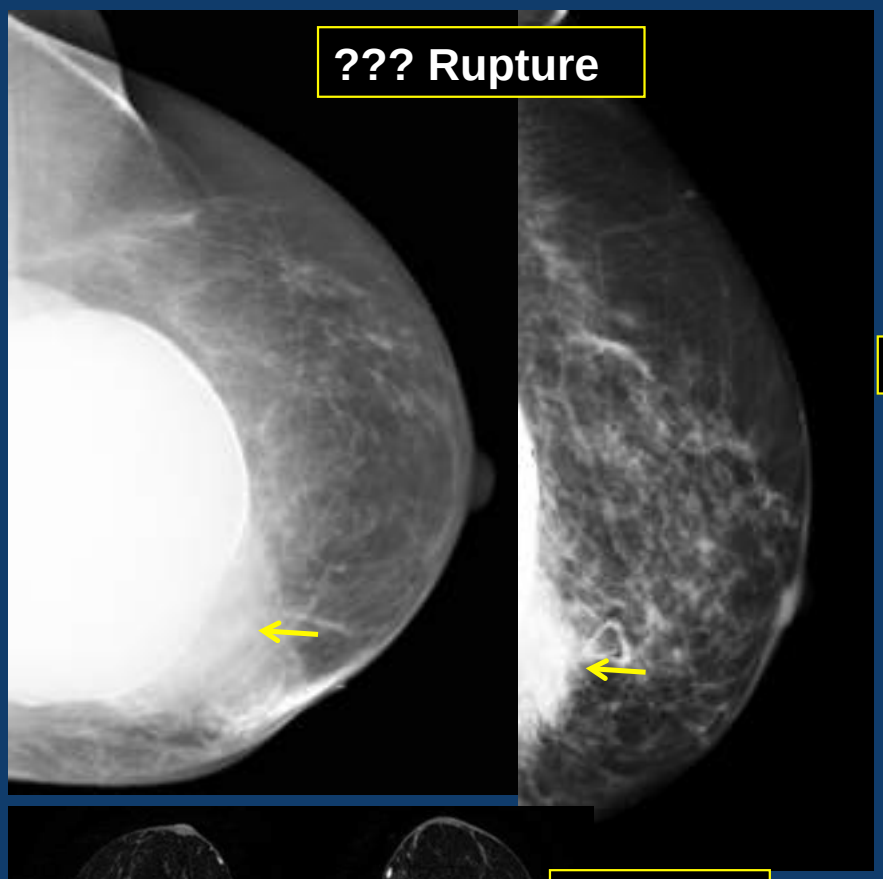
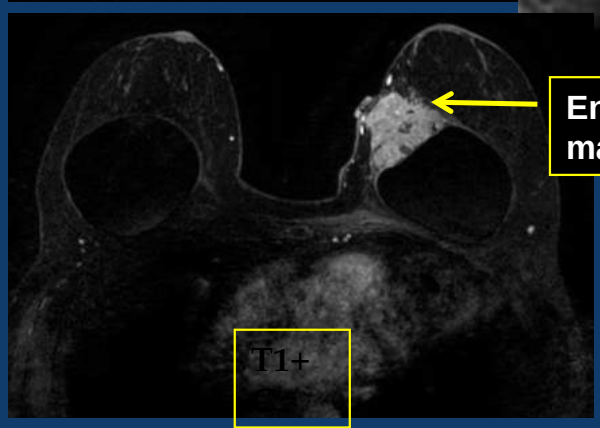
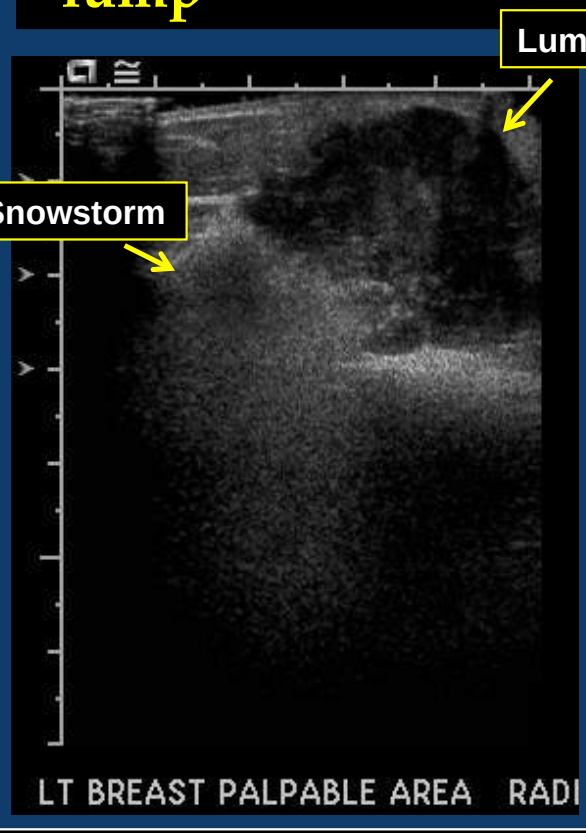
Implant Complications





40+ y/o with palpable "lump"



Bx: IDC
Caveat: Cancer can resemble rupture

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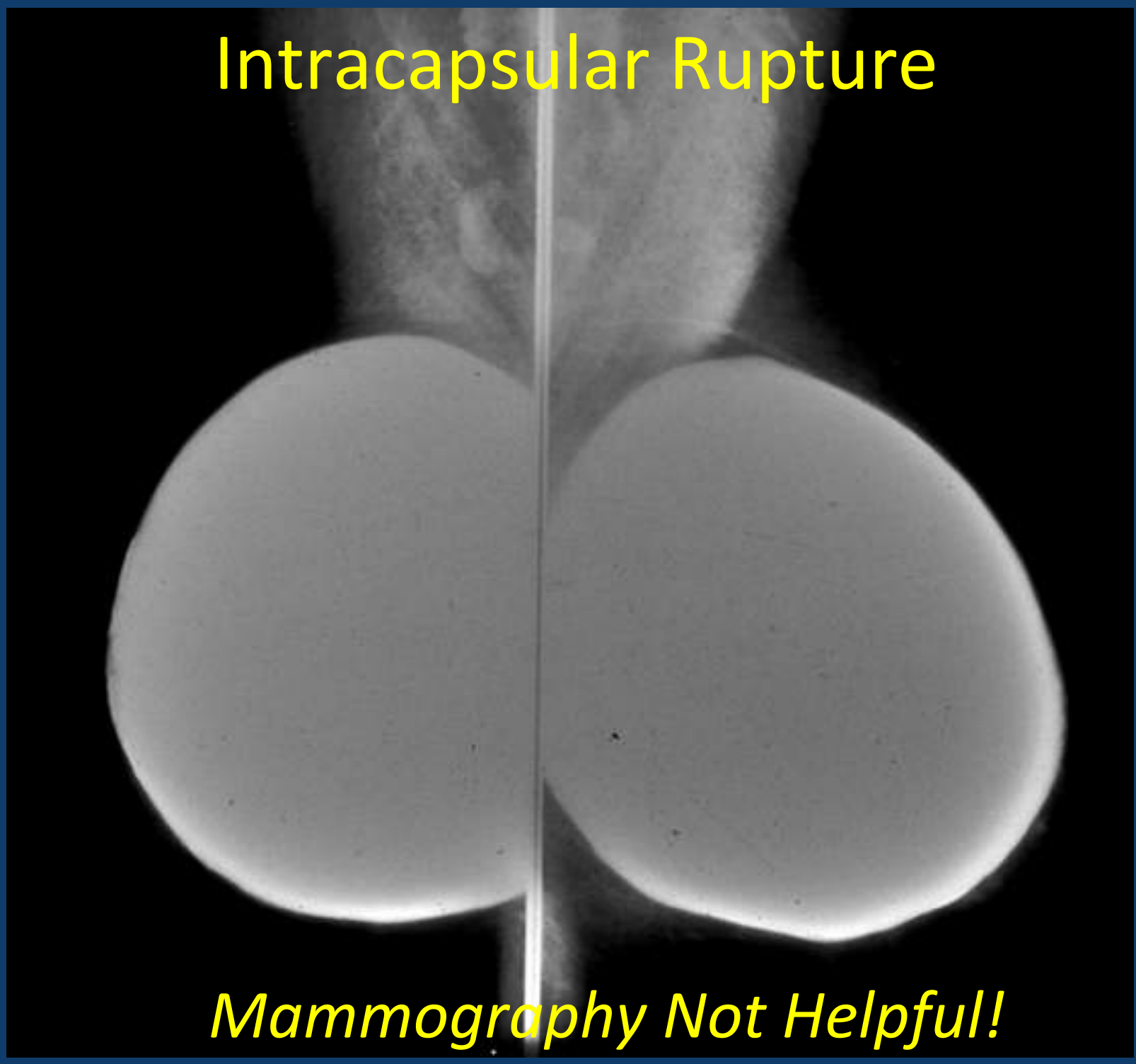
Implant Complications



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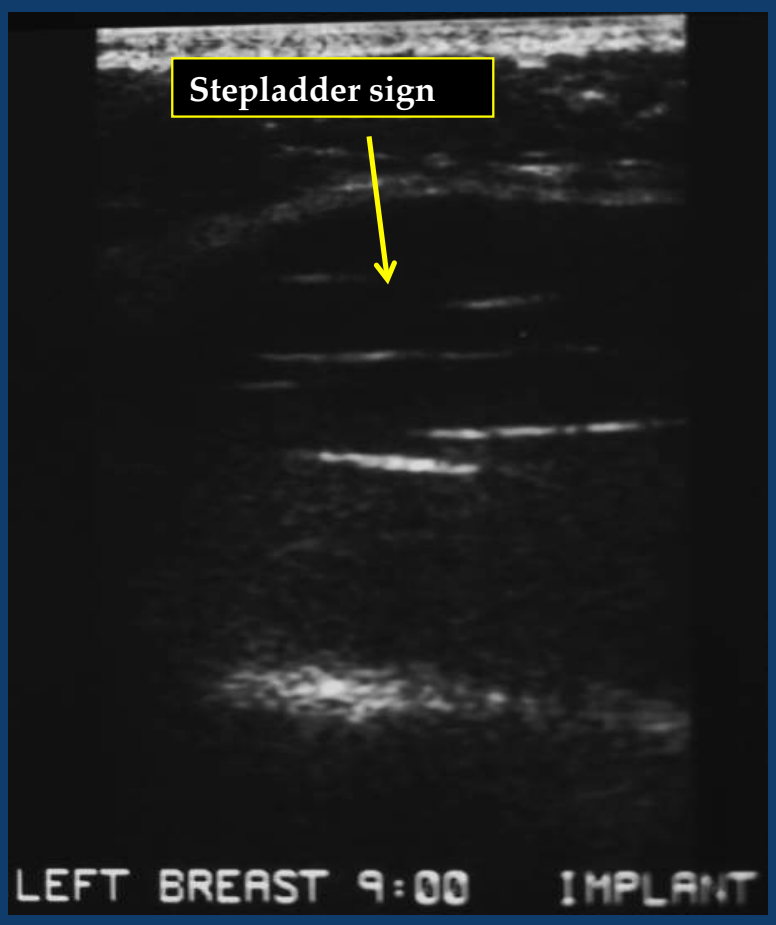
Implant Complications

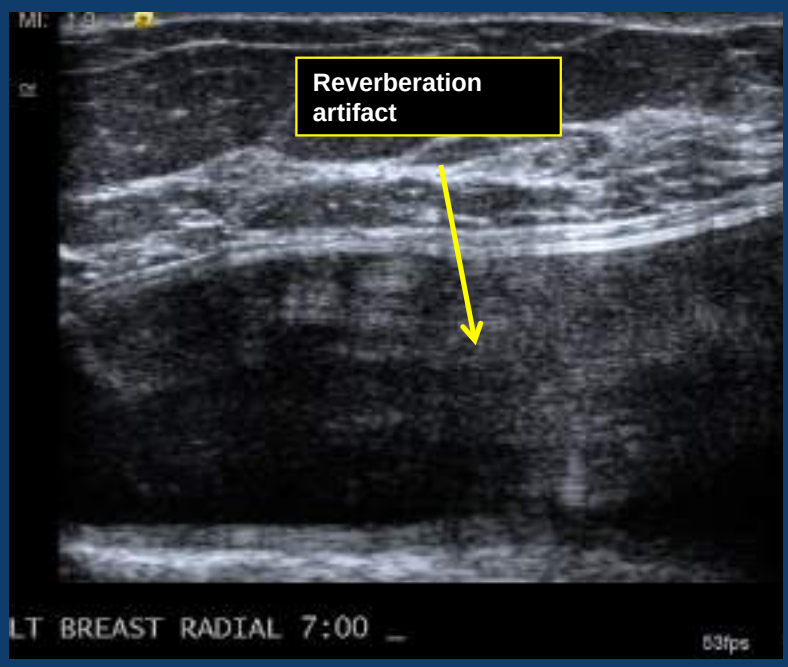
Intracapsular Rupture

- Ultrasound
  - "Stepladder" sign
    - Discontinuous, parallel echogenic lines analogous to a collapsed implant shell
    - Most reliable sign with US
    - Caveat: Reverberation artifact from normal implant shell
  - Peri-implant fluid less reliable sign of rupture
  - False negative US common, MRI remains "gold standard"

