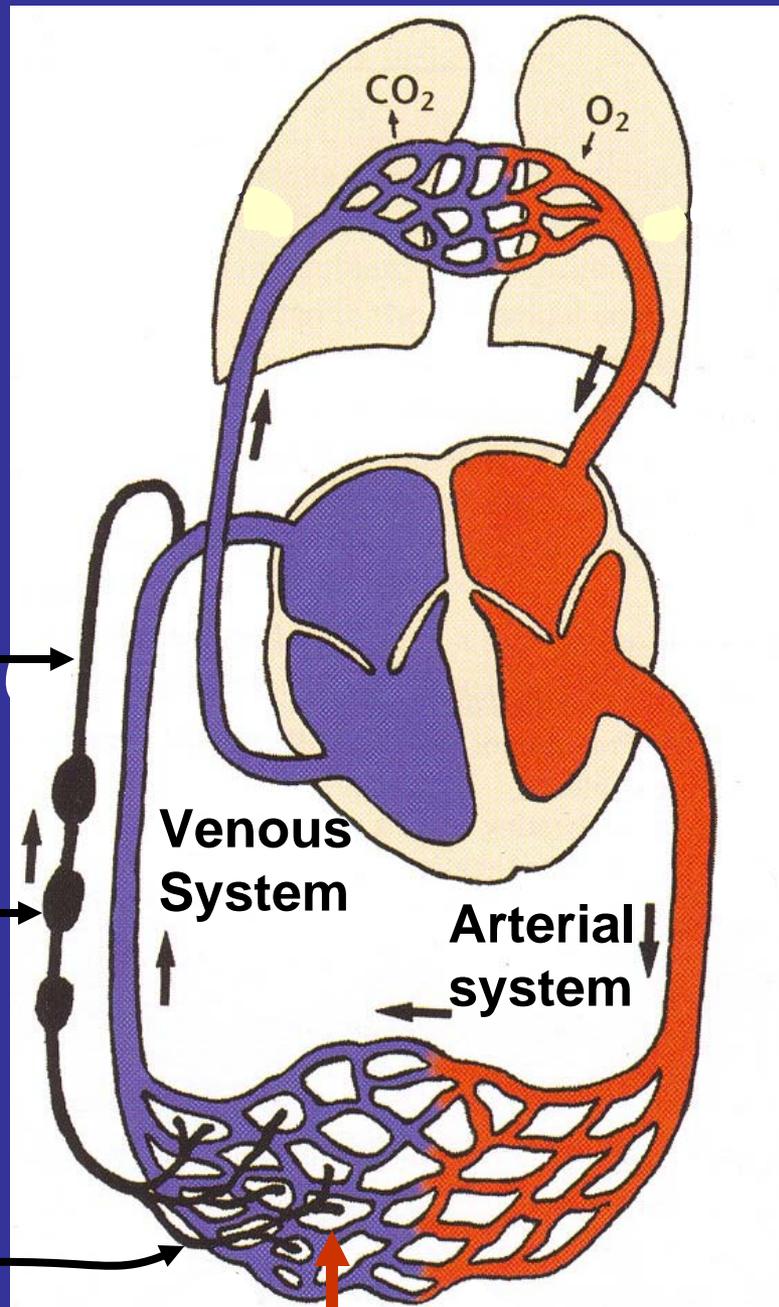


Assessment of Local Tissue Edema in Arms of Women with Postmastectomy Lymphedema



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University, Ft. Lauderdale, Florida 33328

