Cryotherapy in breast cancer

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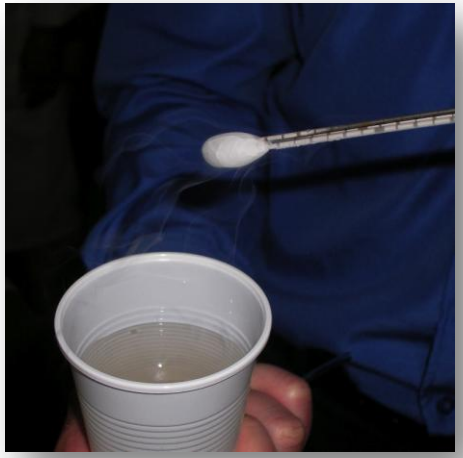
Epidemiological challenges

- Risk of breast cancer
  - 30% of the population >70 yo in the coming decades
  - 30% of patients over 70 years have breast cancer[1]
- Complications of surgery increase with age
  - Asymmetries, bleeding, infection
- Cons-indications for general anesthesia increases with age
  - Heart failure
  - Respiratory failure

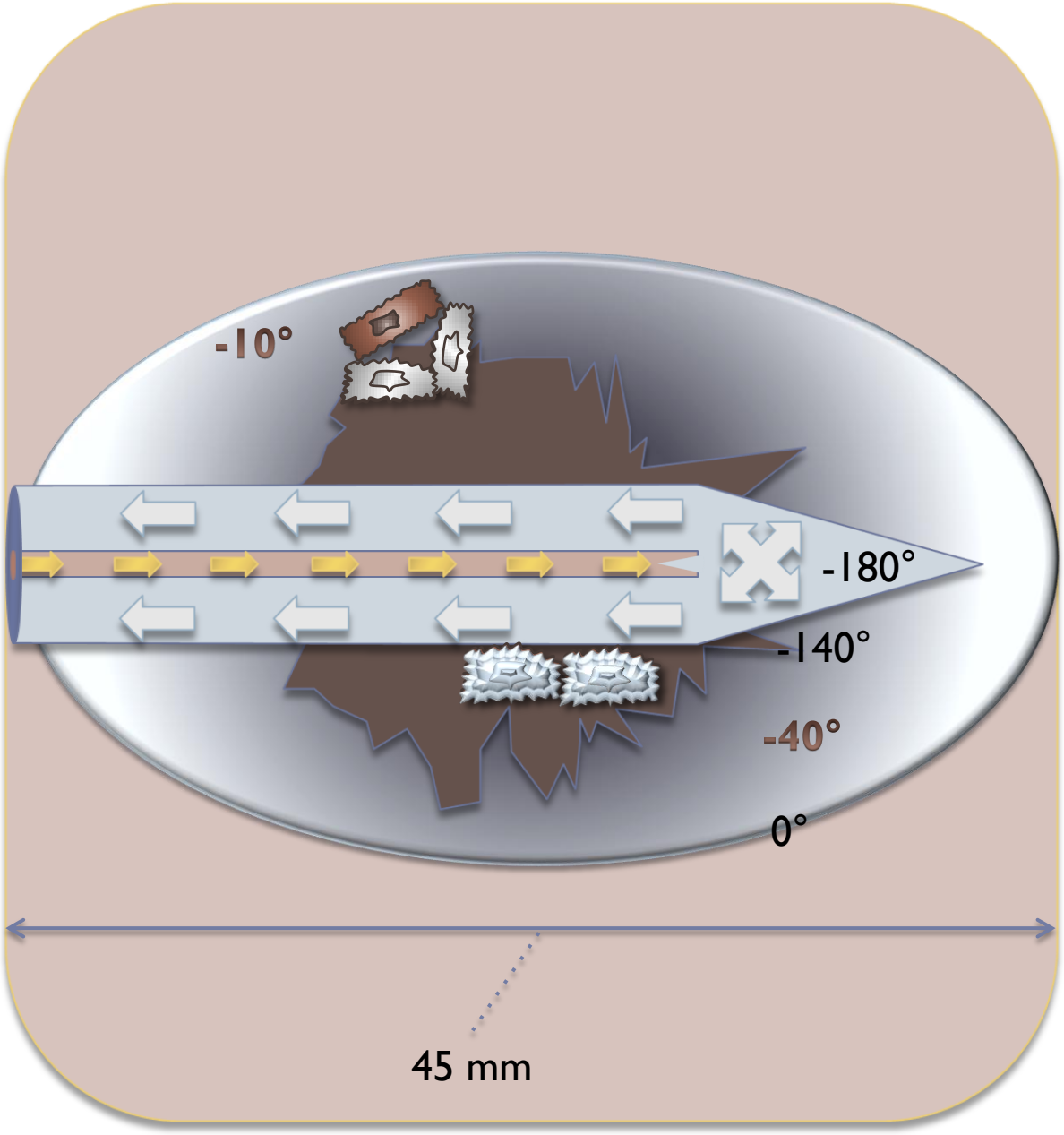


➔ **Need of a new technique such as Cryotherapy**

[1]Kimmick GG.Hematol Oncol Clin North 2000, [2]Van Esser S.World J Surg 2007; 31: 2284 –2292.

Technical considerations

Cryotherapy in breast cancer



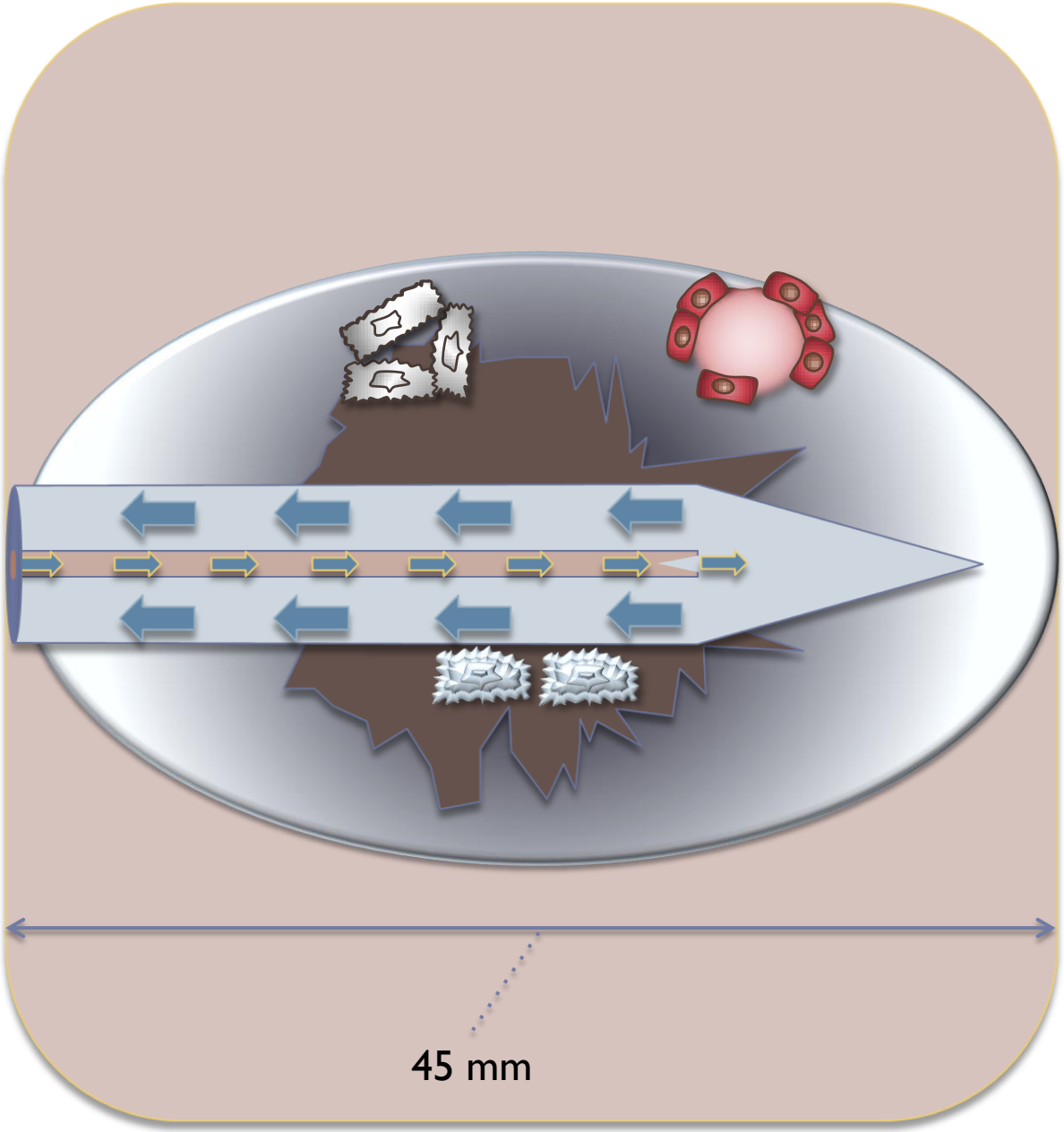
Freezing phase

Joule-Thomson effect

Argon compressed distends into a cannula at its end into the probe and is cooled to -180 °

