Pre-Surgical Biophysical Lymphedema Assessments of Patients with Breast Cancer

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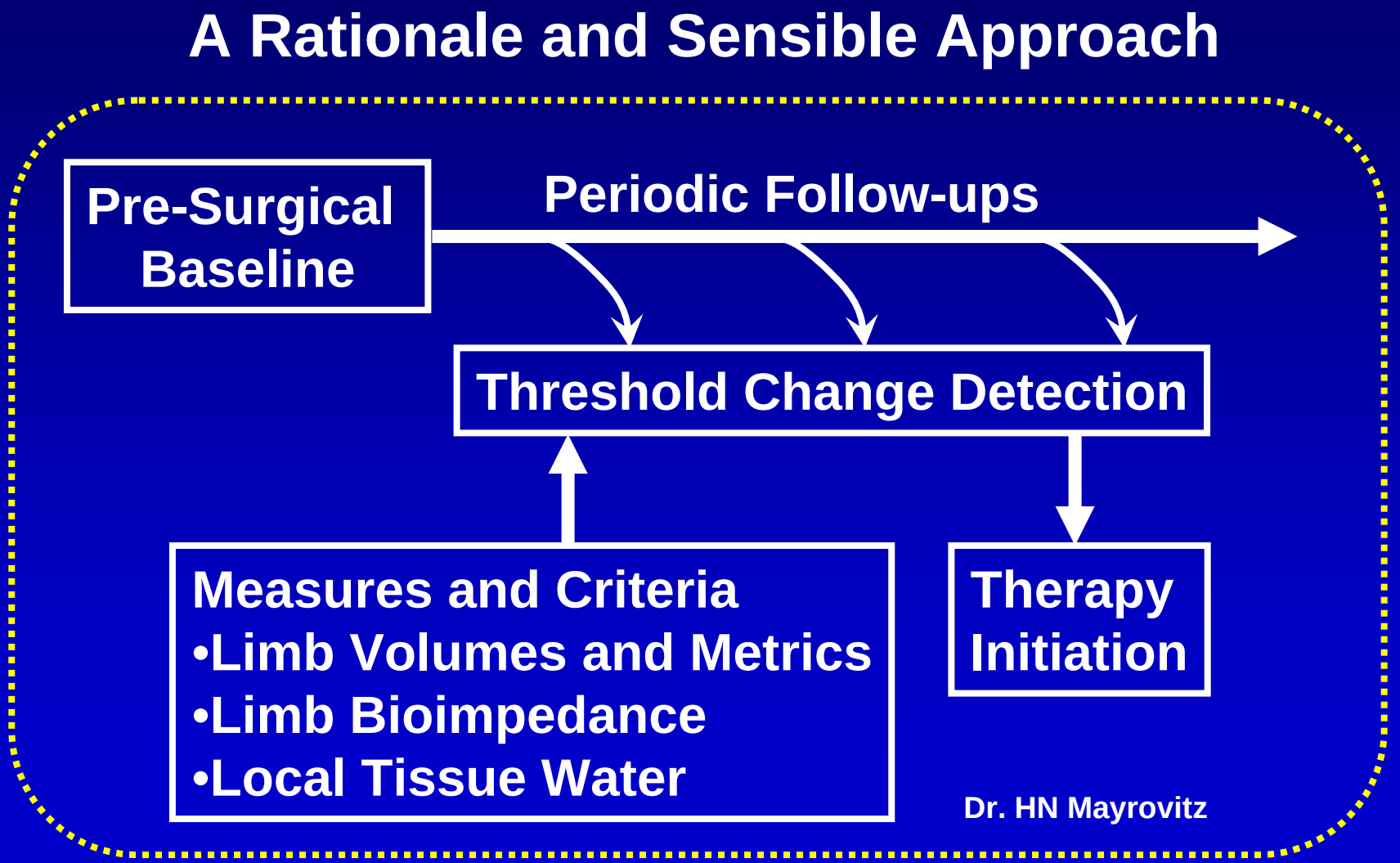
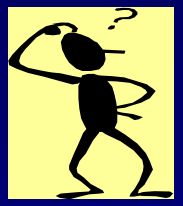
Goal: Earlier Detection and Intervention



Goal: Earlier Detection and Intervention

Not Often Done

Can We Estimate Impact?



Pre-Surgical Baseline

Periodic Follow-ups

Threshold Change Detection

Measures and Criteria
- Limb Volumes and Metrics
- Limb Bioimpedance
- Local Tissue Water

Therapy Initiation

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Subjects and Procedure Overview

40 Women Diagnosed with Unilateral Breast Cancer

- Age range: 39 – 82 (61.6 ± 13.4 years)
- BMI range: 17.8 – 45.5 (28.0 ± 6.4 Kg/m^2)
- Cancer: Dominant Arm Side 17/40 (42.5%)

Evaluated 1-2 weeks prior to surgery

- Arm Volumes – Circumferences - Frustum model
- Arm Bioimpedance – ImpediMed XCA – 50 KHz
- Local Tissue Water – (Tissue Dielectric Constant)
  Delfin MoistureMeter-D – 300 MHz
  - Forearms
  - Biceps
  - Axilla
  - Thorax