Implant Complications

Intracapsular Rupture





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Implants—MR Sequences

	Silicone	Fat	Water
FSE T2	Bright	Mod	V. Bright
FSE T2, water sat	Bright	Mod	Dark
STIR	Bright	Dark	V. Bright
STIR, water sat (silicone only)	Bright	Dark	Dark
T1, fat sat (± contrast)	Dark	Mod	Dark

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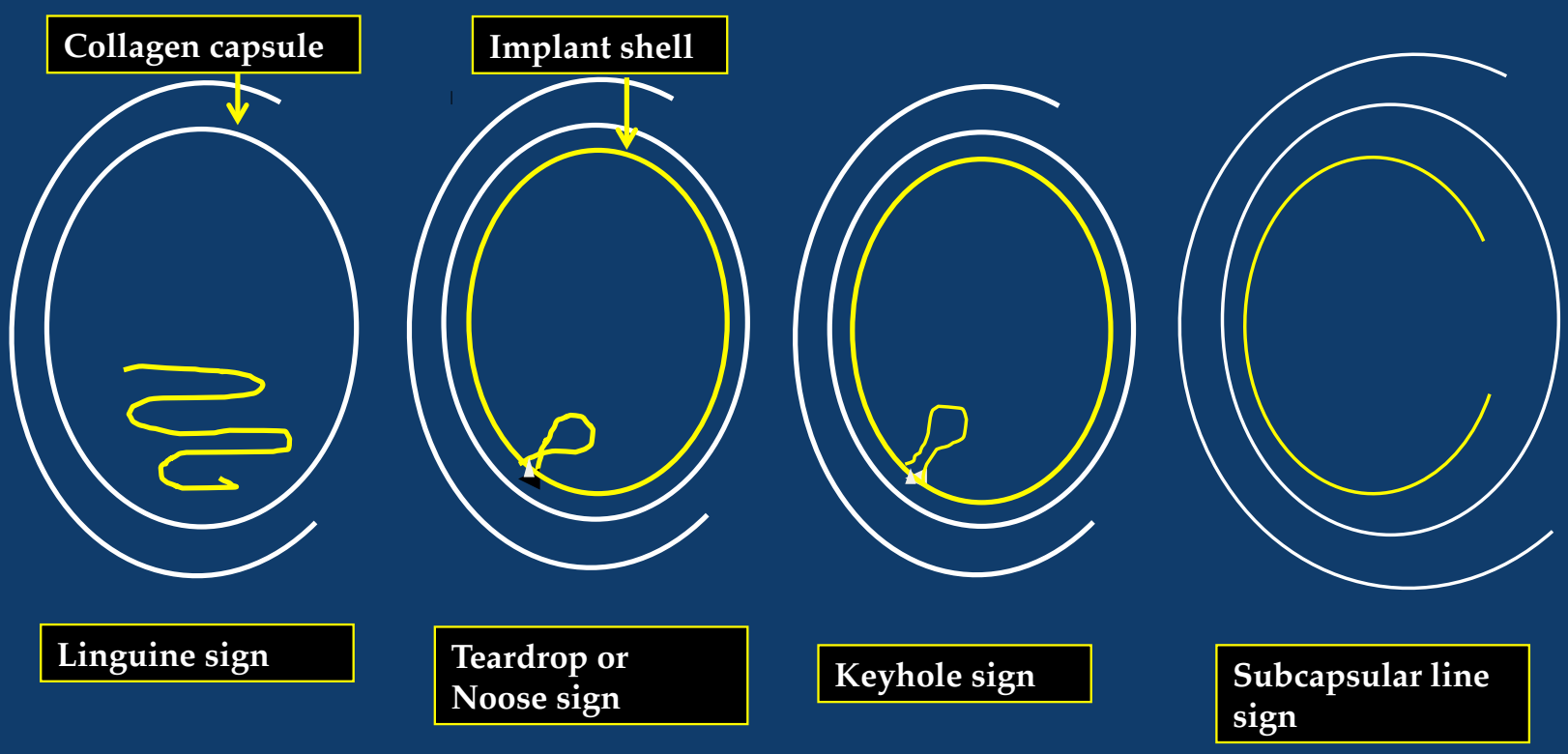
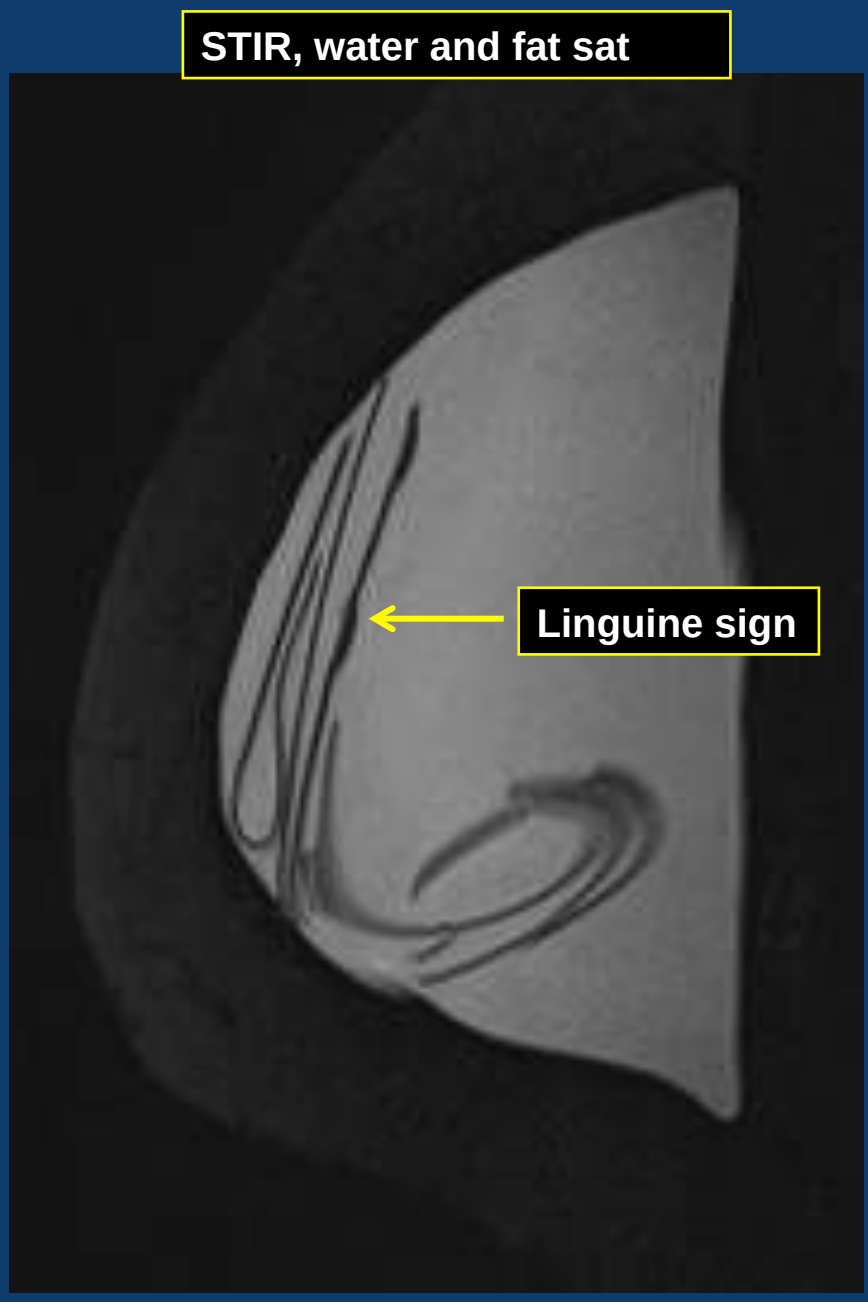
Intracapsular Rupture



Intracapsular Rupture

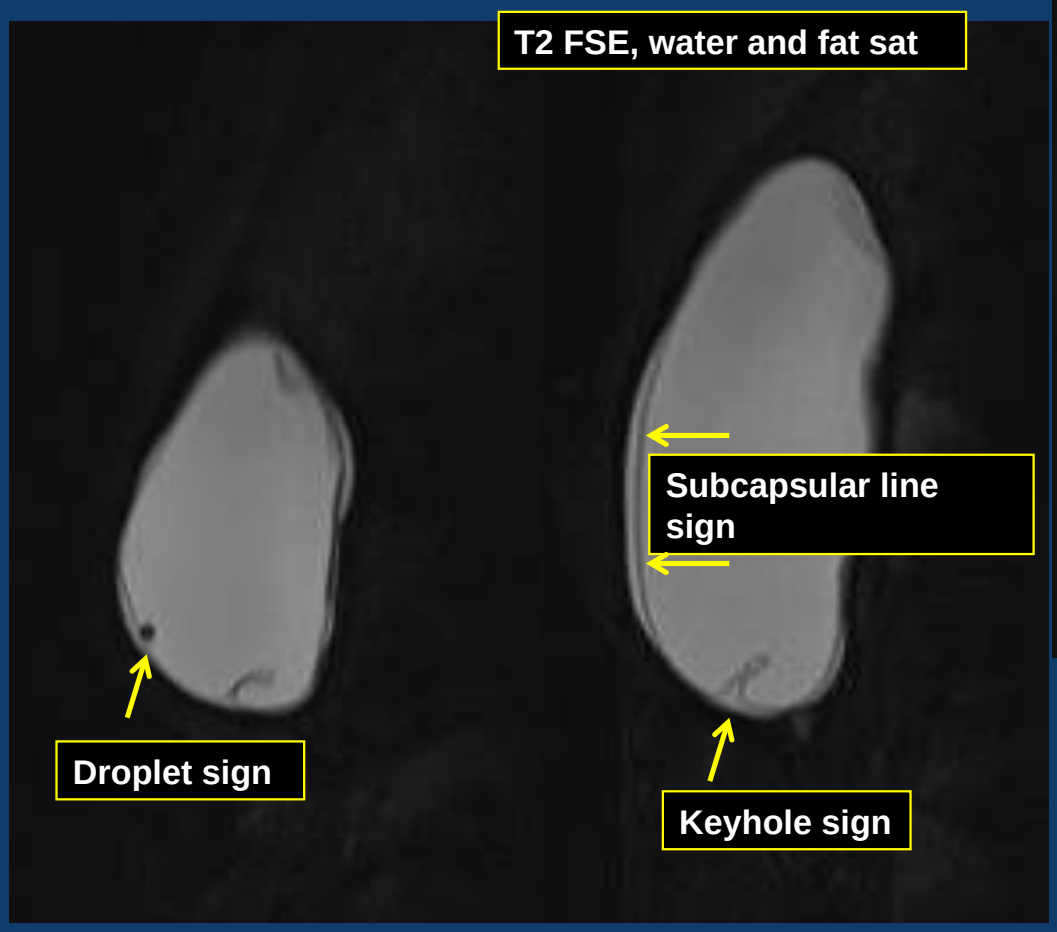
MRI findings:

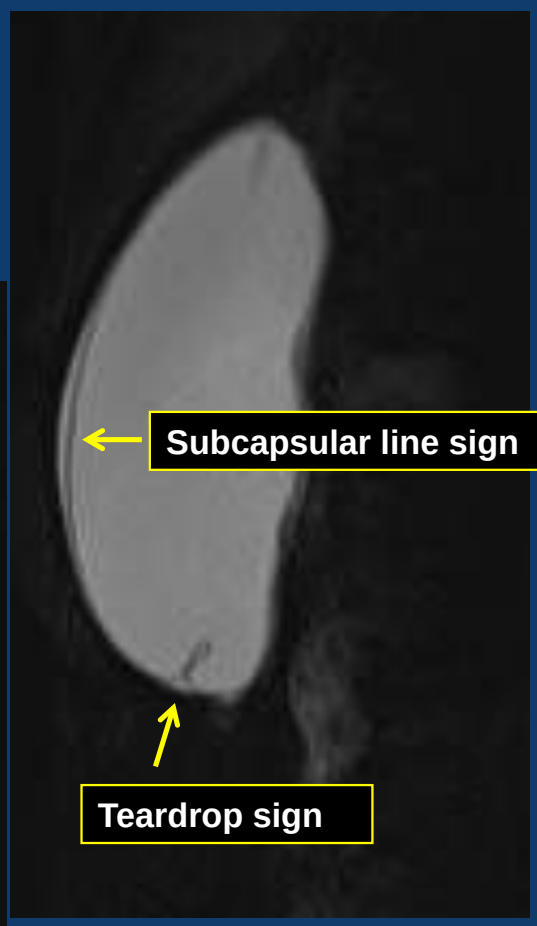
- Linguine sign
  - collapsed implant shell floating in silicone
- Teardrop and Keyhole signs
  - tear of silicone shell resulting in focal silicone between inner shell and fibrous capsule
- Subcapsular line sign
  - Portion of implant shell extending from one surface of implant to another
- Droplet or Salad Oil sign
  - nonspecific
  - air or water droplets within implant