The Third Circulatory System



Lymphatic System

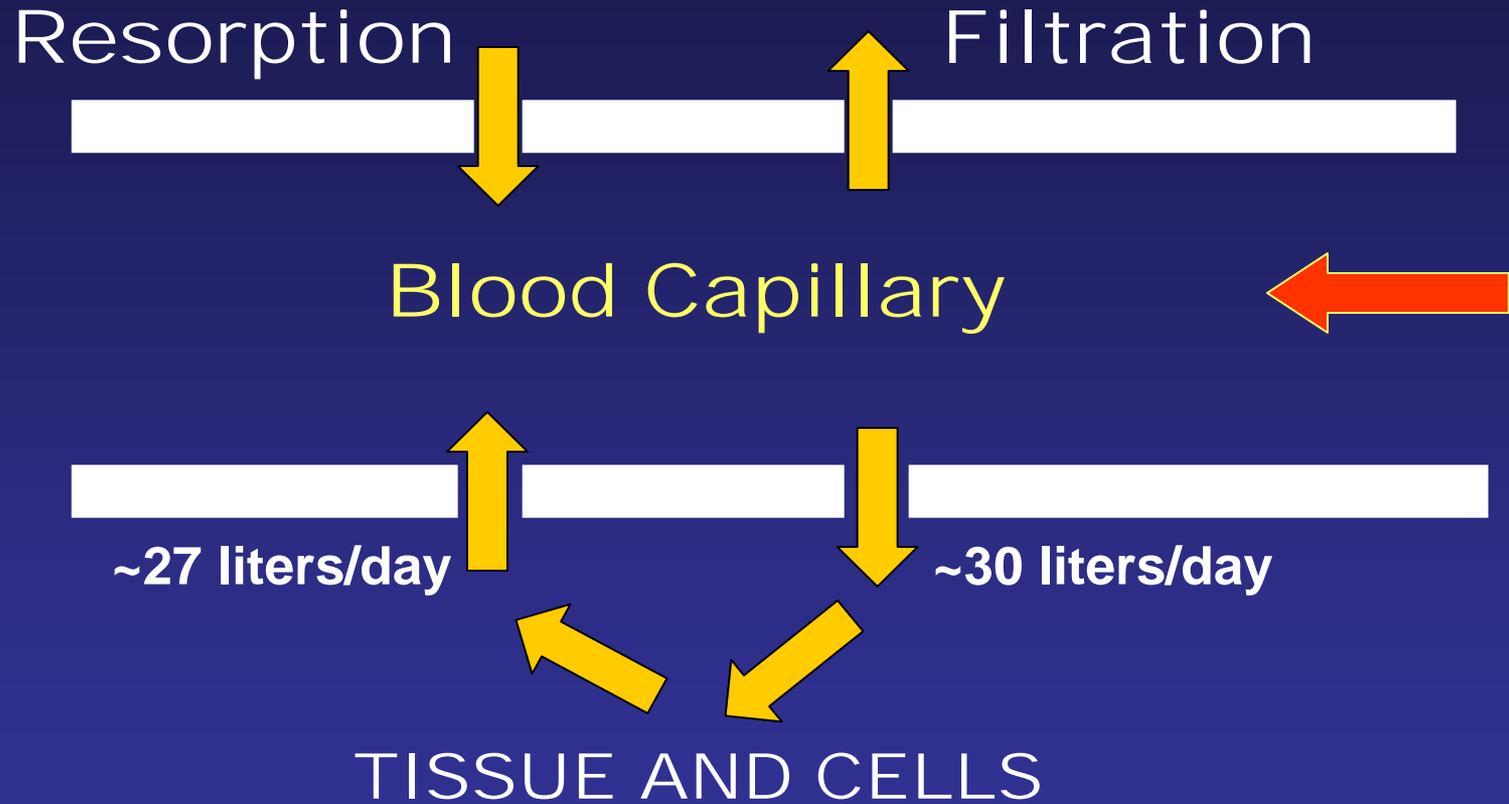
Lymphatic Vessels

Lymph Nodes

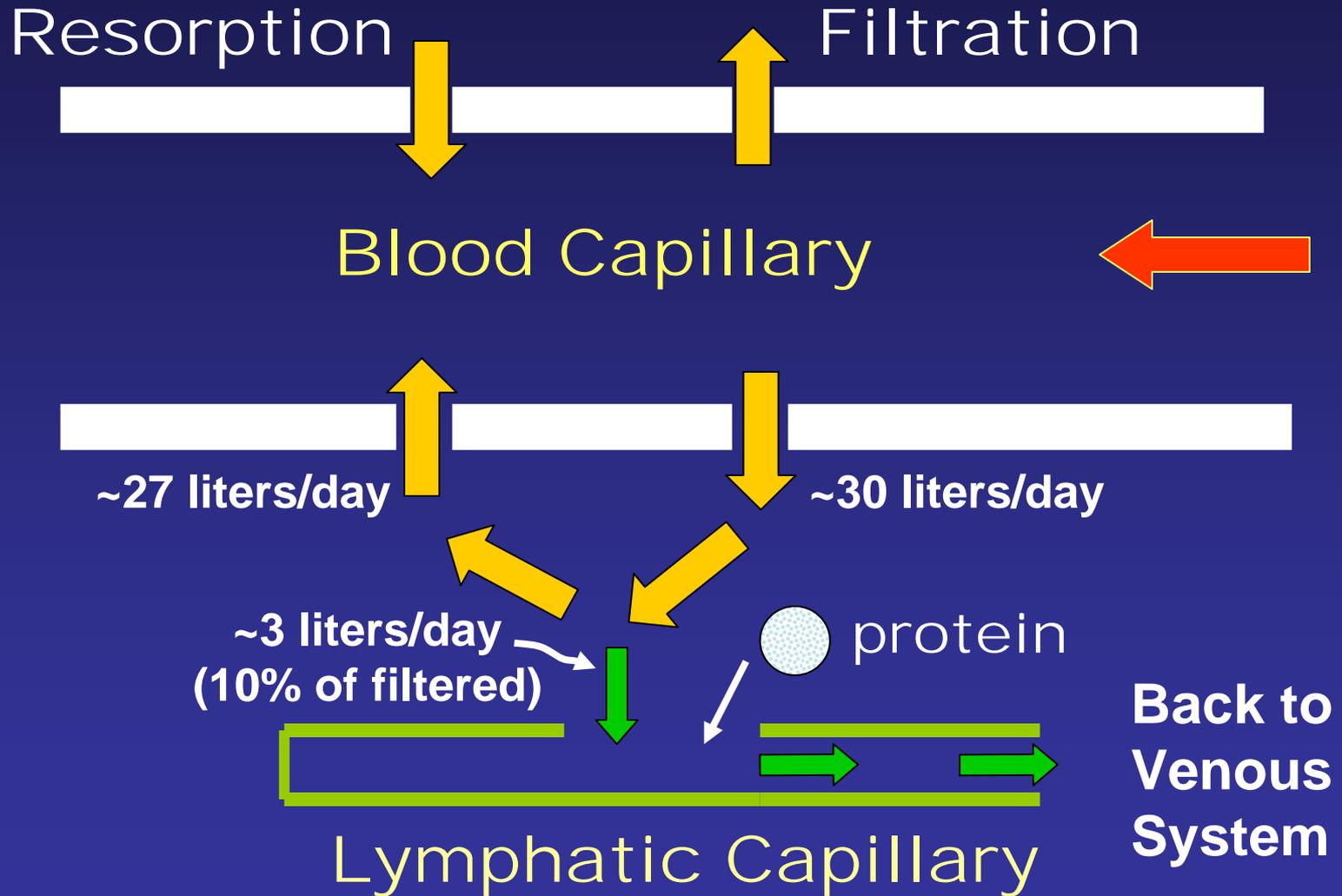
Lymphatic Capillaries

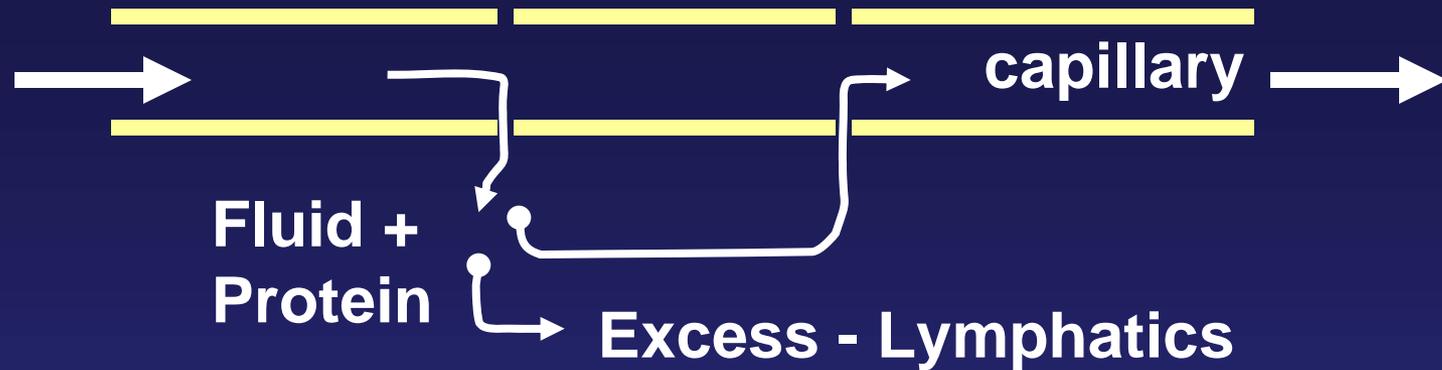
Blood Capillaries

Normal Fluid Balance



Normal Fluid Balance





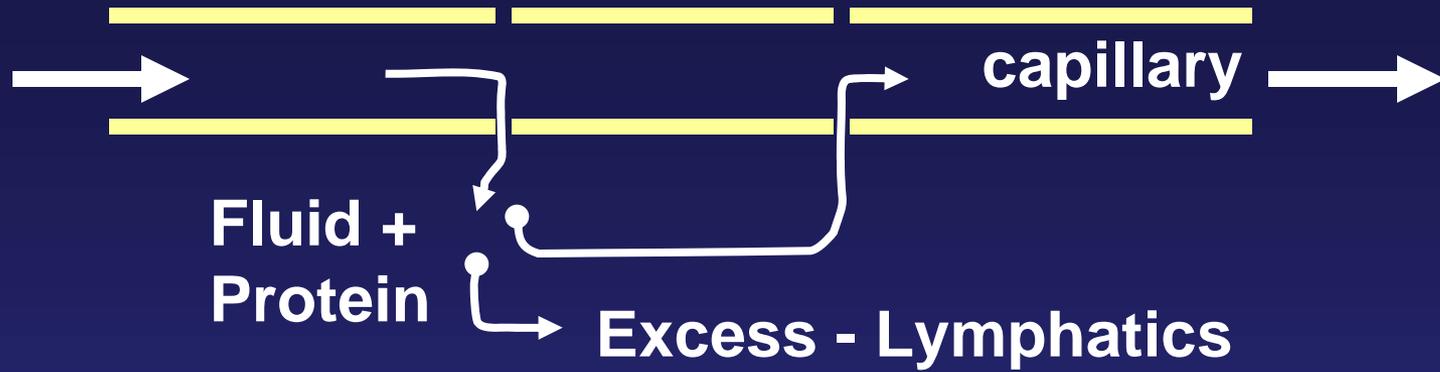
**If Net Filtration Exceeds
Lymphatic Transport Capacity**

Overload = Edema

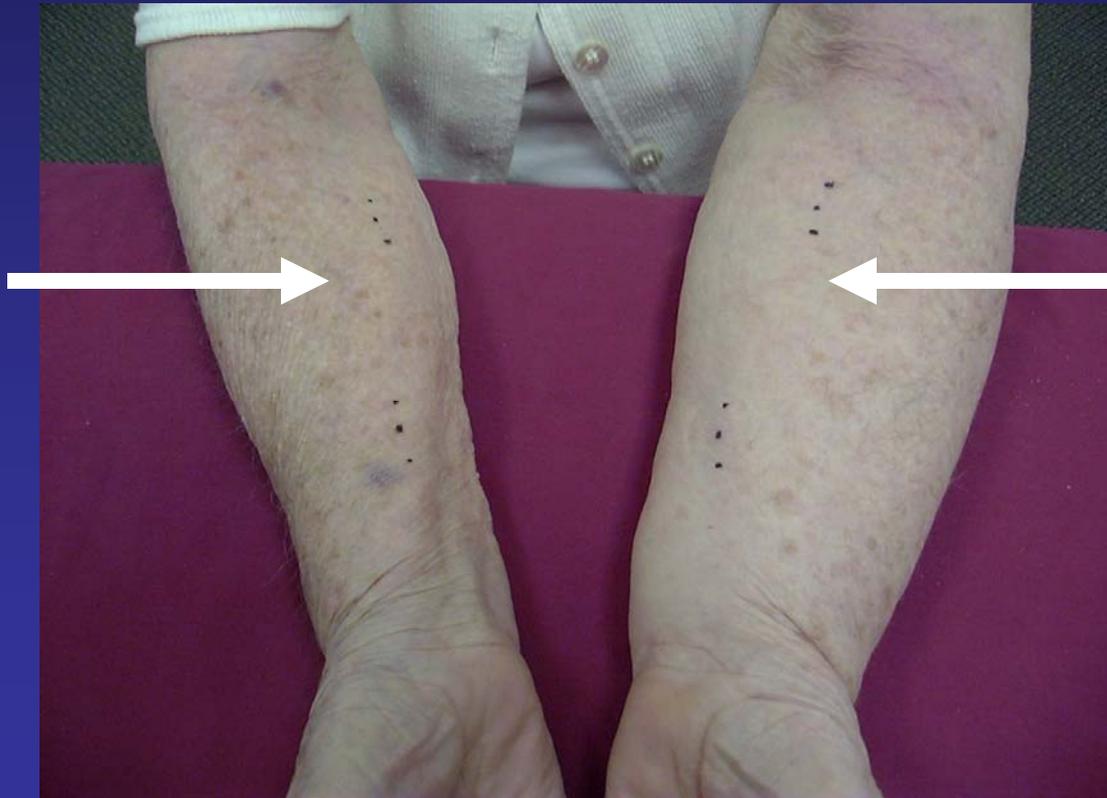
+ [Protein]

= Lymphedema

Complications

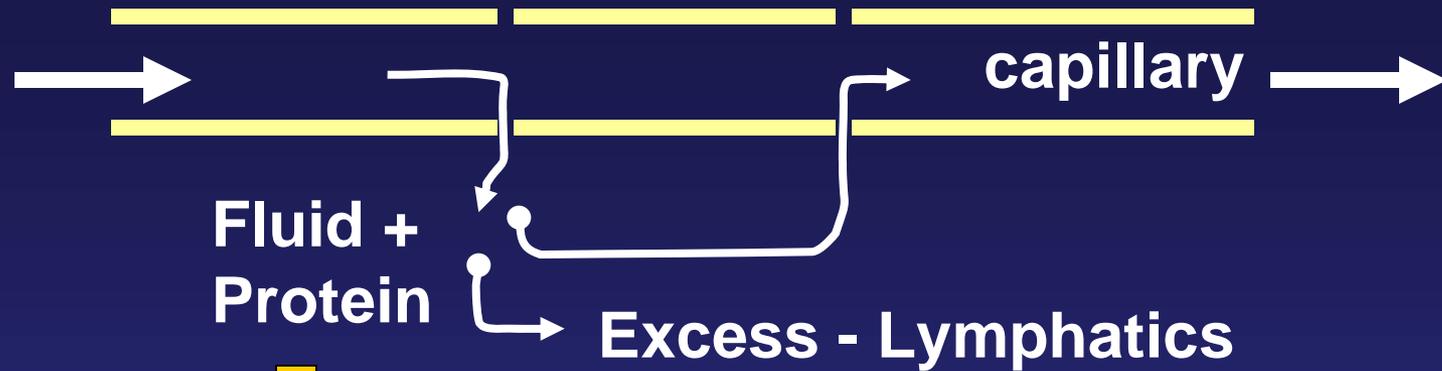


**System
Works
OK Here**



**System
Not OK
Here**

Complications



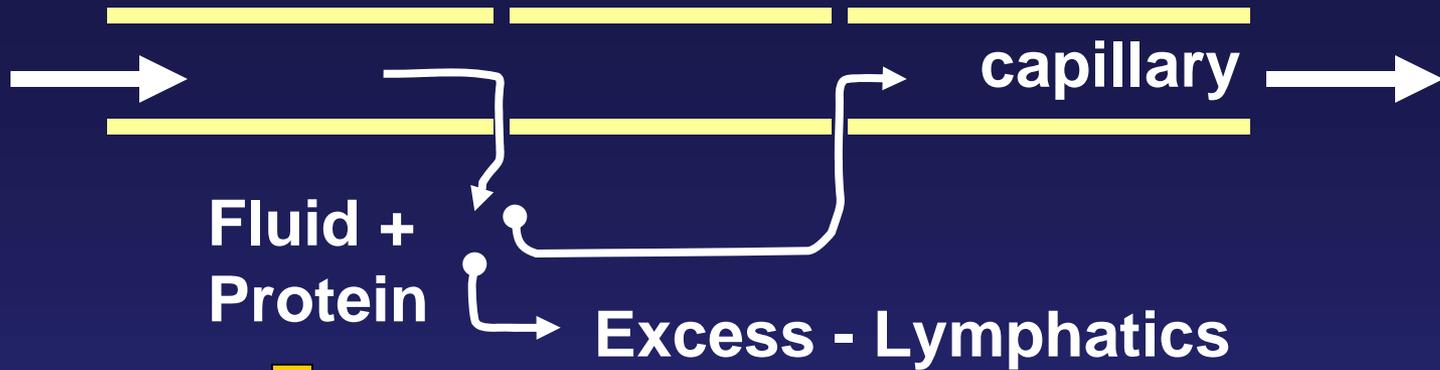
Proteins ↓ **Accumulate if Lymphatic Dysfunction**