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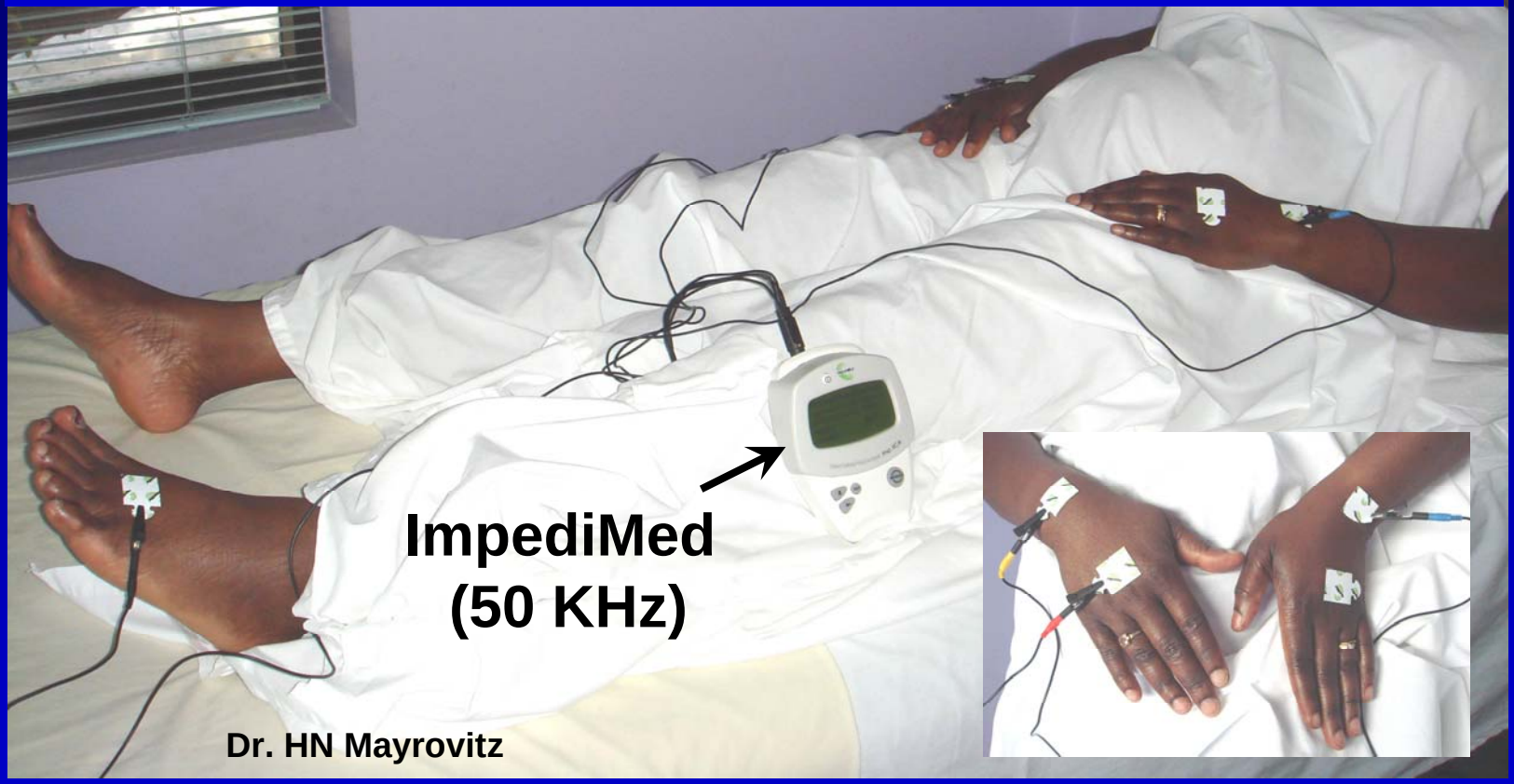
Bioimpedance Measurements

Arm Electrical Impedance ~ Total Arm Tissue Water



Tissue Water via Dielectric Constant

- 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 78
- Calibrated for each probe from 1 - 80

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TDC Measurement Sites

Forearm

Biceps

Lateral Thorax

Axilla

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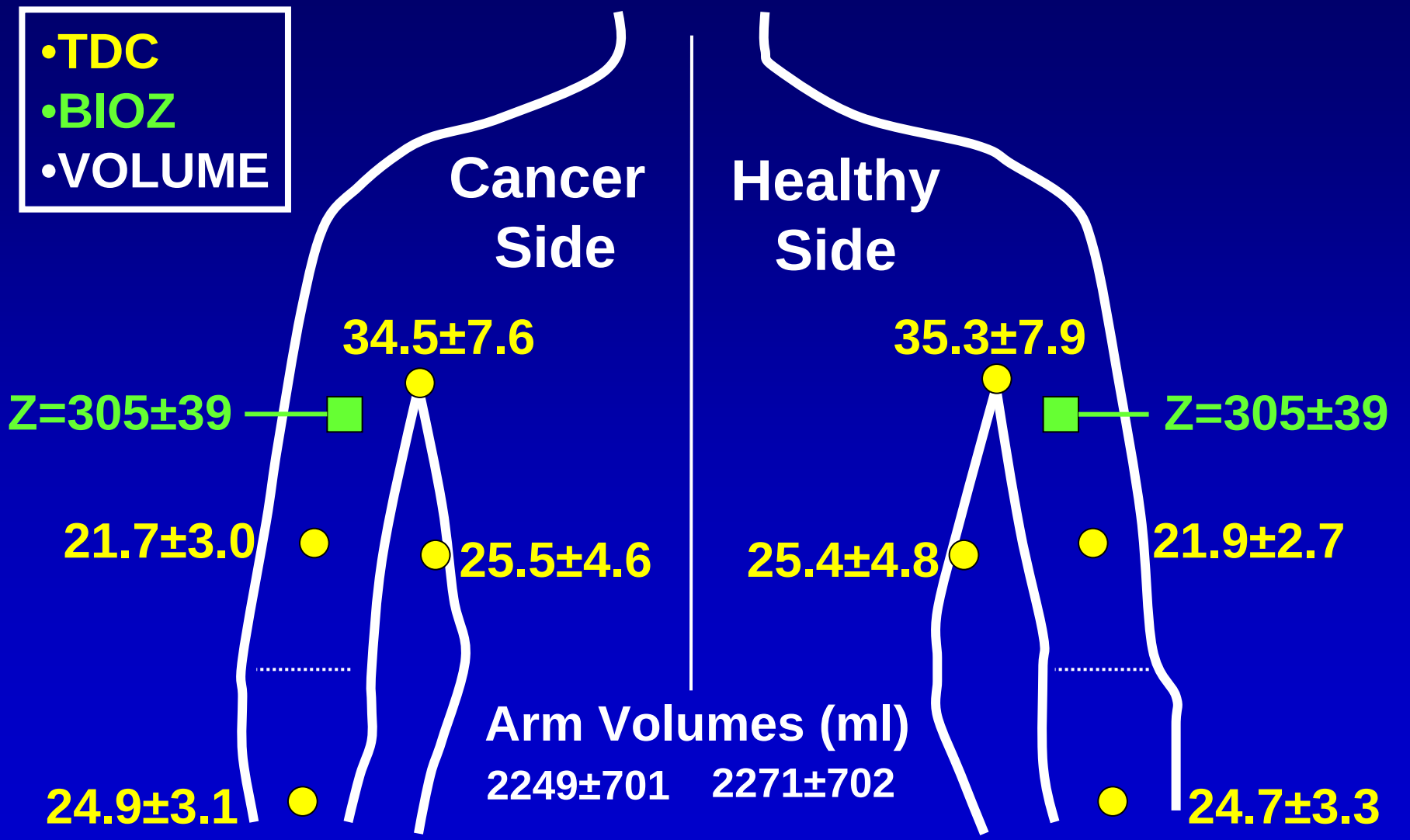
Cancer vs. Healthy Sides