Intracapsular Rupture

43 y/o with ?contour abn of implant on screening mammo





Dx: Intracapsular rupture

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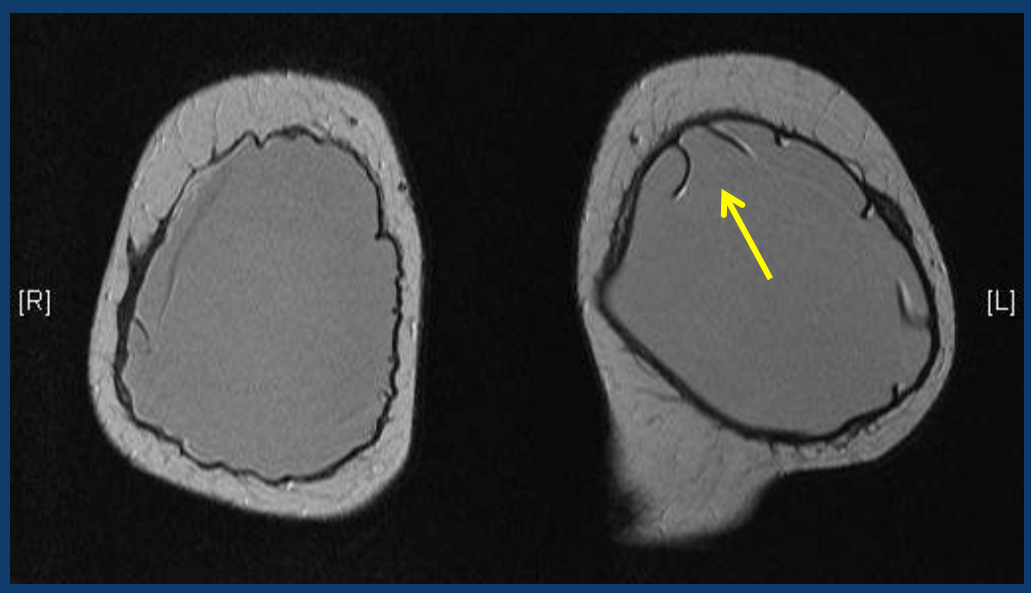
Implant Rupture--Pitfall

Radial folds

- Normal infoldings of implant shell
- May be multiple, complex
- May mimic rupture (common false + MR)
- May be observed with capsular contracture



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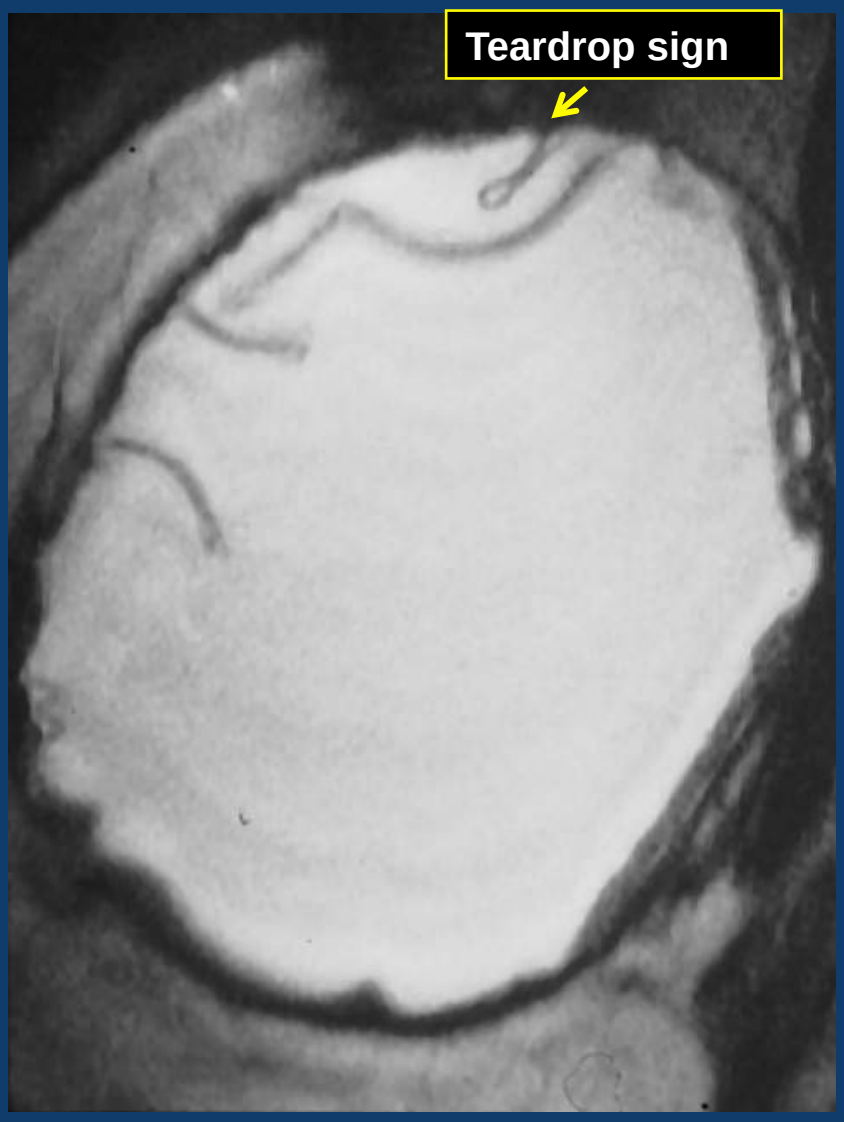
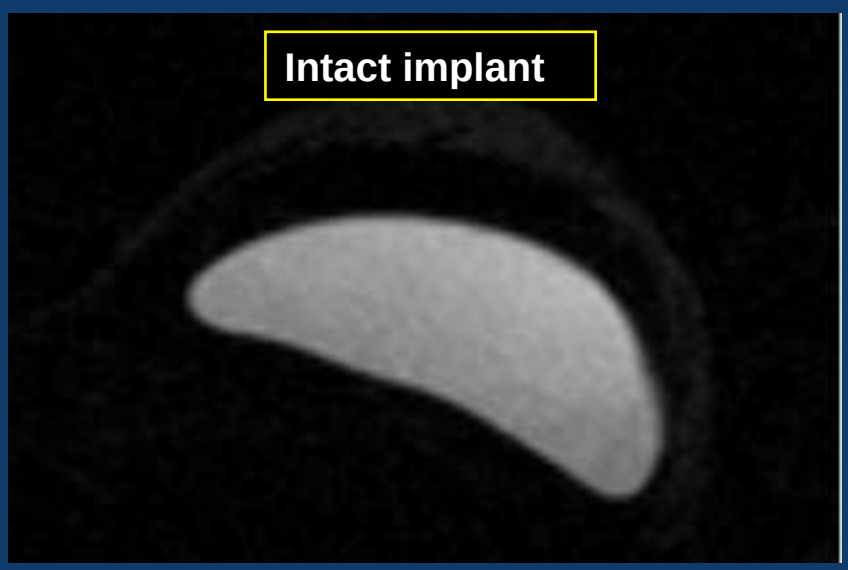
Gel Bleed

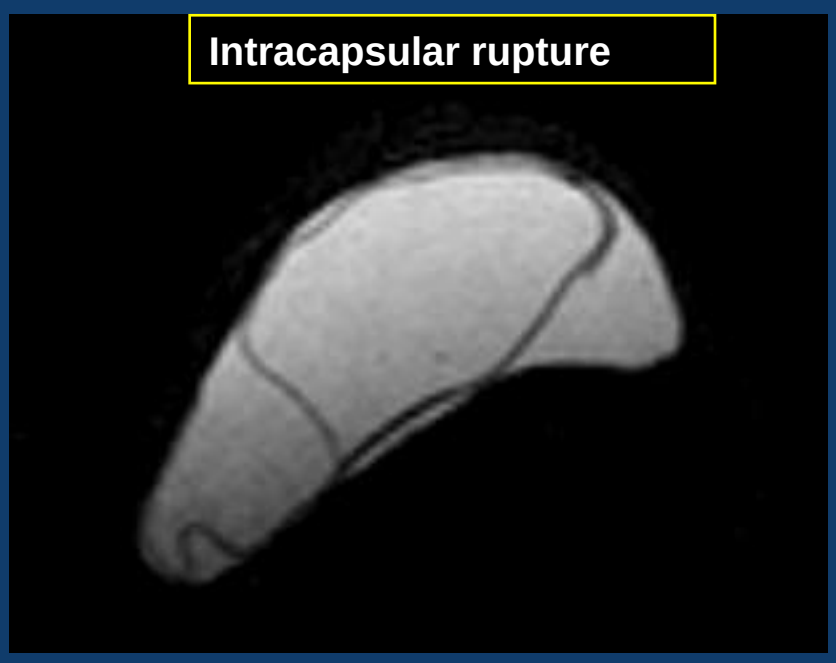
- Microscopic leak of silicone through intact shell
- Small leaks difficult to detect by any imaging
- Larger leaks may mimic intracapsular rupture (teardrop sign) or may migrate to nodes
- Not seen with newer, cohesive silicone implants



Cohesive “Gummy Bear” Implants

- Heden, et al.
  - 144 pts, 5-9 yr f/up
  - MRI findings
    - 99% intact
    - 0.3% rupture
    - 0.7% indeterminate

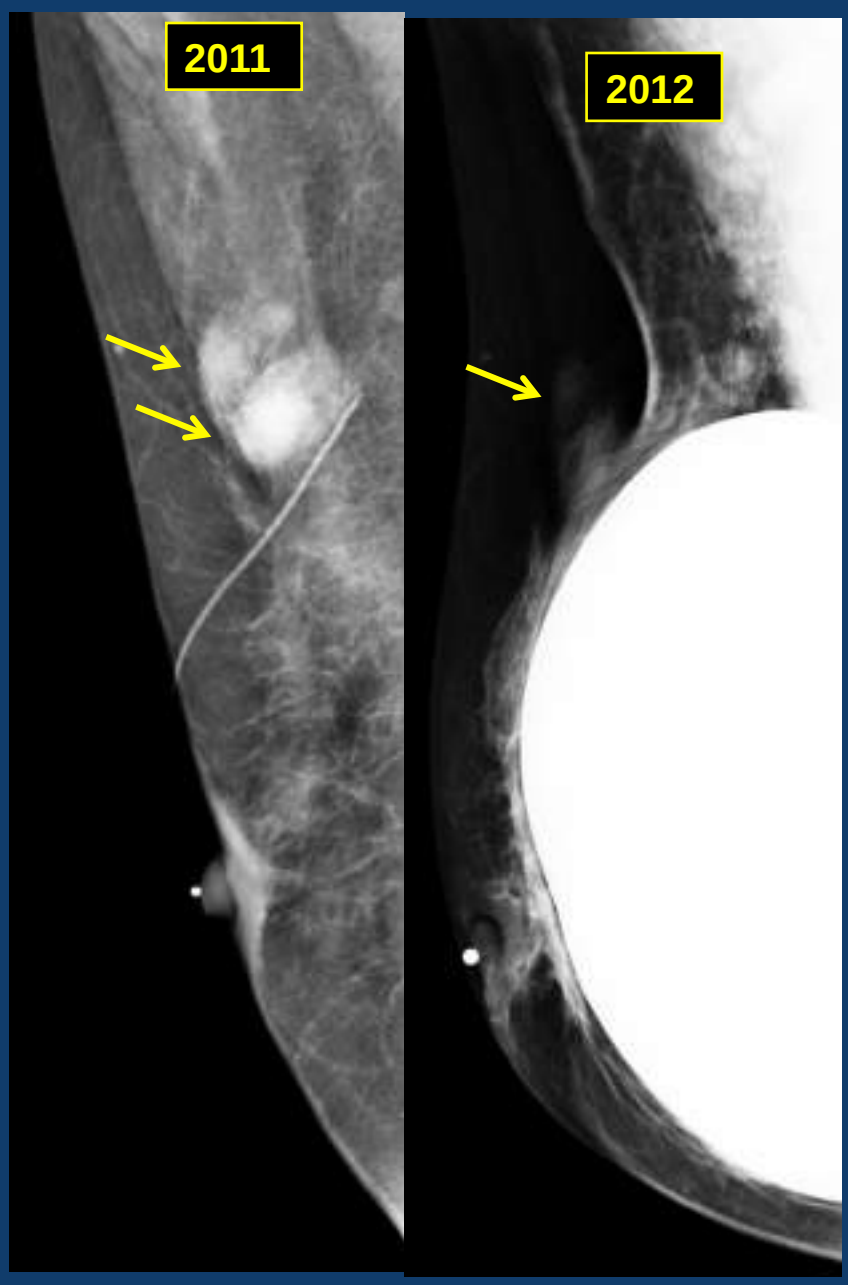




Explantation

Mammo. Findings:

- Residual free silicone
- Collapsed, calcified fibrocapsule
- Complications
  - Seroma
  - Infection
  - Hematoma