Direct cell injuries

1. Crystal formation
2. Appotosis



Thawing phase

Helium

Vascular injuries

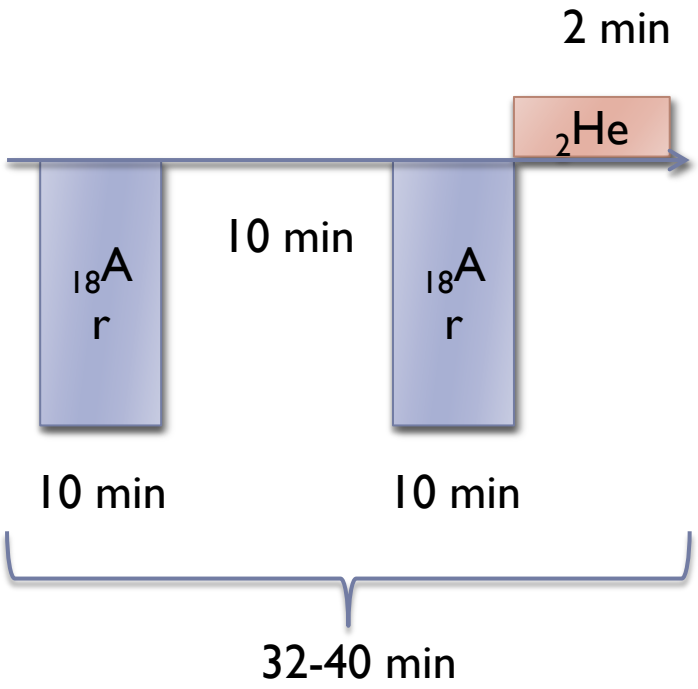
1. loss of blood supply

Freeze-thaw cycle

4 Phases

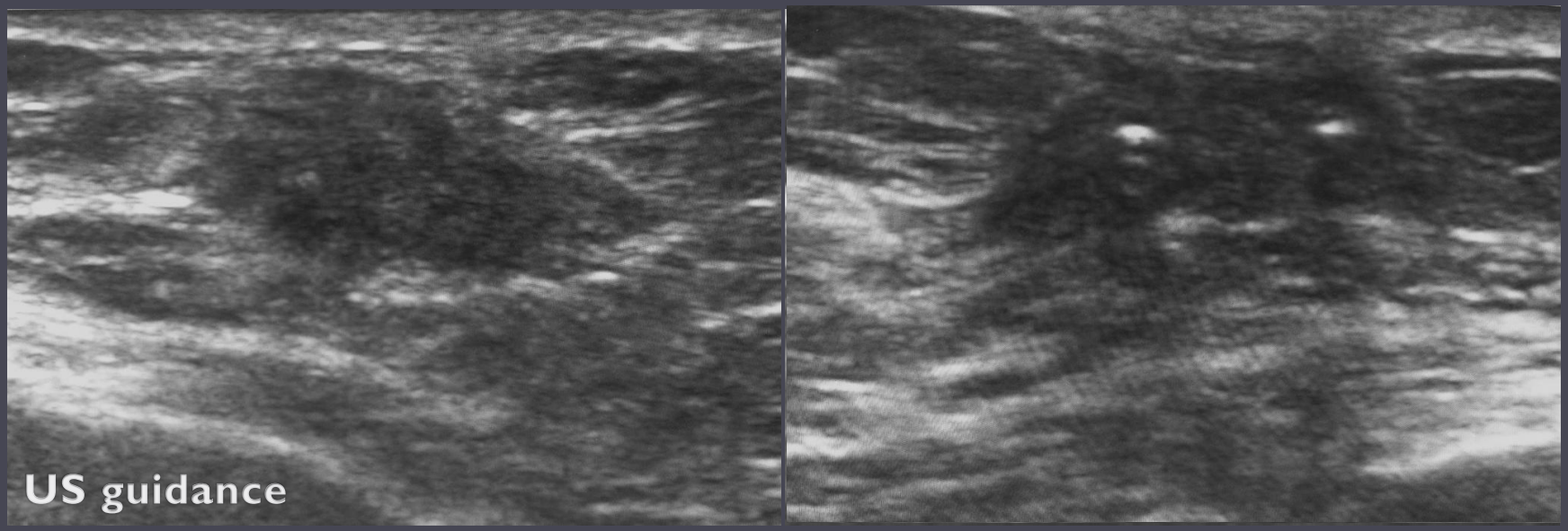
- 1st freezing ($_{18}$Ar)
  - 10 minutes
- 1st thawing (passive)
  - 10 minutes
- 2nd freezing ($_{18}$Ar)
  - 10 minutes
- 2nd thawing ($_{2}$He)

Timing



Procedure

Similar to a biopsy under ultrasound guidance with local anesthesia (Xylocaine 2%)



Procedure

77 yo, IDC at the ULQ of the right breast

Procedure

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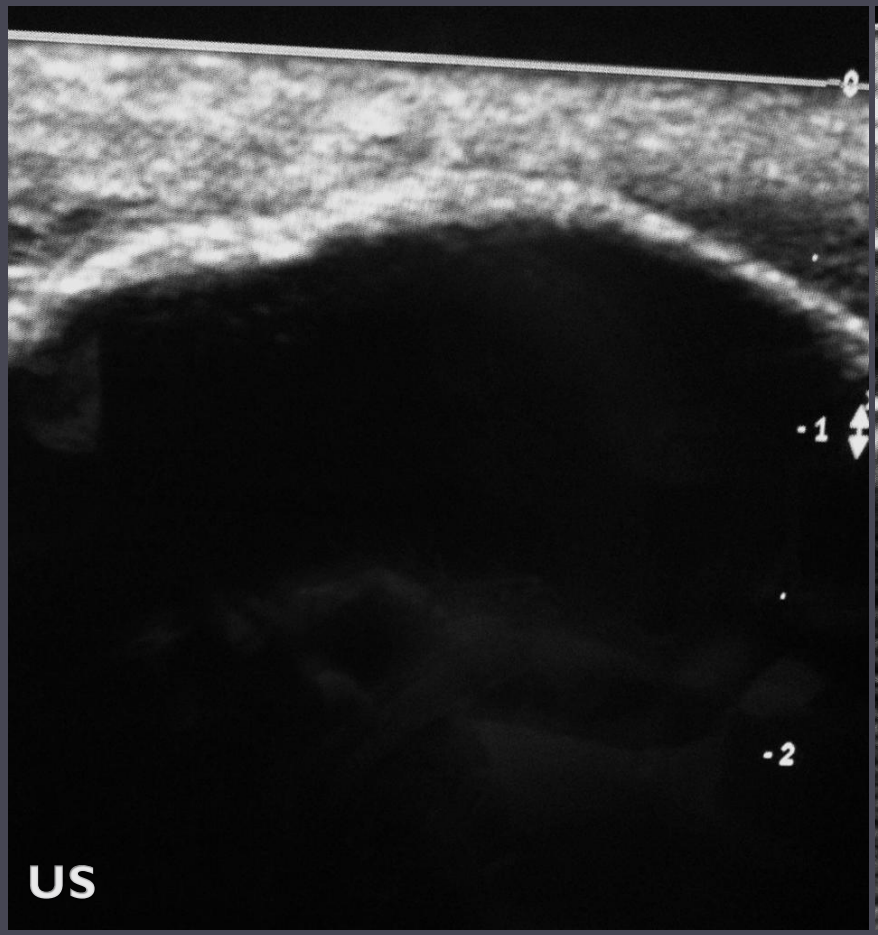
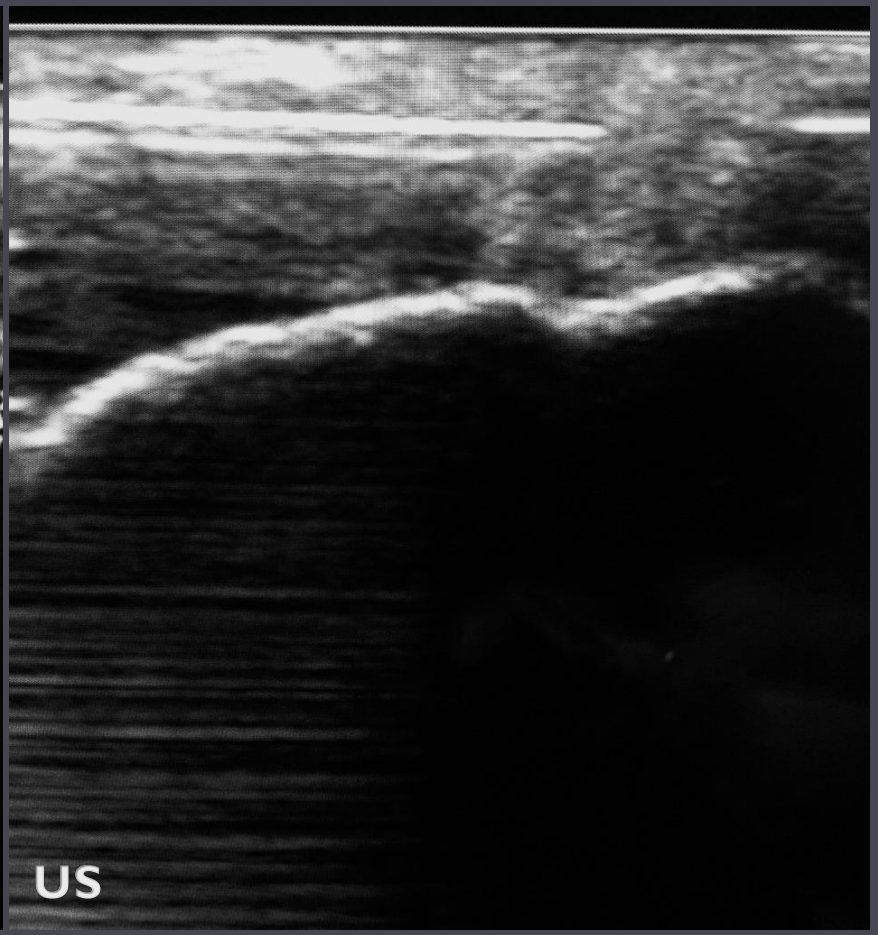
Procedure

77 yo, IDC at the ULQ of the right breast

Procedure

Skin protection by clinical monitoring, warming, and salin serum injection between the skin and the ice block





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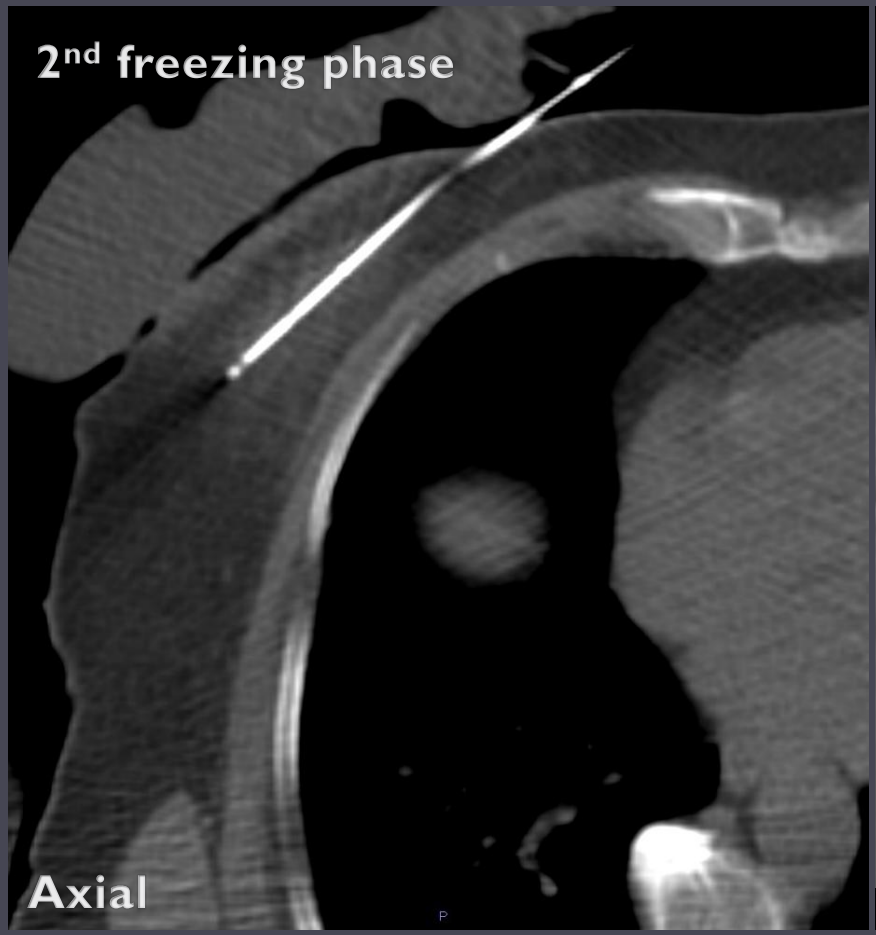