No difference between sides



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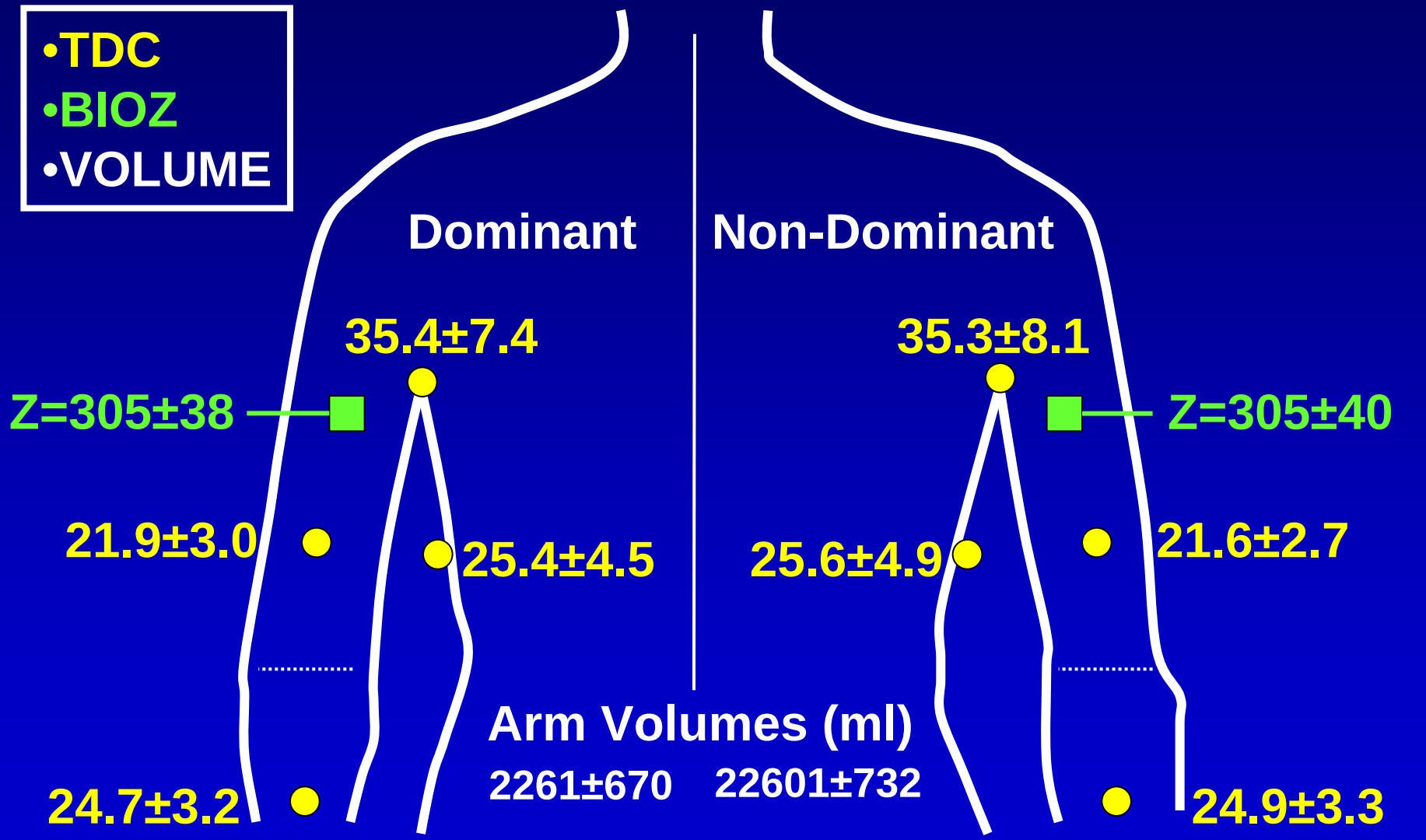
Dominant vs. Non-Dominant Sides

No difference between sides

- TDC
- BIOZ
- VOLUME



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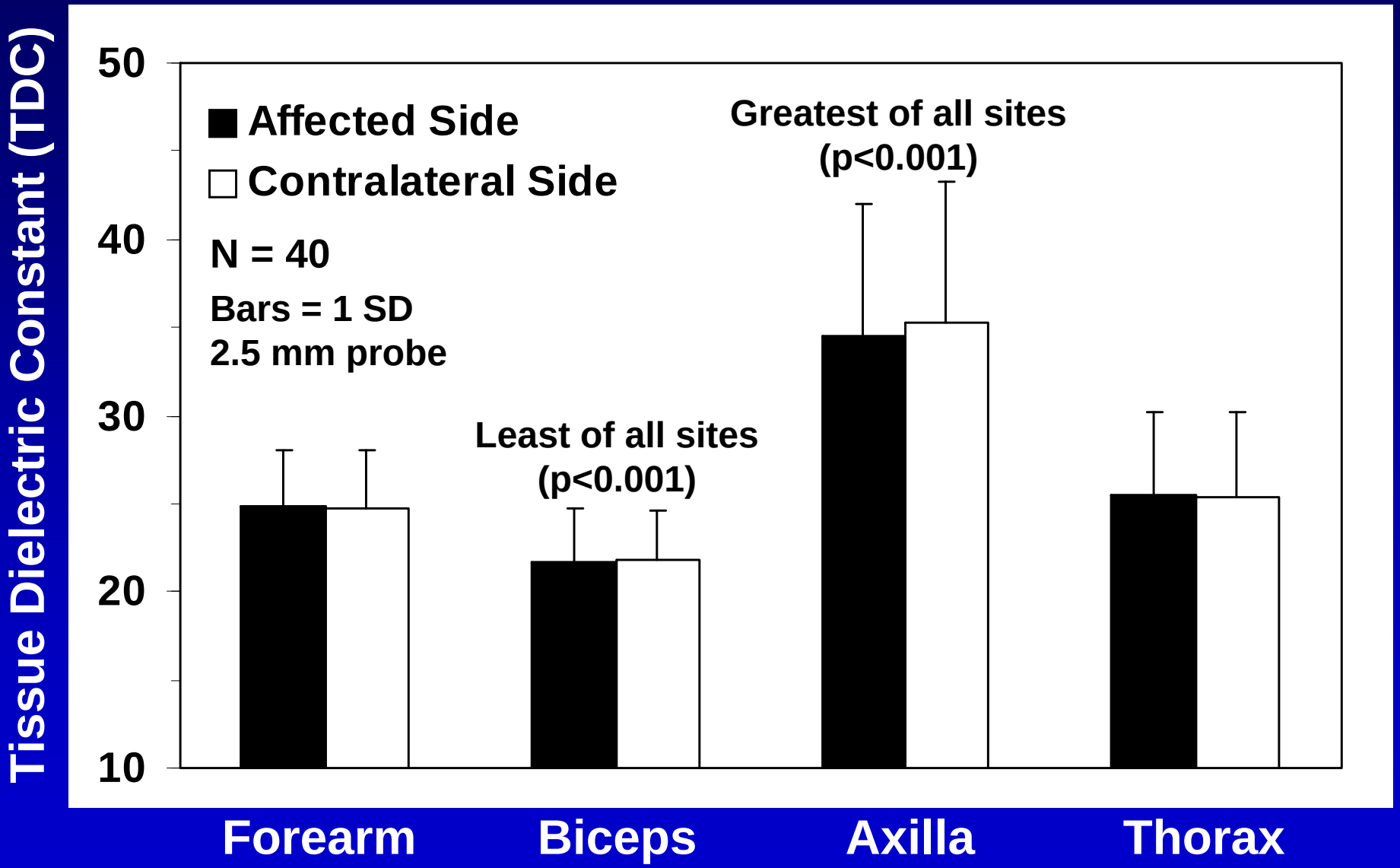
Local Tissue Water by Anatomical Site



