

## MRI Guided Breast Biopsy

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## MRI of the breast

- Is an important tool for the detection of breast cancer &
- Assessment of silicone implant integrity
- The use of MRI with contrast agents for the detection of breast cancer was first reported in 1986<sup>1</sup>



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Howang 1986

## Current Indications for Breast MRI

- Axillary metastasis of unknown origin
- High risk patients (Screening MRI)
- Extent of disease (with new diagnosis)
- Aid to pre-surgical treatment planning
- Treatment response/follow-up
- History of chest radiation



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## Current Indications for Breast MR

- Differentiating postoperative changes from recurrence
- Reduced mammographic sensitivity
- Problem solving for selective inconclusive clinical or mammographic/ultrasound findings
- Guidance for biopsy



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## Breast MRI technique

- MRI creates images of the breast by measuring changes in the movement of protons in fat and water with the application of changing magnetic fields
- By utilizing the differences in tissue relaxation characteristics, an image is acquired by processing the signal changes that occur following application of pulses of energy



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Chernoff 2020

## Breast MRI technique

- Breast MRI for the detection of breast cancer requires administration of the contrast agent gadolinium
- The use of contrast MRI for breast cancer detection is based on the concept of tumor angiogenesis or neovascularity



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## Breast MRI technique

- Tumor-associated blood vessels have increased permeability, which leads to prompt uptake and release of gadolinium within the first 1-2 minutes after administration, leading to a pattern of rapid enhancement and washout on MRI



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## MR Breast Lexicon

- 1) Focus/foci (tiny spot <5mm) no other descriptor
- 2) Mass (3D space-occupying lesion)
  - a. Shape (round, oval, lobulated, irregular)
  - b. Margin (smooth, irregular, spiculated)
  - c. Mass enhancement (homogeneous, heterogeneous, Rim, Non-enhancing septations, enhancing septations)



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## MR Breast Lexicon, cont.

- 3) Non-mass enhancement
  - a. Focal, linear, ductal, segmental, regional, multiple regions, diffuse
  - b. Homogeneous, heterogeneous, stippled/punctate, clumped NMLE



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## MR Breast Lexicon, cont.

- 4) Symmetric or asymmetric
- 5) Other findings: Nipple retraction, edema, lymphadenopathy, pectoralis muscle or chest wall invasion, skin thickening/invasion
- 6) Kinetic curves



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## MRI of the breast

Evaluates:

- Morphology
- Kinetics/Angiogenesis



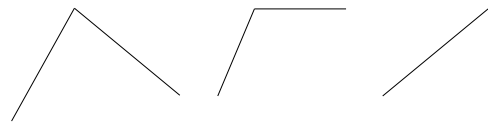
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## Kinetic curves

Washout.

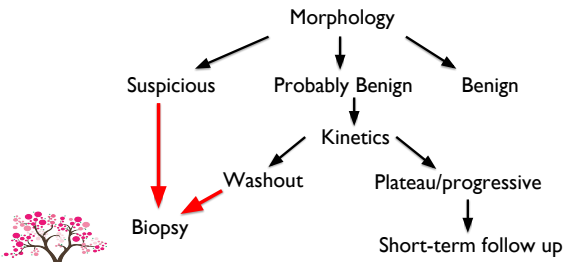
Plateau

Persistent



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## MR findings flow chart



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## Breast MRI

- Correlate with Mammogram/Ultrasound
- 2<sup>nd</sup> look Mammogram/Ultrasound after MRI imaging/finding
- May be able to convert biopsy to US guidance



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## MRI Breast Biopsy- "The why"

- Performed if lesion cannot be identified by other modalities
- 14g core can be done
- Vacuum assisted core is gold standard



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## MRI Breast Biopsy- "The why"

- Dedicated coil for biopsy
- Varies from standard bilateral coil used
- Typically far fewer coils
- Unilateral imaging only



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## "Our" Standard coil-16 channel