Lesions > 10 mm

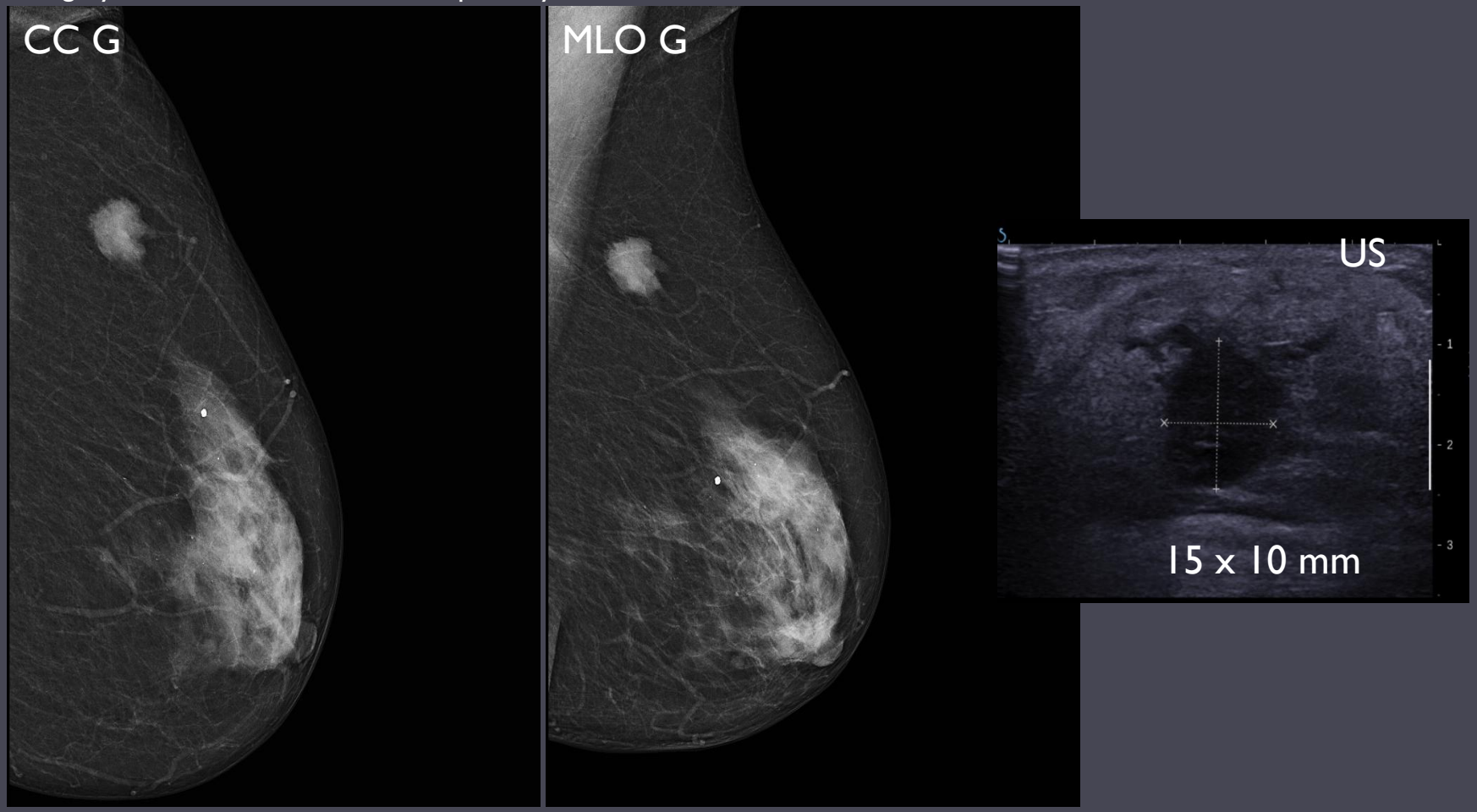
- Multiple probes
  - 1 probe per additional cm of tumor
  - 3 probe = blocs of ice of 5 cm

[1] Littrup PJ. J Vasc Interv Radiol 2009

Multiple probes

91 yo, IDC of the external uper quadrant of the left breast after hormonal treatment

Surgery contraindicated due to a respiratory failure



Multiple probes – CT monitoring

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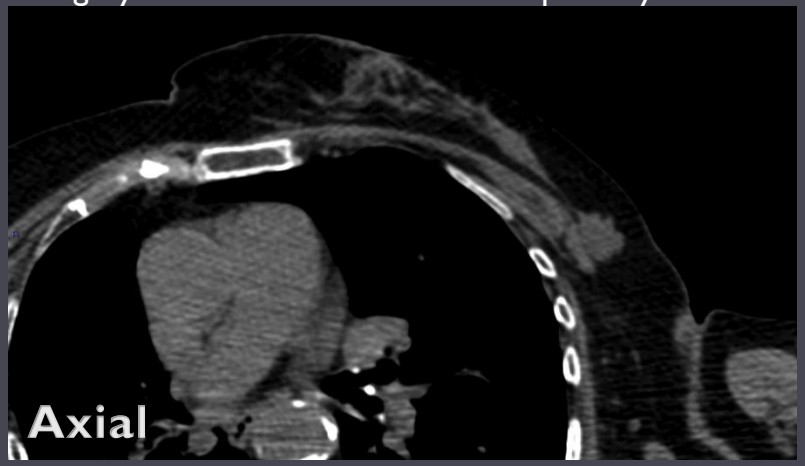

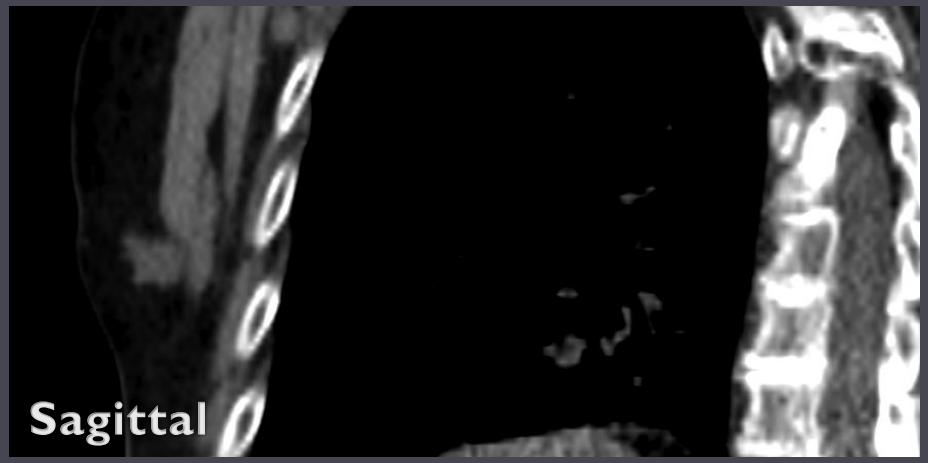

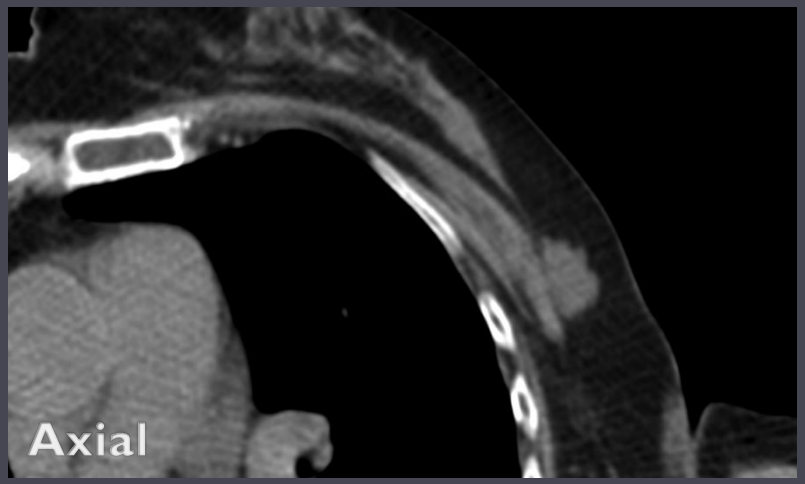

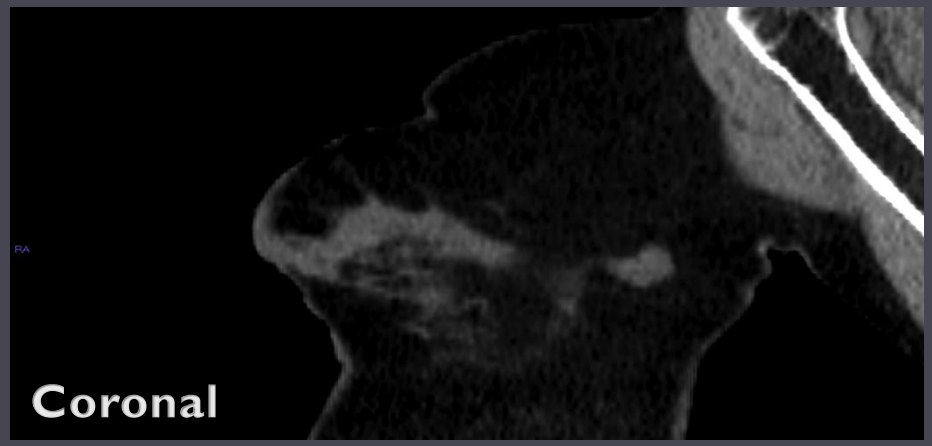

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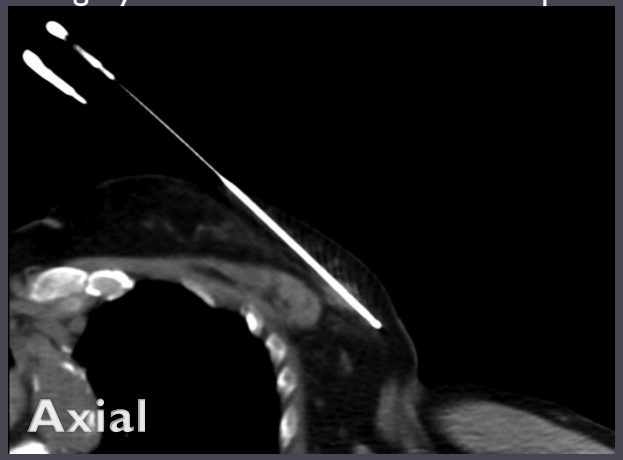