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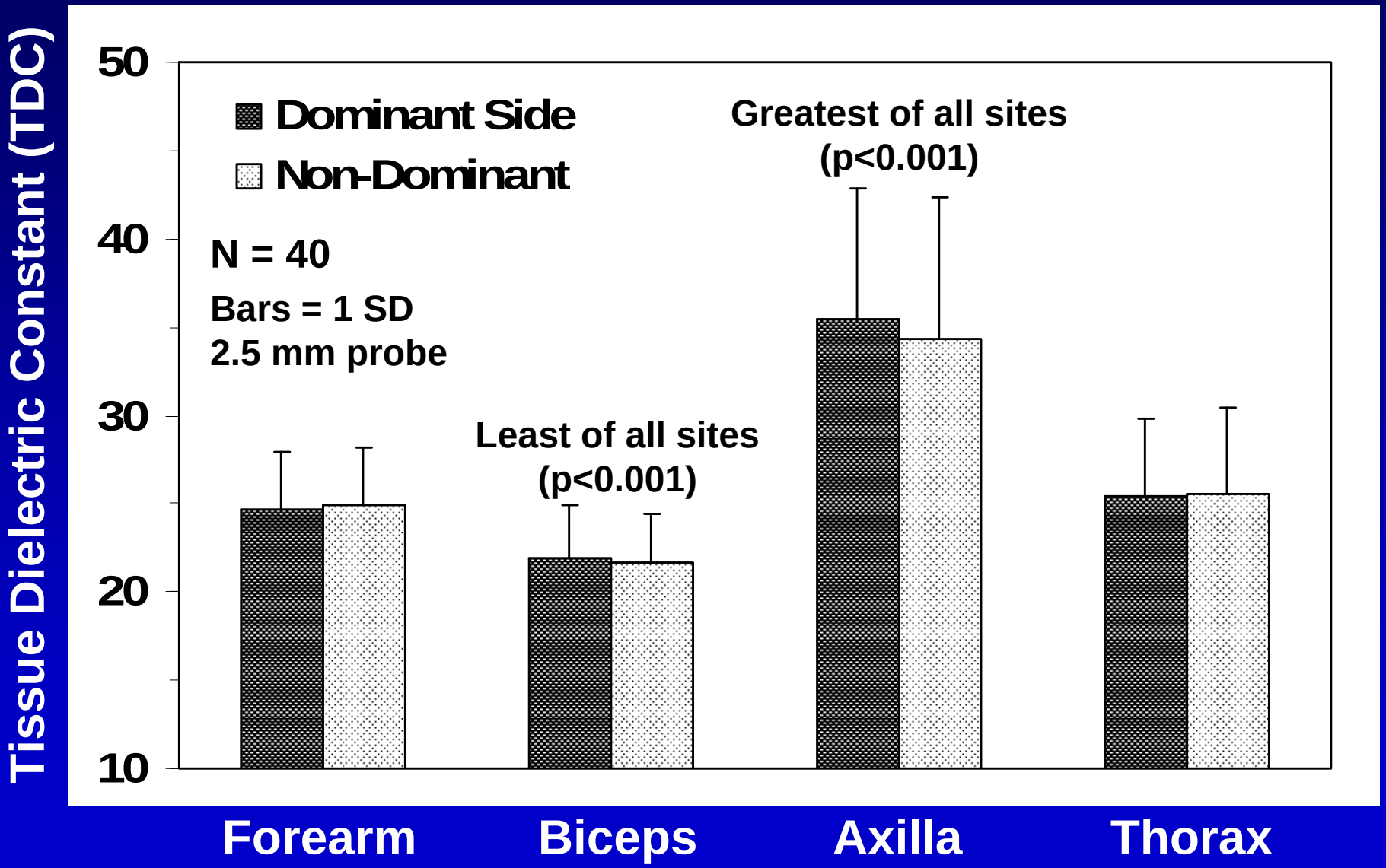
Local Tissue Water by Anatomical Site



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Conclusion

Similarity of side-to-side values in

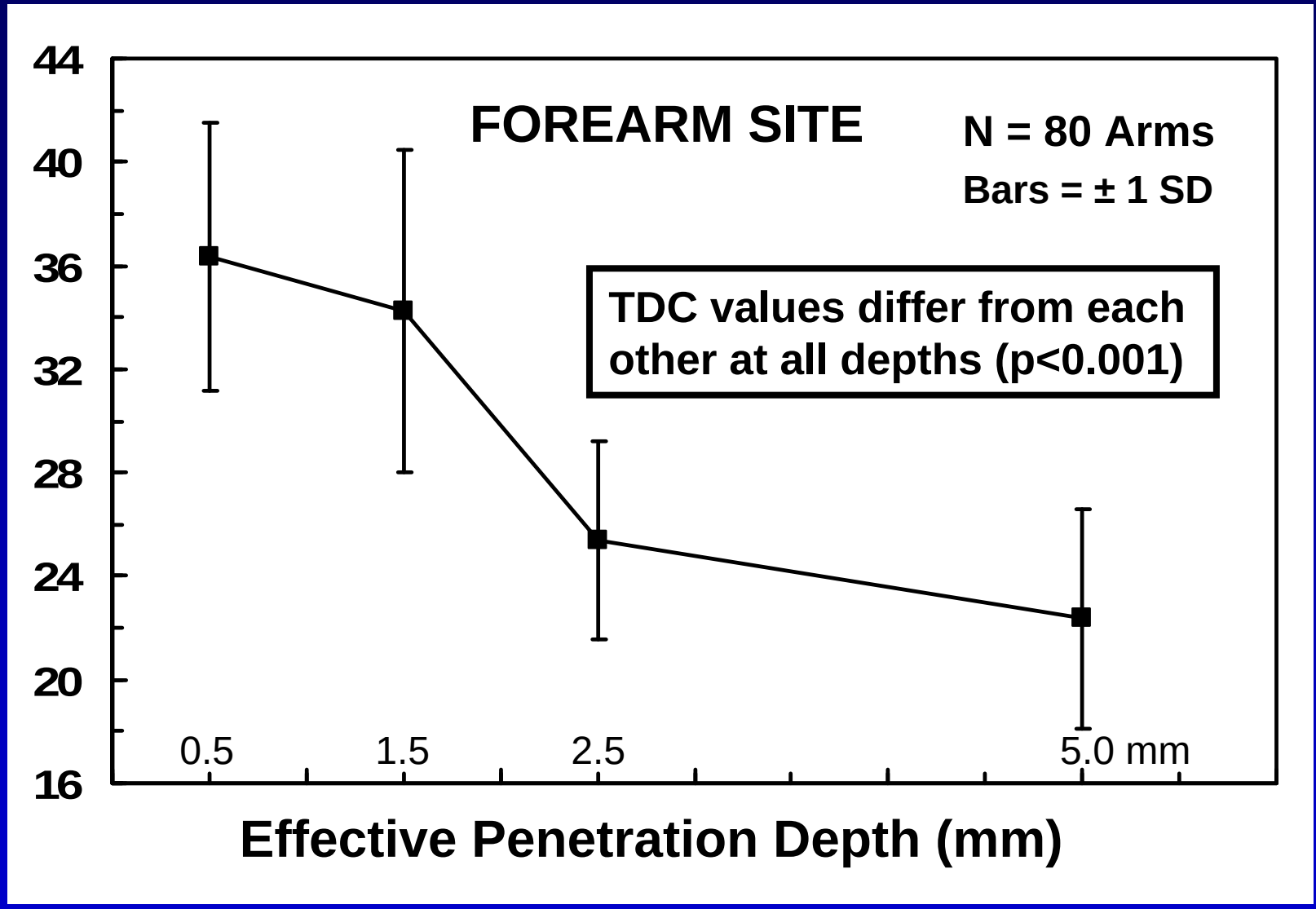
- **Arm Volumes**
- **Arm Impedances**
- **TDC values at all sites**