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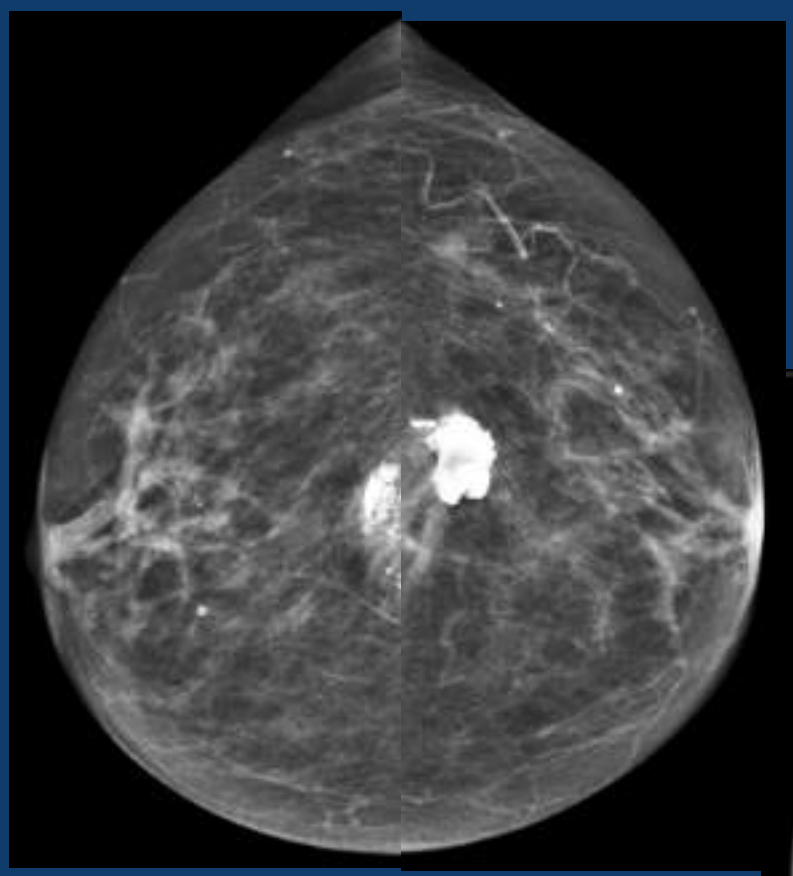
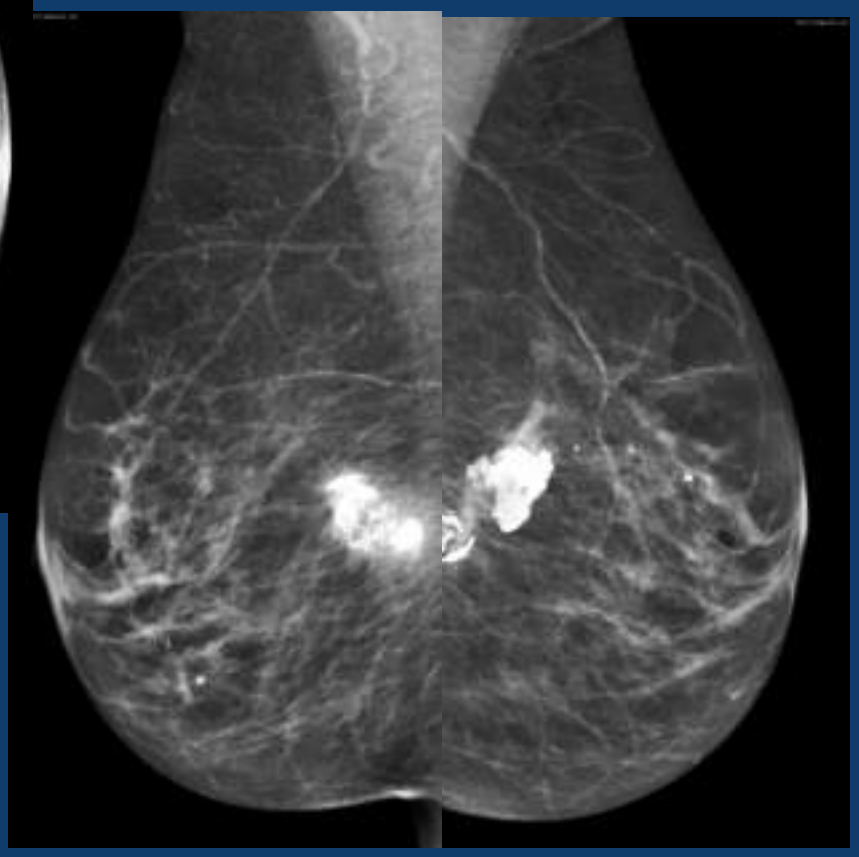
Explantation



Mammography findings



Dx: Collapsed calcified fibrocapsule

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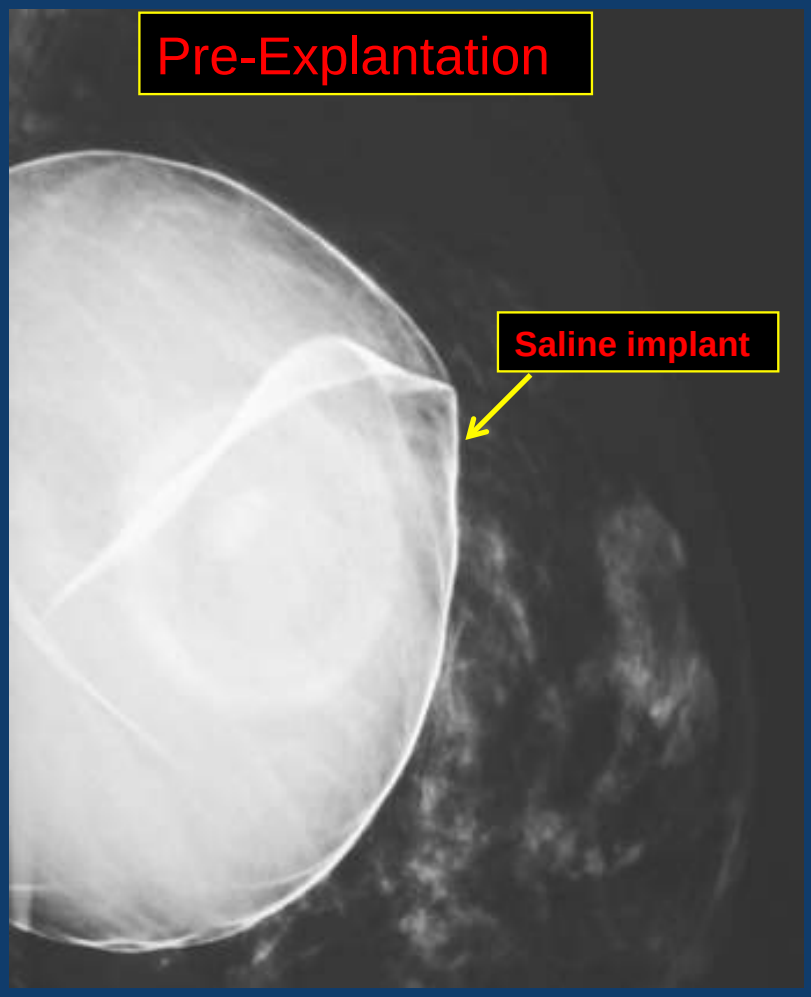
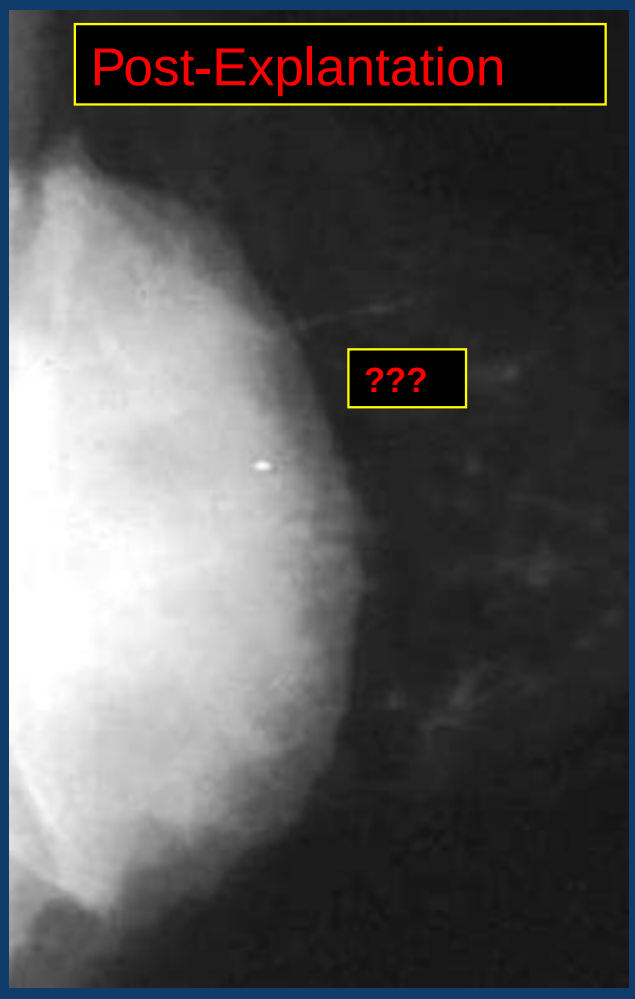
Explantation

43 y/o status post explantation





Dx: Seroma in residual fibrocapsule

Breast Reconstruction

- Tissue Expander/Implant
- Autologous Myocutaneous Flaps (AMF)
- Immediate
  - Pts not needing XRT
- Delayed
  - Pts who need XRT

Breast Reconstruction

- Routine imaging controversial, not rec. by plastic surgery literature
  - Low rate of recurrence
  - False +
  - Not cost-effective
- Helvie, et al
  - 8 cancers in 6 pts
  - 5 of 6 pts presented with palpable lumps
  - 1 found by screening mammography

We do not routinely screen recon. breasts!

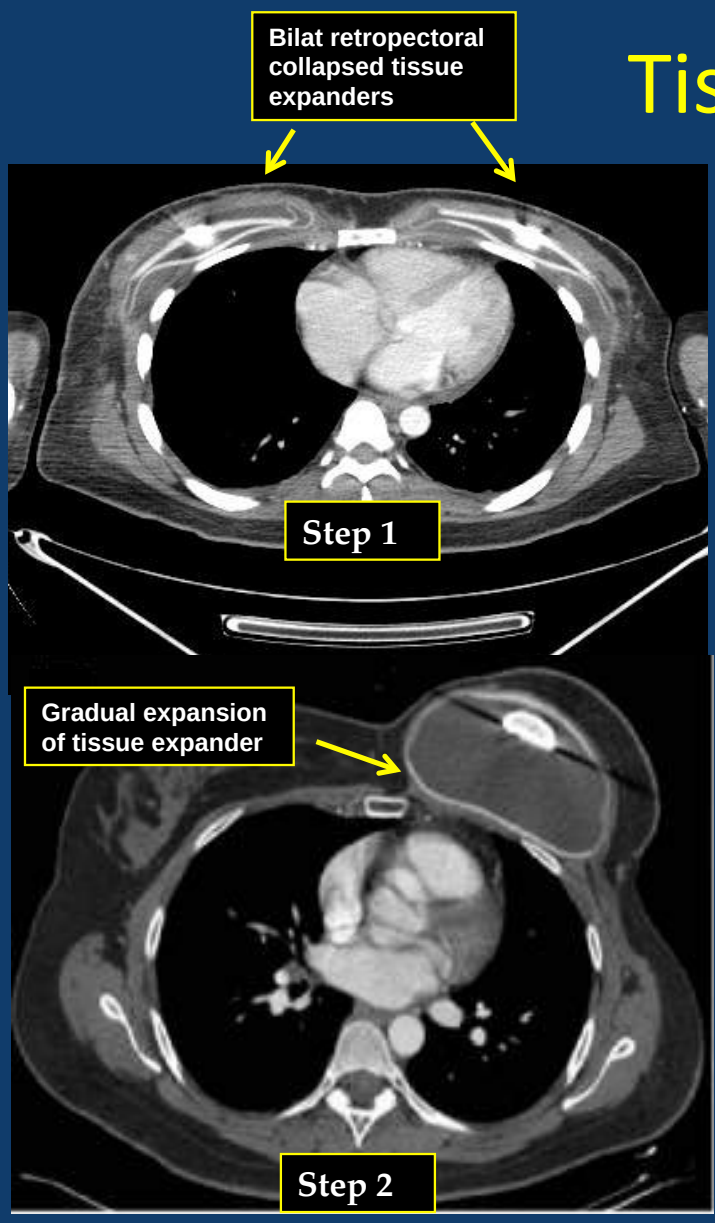
Breast Reconstruction

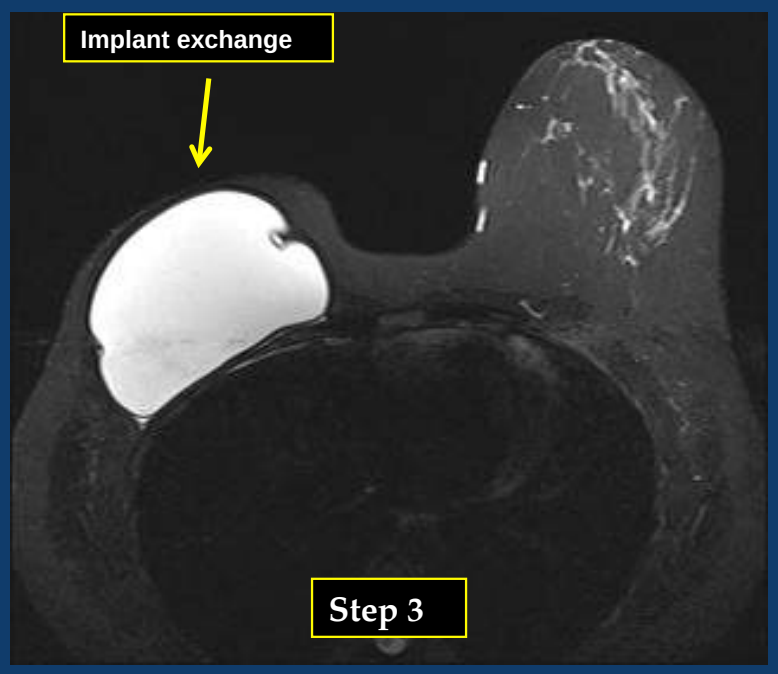
Tissue Expander/Implant

- Most common recon method in US
- Staged approach with expander placement, inflation over several months and implant exchange
- Final stages: nipple recon, contouring (fat injections), contralat surgery (for symmetry)