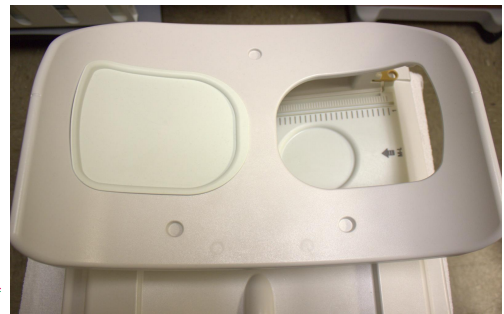


Courtesy Philips corporation



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## "Our" biopsy coil- 7 channel



Courtesy Philips corporation



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## Pitfalls

- Some systems are limited to lateral approach only
- Breast size
- Posterior lesions
- IMF lesions
- High axillary lesions



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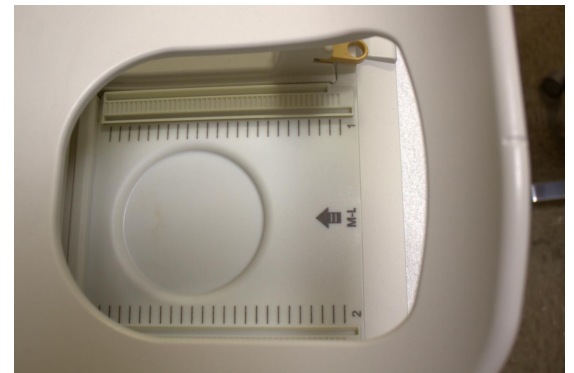
## Looking through coil base



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## Patient JMF

- Hx prior Stage IIA IDCA 2005
- Triple neg
- Stage
- BRCA1+
- Treated with BCS, chemo & XRT
- Annual MRI added to surveillance



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## “The Why”

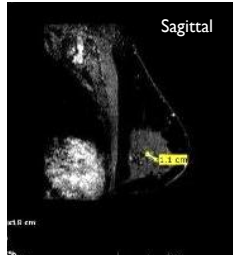
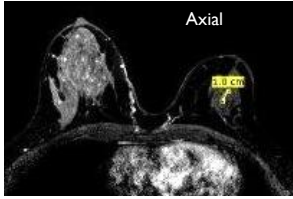
Finding L1  
 Location  
 L, LO, 5 o'clock, middle

CAD summary

Cor Ax-Eff Sag-ML

L Med Lat

Distance (cm) edge to:  
 Nipple: 3.9 (radial 1.9)  
 Size  
 Diameters: 1.1 x 0.42 cm



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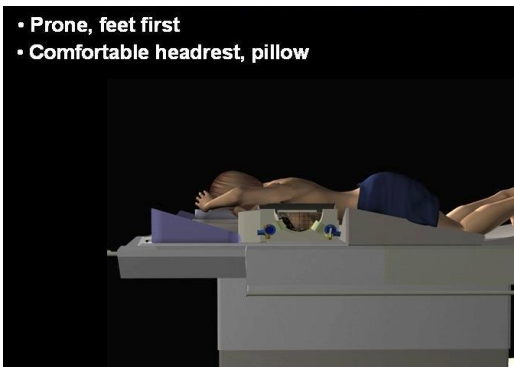
## MRI breast biopsy-“The How”

- Position patient in biopsy cradle
- Skin is cleaned *before* patient is positioned in the biopsy coil
- It will be cleaned a 2<sup>nd</sup> time, before giving anesthetic



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- Prone, feet first
- Comfortable headrest, pillow



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## MRI breast biopsy position

- Breast is supported in the biopsy cradle/coil by 2 plates
- Grid on aspect/side of breast accessed for biopsy stabilizes breast
- Opposite side of breast supported by solid plate



