

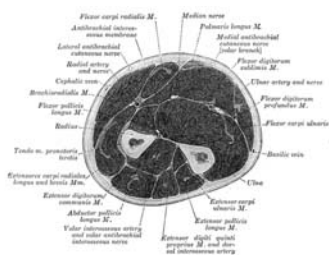


## Evaluation of a technique to measure the amount of fat in skeletal muscles with magnetic resonance imaging

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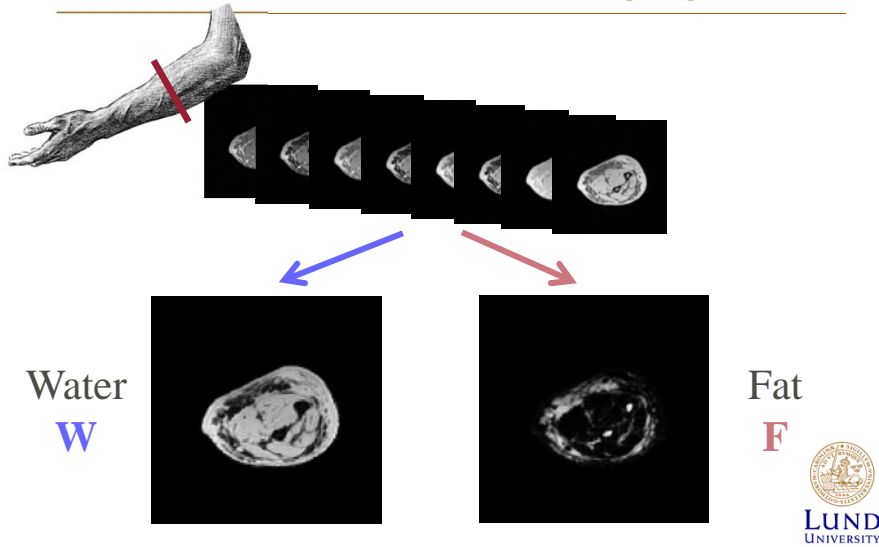
## Introduction – Fat accumulation in lymphedema



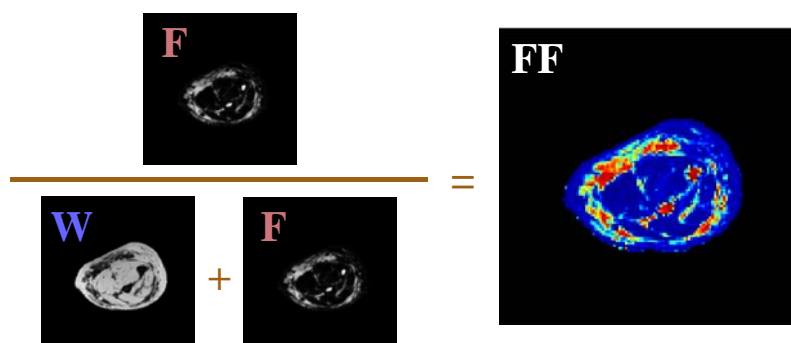
- Common complication after breast cancer treatment
- Excess adipose tissue
  - Epifascially
  - Subfascially?
- Intermuscular adipose tissue (IMAT)
  - Between muscles
  - Within muscles



## Introduction – Water/Fat Imaging



## Introduction – Water/Fat Imaging



## Aim

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- To evaluate the accuracy and repeatability of water/fat imaging for investigation of fatty infiltration in skeletal muscle in lymphedema



## Method - Summary

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### MRI examinations at 1.5 T

**Accuracy**  
Phantom experiment,  
comparison with  
known FFs

**Repeatability**  
Healthy volunteers,  
repeated  
measurements

**For reference**  
Lymphedema  
patients



## Method – Phantom construction

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- 6 Intralipid phantoms
  - Plastic 50 ml-vials
  - Diluted to FFs 0.6 % - 20 %
- 6 pure soybean oil phantoms



## Method – Human subjects

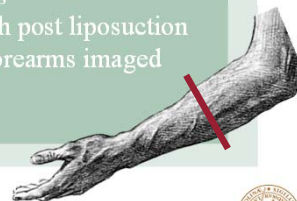
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### Controls

- 10 healthy volunteers
- Both forearms imaged
- Repeated imaging of right forearm

### Patients

- 6 arm lymphedema patients
- 1 month post liposuction
- Both forearms imaged



## Method – MRI protocol

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- Three slices
  - 5 mm slice thickness
  - Centered 10 cm distally of the humeral epicondyle
- Gradient echo sequence
  - 8 echo times
  - For separation of fat and water signals
- Small flip angle
  - Avoid T<sub>1</sub>-weighting



## Method - Evaluation

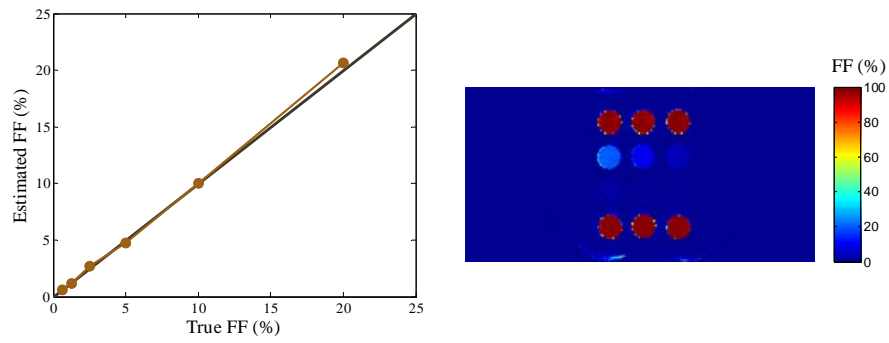
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- FF map reconstructed from separated fat and water images
- Subfascial compartment, excluding bone
  - Region-of-interest manually drawn
- IMAT calculated within ROI according to:

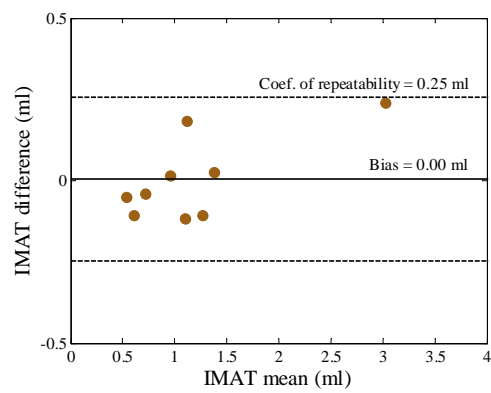
$$\text{IMAT} = \text{voxel volume} \cdot \sum_{v=1}^V FF_v$$



## Results - Accuracy



## Results - Repeatability



## Results – Reference values

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### Controls

- Right arm: 2.2 ml (1.9-5.4 ml)
- Difference: 0.9 ml (0.0-1.4 ml)

### Patients

- Healthy arm: 5.8 ml (3.8-7.3 ml)
- Difference: 1.6 ml (-2.0-2.6 ml)



## Conclusion

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- Water/fat imaging can accurately measure the FF
- The detected repeatability is sufficient for IMAT measurements in healthy subjects and lymphedema patients





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