PROTEINS

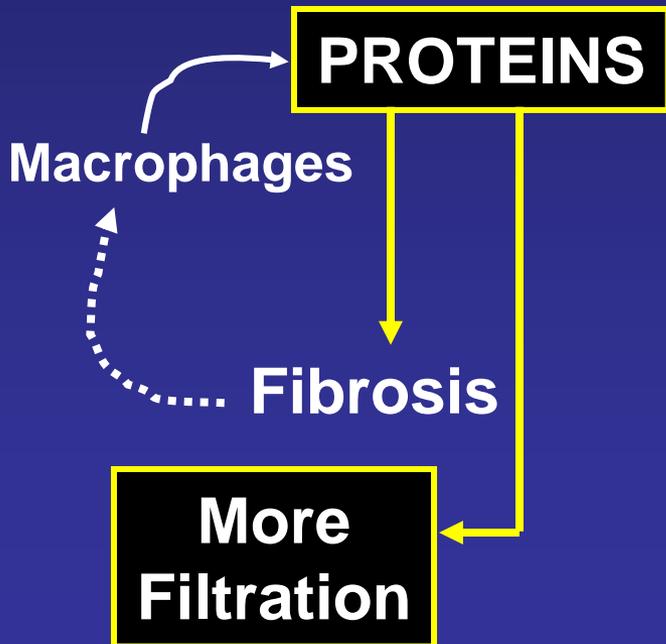
- Lymphatic vessel/node**
- Trauma
 - Removal
 - Radiation
 - Blockage
 - Overload
 - Genetic - Primary

More Filtration

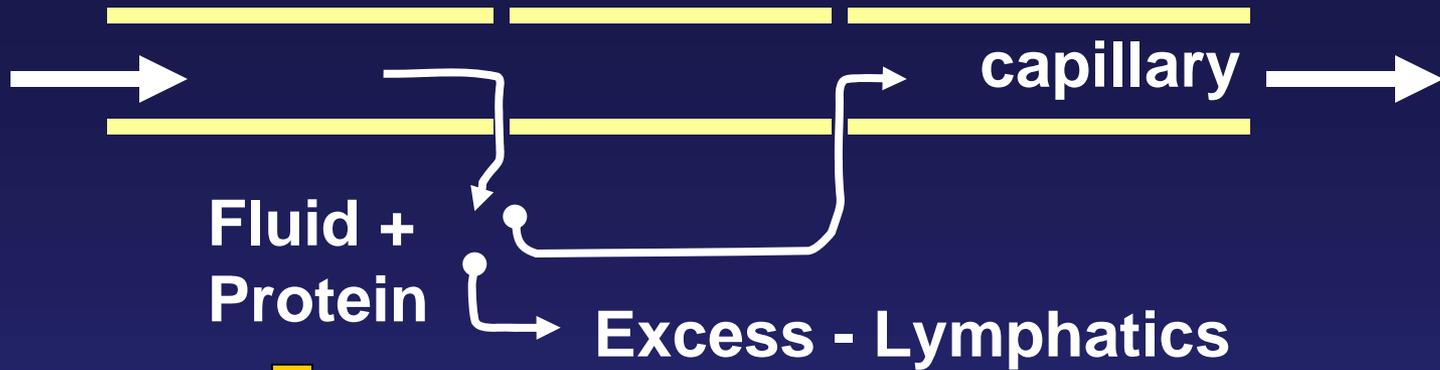
Complications



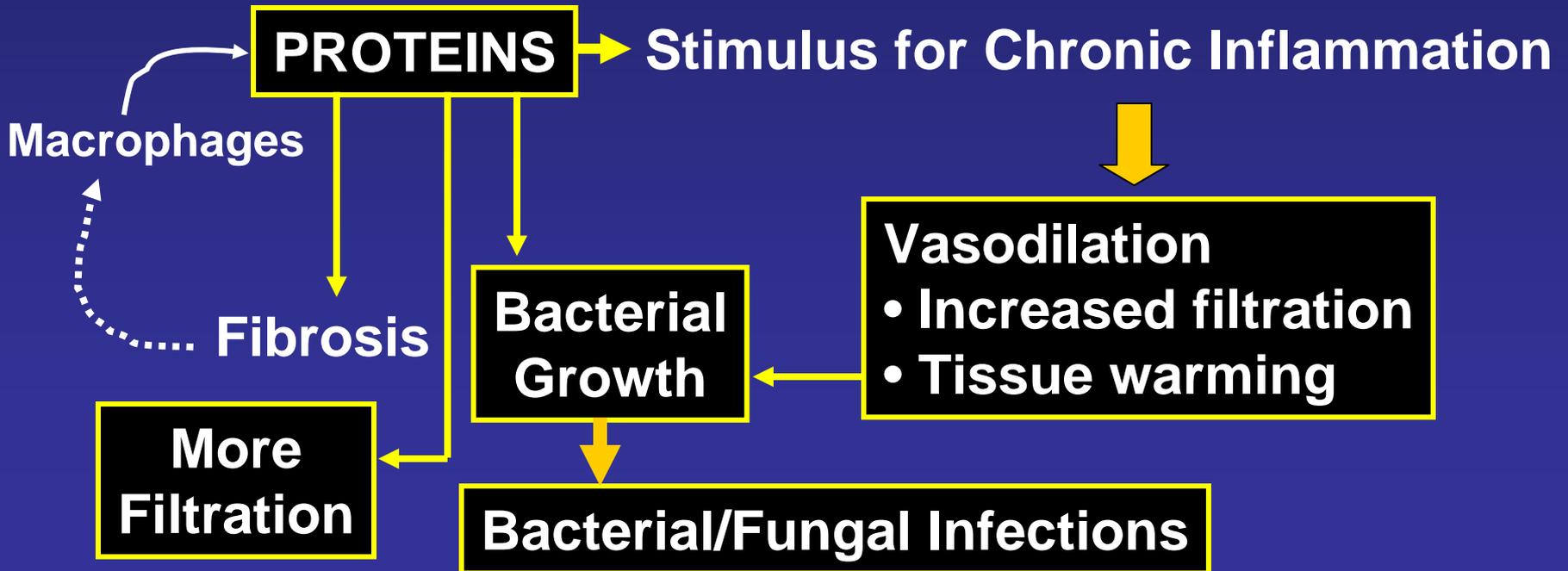
Proteins ↓ **Accumulate if Lymphatic Dysfunction**



Complications



Proteins ↓ **Accumulate if Lymphatic Dysfunction**



Postmastectomy Lymphedema



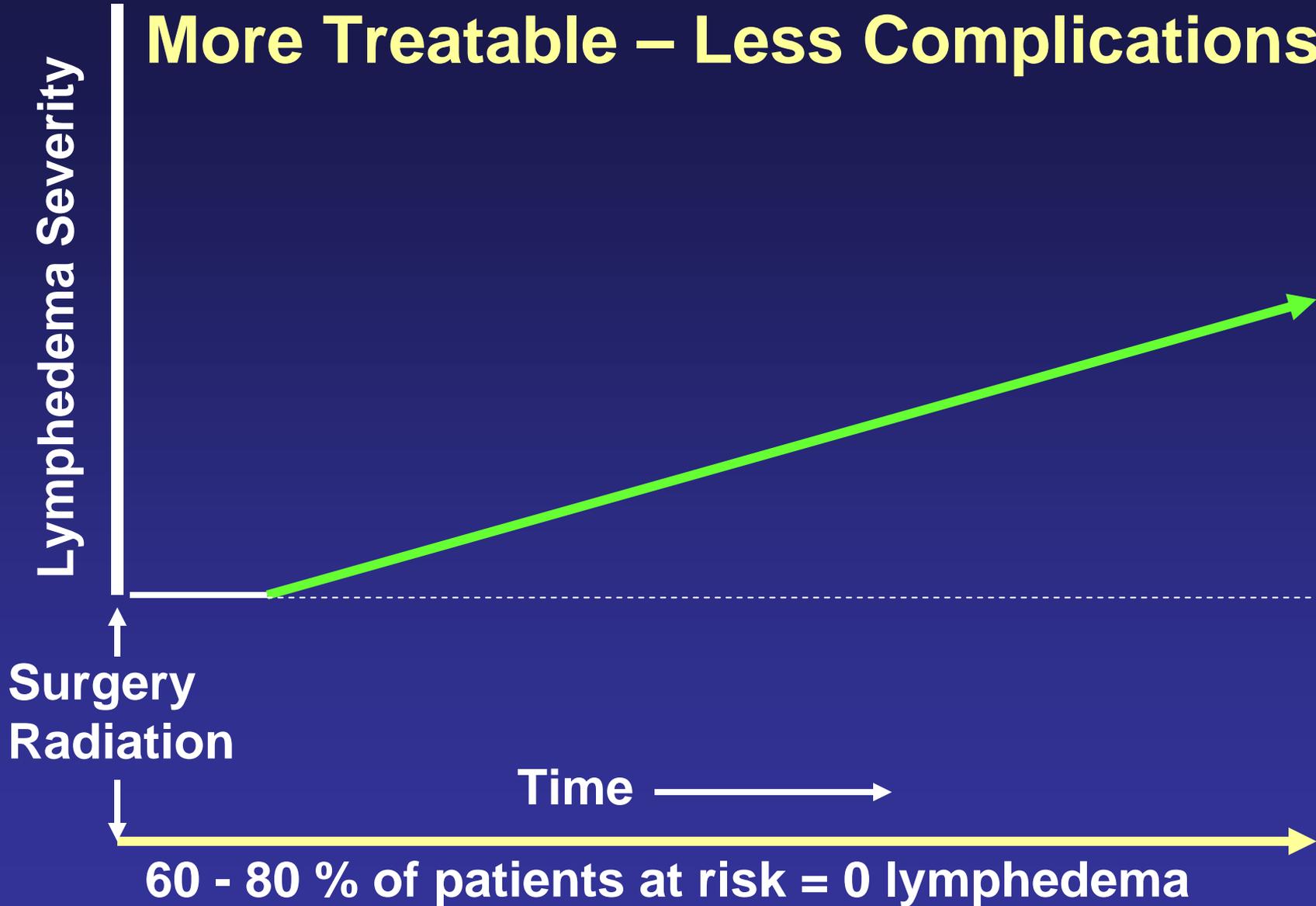
“Recognizing lymphedema early and treating it promptly is the best way to manage the condition”