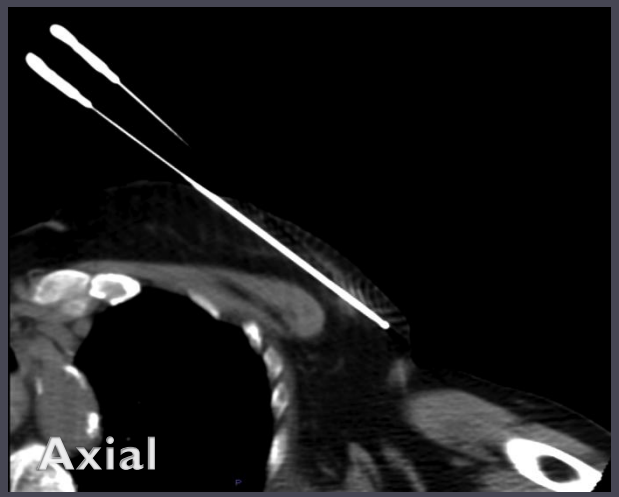

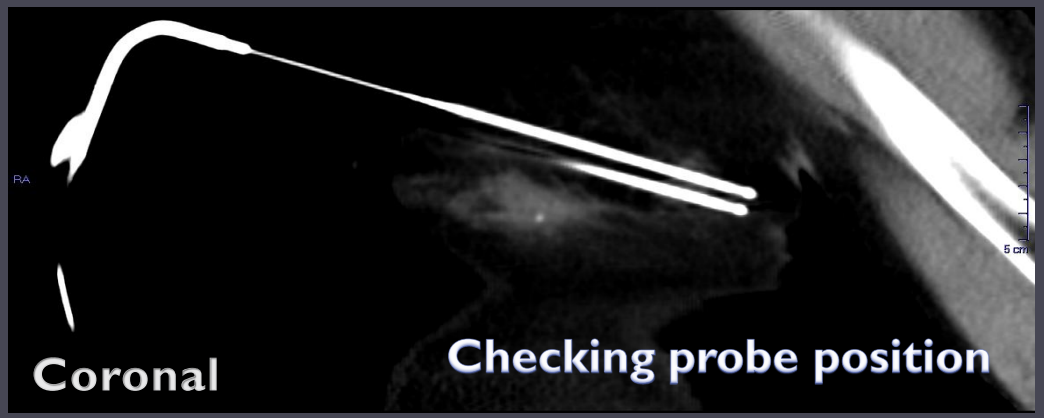

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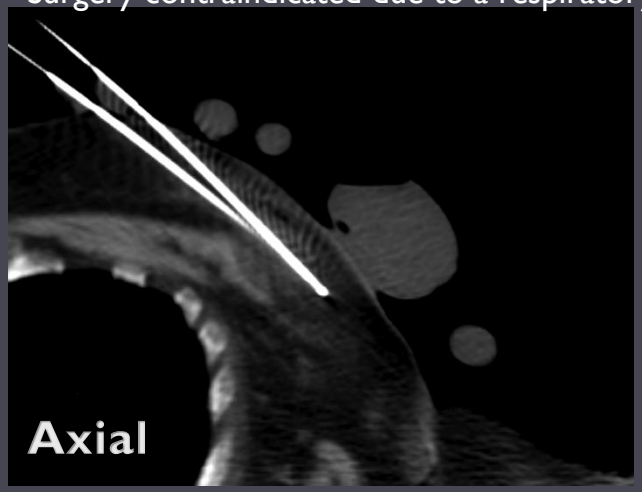

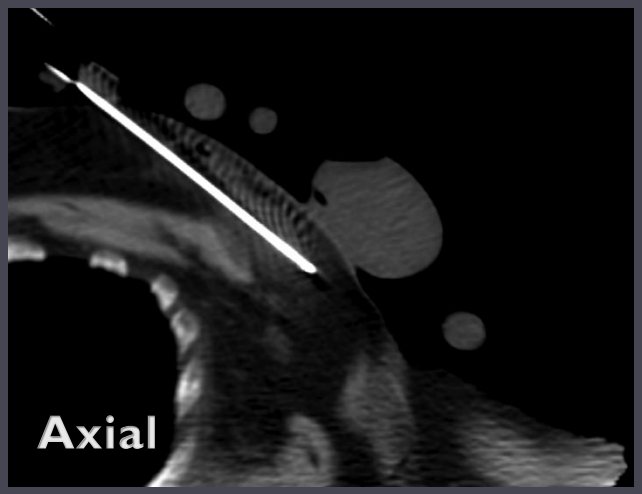

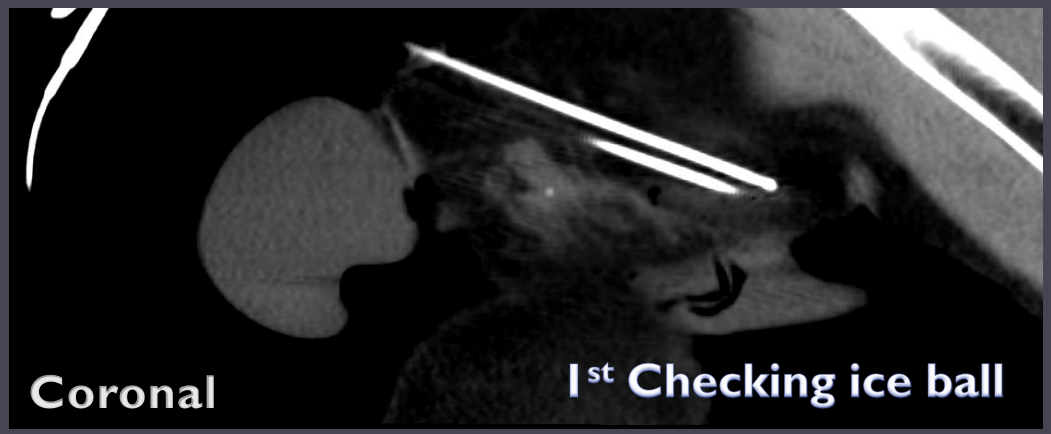

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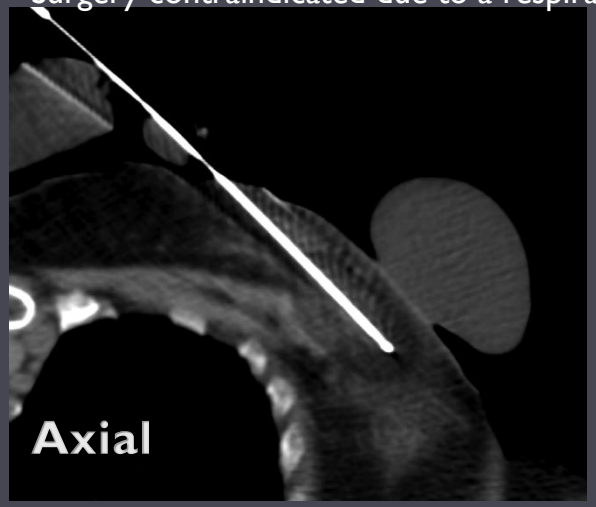
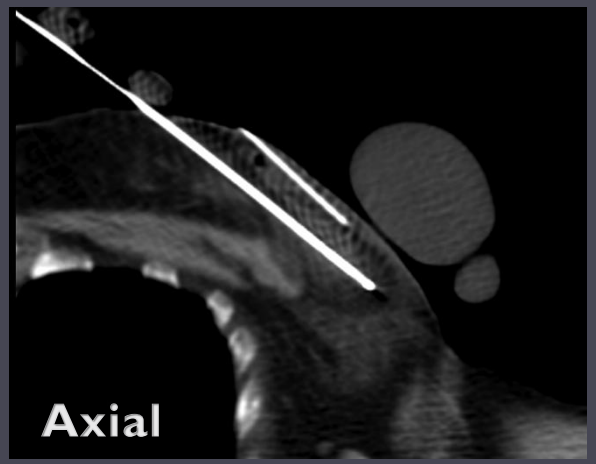
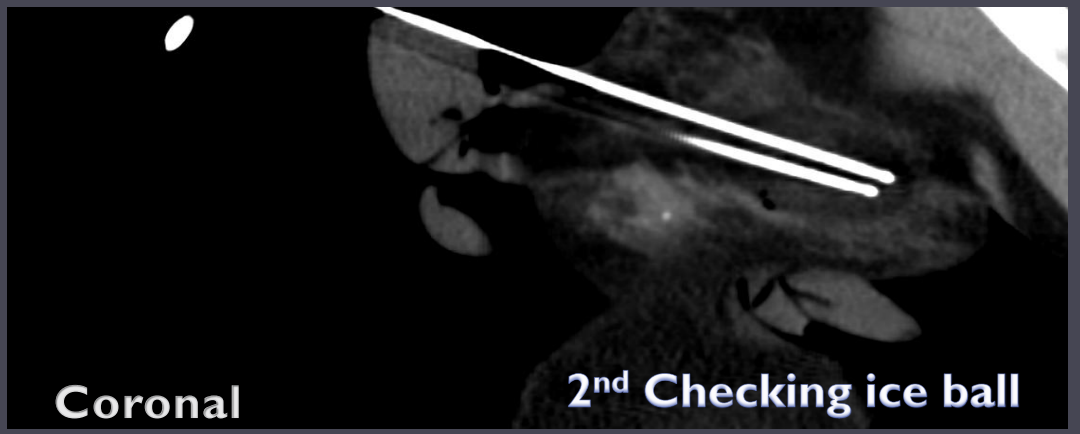
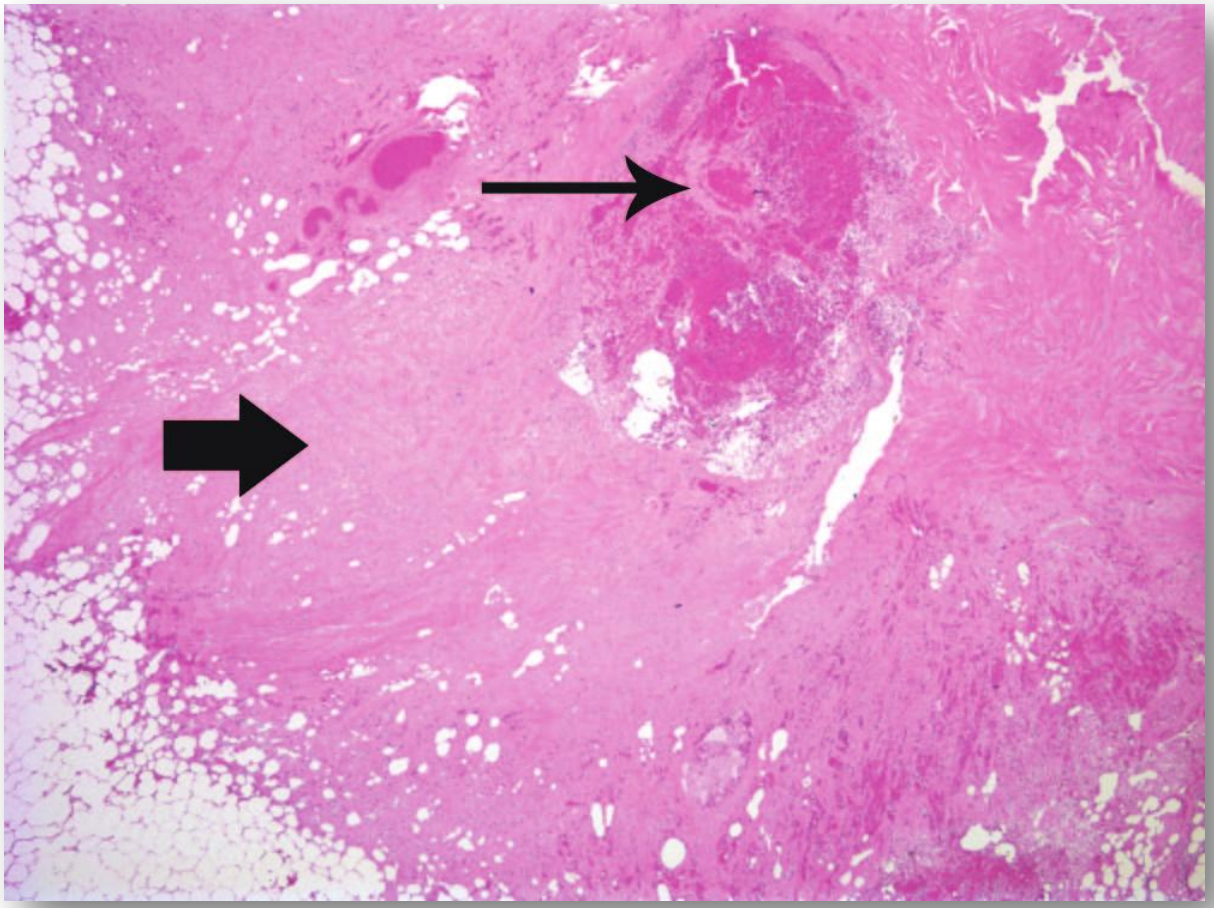