Breast Reconstruction

Tissue Expander/Implant





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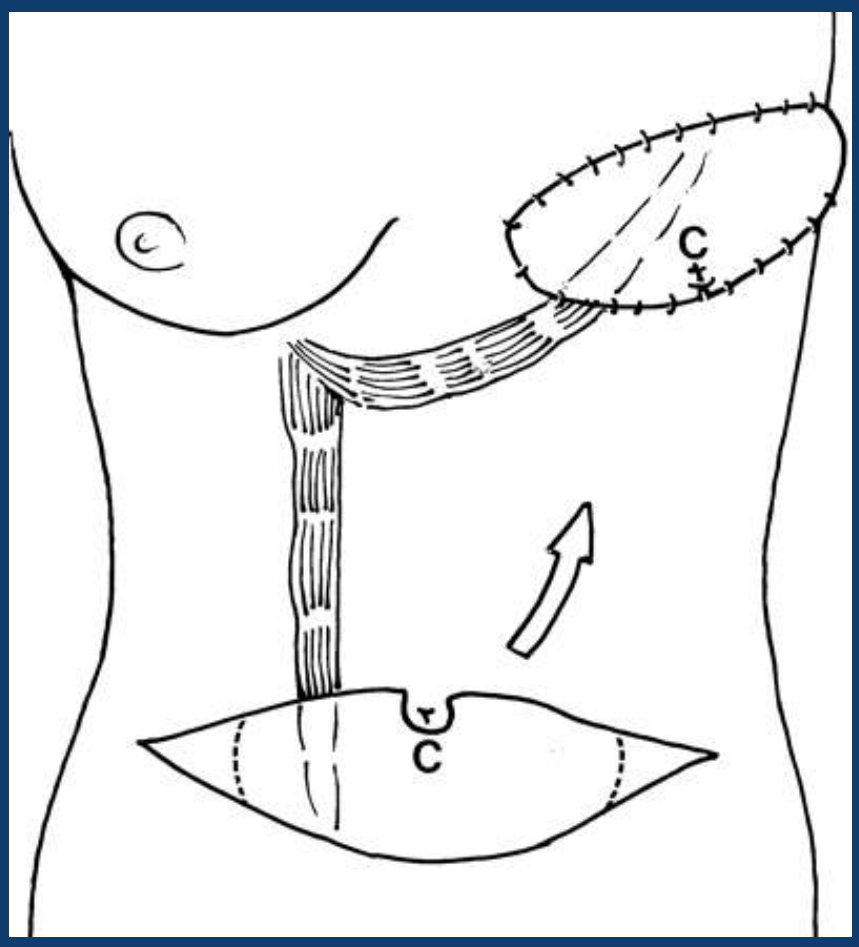
Breast Reconstruction

Autologous Myocutaneous Flaps (AMF)

- TRAM (Transverse Rectus Abdominus Myocutaneous)
- LD (Latissimus Dorsi)
- DIEP (Deep Inferior Epigastric Perforator)
- Others (SIEA, GAP, TUG)
- NCCN guidelines—XRT (if needed) should occur before AMF recon.

Breast Reconstruction—Pedicled Flaps

- TRAM
- Most Common AMF in US
- Lower abdominal muscle, fat and soft tissue
- Pedicled
- Blood supply—superior epigastric
- Free flap
- Inferior epigastric artery and vein
- Combination flap



Hogge, et al. Radiographics, 1999

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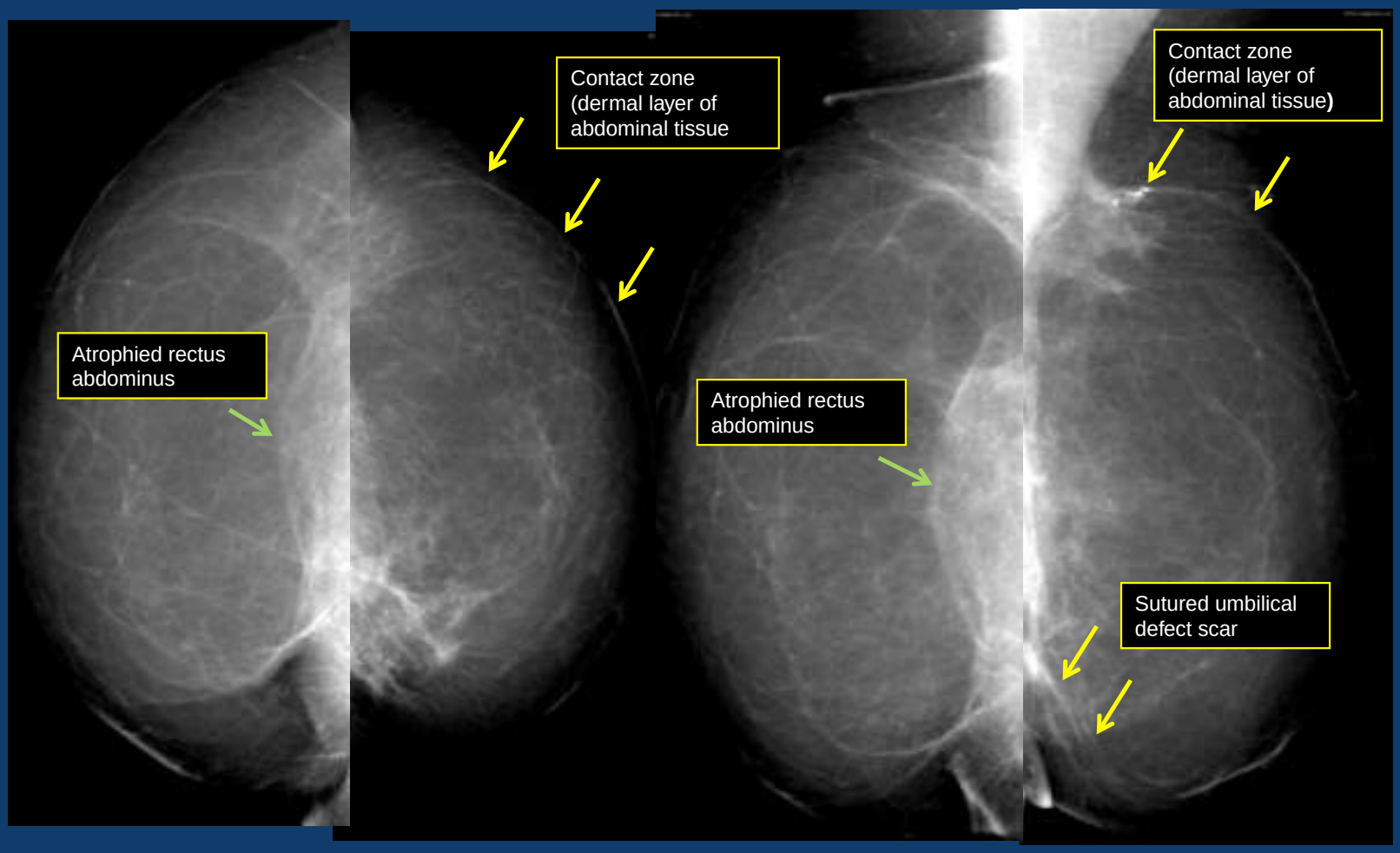
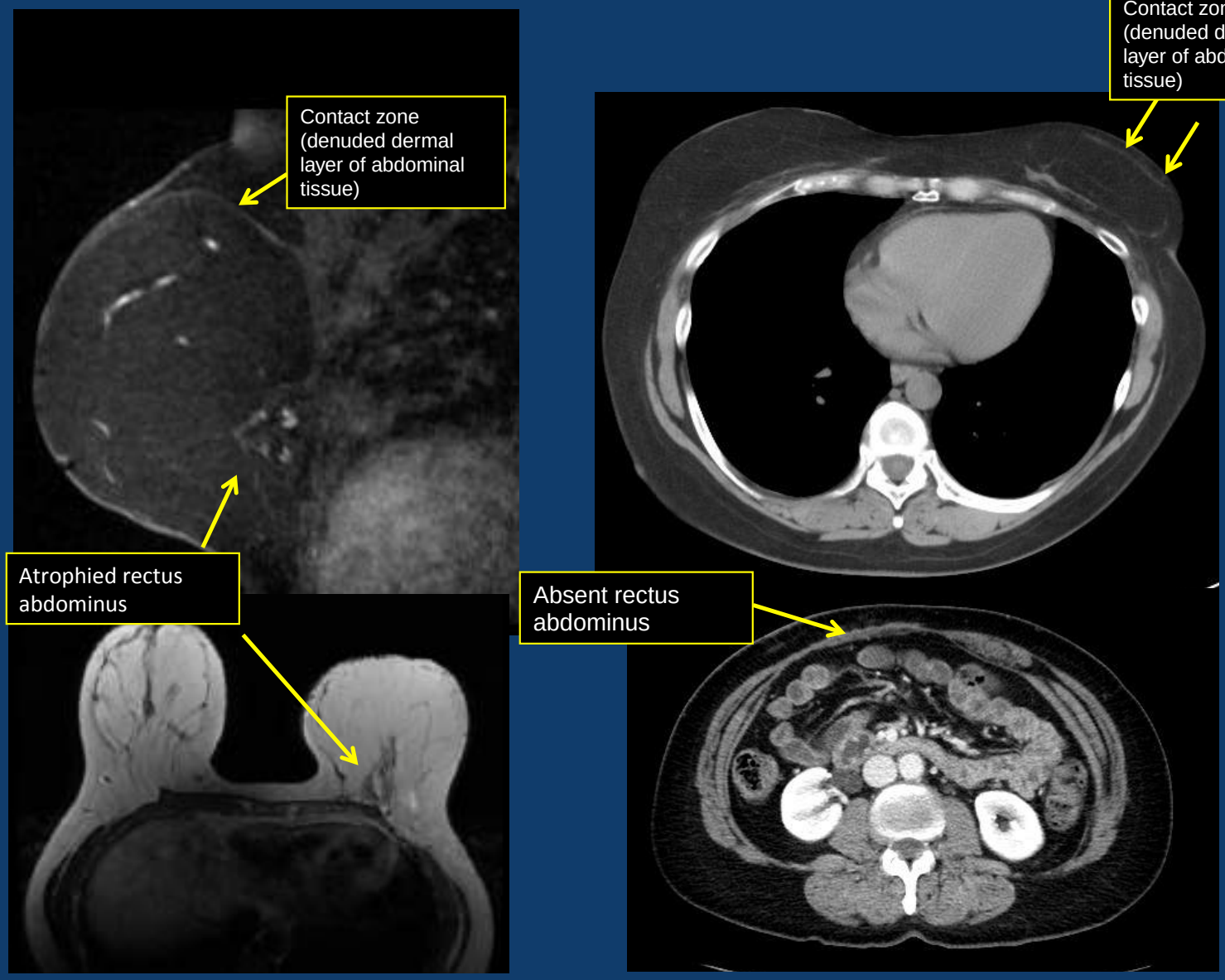
TRAM flap--Mammography



Pedicled TRAM flap—CT/MRI



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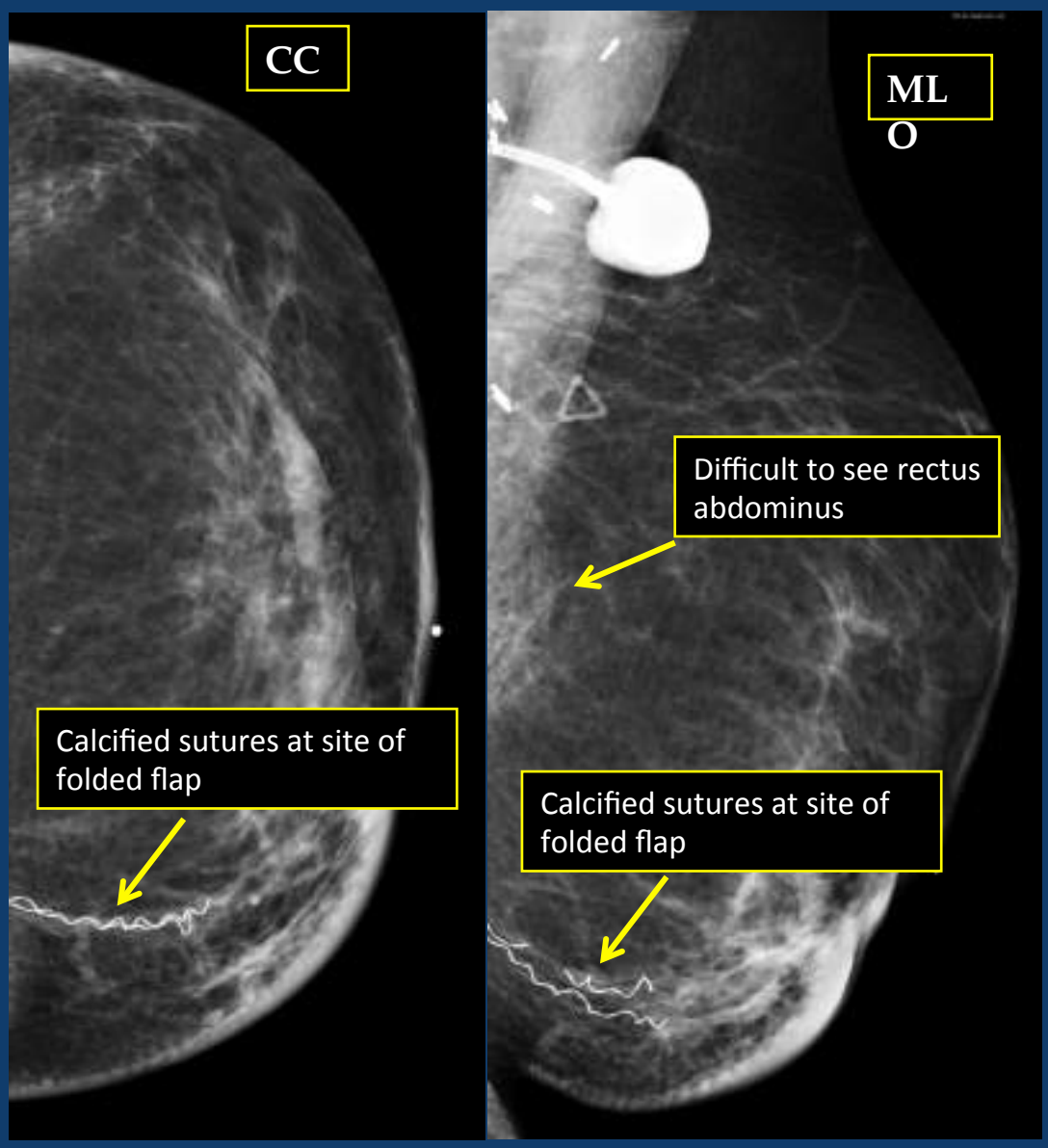
“Supercharged” TRAM