Judith R. Casley-Smith & J.R. Casley-Smith

- Develops secondary to surgery and/or radiation therapy
- Occurs in 20-40% of persons treated for breast cancer
- Onset can be from months to years after surgery
- If untreated, gets progressively worse

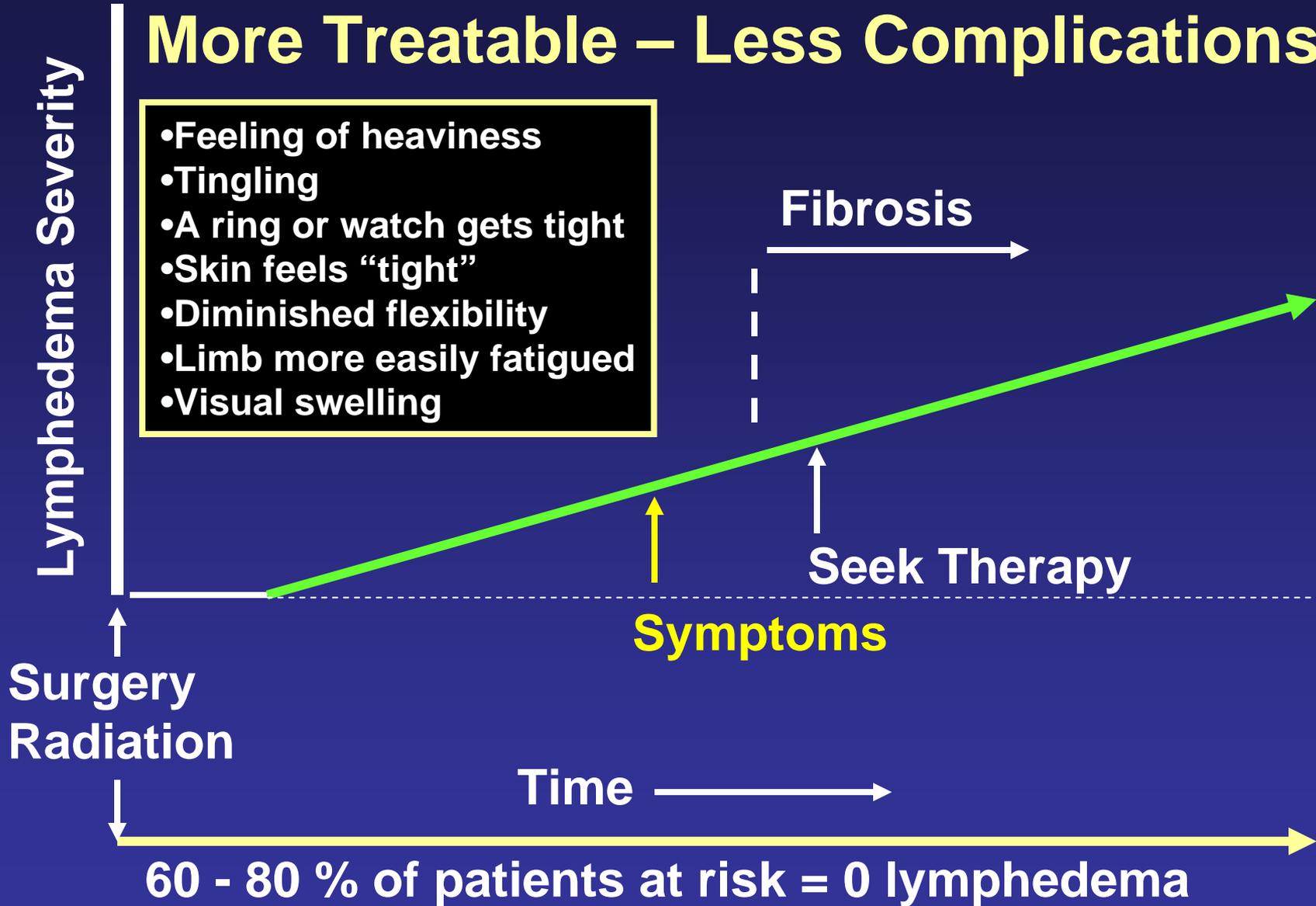
Ultimate Goal - Catch it Early

More Treatable – Less Complications



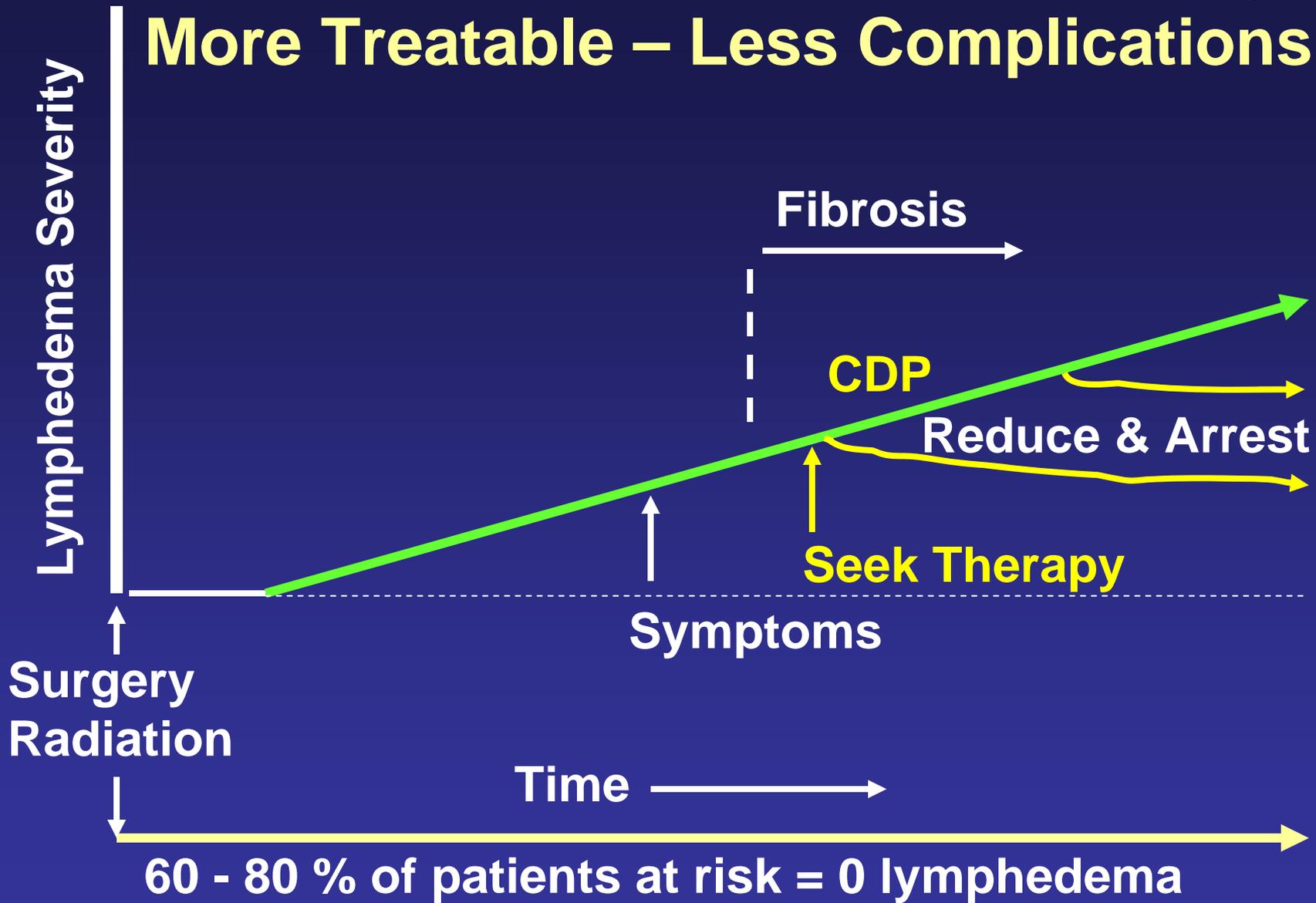
Ultimate Goal - Catch it Early

More Treatable – Less Complications



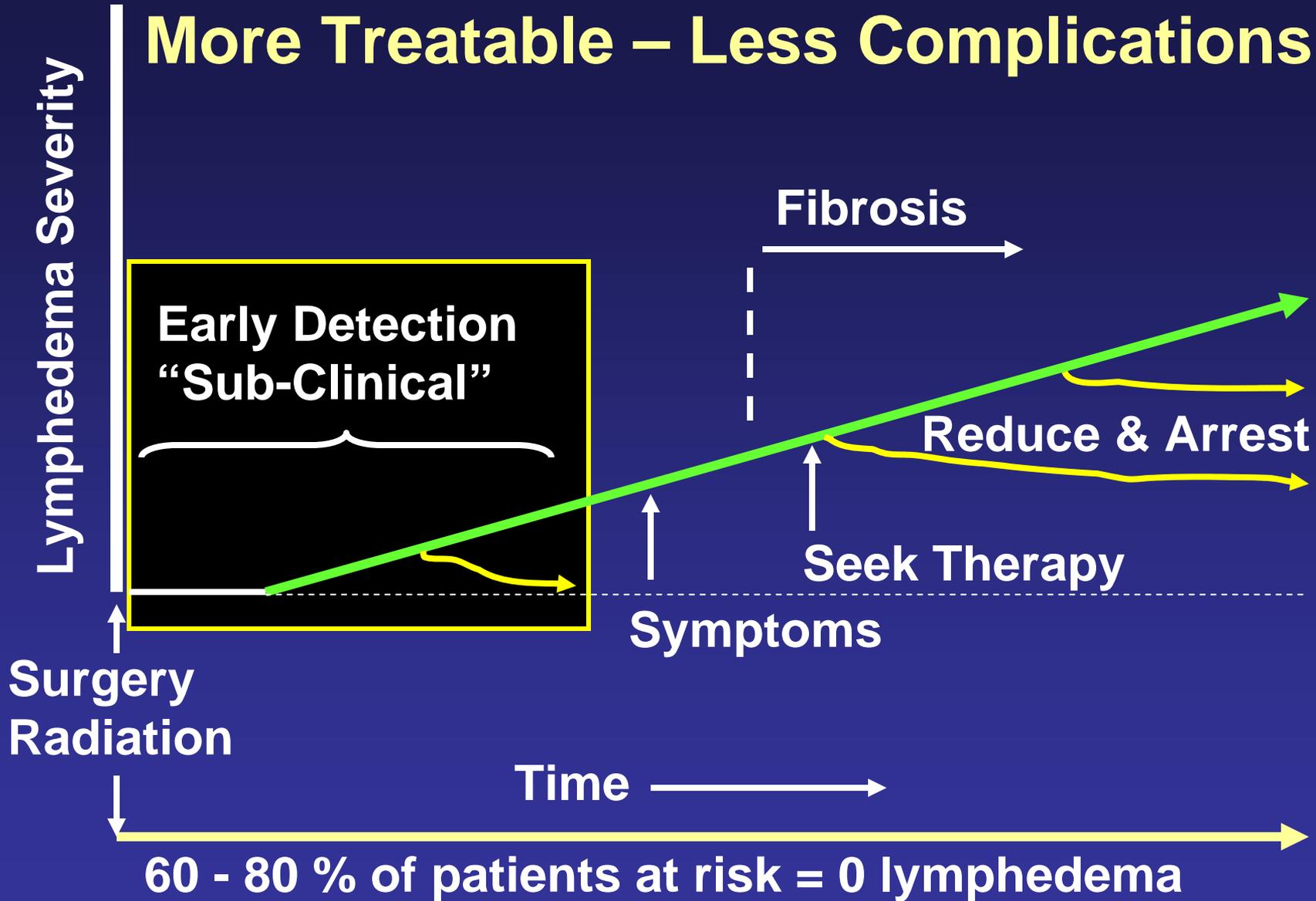
Ultimate Goal - Catch it Early

More Treatable – Less Complications

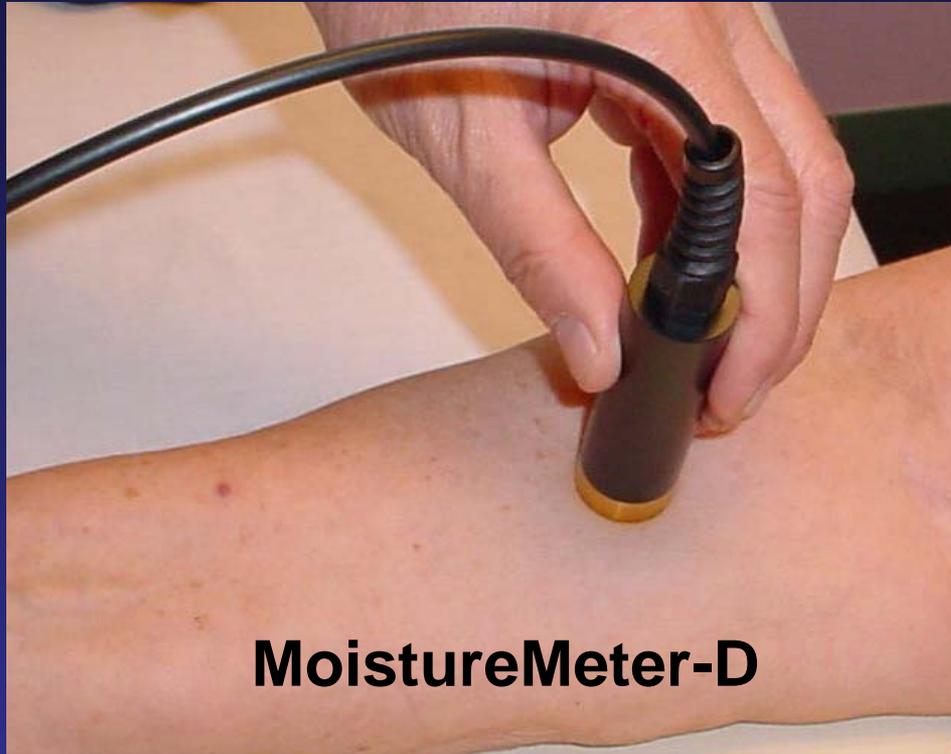


Ultimate Goal - Catch it Early