suggest that if pre-surgery measurements are not obtained, subsequent differentials between sides that exceed established thresholds may still be useful for early detection purposes.

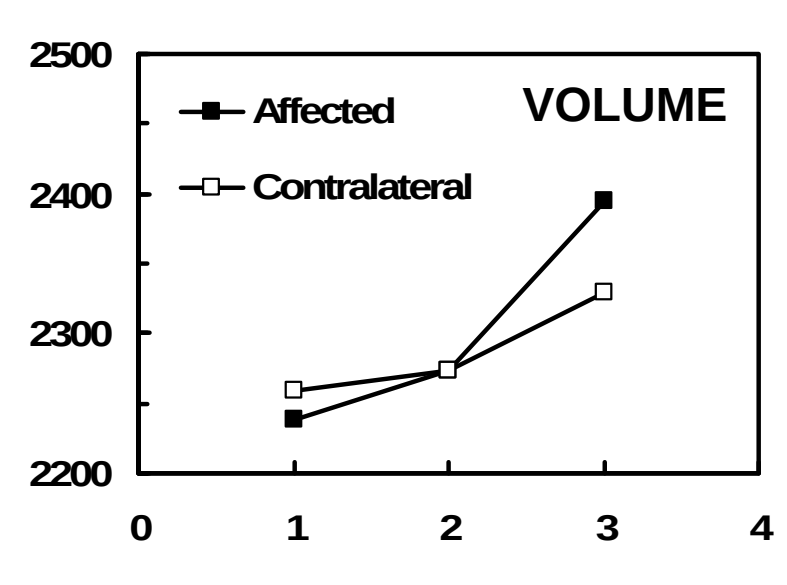

Thanks for your Attention

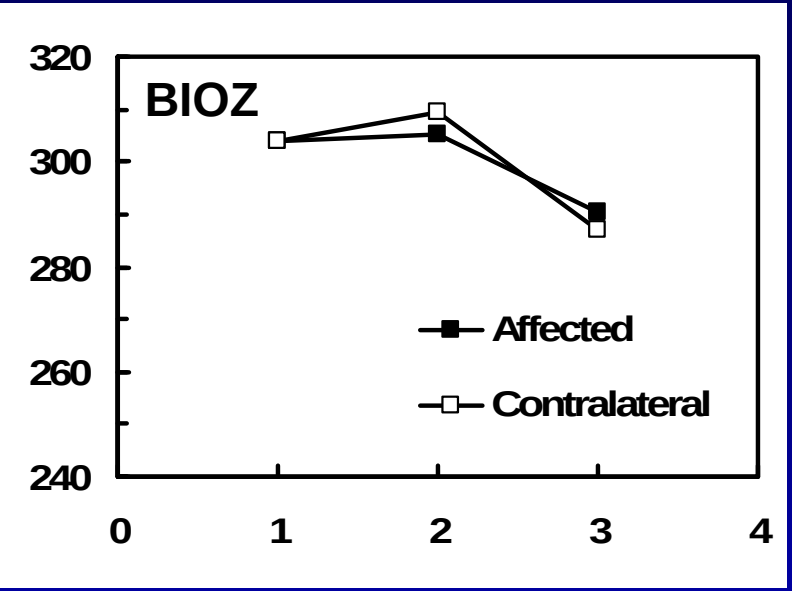
Supplementary Slides

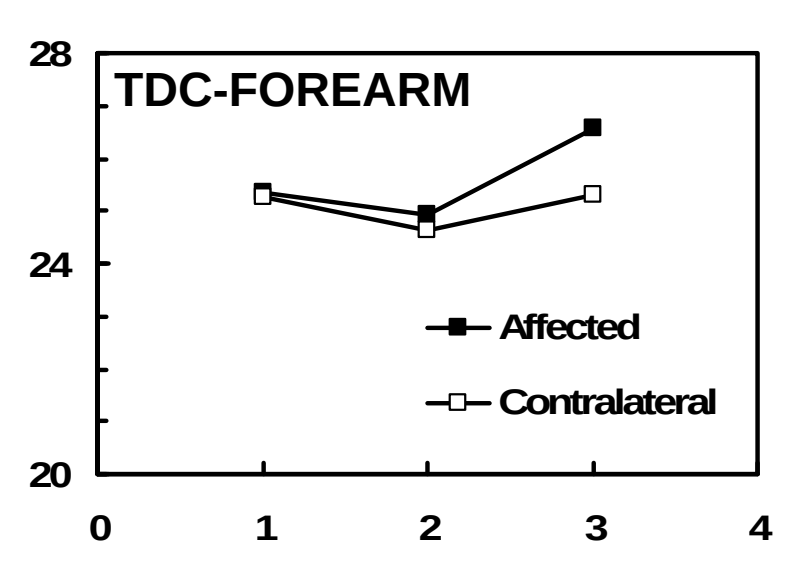
TDC Depth Dependence

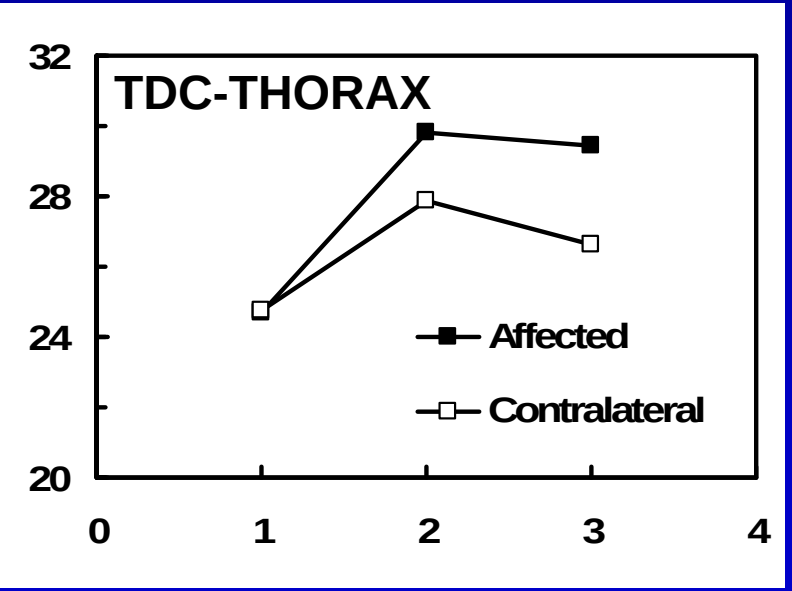


Parameter Trends (n=20)