- Favored for pts with obesity, atherosc l., DM, etc
- Pedicled TRAM + microsurgical vasc. anastamosis
- Augment blood supply to pedicle flap
- DIE vessels to long thoracic or int. mamm

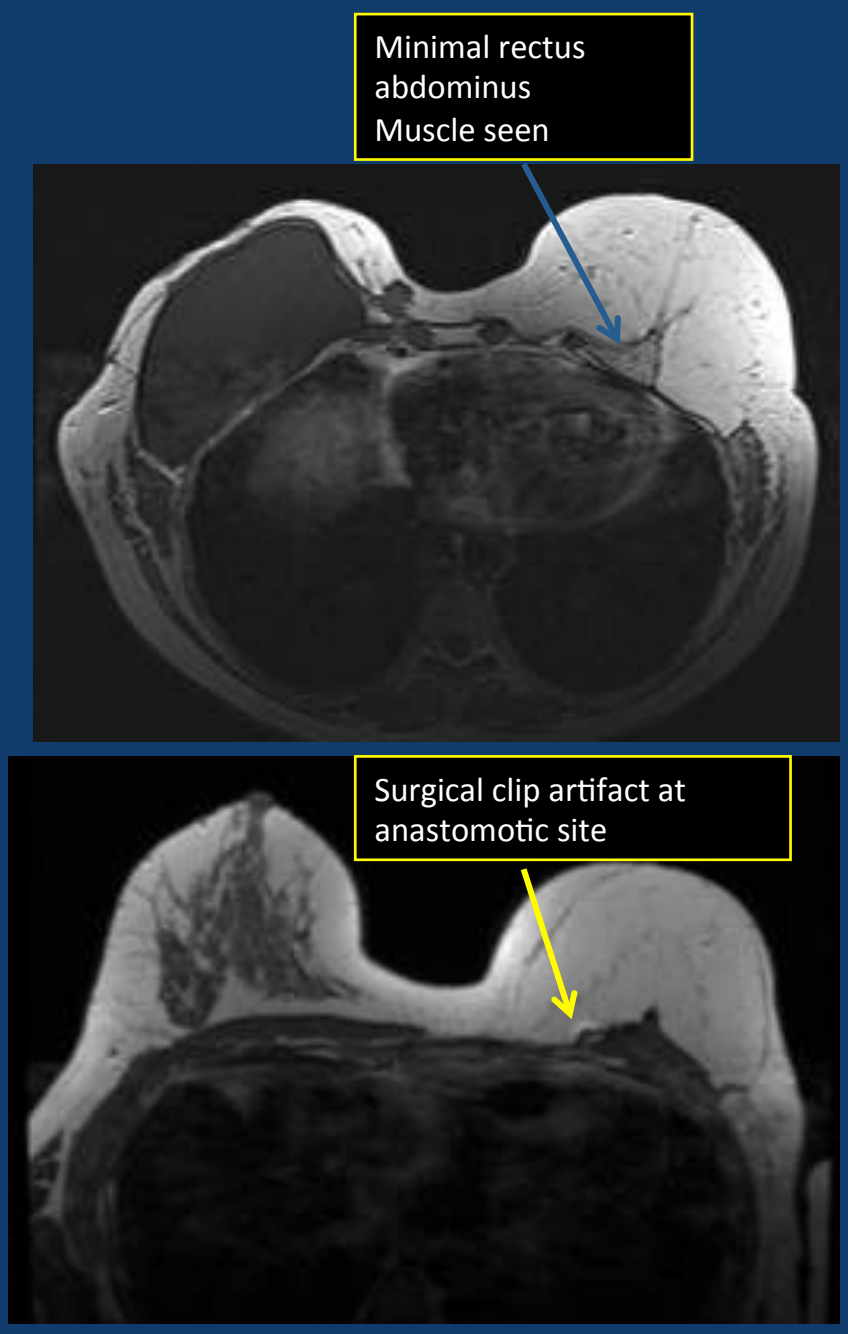
Free TRAM

- Requires less rectus abdominus muscle
- Difficult to distinguish from pedicled TRAM on imaging



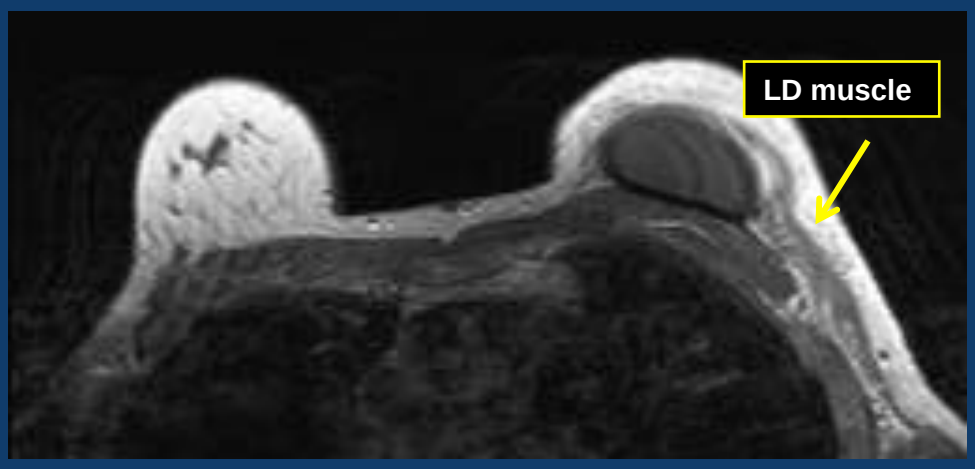
Free TRAM

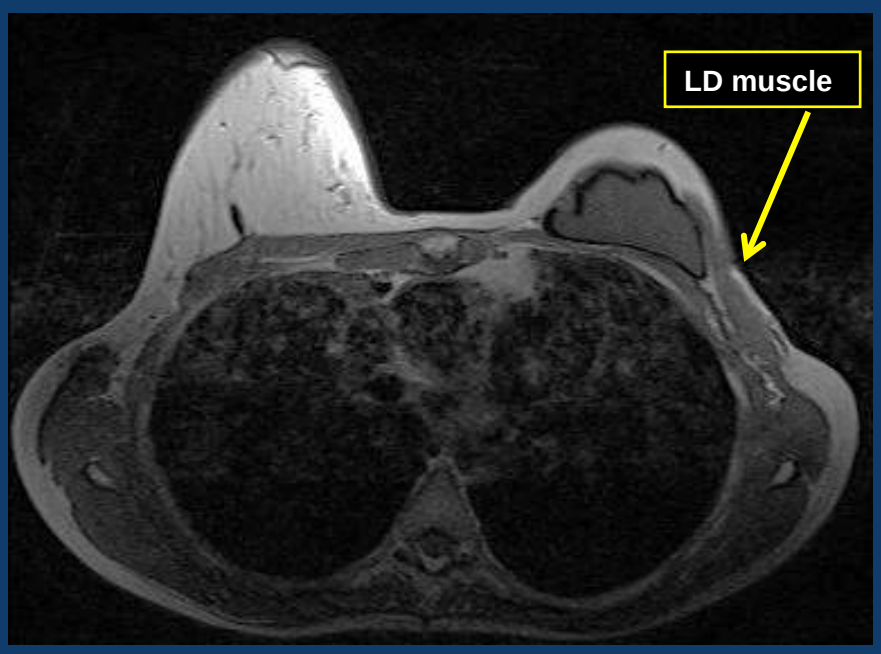
- Less risk of abd wall hernia
- Inf epig. art/vein
- Favored for pts with atherosclerosis, DM, etc



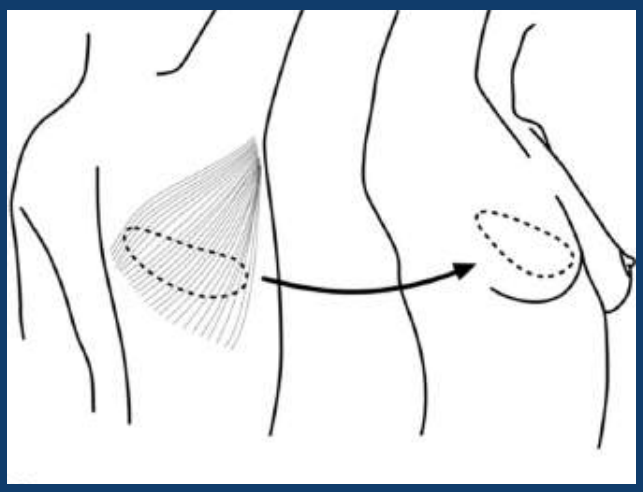
Latissimus Dorsi (LD) Flap

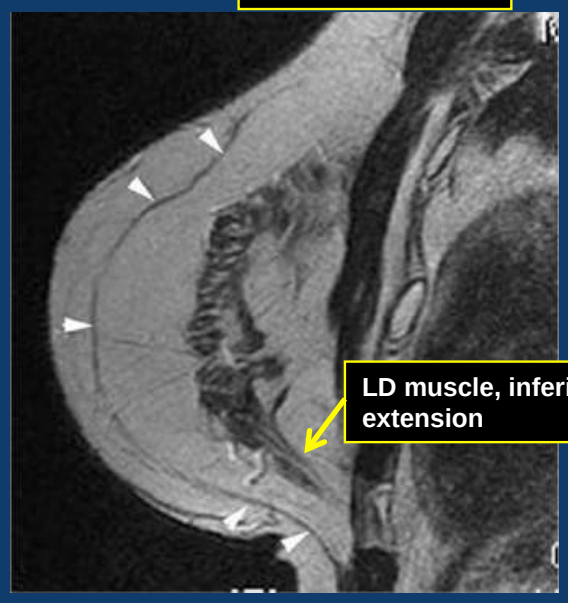
- Less common than TRAM
- Reserved for pts with contraindication to TRAM
- Commonly combined with tissue expander/ implant
- Can be used in pts with previous XRT