More Treatable – Less Complications



Tissue Water via Dielectric Constant



MoistureMeter-D

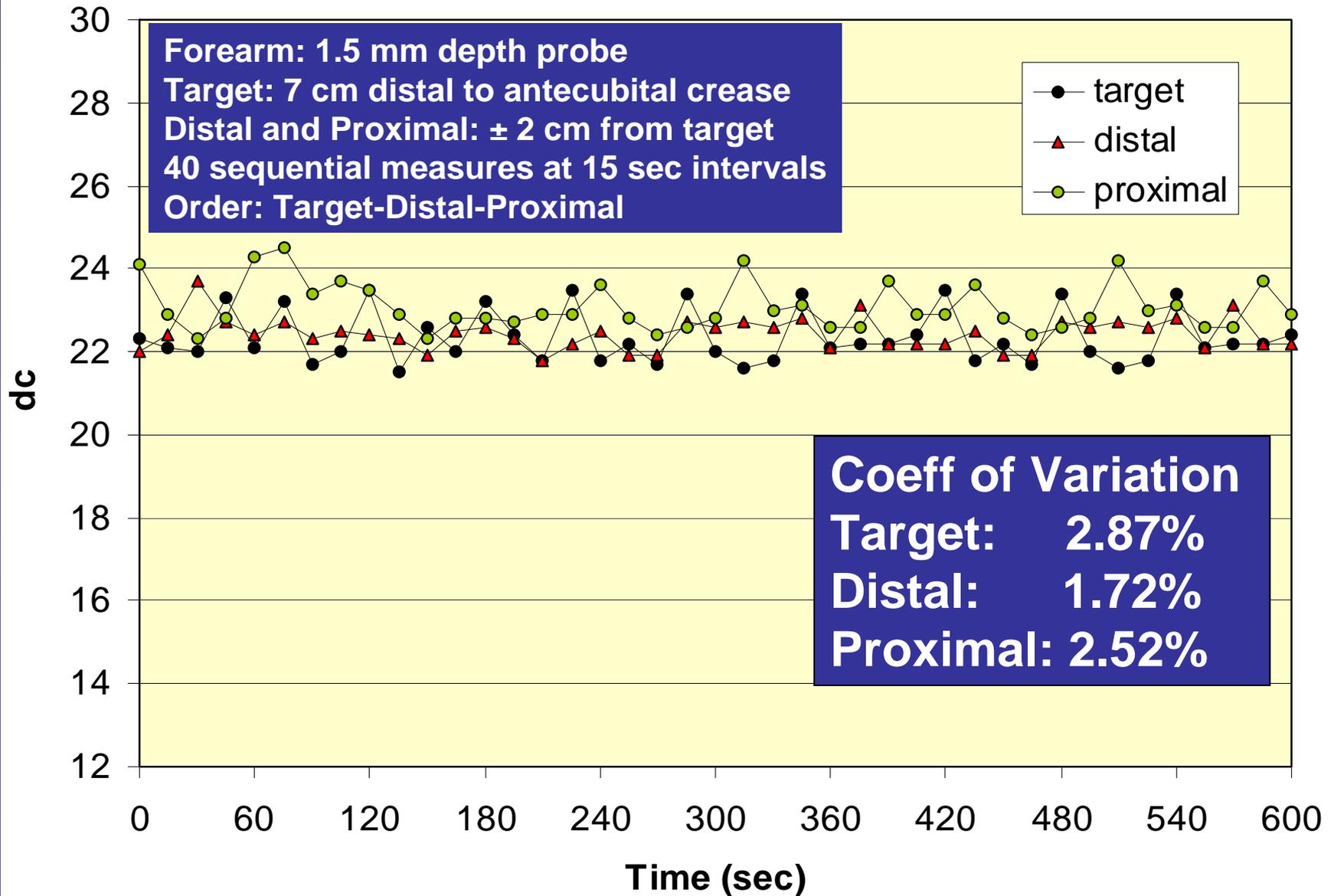
Penetration Depth (0.5 – 5 mm)



0.5 1.5 2.5 5.0 mm

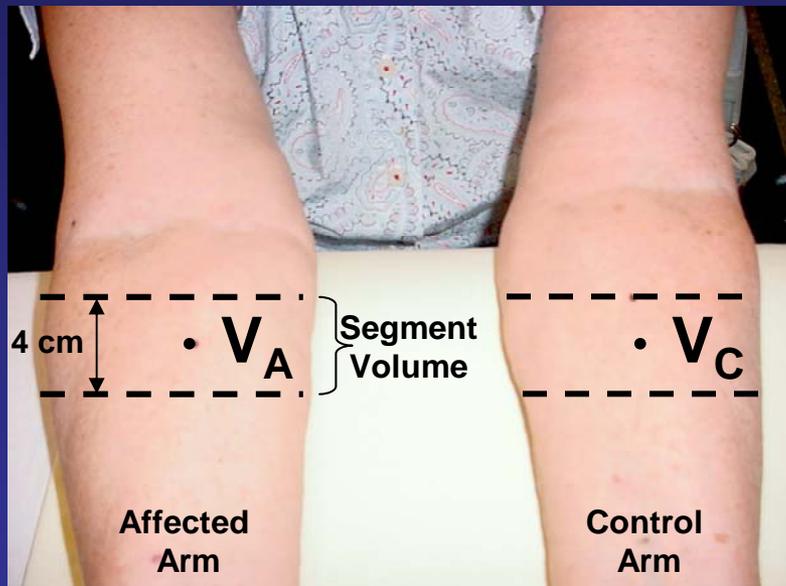
- Low power 300 MHz incident wave
- Reflected wave depends on the tissue's dielectric constant
- Dielectric constant depends on total tissue water (free + bound)
- Pure water has a dielectric constant of about 80
- Calibrated for each probe from 1 - 80

Short-Term Reproducibility



Subjects and Protocol

12 women with unilateral arm lymphedema (74 ± 16 yrs)
12 premenopausal women (25.5 ± 3.7 yrs)
12 postmenopausal women (61.0 ± 6.7 yrs)

