

# Biceps Area Ratio (BAR) Can Predict The Need for Surgery in Brachial Plexus Birth Palsy: A Pilot Study

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## The Problem

It can be difficult to decide who should get nerve reconstruction surgery

Decision algorithms based on physical exam

Physical examination of an infant is:

- Difficult
- Time Consuming
- Subjective
- Requires a lot of experience

Unhelpful Solutions:

- MRI/CT
- NCS/EMG



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## What would a solution look like?

Objective

Repeatable

Fast

Cheap

Easy to learn

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## Assumptions

Denervated muscle is smaller than innervated muscle

Muscle atrophy can be seen in neurologic conditions (e.g. thenar wasting in carpal tunnel syndrome)

As muscle gets stronger, it gets larger

Therefore, if we can measure that the biceps is smaller than usual, we have objectively shown it is denervated

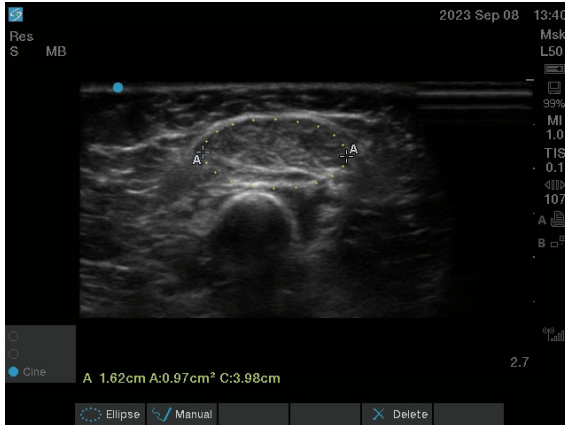
If we can measure improvements in biceps size, we can objectively show increase in muscle strength



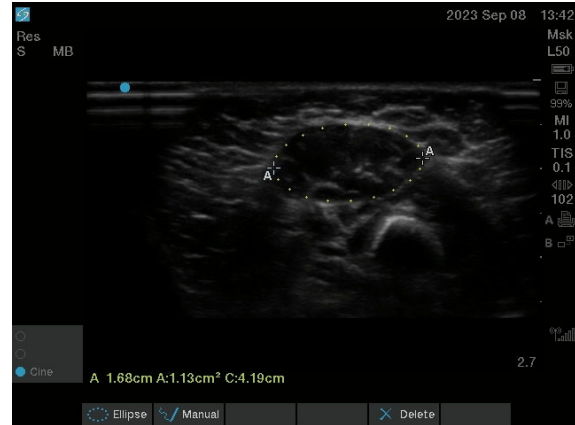
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## Biceps Area Ratio



BP Side



Non-BP Side

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## Technique

Using in-office ultrasound machine, the cross-sectional area of the biceps is measured at the midpoint between the acromion and the elbow flexion crease

Both the affected and unaffected arms are measured

The unaffected arm serves as a control, so that the measurement is:

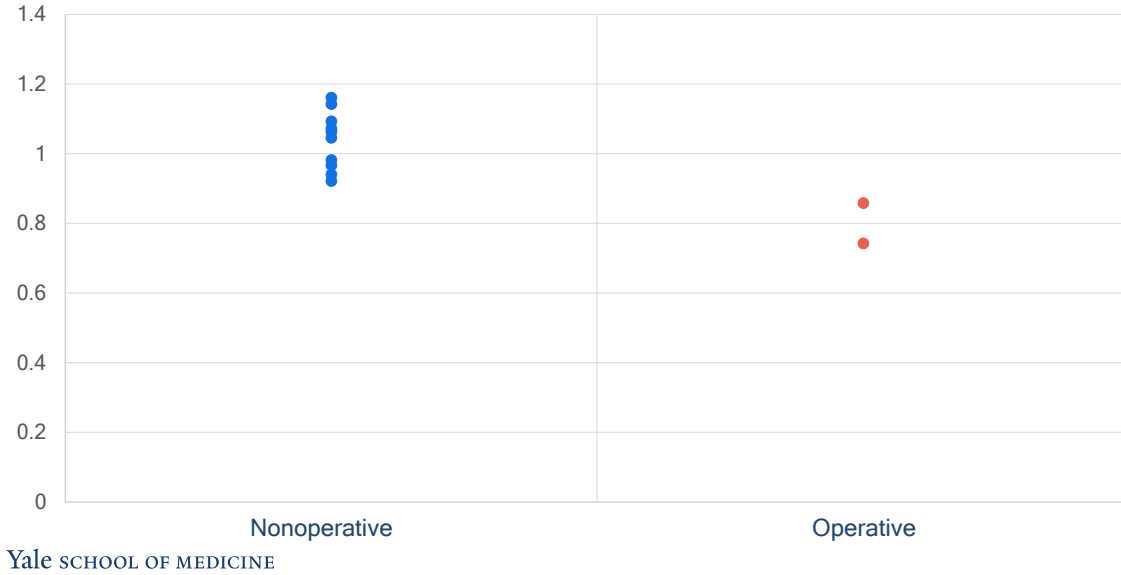
$$\text{Biceps Area Ratio} = \frac{\text{Area of Biceps on Side with BPBP}}{\text{Area of Biceps on Side withOUT BPBP}}$$