Treatment follow-up

Cryotherapy in breast cancer



Pathology

1. Hemorragique necrosis
    1. Ghosts dead cells
    2. cellular debris
    3. neutrophils
2. Cytosteatonecrosis

Roubidoux M. Radiology 2004

Treatment follow-up

- MRI
  - Baseline
  - 3 month
  - 6 month
  - 12 month
- CT when MRI is contraindicated
  - Dynamic contrast enhancement study

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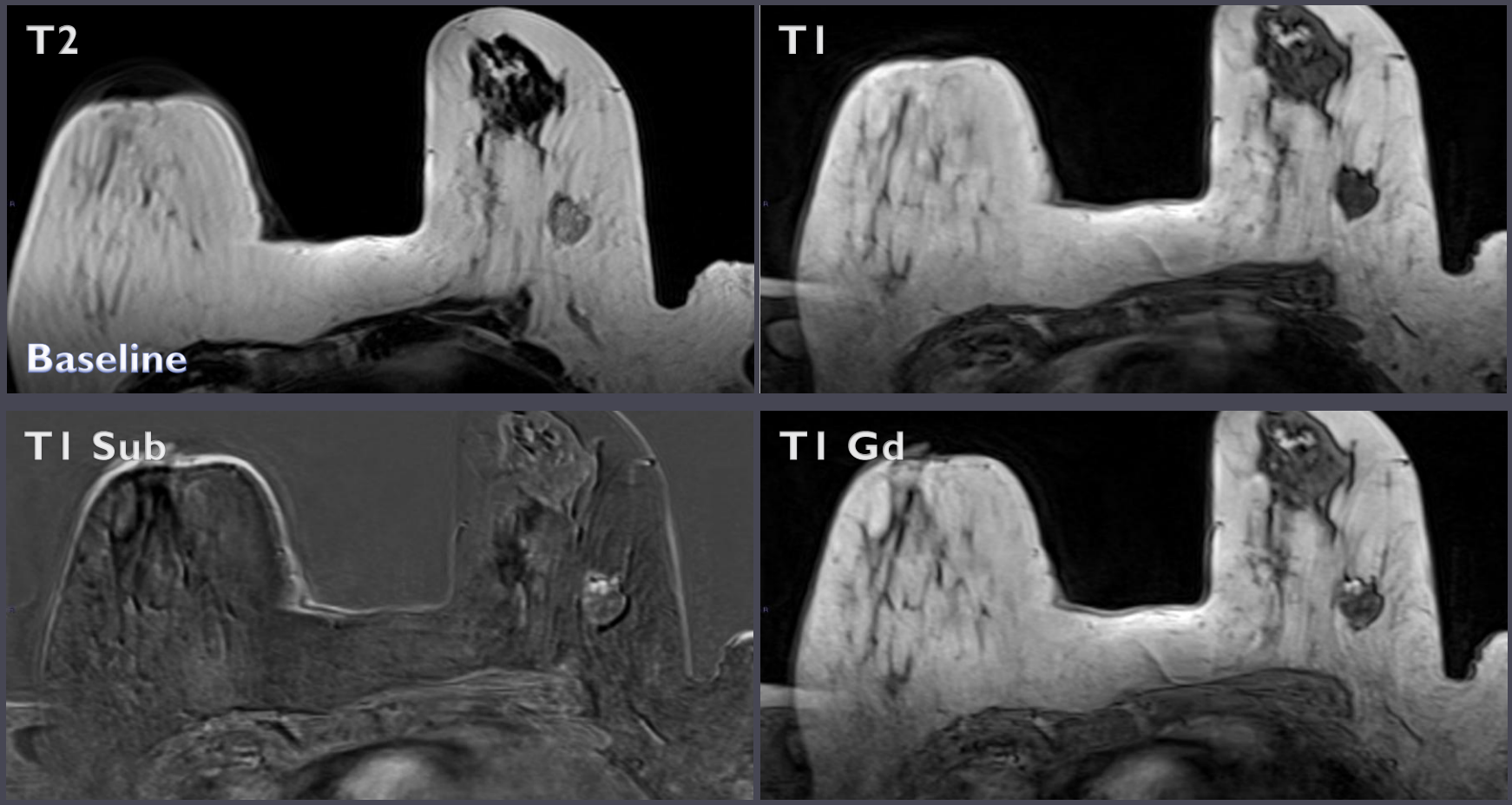

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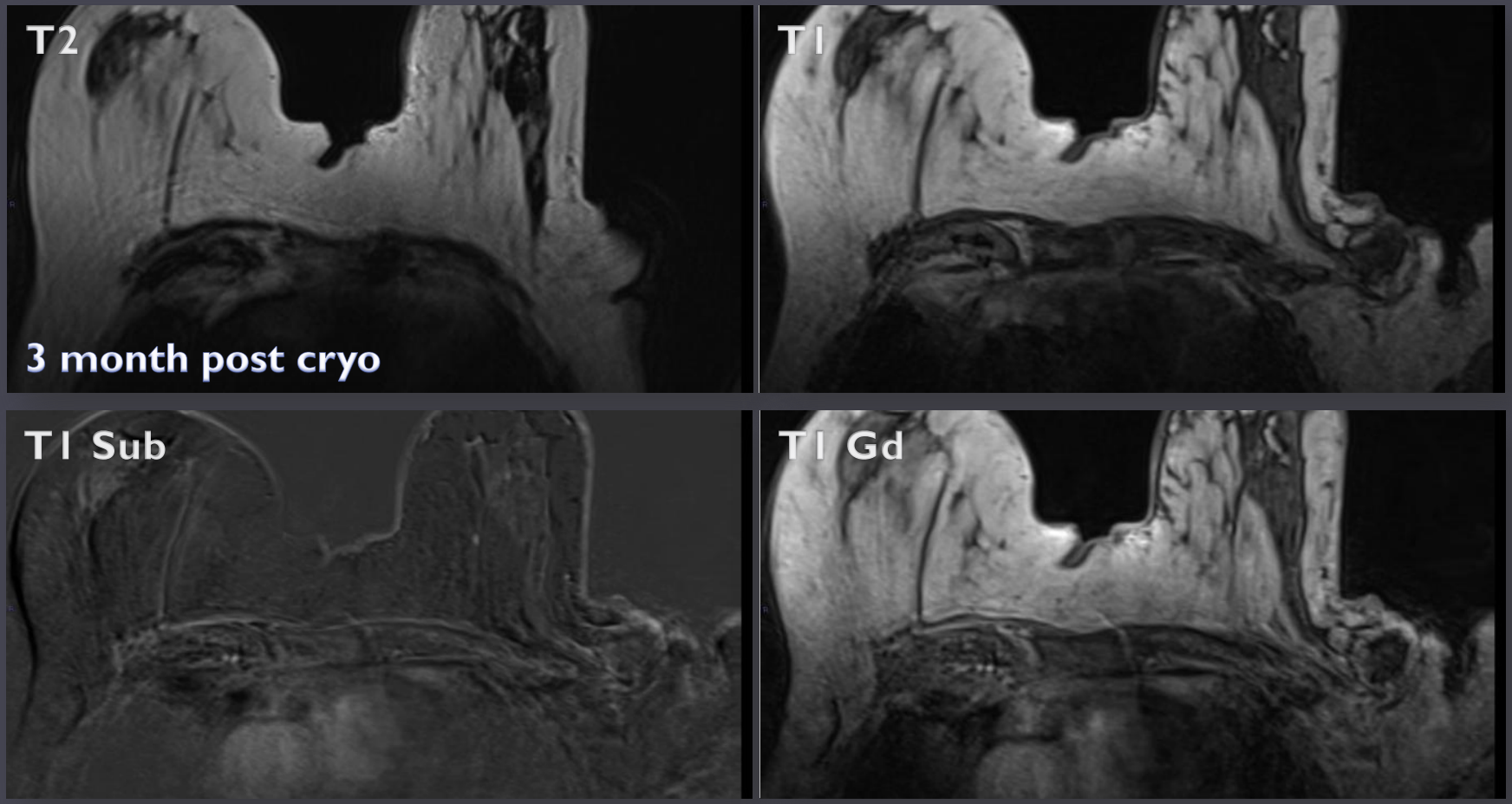

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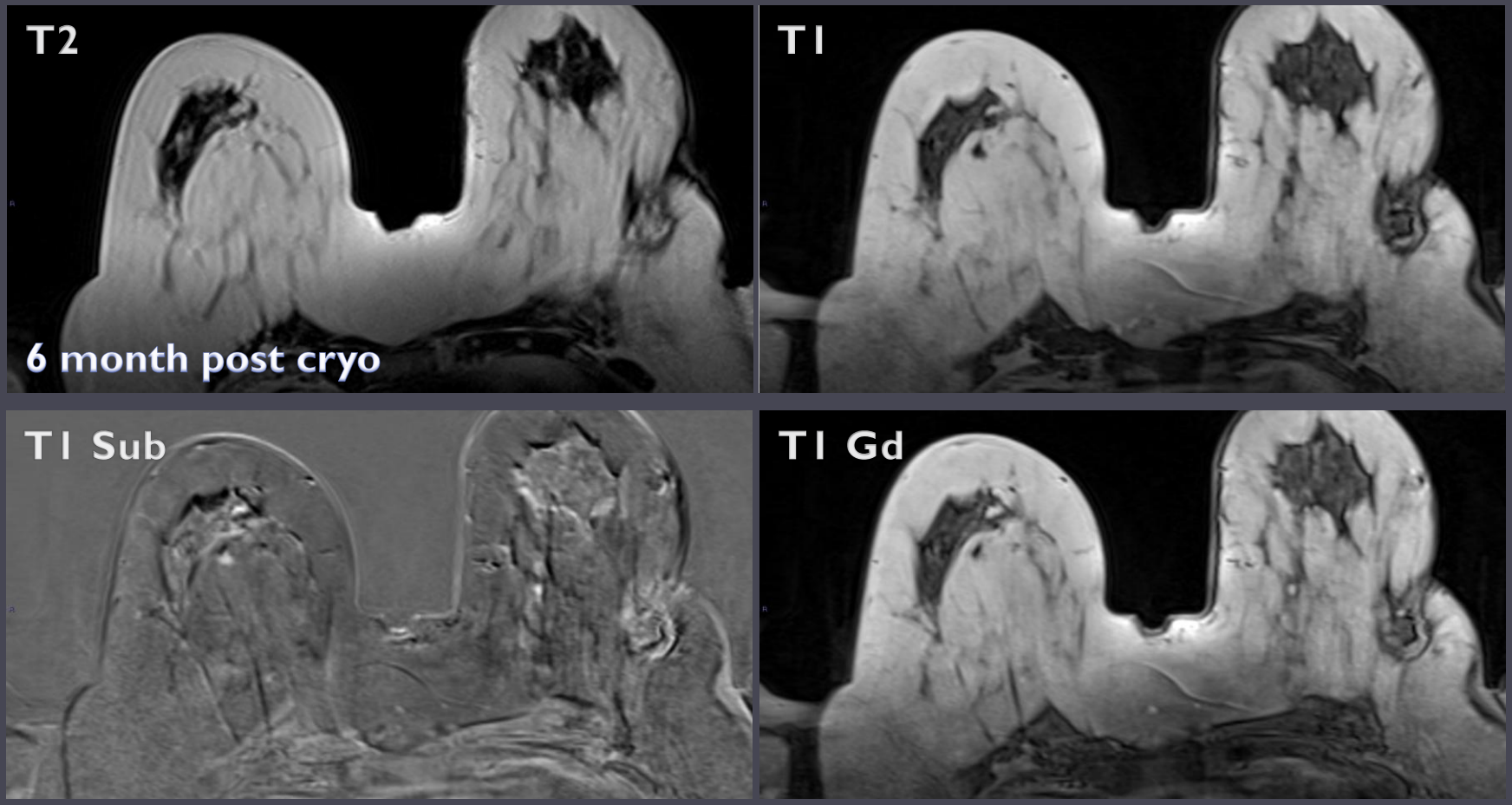