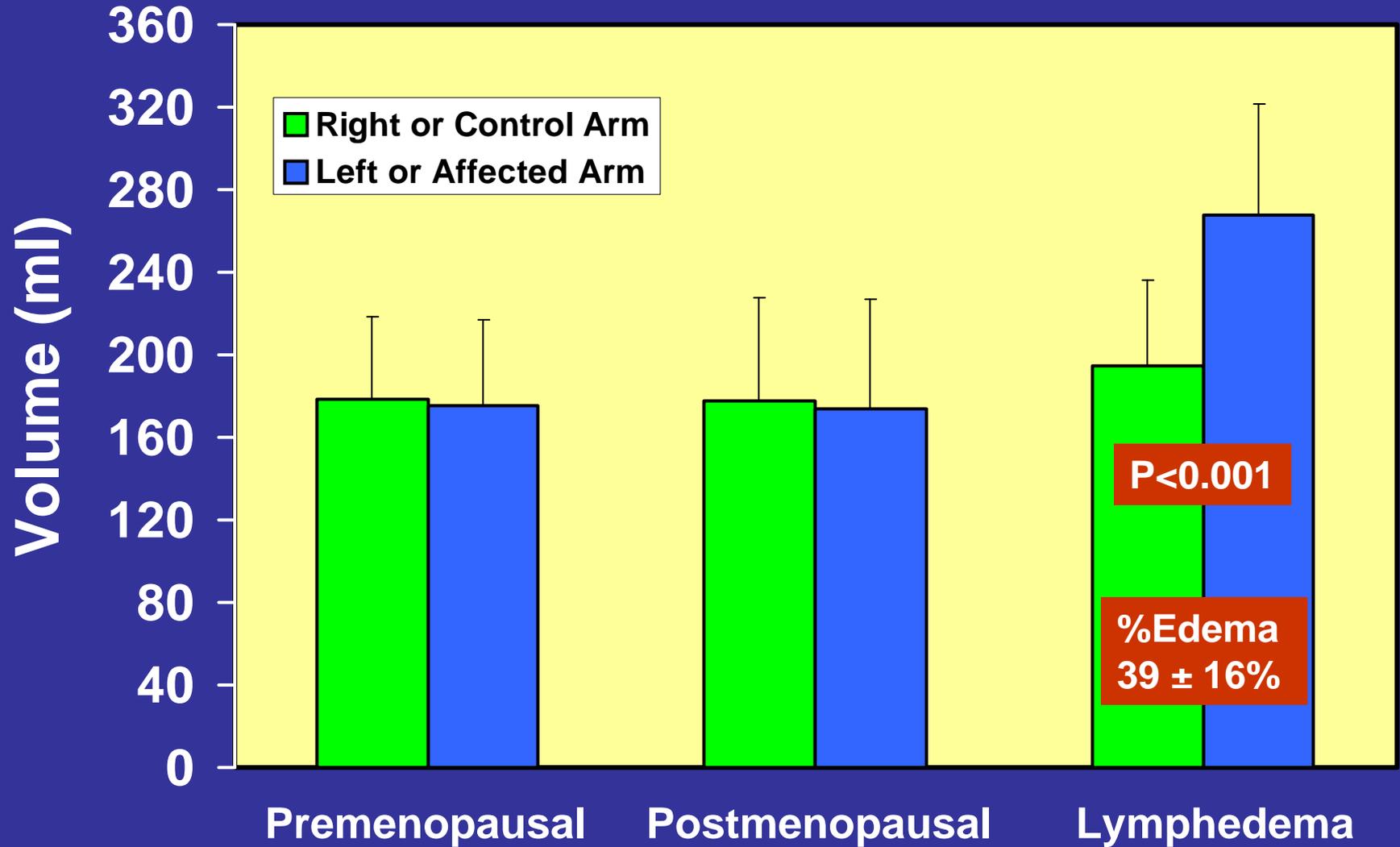


- Triplicate dielectric values on each arm with each probe
- Segment volumes determined based on frustum model
- Segmental percentage edema

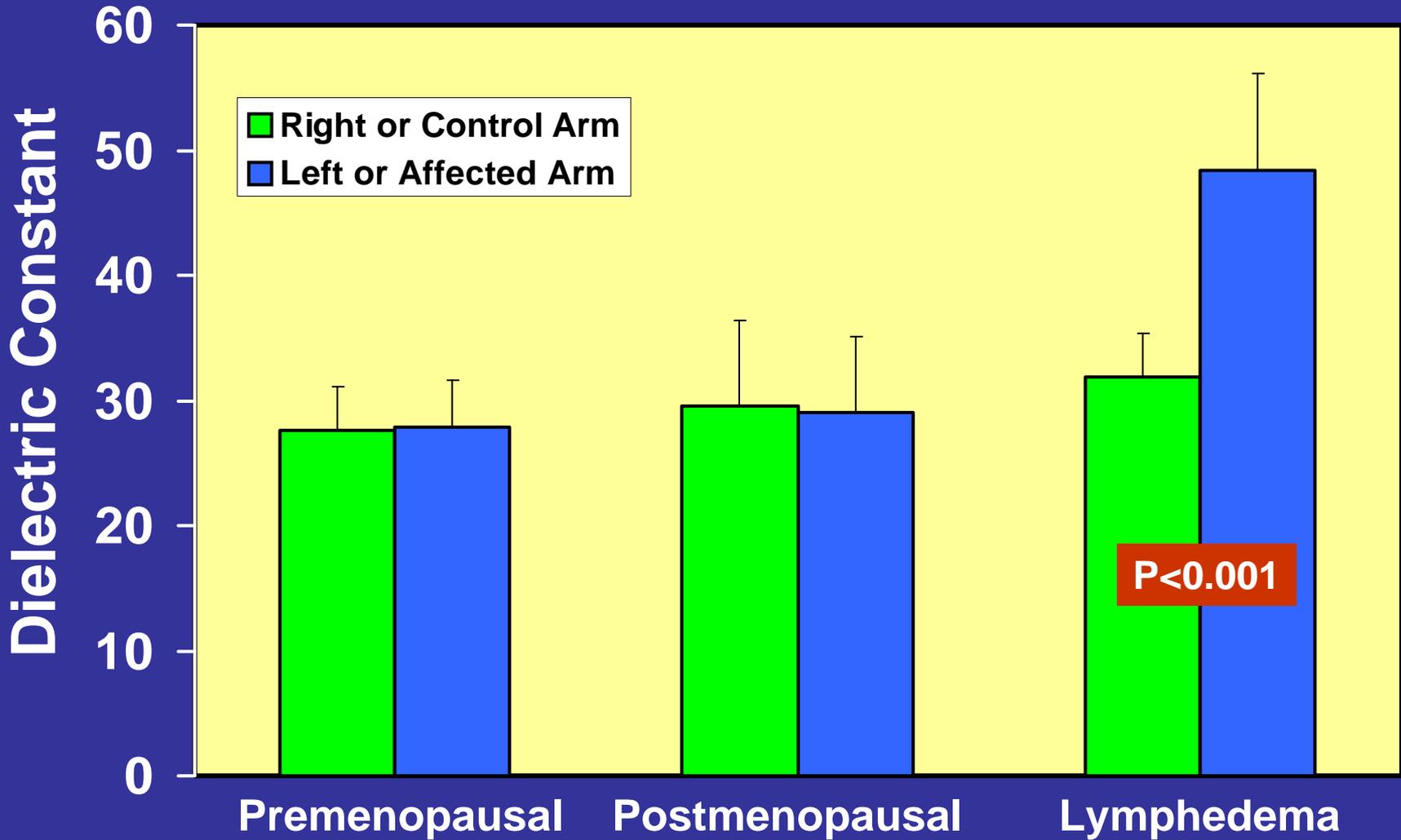
$$100 \times \frac{V_A - V_C}{V_C}$$

*Measurements on lymphedema patients **prior to treatment***
*Measurements on premenopausal **4 days after menses***