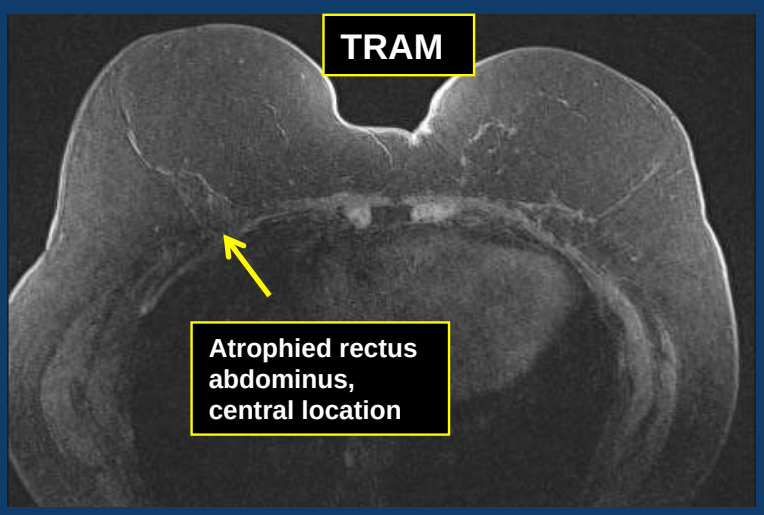




LD Flap



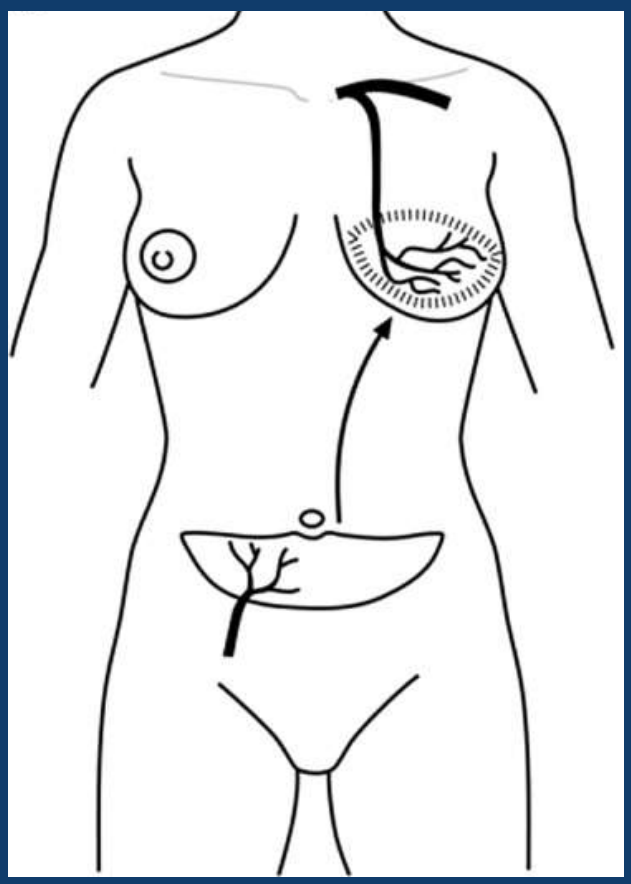




Juanpero, et al. Insights Imaging, 2011

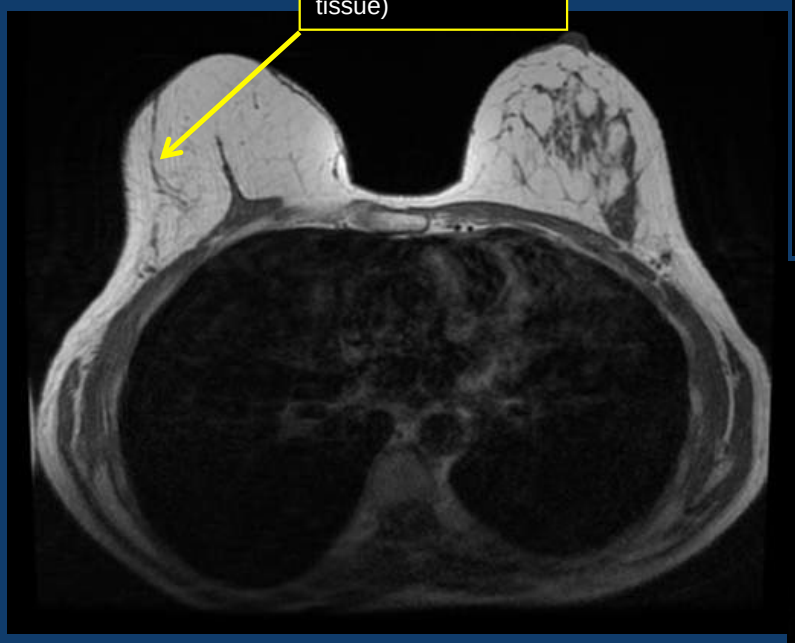
Deep Inferior Epigastric Artery Perforator Flap(DIEP)

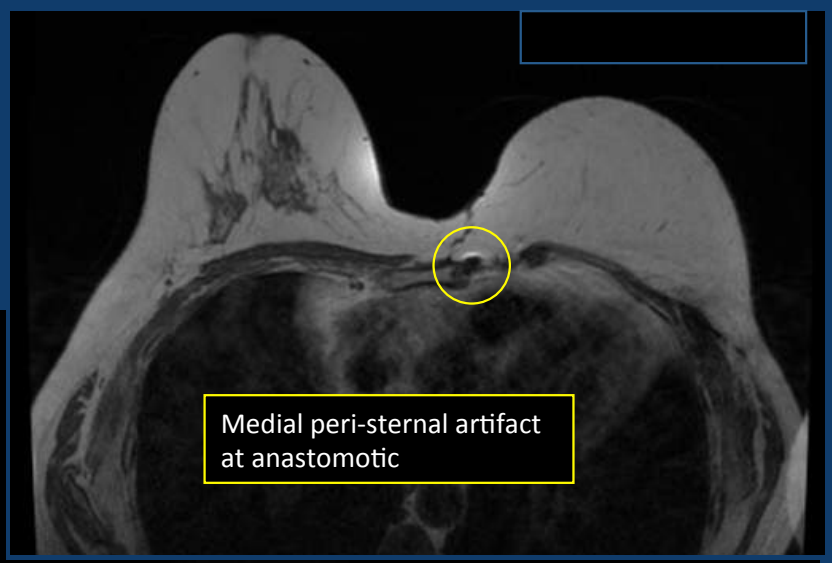
- Donor skin/fat from lower abdomen
- Deep inferior epigastric artery and vein intramusc perforators anastomosed to internal mamm branches
- Young, healthy pts best candidates

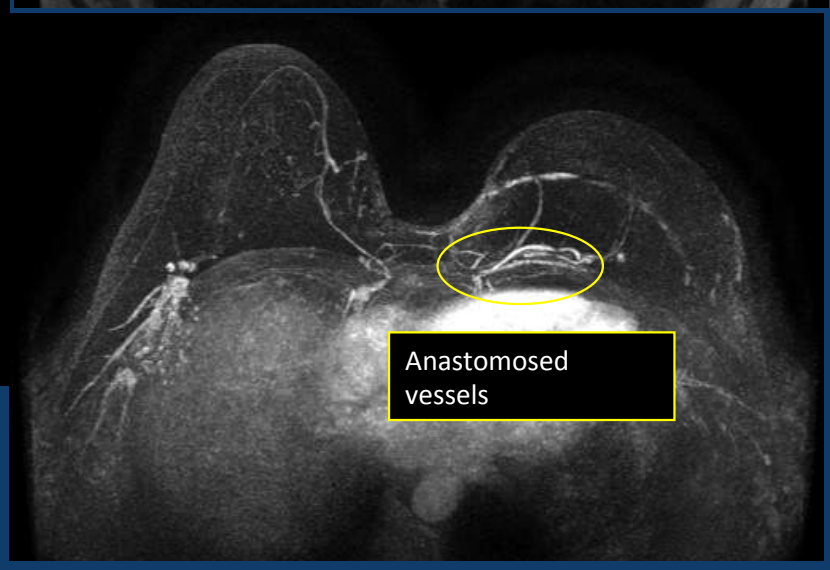


Juanpero, et al. Insights Imaging, 2011

Breast Reconstruction—DIEP







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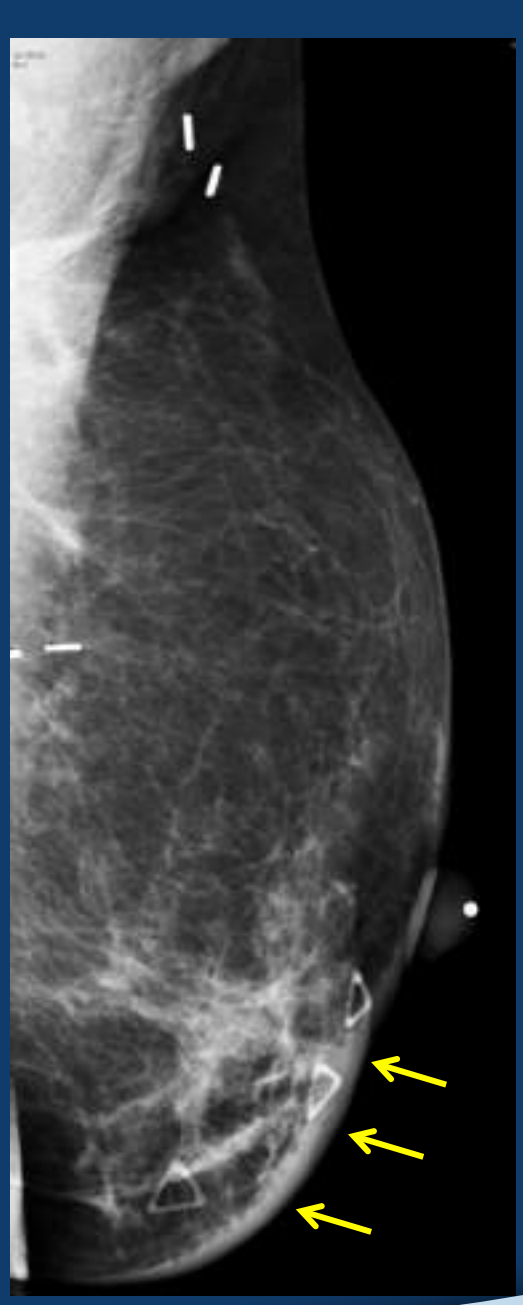
Reconstruction--Complications

- Implant deflation
- Hematoma/seroma
- Infection
- Skin thickening/fibrosis
- Fat necrosis
- Tumor recurrence

Reconstruction--Complications

Skin thickening/fibrosis

- Usually benign
- Sequelae of XRT
- Lymphedema (surgery affecting lymphatic drainage)
- No significant enhancement on T1+C MRI (as opp to inflamm ca)
- MR-- low signal on T2 (iso to hyperintense with inflamm ca)



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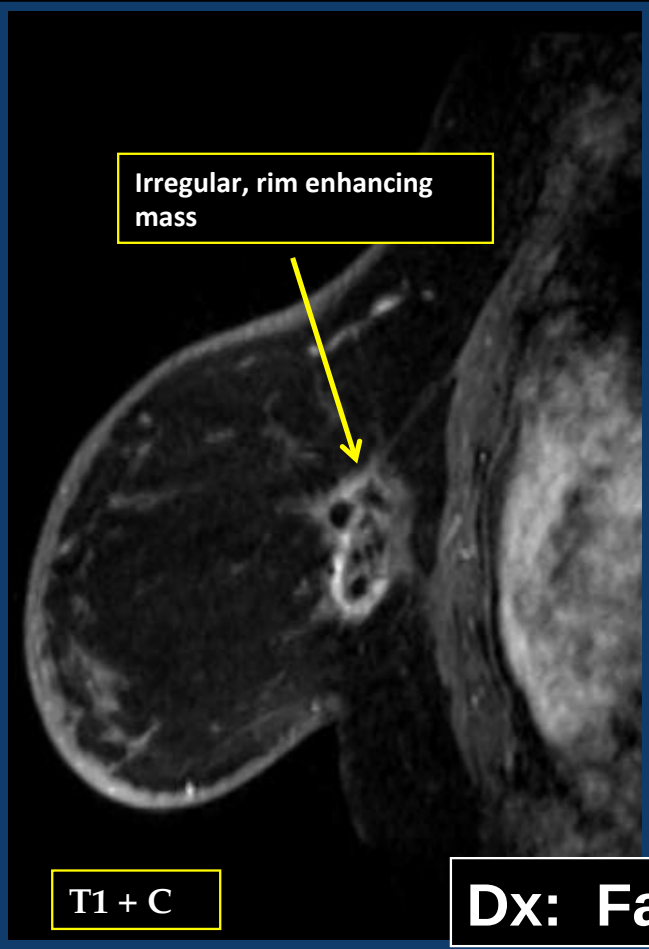
Reconstruction--Complications

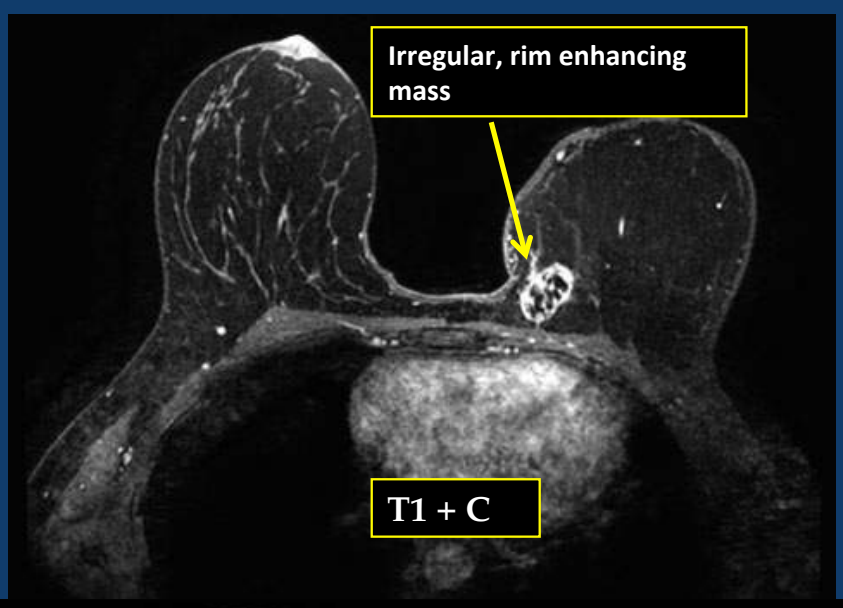
Fat Necrosis

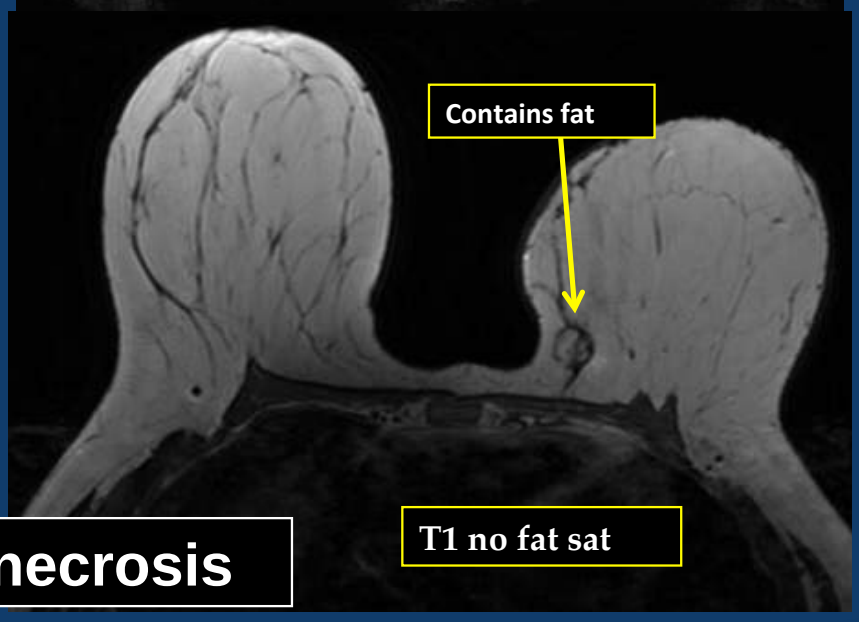
- Rate 10-26% in free or pedicled AMF's
- Mammography may be diagnostic
- Usually seen at periphery of flap (poor blood supply)
- Common false + on imaging
- May require a bx if imaging is indeterminate
- AMF lesion needle bx safe after 3-4 mths post op

Reconstruction--Complications

34 y/o w/palp lump, s/p mastec and pedicled TRAM recons.