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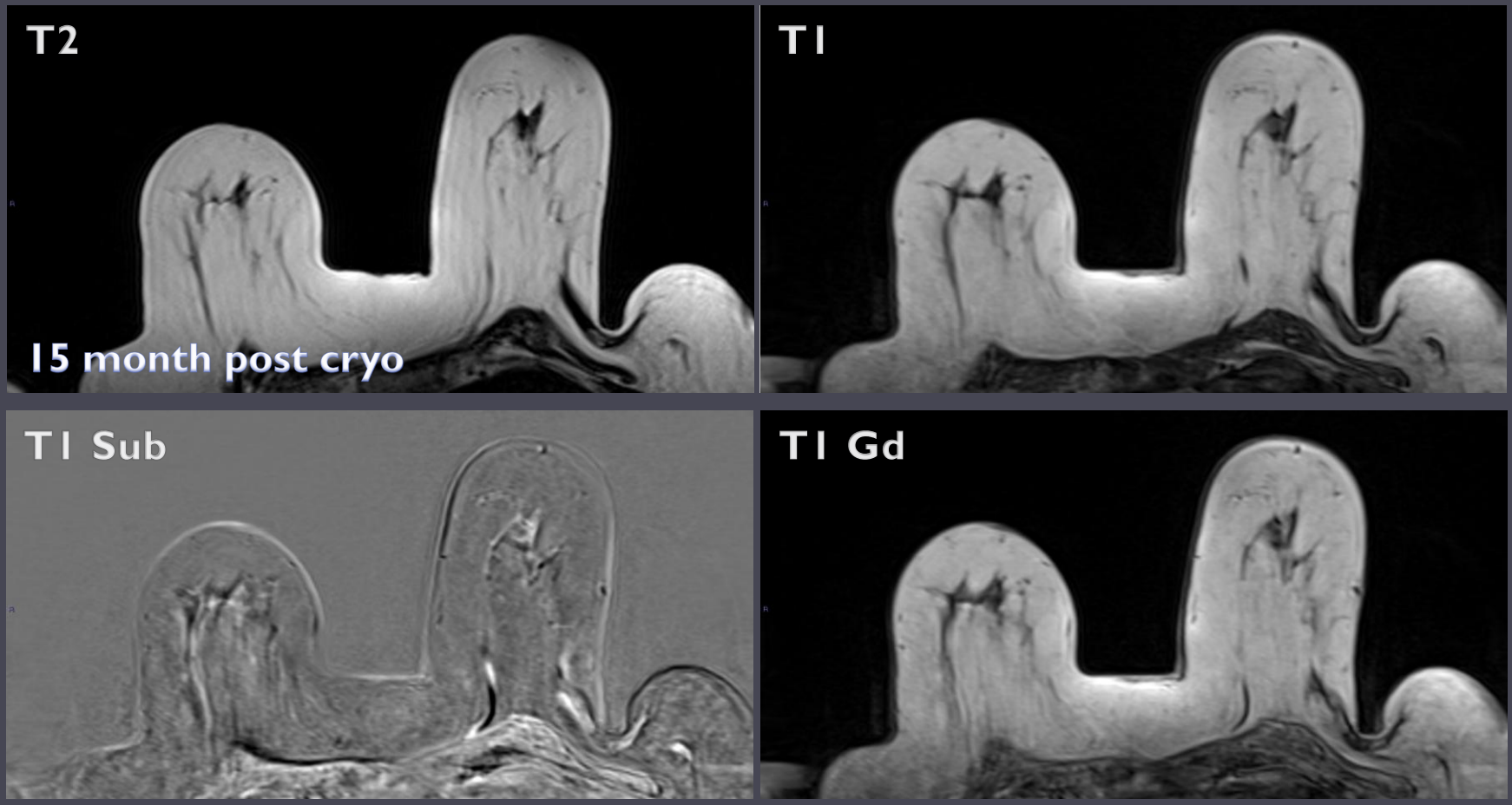
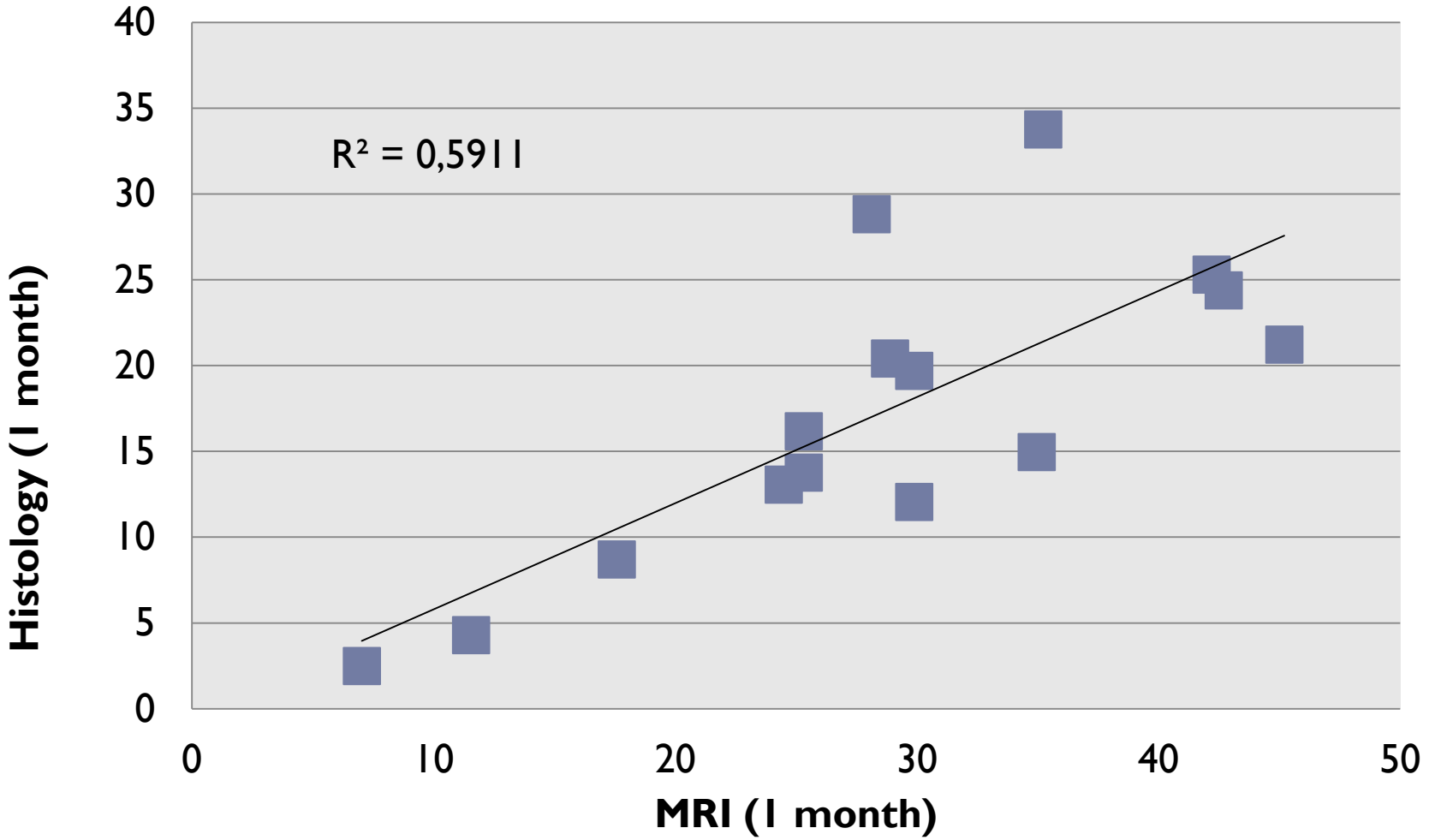


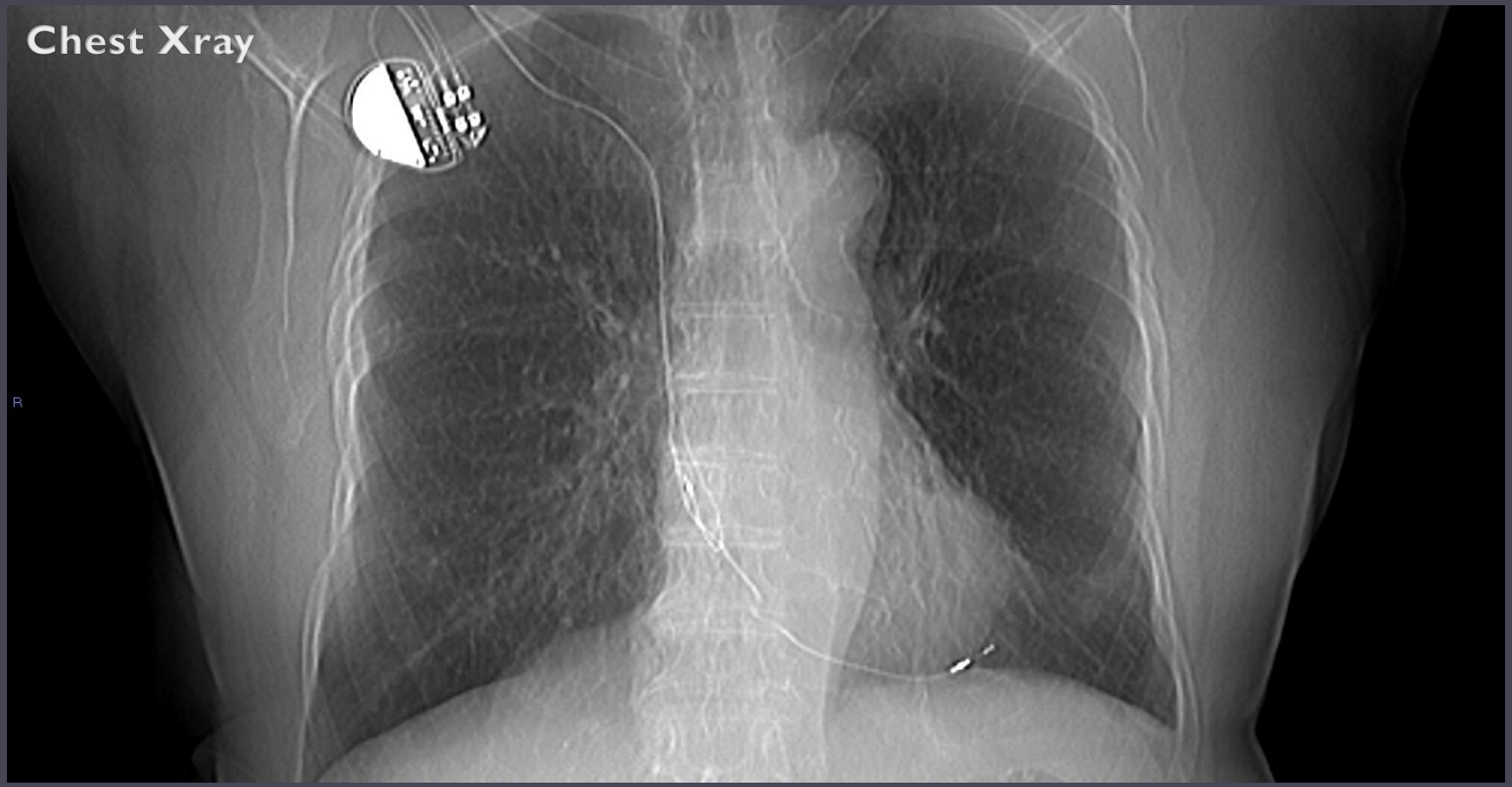
Necrosis extension in MRI versus Pathology