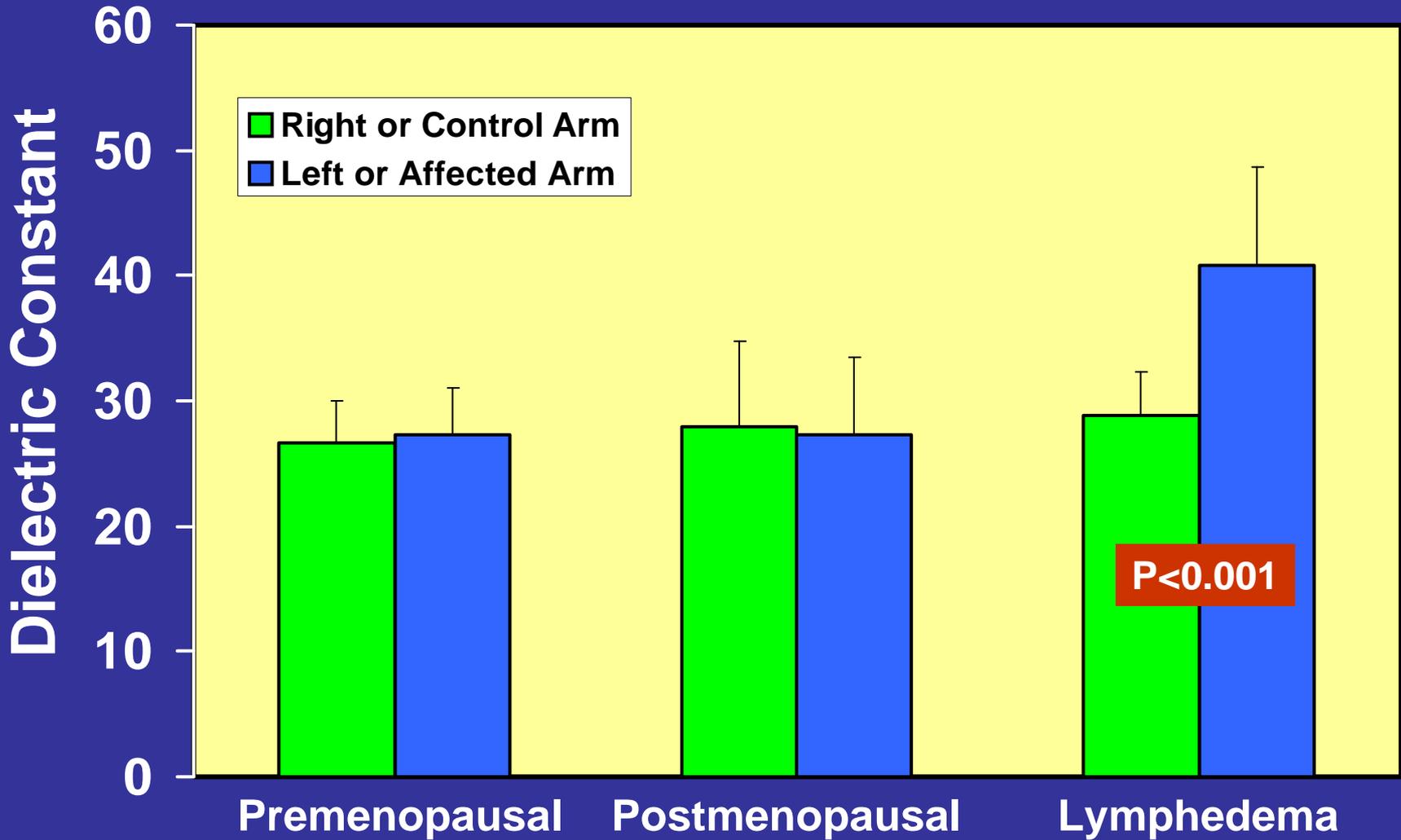
Segmental Volumes



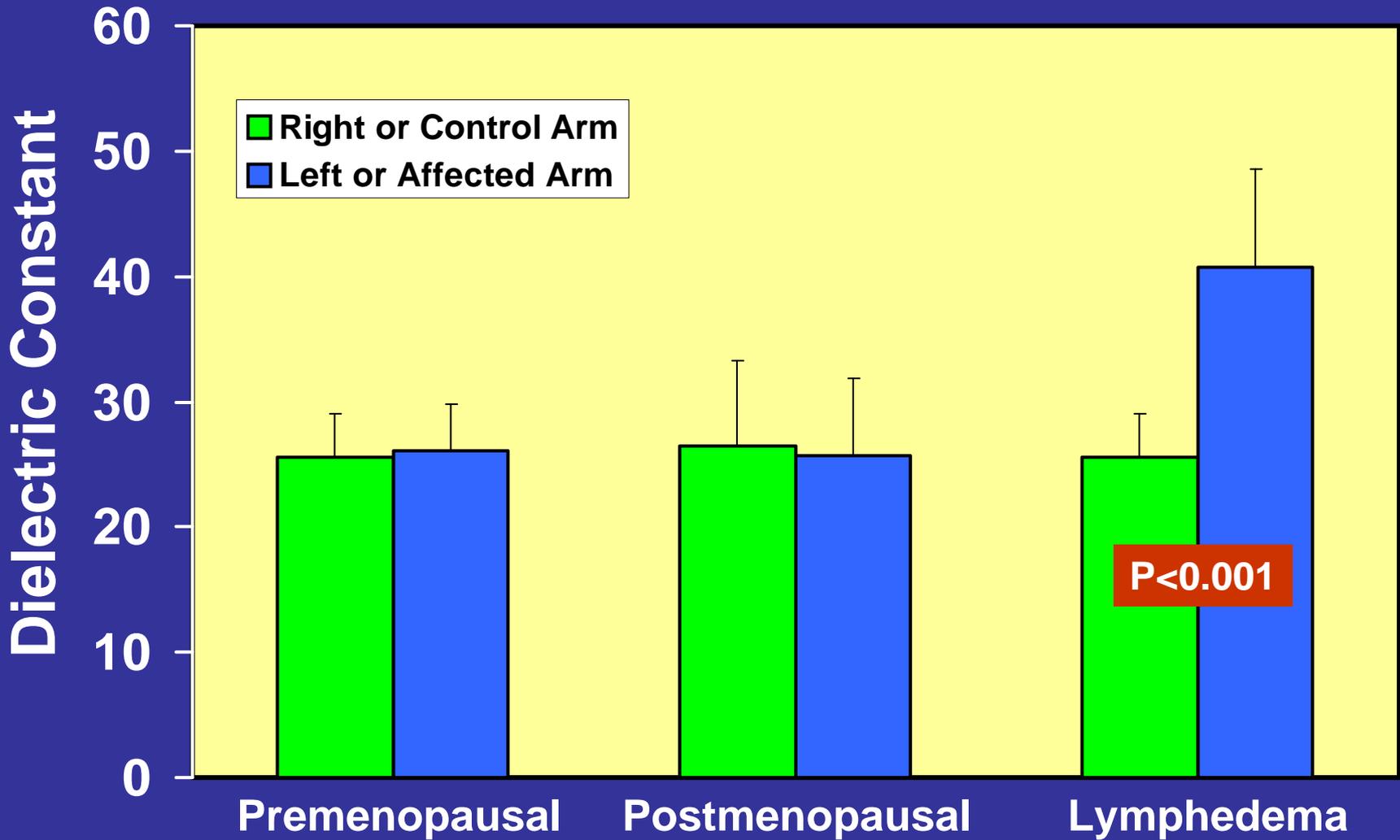
Relative Tissue Water (0.5 mm)



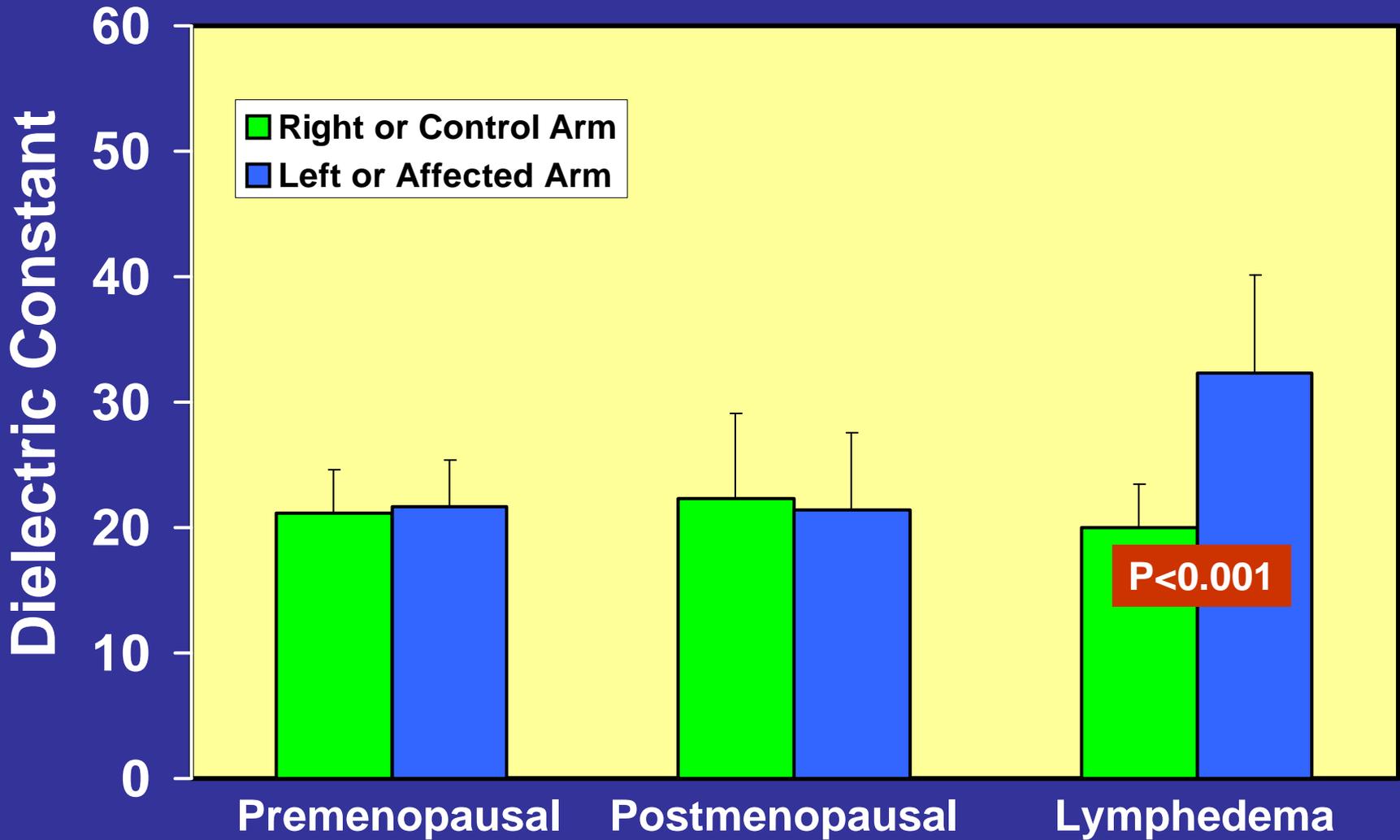
Relative Tissue Water (1.5 mm)