Visit # (1=baseline, 2=3 mo, 3=6 mo)

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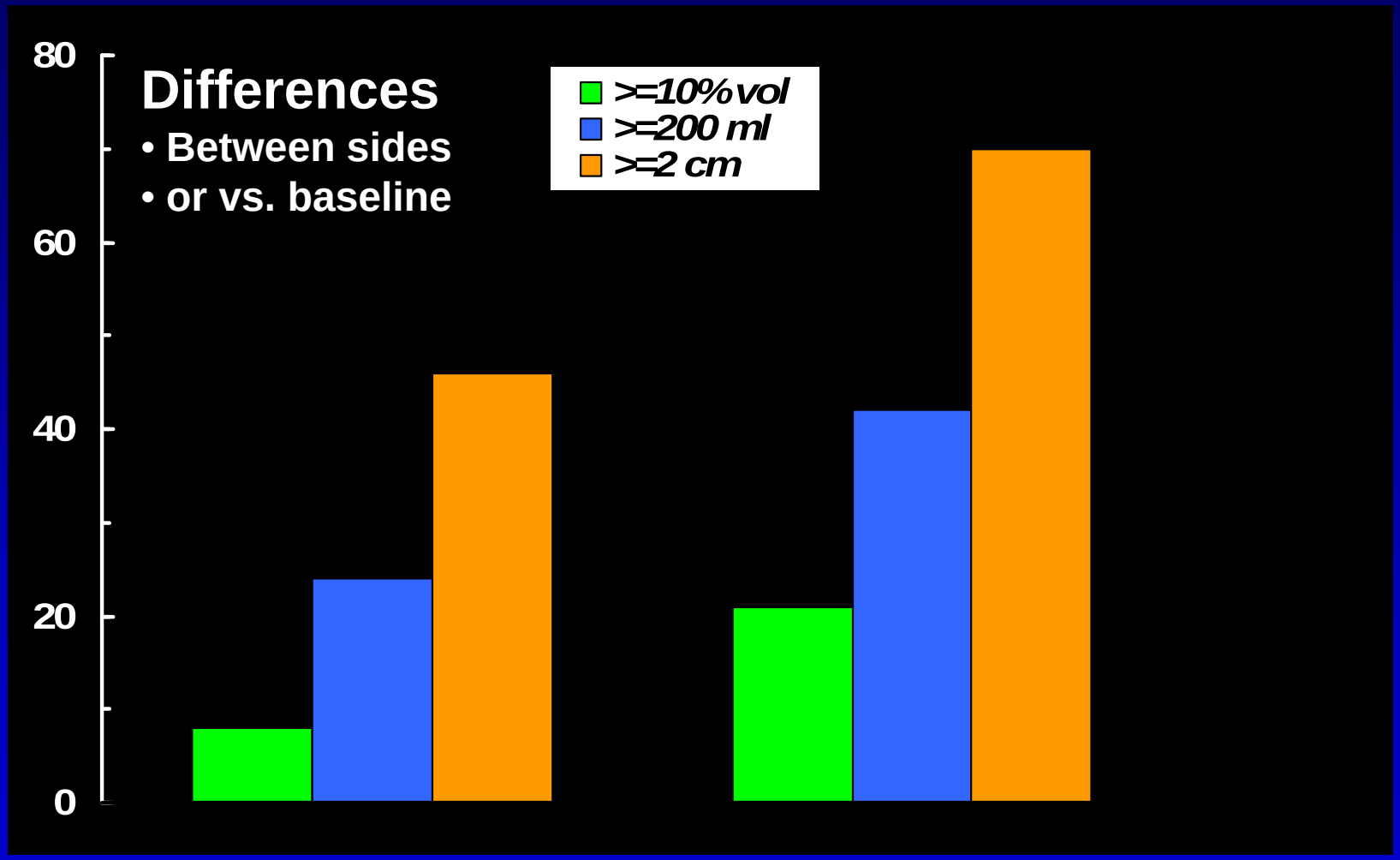
Arm Lymphedema Metric Criteria

LE rate dependent on criteria used



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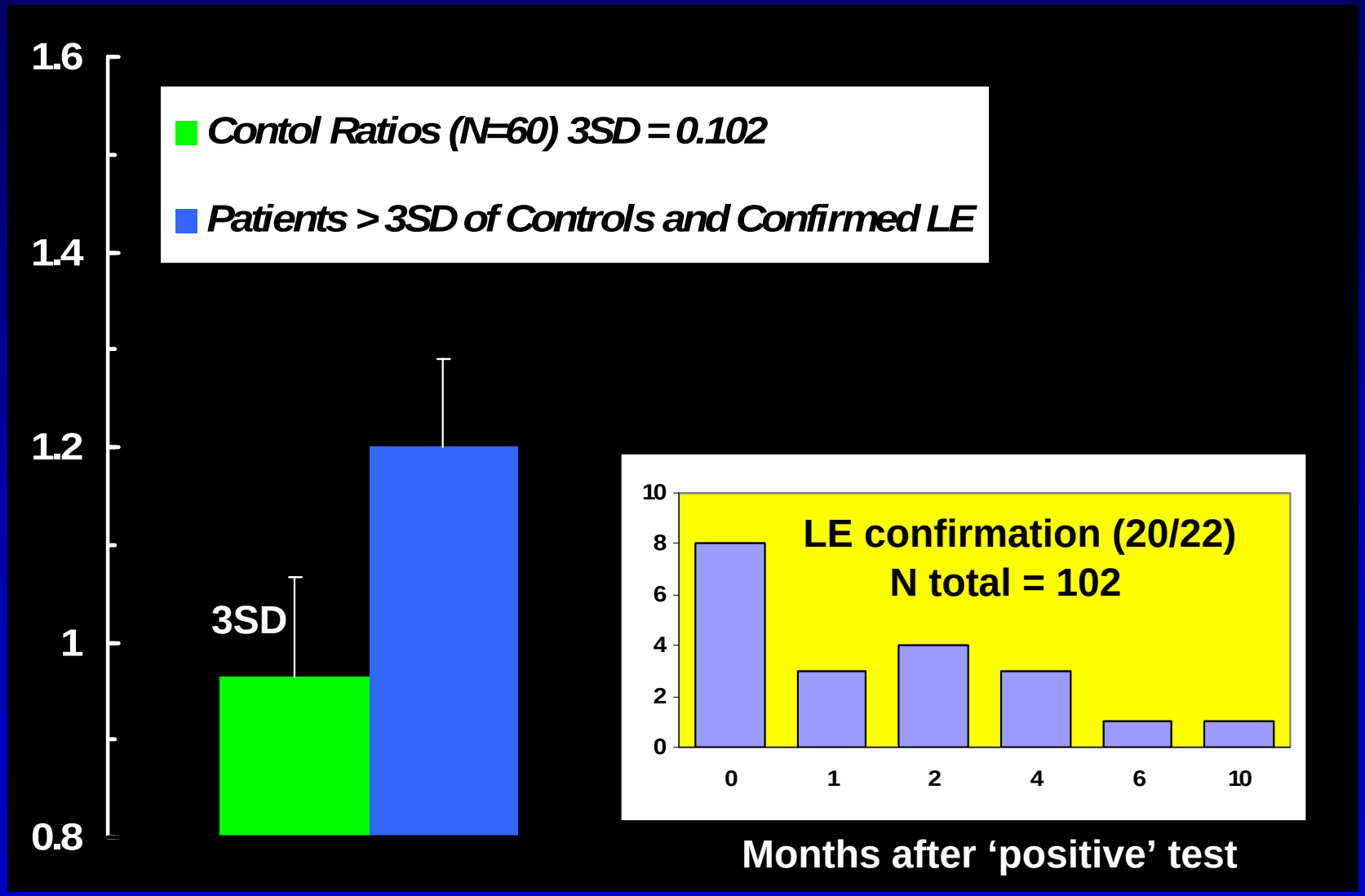
Data from: Armer and Stewart Lymphat Res Biol. 2005;3(4):208-217.