Manenti G. Eur Radiol 2011

Treatment follow-up in CT

87 yo, IDC of the Internal superior quadrant of the left breast



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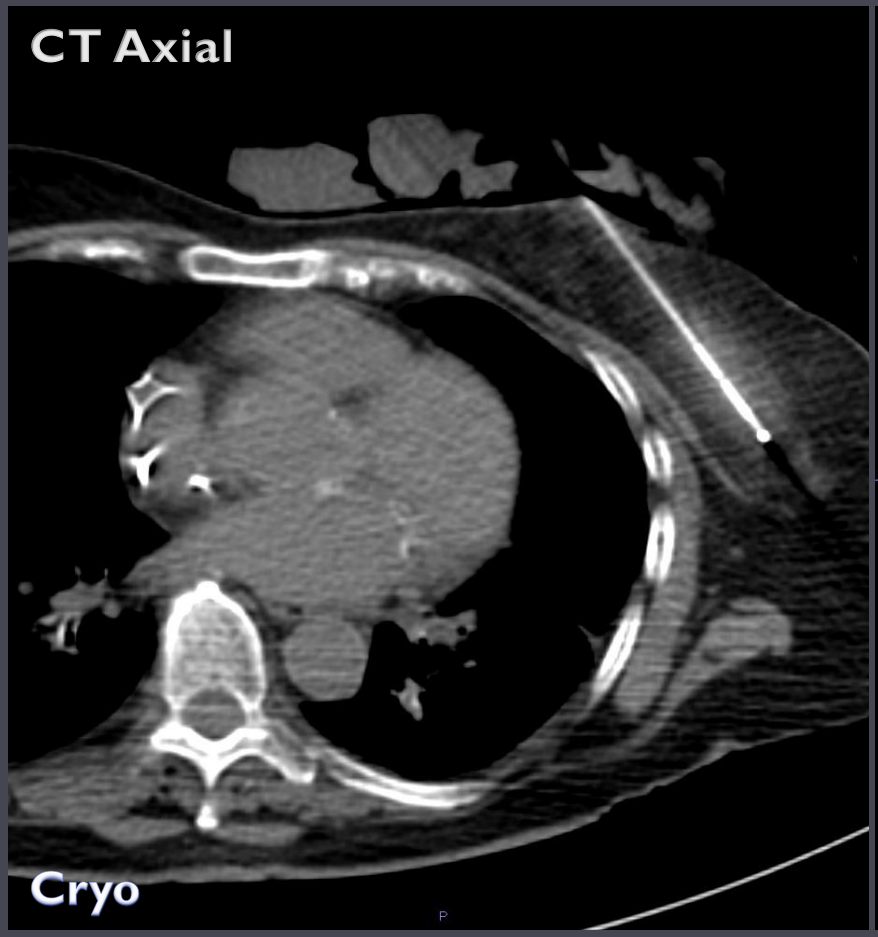

Treatment follow-up in CT

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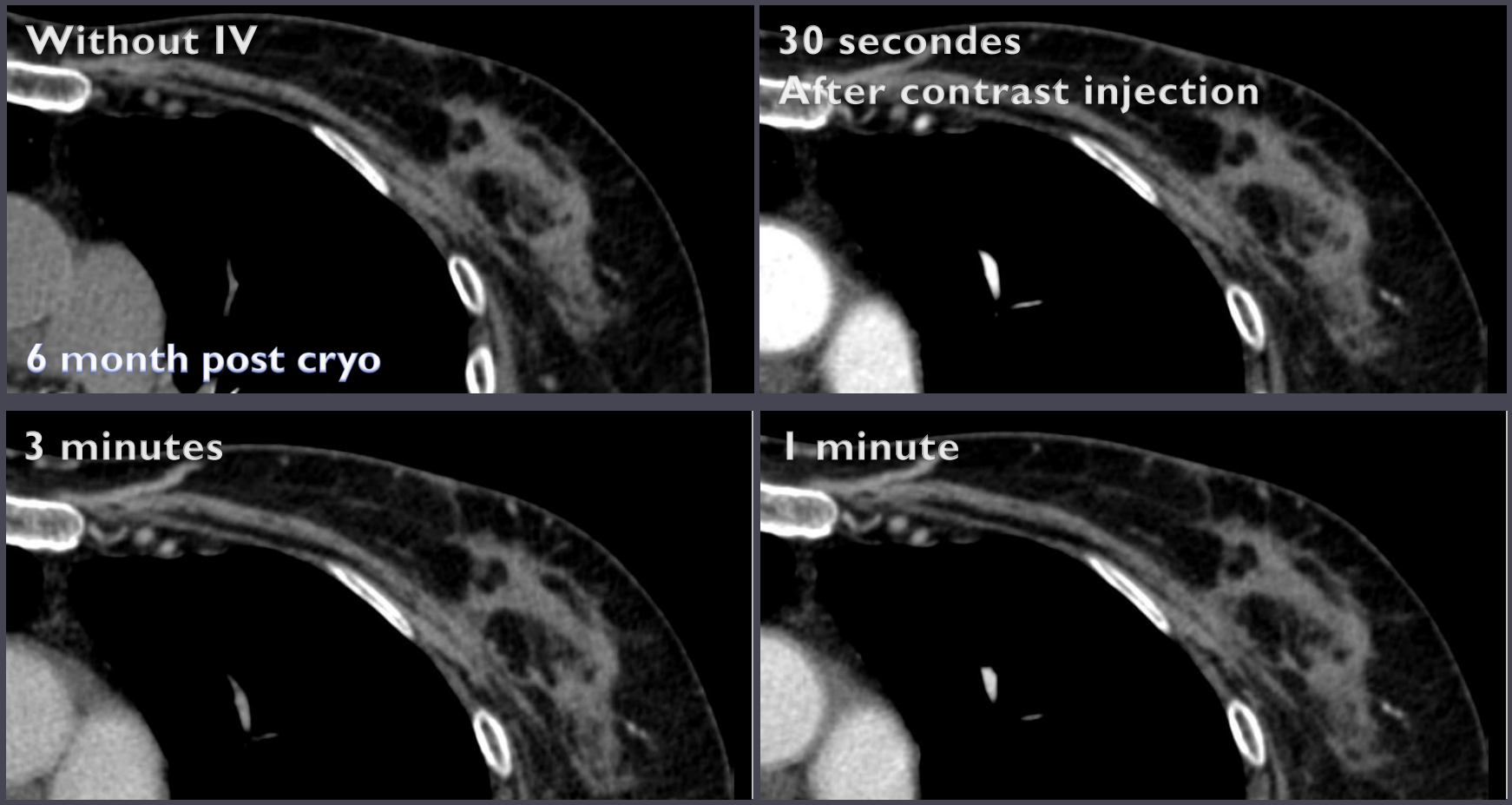
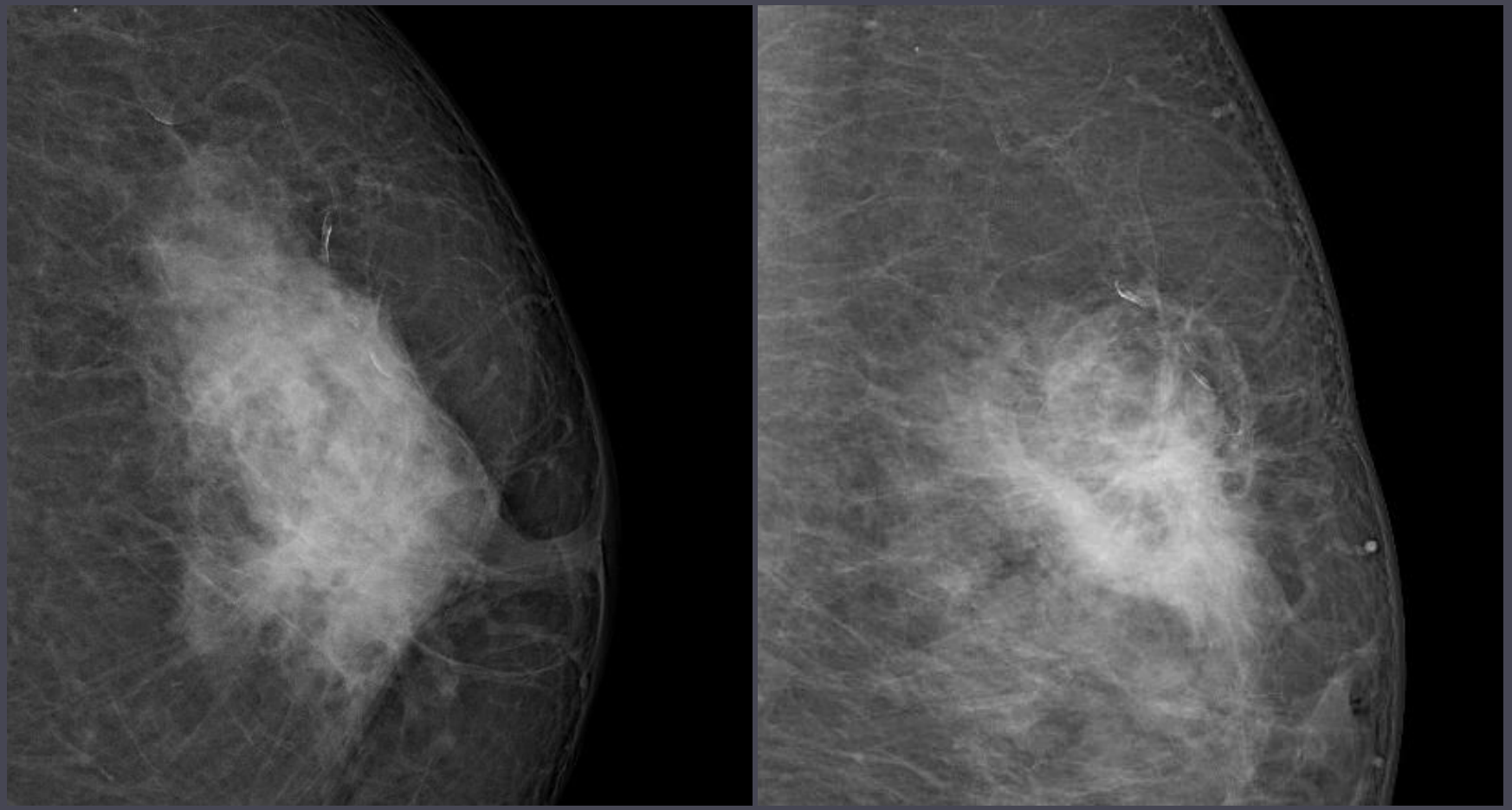