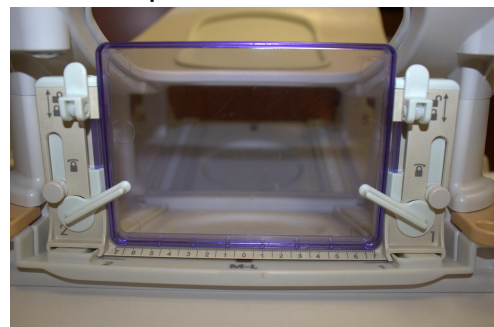
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## Solid & Grid compression plates



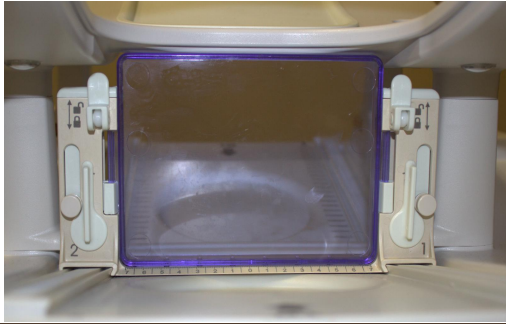
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## Solid plate “unlocked”



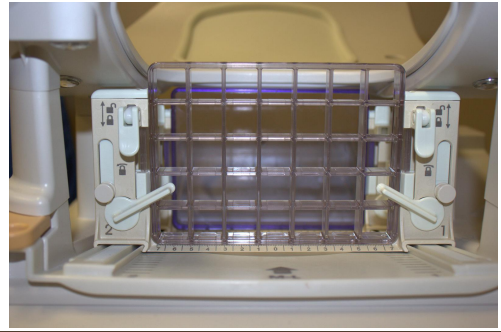
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Solid plate “locked”



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Grid support plate “unlocked”



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Introducer kit & tissue marker “clip”



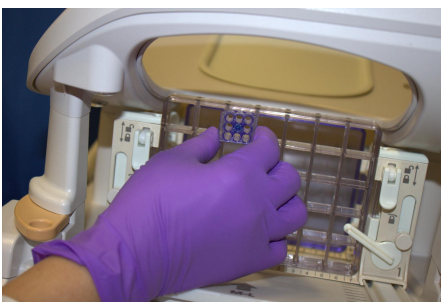
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Fiducial



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Fiducial placed in grid



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MRI breast biopsy-”The How”

- Perform “scout” scan for parameters
- Give GAD injection
- Perform dynamic imaging
- “Send” images to CAD program
- Localize skin fiducial & lesion for targeting data, using CAD program



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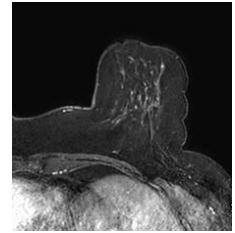
## MRI CAD Program

- Provides lesion identification, analysis and kinetics from screening or work-up study
- Used with biopsy procedures for targeting lesion or ROI to be sampled



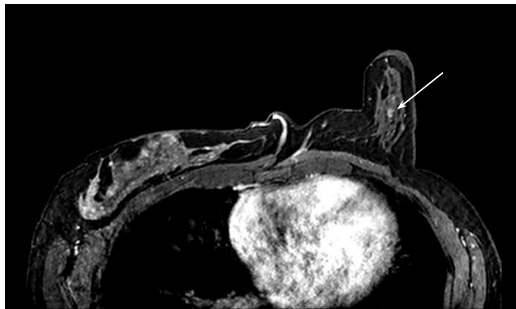
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## Patient positioned in bx coil/cradle



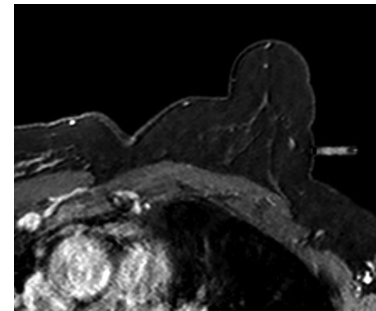
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## 1<sup>st</sup> post contrast image