Arm Lymphedema



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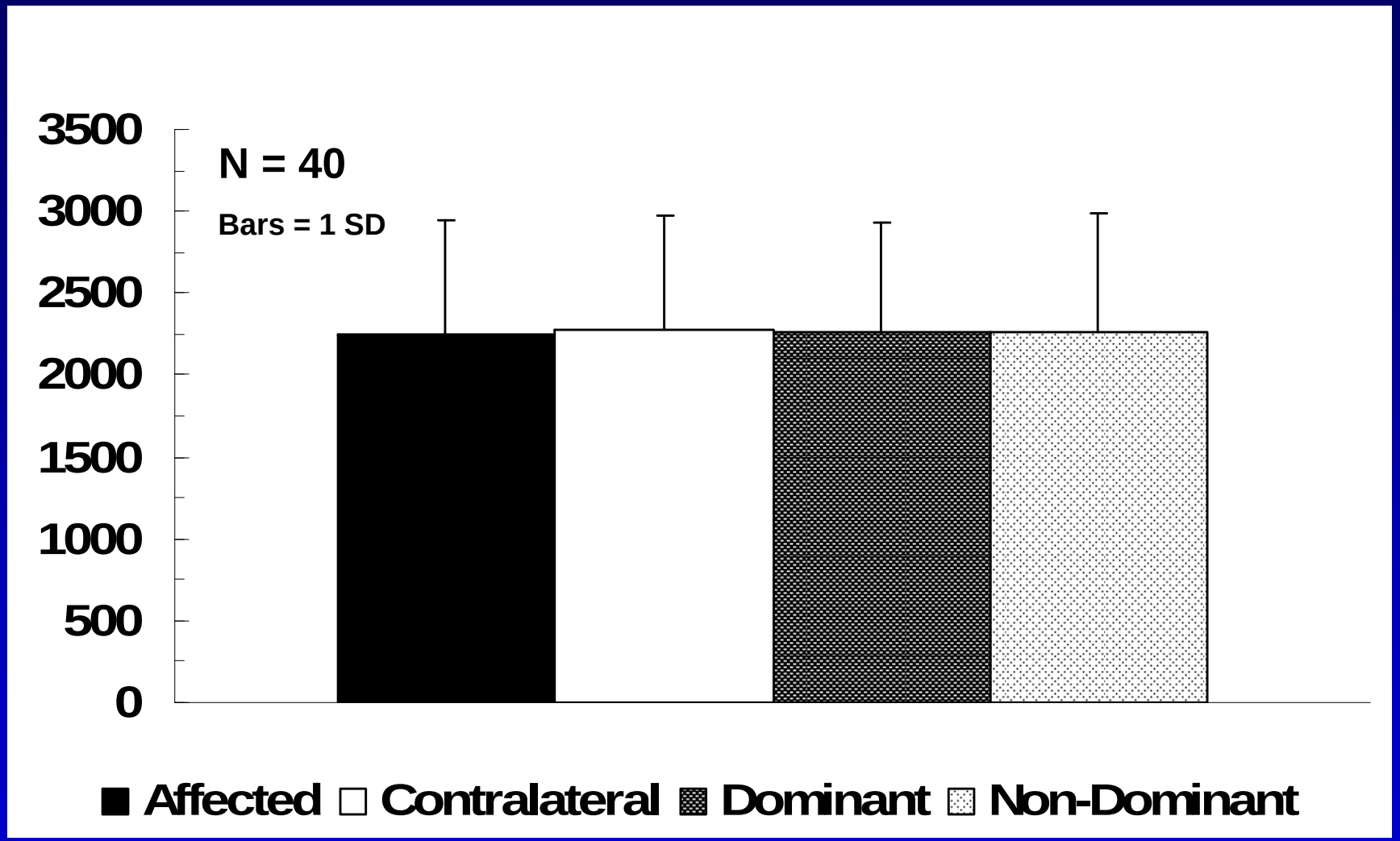
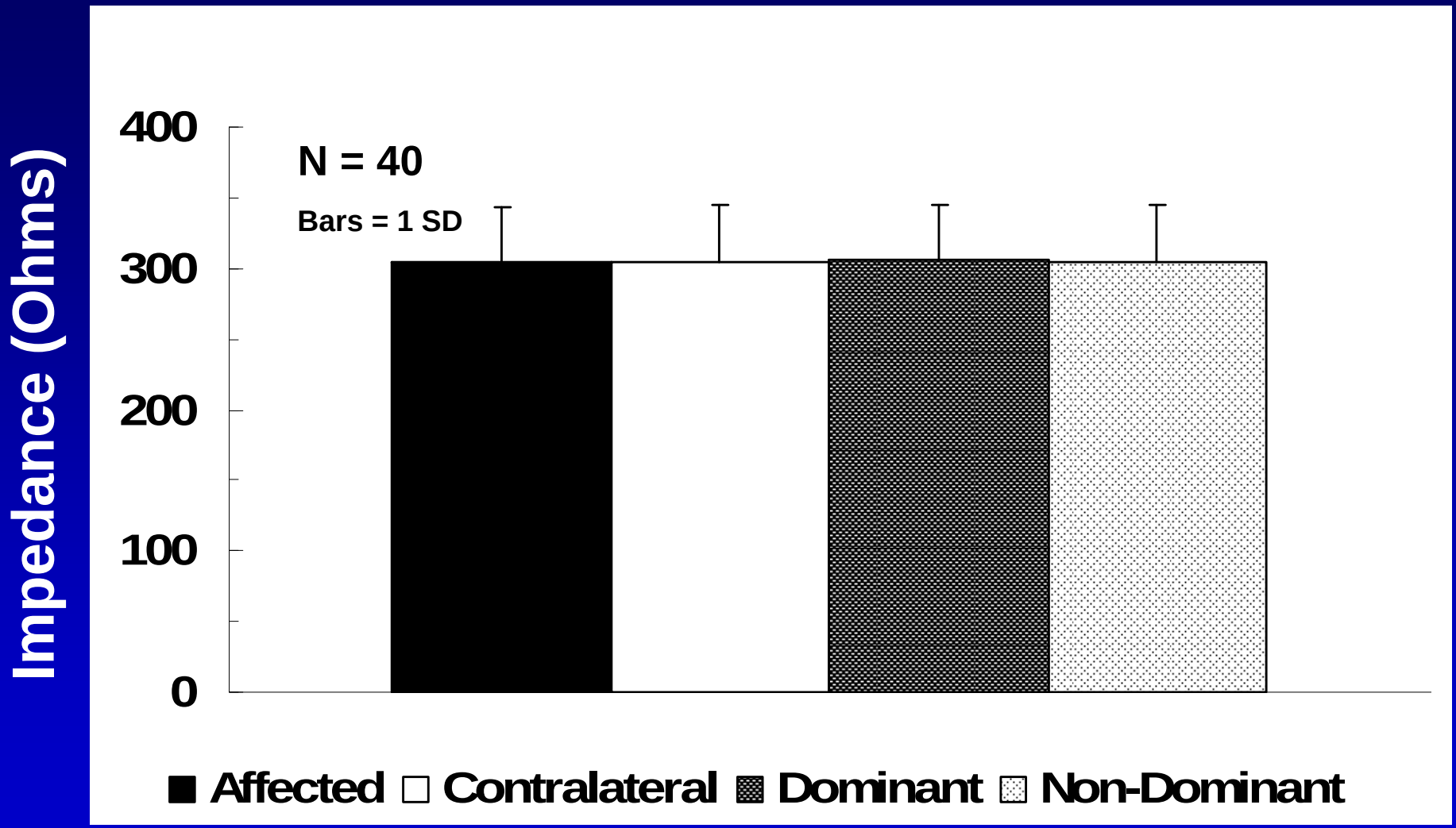
Data from: Cornish BH et al. Lymphology. 2001;34(1):2-11.