Dx: Fat necrosis

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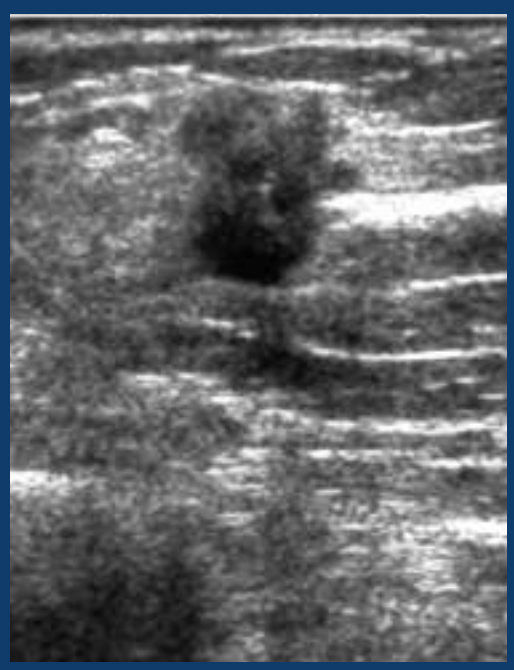
Reconstruction--Complications

Tumor recurrence

- Rate 5-15%
- Most within 5 yrs
- Primary location--superficial, palpable, “contact zone”
- Second common location--chest wall

Reconstruction--Complications

54 y/o w/palp mass, s/p mastec and free TRAM recons.



Dx: IDC

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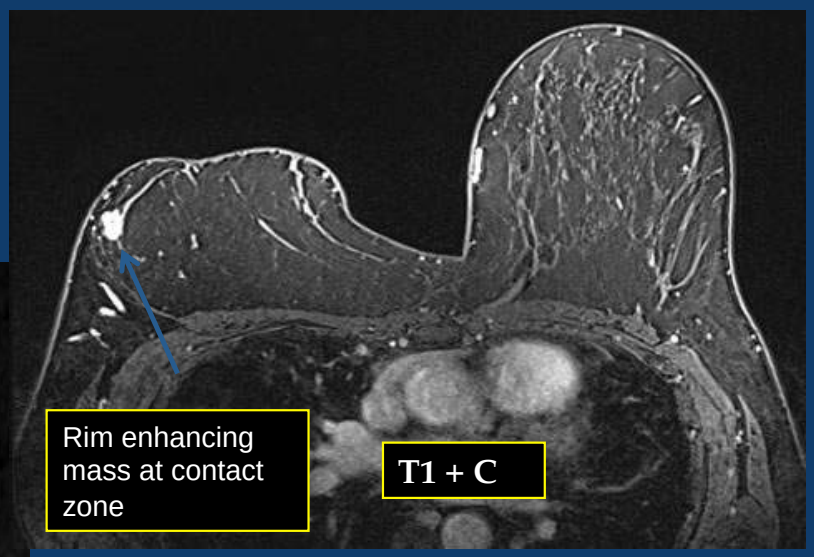
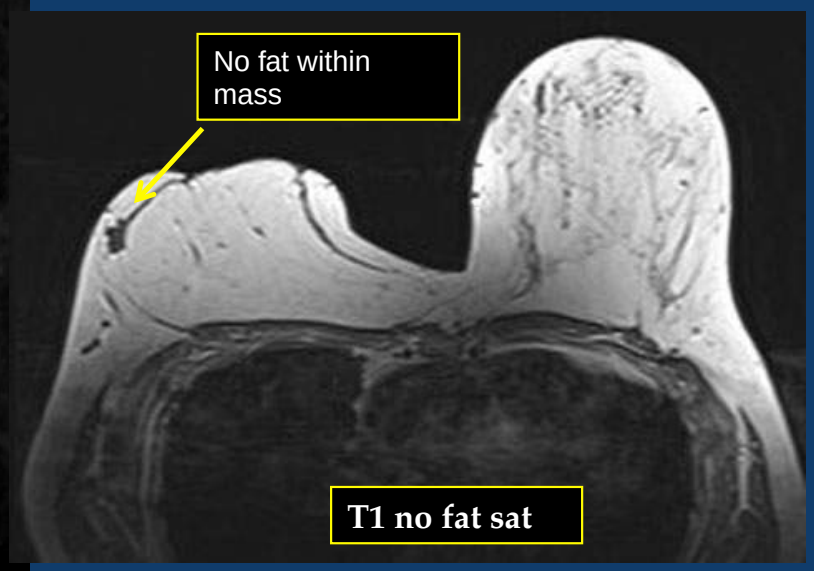
Reconstruction--Complications

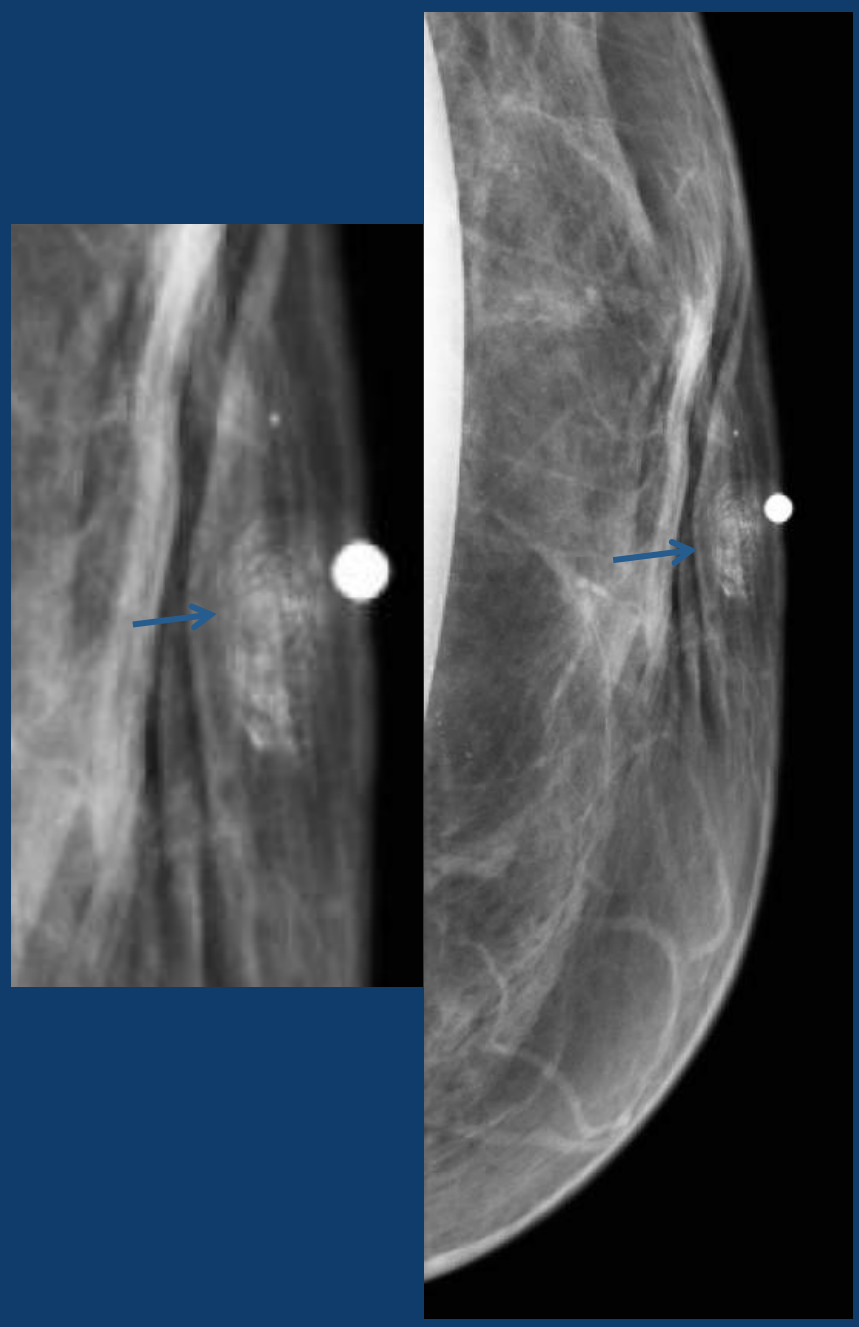
54 y/o w/palp mass, s/p mastec and free TRAM recons.





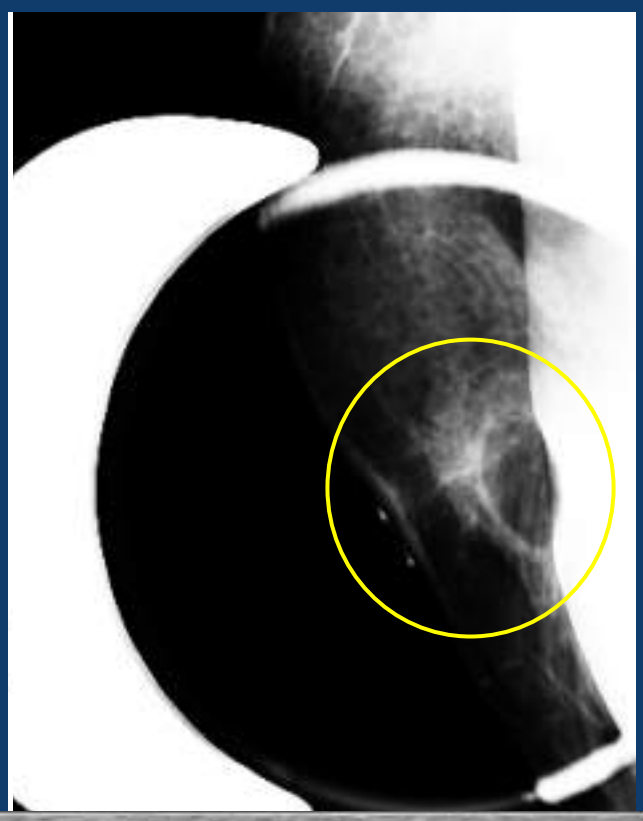
Nipple-areolar Reconstruction

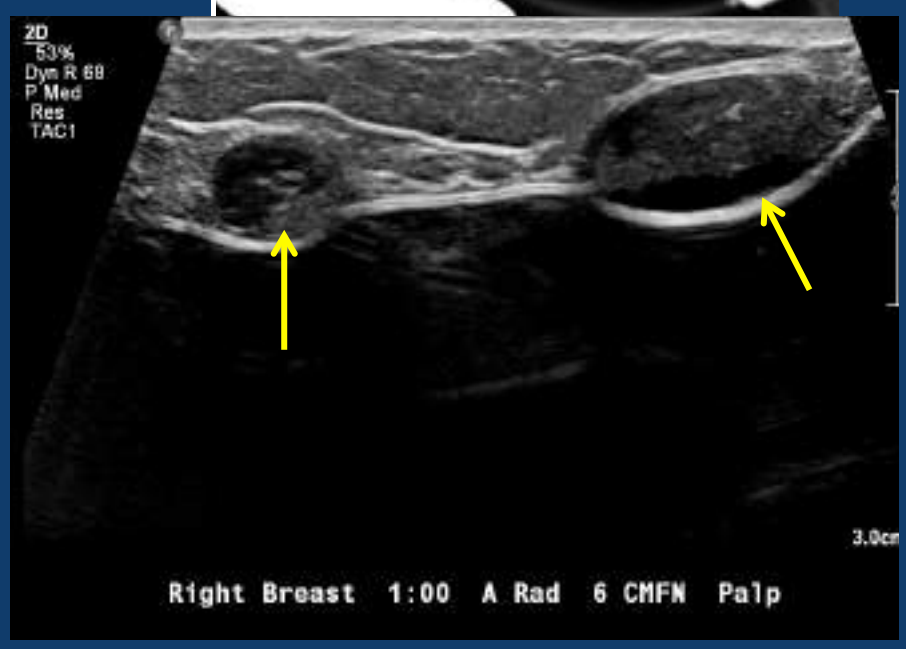
- Last step of reconstruction
- Options: nipple sharing, grafts, intradermal tattoo, etc
- Pigment-gel suspension technique
- Pigment contains titanium dioxide—may mimic ca+ on mammo
- Produces blooming artifact on MR



Fat Grafting

- Last step of reconstruction
- Options: nipple sharing, grafts, intradermal tattoo, etc
- Pigment-gel suspension technique
- Pigment contains titanium dioxide—may mimic ca+ on mammo
- Produces blooming artifact on MR





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Fat Grafting

Post surgery

Post flap reconstruction

Post fat grafting and nipple areolar reconstruction

Courtesy of Scott Hollenbeck, MD