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
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")
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
Implants

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

▪ Immediate
  • Seroma
  • Hematoma
  • Infection (1.2%)
  • Deflation (1.8%)

▪ Delayed
  • Capsular contracture
  • Rupture
Implant Complications

Seroma

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

Seroma

Aspiration recommended of larger seromas (infection risk)
Implant Complications

Infection/abscess

- Usually occur within a month post-op
- Organisms: staph aureus, staph epidermis, (rarely, anerobes or mycobacterium)
Implants 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—infiammation, bacterial contamination, implant leak
- More common with subglandular placement

Imaging not helpful!

42 y/o with suspected cc on exam

Post capsulotomy

Capsular contracture
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)
Extracapsular Rupture (Mammography)

- Focal bulge
- Focal irregularity
- Free silicone in nodes

Caveat: Not all free silicone = current rupture
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!)
52 y/o with silicone implants, ? focal bulge laterally on screening mammo

**Dx:** Extracapsular Rupture
40+ y/o with palpable “lump”

Lump

Snowstorm

Enhancing mass

??? Rupture

Bx: IDC

Caveat: Cancer can resemble rupture
Intracapsular Rupture

Mammography Not Helpful!
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"
Intracapsular Rupture

Stepladder sign

Reverberation artifact
## Implants—MR Sequences

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Silicone</th>
<th>Fat</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSE T2</td>
<td>Bright</td>
<td>Mod</td>
<td>V. Bright</td>
</tr>
<tr>
<td>FSE T2, water sat</td>
<td>Bright</td>
<td>Mod</td>
<td>Dark</td>
</tr>
<tr>
<td>STIR</td>
<td>Bright</td>
<td>Dark</td>
<td>V. Bright</td>
</tr>
<tr>
<td>STIR, water sat (silicone only)</td>
<td>Bright</td>
<td>Dark</td>
<td>Dark</td>
</tr>
<tr>
<td>T1, fat sat (+ contrast)</td>
<td>Dark</td>
<td>Mod</td>
<td>Dark</td>
</tr>
</tbody>
</table>
Intracapsular Rupture

- Collagen capsule
- Implant shell

Signs:
- Linguine sign
- Teardrop or Noose sign
- Keyhole sign
- Subcapsular line sign
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
43 y/o with ? contour abn of implant on screening mammo

Dx: Intracapsular rupture
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
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
Explantation

Mammography findings

Dx: Collapsed calcified fibrocapsule
43 y/o status post explantation

Pre-Explantation

Post-Explantation

Saline implant

Dx: Seroma in residual fibrocapsule
Reconstruction
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), contralateral surgery (for symmetry)
Tissue expander post inflation

Step 1

Gradual expansion of tissue expander

Step 2

Bilat retropectoral collapsed tissue expanders

Step 3

Implant exchange

Implant exchange

Step 3
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
Atrophied rectus abdominus

Contact zone (dermal layer of abdominal tissue)

Atrophied rectus abdominus

Contact zone (dermal layer of abdominal tissue)

Sutured umbilical defect scar
Pedicled TRAM flap—CT/MRI

Contact zone (denuded dermal layer of abdominal tissue)

Atrophied rectus abdominus

Absent rectus abdominus
“Supercharged” TRAM

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

Surgical clip artifact at anastomotic site

Atrophied rectus abdominus
Free TRAM

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

- Calcified sutures at site of folded flap
- Difficult to see rectus abdominus
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

Deep Inferior Epigastric Artery Perforator Flap (DIEP)

- Donor skin/fat from lower abdomen
- Deep inferior epigastric artery and vein intramuscular perforators anastomosed to internal mammary branches
- Young, healthy pts best candidates
Breast Reconstruction—DIEP

Contact zone (denuded dermal layer of abdominal tissue)

No muscle seen

Medial peri-sternal artifact at anastomotic site

Anastomosed vessels
Reconstruction--Complications

- Implant deflation
- Hematoma/seroma
- Infection
- Skin thickening/fibrosis
- Fat necrosis
- Tumor recurrence
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)
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
34 y/o w/palp lump, s/p mastec and pedicled TRAM recons.

Irregular, rim enhancing mass

T1 no fat sat

Dx: Fat necrosis

Irregular, rim enhancing mass

Contains fat

T1 + C
Tumor recurrence

• Rate 5-15%
• Most within 5 yrs
• Primary location--superficial, palpable, "contact zone"
• Second common location--chest wall
54 y/o w/palp mass, s/p mastec and free TRAM recons. Dx: IDC
54 y/o w/palp mass, s/p mastec and free TRAM recons.

T1 + C Rim enhancing mass at contact zone

T1 no fat sat No fat within mass
Nipple-areolar Reconstruction

- Last step of reconstruction
- Options: nipple sharing, grafts, intradermal tattoo, etc
- Pigment-gel suspension technique
- Pigment contains titanium dioxide—may mimic calcification on mammogram
- Produces blooming artifact on MRI
Fat Grafting

- Still experimental
- No blood supply, relies on wound bed to grow vessels for survival
- Various techniques (centrifugation, fat washing, unprocessed)
- 40-50% fat survives after grafting
- Non surviving fat presents as oil cysts on imaging
Post Reconstruction Outcome

Post surgery

Post flap reconstruction

Post fat grafting and nipple areolar reconstruction

Courtesy of Scott Hollenbeck, MD
Thank you!