Treatment follow-up in mammography

Halo scar



Treatment follow-up in mammography

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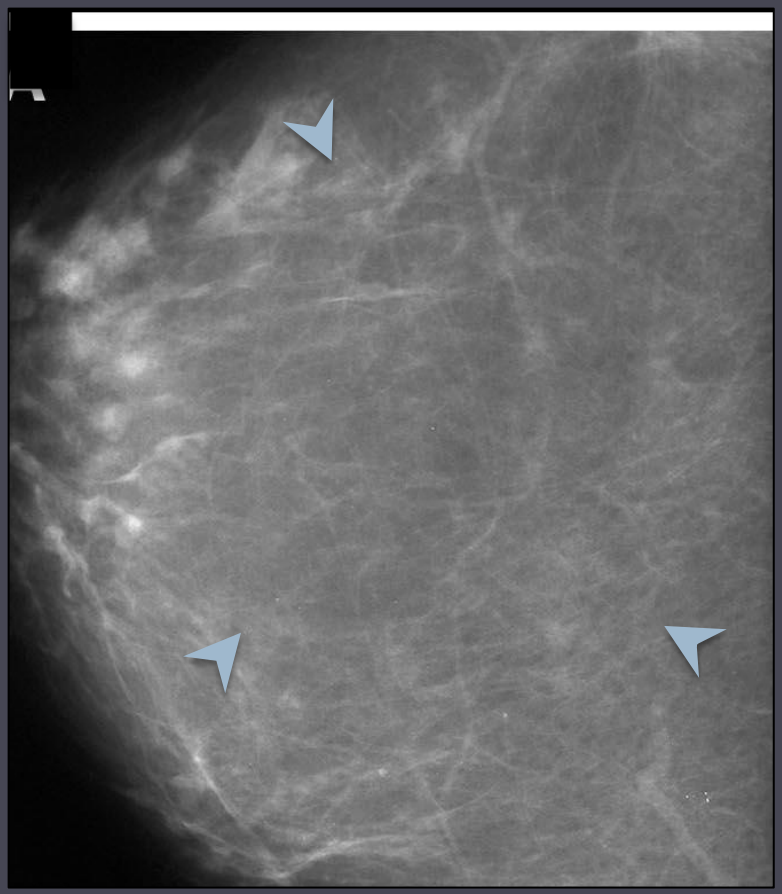
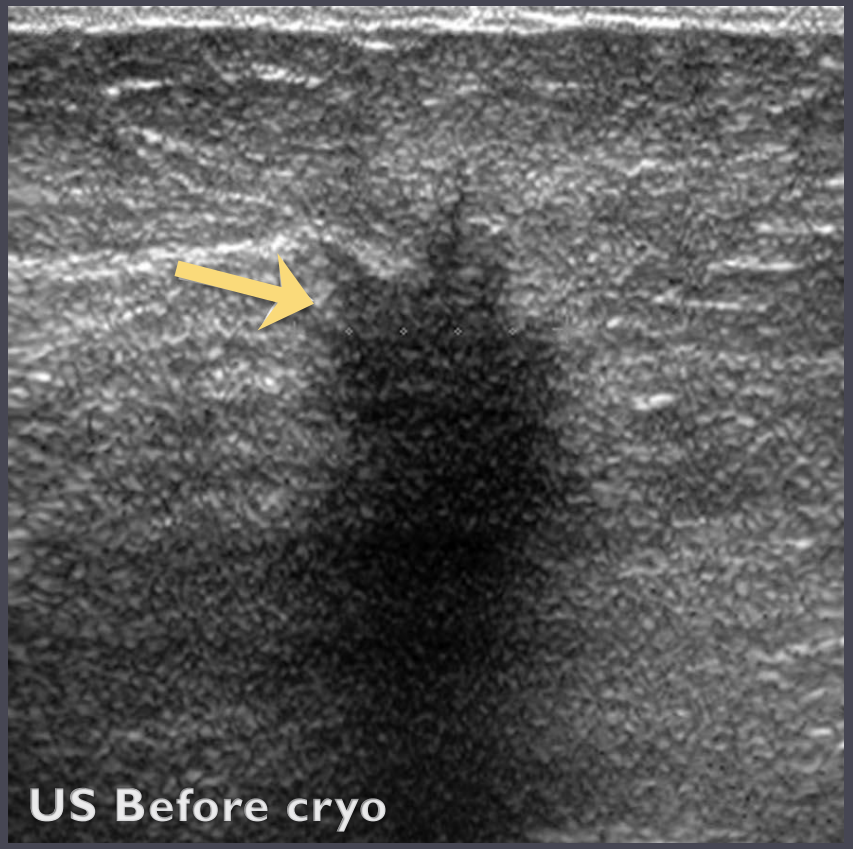
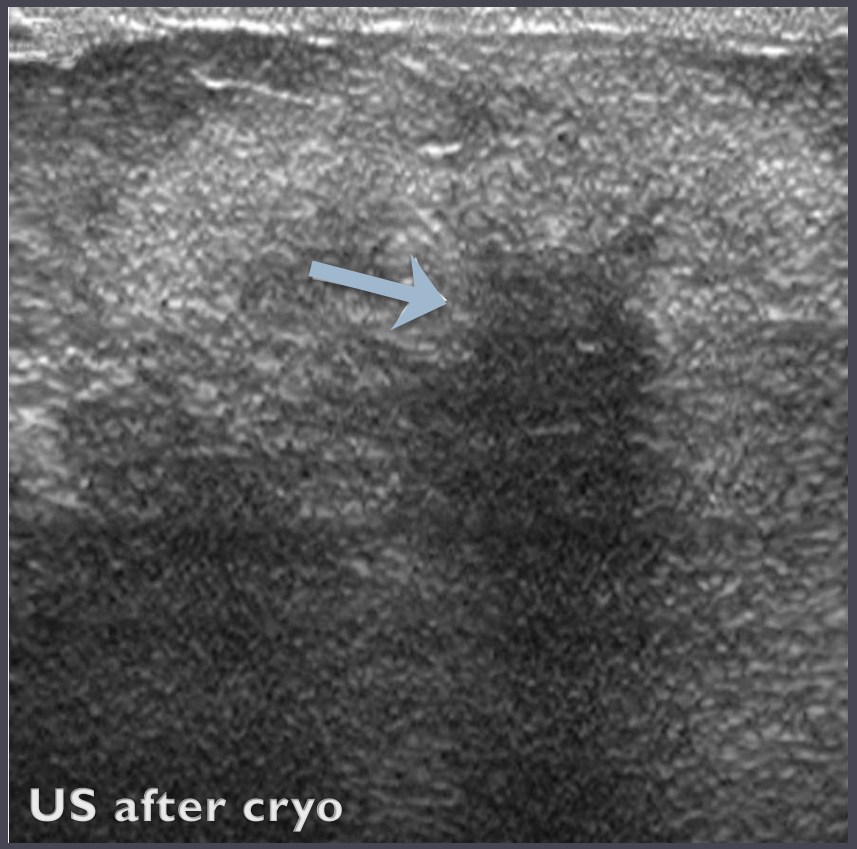


Littrup PJ. JVIR 2009, Roubidoux M. Radiology 2004

Treatment follow-up in US

Halo scar





Littrup PJ. JVIR 2009, Roubidoux M. Radiology 2004

Results

Cryotherapy in breast cancer

Performances

Cancers

- Lesions <10 mm (one needle)
  - Complete destruction in 93-100% of cases[1,2]
- Lesions <15 mm without DCIS[1]
  - 100% destruction
- Lesion <17 mm (single needle)[3]
  - 79% destruction
- Lesion >17 mm (multiple needles)[5]
  - 100% destruction (without recurrence at 18 months)

Fibroadenoma

- ADF <20 mm[4]
  - Disappearance at palpation : 94%
  - Disappearance on US : 100%
- ADF> 20 mm[4]
  - Disappearance at palpation 73%
  - Disappearance on US 98%

[1] Sabel MS, Annals of Surgical Oncology 2004, [2] Manenti G. Eur Radiol 2011
[3] Roubidoux M, Radiology 2004. [4] Kaufman CS, Breast Jour 2005, [5] Littrup PJ. J Vasc Interv Radiol 2009

benefits

- Breast is a safe for percutaneous approach
- Few technical limitations
  - No need for general anesthesia
  - Skin-lesion margins > 5 mm[1]
  - Lesion <3 cm ...
- Follow-up
  - No impact on the analysis of sentinel Lymph node[1,3]
  - No impact on the monitoring of the breast after a few months[1, 4,5]
- Satisfaction index
  - Procedure : Patients 97%, MD 100%
  - Pain at 24h (Visual Analogue Scale) : 0,3 [0-4]
  - Esthetic : Patientes 100%, Médecins 100%

[1] Sabel MS, Annals of Surgical Oncology 2004. [2] Roubidoux M, Radiology 2004
[3] Manenti G. Eur Radiol 2011. [4] Kaufman CS. Breast Jour 2005, [5]Brenner RJ. AJR 1996

Limits

- Lower Performances
  - Poorly defined lesions
    - DCIS : 40% faillures
    - ILC: 60% faillures
    - Spiculated lesion

[1] Sabel MS, Annals of Surgical Oncology 2004, [2] Roubidoux M,Radiology 2004
[3] Pfleiderer S. Eur Radiol 2002, [4] Manenti G.Eur Radiol 2011, [5] Kaufman CS. Breast Jour 2005

Limits

- Side effects
  - Erythema 80% (8h)
  - Palpable scar 30%
  - Hematoma 26%
  - Pain
- Cost
  - 1 cryoprob = 1000€

[1] Sabel MS, Annals of Surgical Oncology 2004, [2] Roubidoux M, Radiology 2004
[3] Pfleiderer S. Eur Radiol 2002, [4] Manenti G. Eur Radiol 2011, [5] Kaufman CS. Breast Jour 2005

Conclusion

Cryotherapy in breast cancer

Take Home Messages

	Initial	Metastatic	Relaps	Adenofibroma
Cancer	<35 mm In situ - Unifocal N-	<35 mm In situ - Unifocal		<25 mm
Patiente	Surgery contra-indicated Surgery refused			
Before Cryo	Biopsy cancer ±lymphnodes MRI	Biopsy cancer MRI	Biopsy cancer ±lymphnodes MRI	Biopsy cancer MRI
Follow-up	Breast MRI at 3, 6, 12, 18, 24 month			Breast MRI at 6, 12 and 24 month Mammography if > 35 yo US every year.