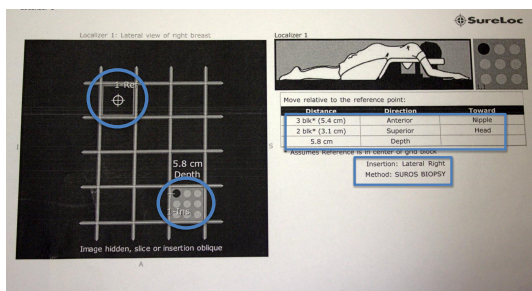
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## Skin Fiducial



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## CAD targeting data



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## MRI breast biopsy- “The How”

- Patient’s skin is cleaned again through the grid section identified by targeting
- Universal time out performed
- Patient given superficial & deep lidocaine
- Skin nick made with scalpel blade
- Plastic introducer stylet and trocar placed in breast (with depth set on hub)



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### Inserting trocar through introducer



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Depth set based on  
targeting data



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### Depth stop hub on introducer



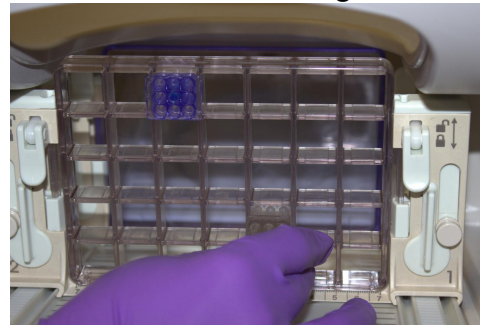
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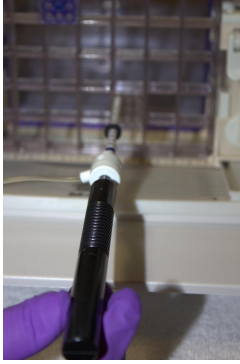
### Placement of needle guide



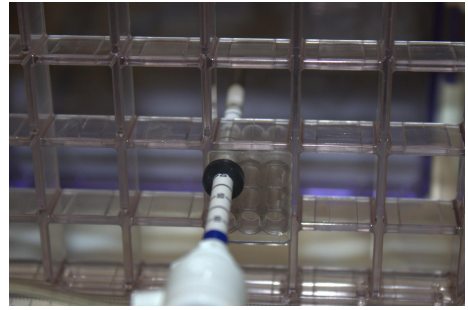
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Needle guide used to support introducer & trocar

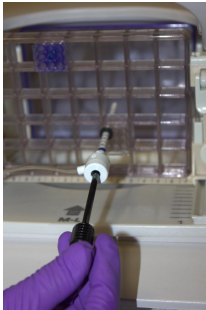


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Obturator placed through needle guide



Final position is flush against needle guide



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## MRI breast biopsy- “The How”

- Plastic obturator replaces trocar
- Needle confirmation scan done
- To ascertain that needle/obturator tip is at desired location relative to target area
- If accuracy confirmed, proceed with tissue sampling

## Needle Confirmation Scan



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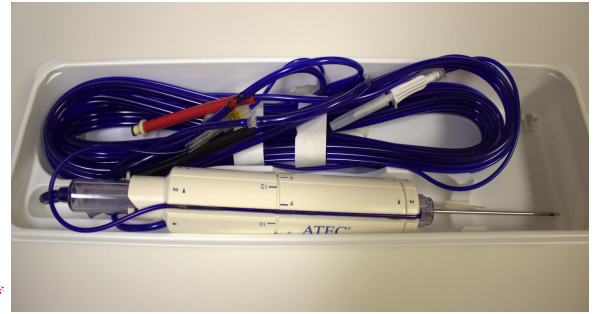
## MRI breast biopsy-”The How”

- Confirmation scan is reviewed for accuracy & need for any adjustments,
- Plastic obturator is removed
- Tissue sampling can begin
- VAC assisted probe inserted through needle guide to targeted lesion