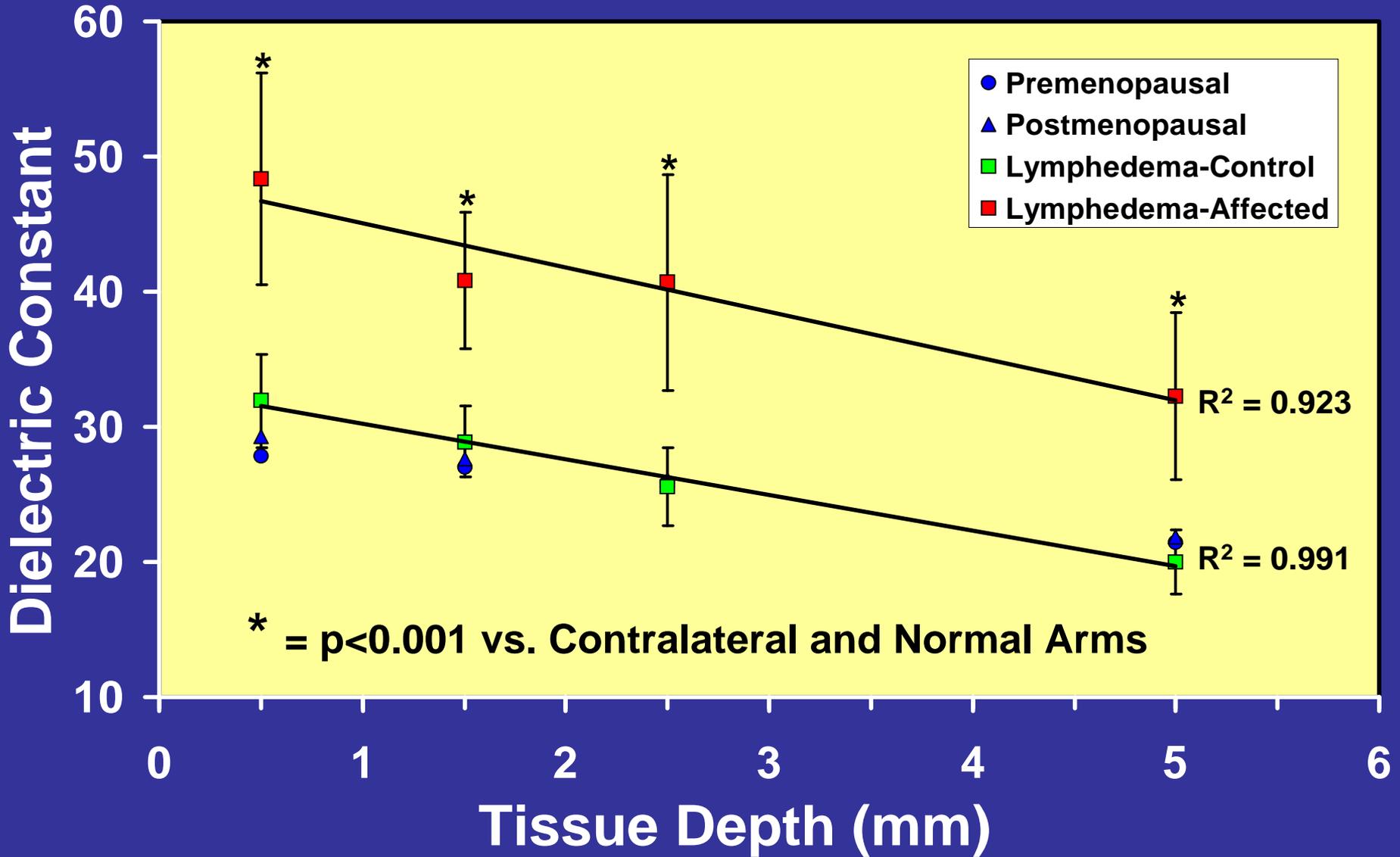
Relative Tissue Water (2.5 mm)



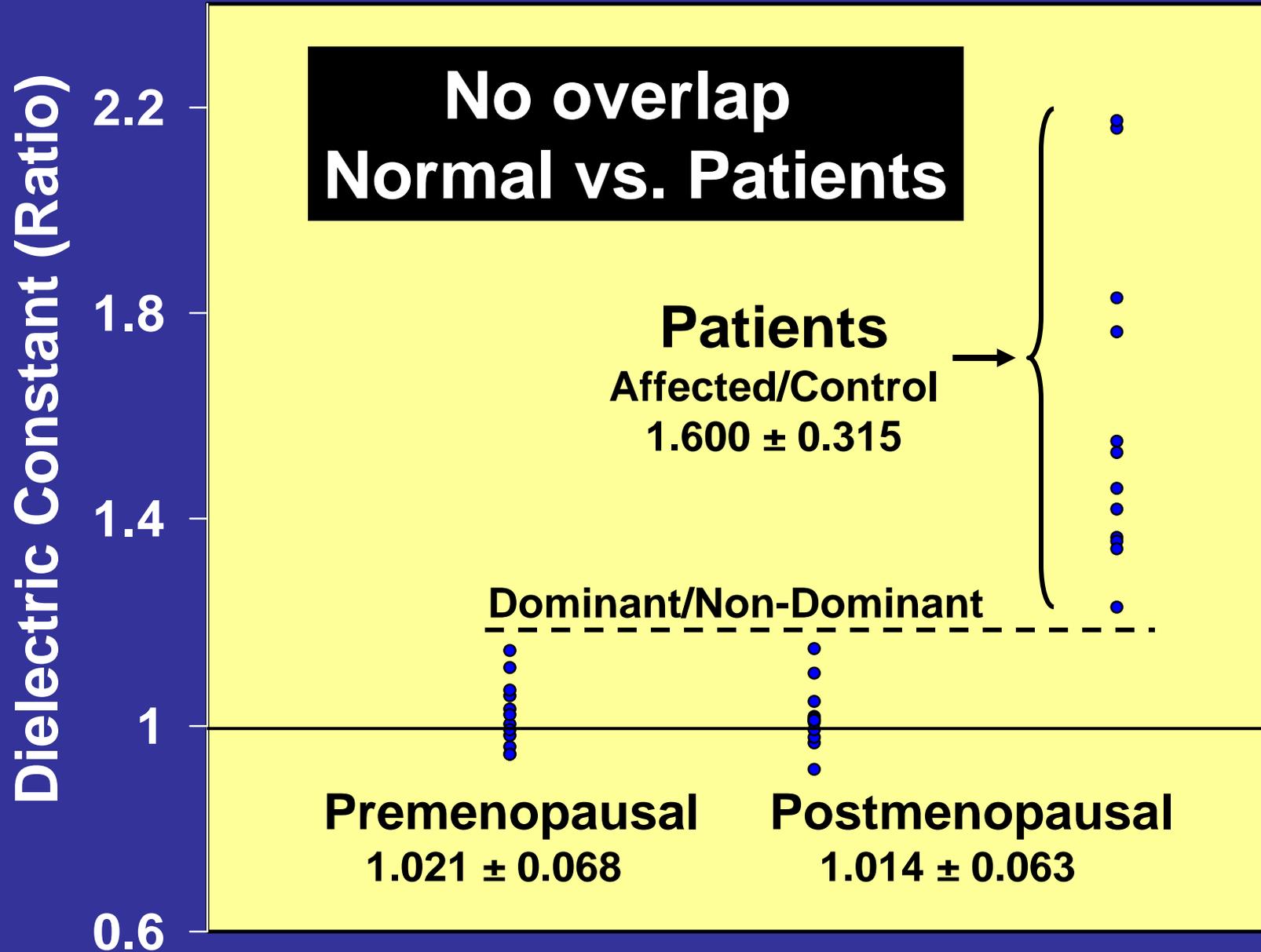
Relative Tissue Water (5.0 mm)



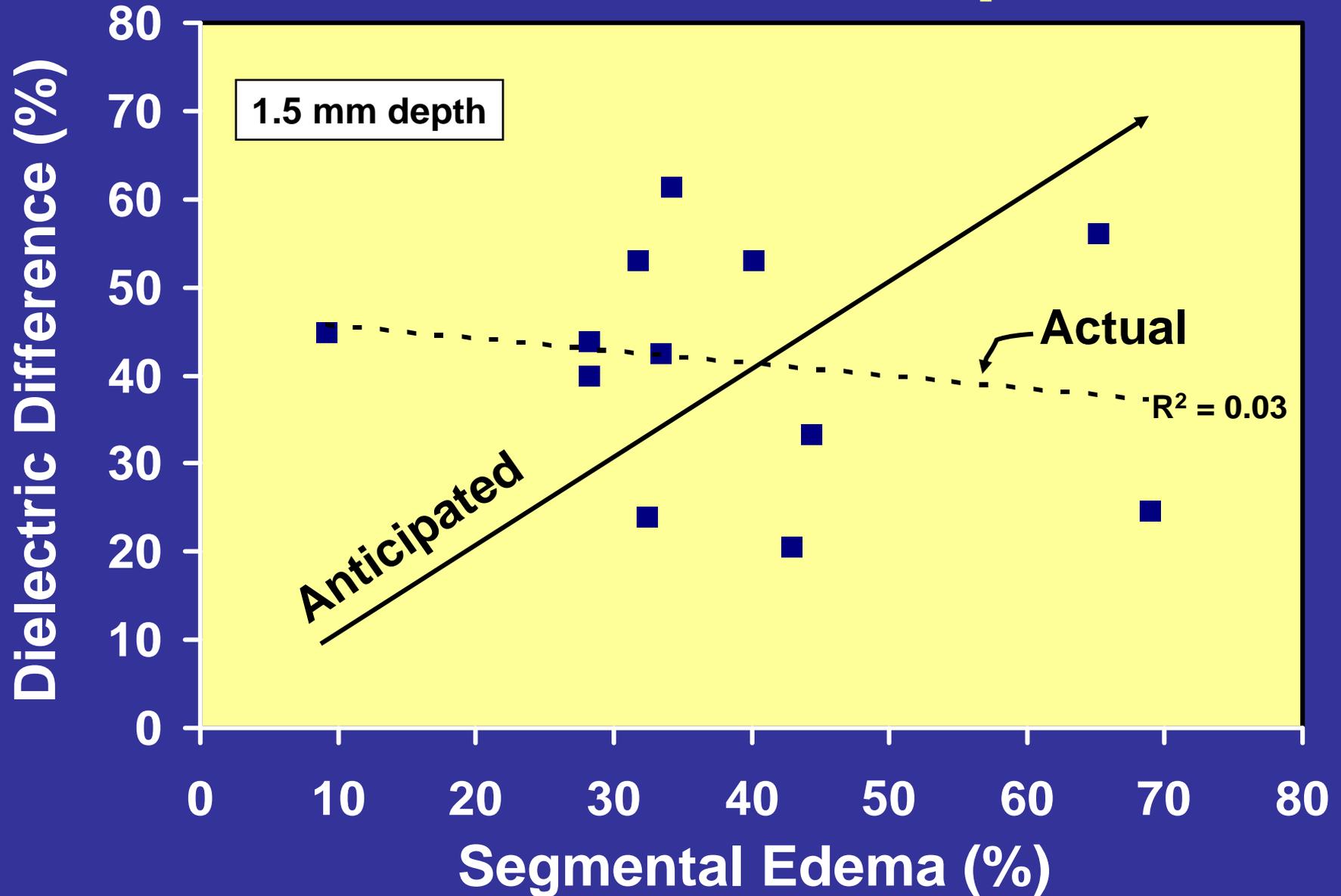
Depth Variation



Diagnostic Utility



Threshold-like Properties



Conclusions

- This local tissue water method can serve as a ***rapid quantitative assessment procedure*** to document edema and lymphedema
- May also have utility for ***early detection*** of incipient lymphedema not yet clinically seen

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- This local tissue water method can serve as a ***rapid quantitative assessment procedure*** to document edema and lymphedema
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Criteria ***as of now*** for the limited data set:

- For ***at-risk unilateral cases***: Arm TDC ratio > 1.2
- For bilateral cases or using ***absolute values***:
Threshold depends on depth (3 sd)

Depth	0.5 mm	1.5 mm	2.5 mm	5.0 mm
TDC	>42	>37	>37	>32

Thank you for your attention!



Dawn Brown-Cross



Zee Washington