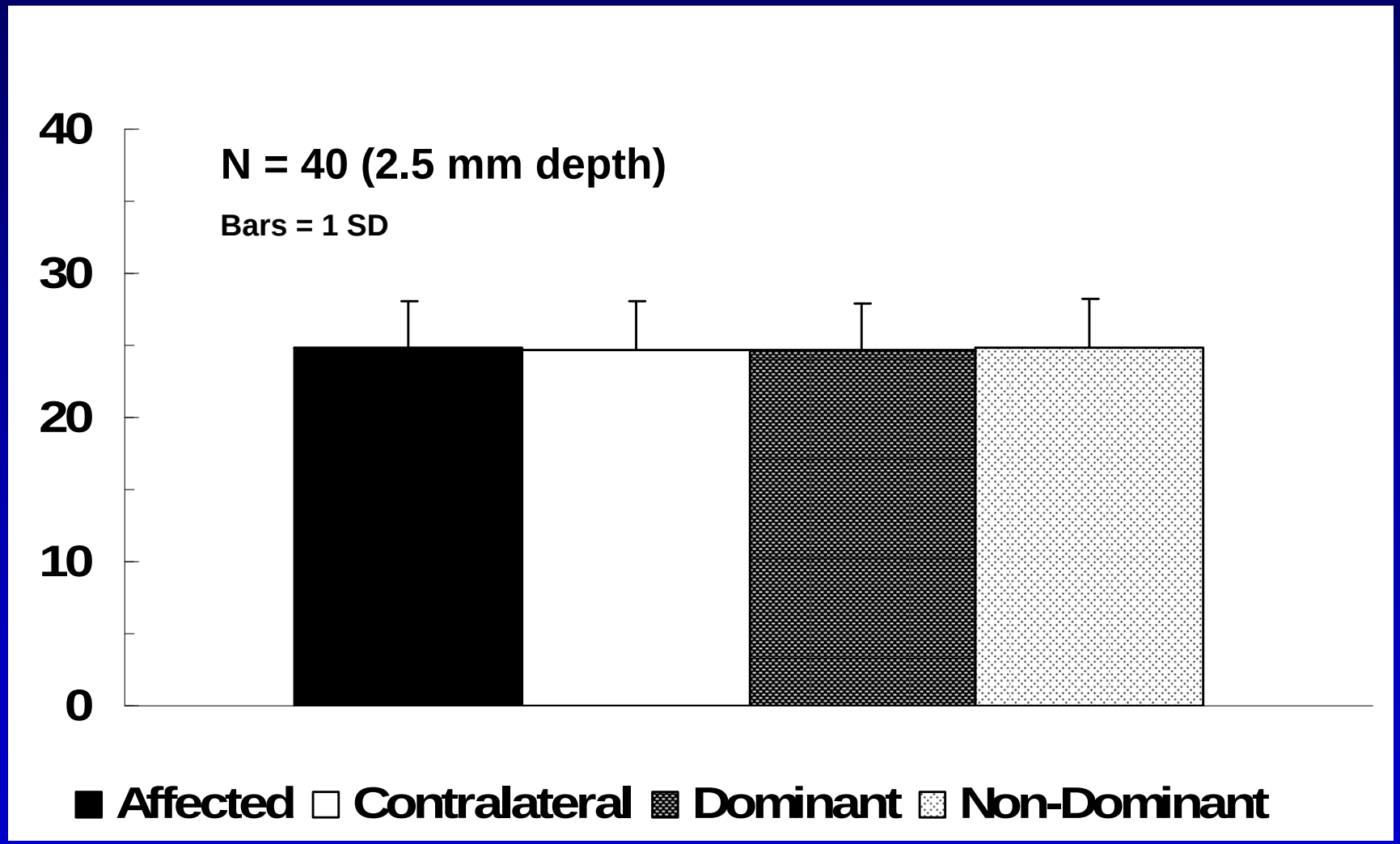
Arm Volumes


Volume (ml)
3500
3000
2500
2000
1500
1000
500
0
N = 40
Bars = 1 SD
Affected
Contralateral
Dominant
Non-Dominant

Arm Impedance



Forearm TDC


Tissue Dielectric Constant
40
30
20
10
0
N = 40 (2.5 mm depth)
Bars = 1 SD
Affected
Contralateral
Dominant
Non-Dominant

Dr. HN Mayrovitz, Principal Investigator