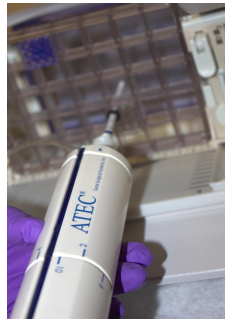
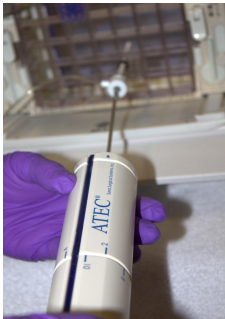
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## Biopsy probe



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## Probe replaces obturator



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## Biopsy Samples taken

- Probe rotated around clockface
- Quadrant or hemisphere or “clock” identified by relative position of ROI/lesion to probe
- Vacuum assisted sampling
- Lavage after sampling



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## 9 g Vacuum assisted system



Stays outside of room-  
Console NOT MRI Compatible



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## Tissue samples retrieved



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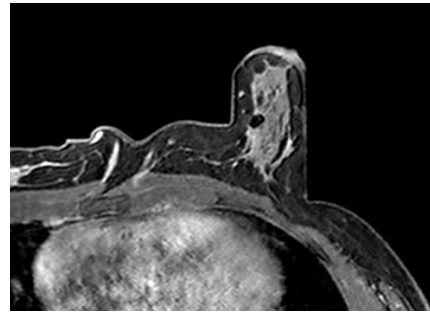
## MRI breast biopsy- “The How”

- Marker clip placement
- Inserted through introducer, similar to stereotactic biopsy
- Post-clip placement scan may be done if desired



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## Post clip scan



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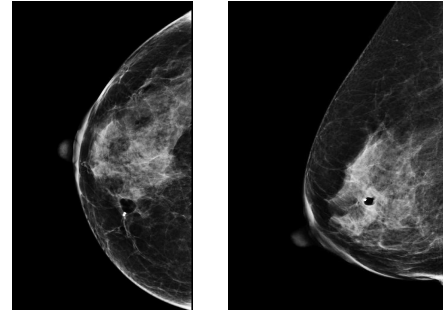
## MRI breast biopsy-”The How”

- After hemostasis achieved:
- Wound dressing placed &
- Post-biopsy mammogram done for clip placement evaluation



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## Post biopsy mammogram



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## Pathology results

- DCIS Intermediate grade
- Concordant with Imaging findings
- Patient elected bilateral mastectomy
- SLNB negative
- Patient went on to 2-stage reconstruction



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## MRI breast biopsy- “The How”

- Position patient (after cleaning skin)
- Perform “scout” scan for imaging parameters
- Give GAD injection
- Perform dynamic imaging
- Localize skin fiducial & lesion for targeting data with CAD program
- Clean skin second time
- Universal time-out pause



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## MRI breast biopsy- “The How”

- Administer superficial & deep lido
- Make skin nick
- Insert needle guide into grid
- Insert introducer & advance trocar to target
- Replace trocar with obturator
- Perform needle confirmation scan



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## MRI breast biopsy- “The How”

- Remove obturator &
- Perform tissue sampling
- Place marker clip
- Do post biopsy mammogram
- Follow-up as directed by pathology results



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## Summary

- MRI is an important tool for the detection of breast cancer & assessment of silicone implant integrity
- Images are analyzed for morphology & initial/delayed contrast enhancement.
- Sensitivity is high, but specificity is lower
- Provides biopsy guidance for MRI- only imaging findings



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## References

1. Chernoff Daniel, MD PhD, *Principles of magnetic resonance imaging*. UpToDate. Jan2020.
2. Heywang SH, Hahn D, Schmidt H, et al, *MR Imaging of the breast using gadolinium*. J Computer Assisted Tomography 1986; 10:199
3. Lehman CD, Gatsonin C, Kuhl CK, et al. *MRI evaluation of the contralateral breast in women with recently diagnosed breast cancer*. NEJM 2007; 356:1295
4. Slanetz, Patricia J, MD,MPH,FACR. *MRI of the breast and emerging technologies*. UpToDate. Aug 2020.



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**Thank you!**

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