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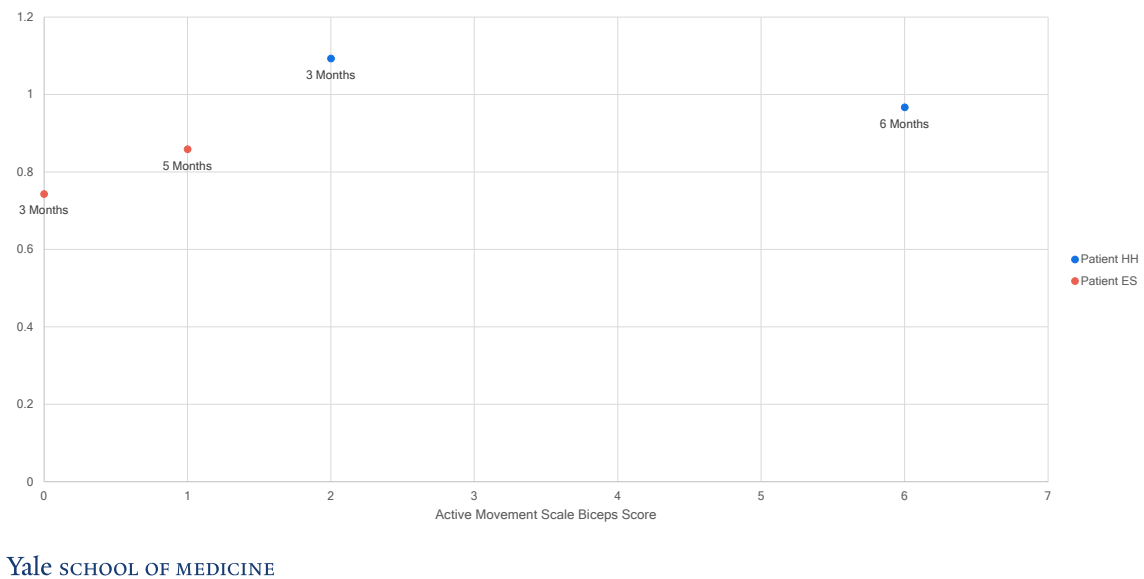
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## BAR Differences Can Be Predictive of Surgery



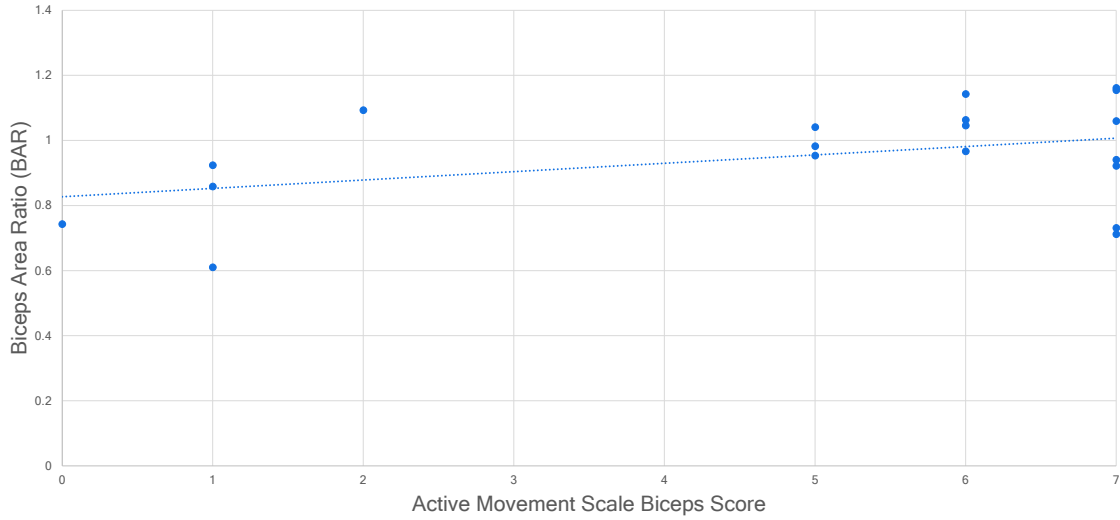
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## BAR Differences Can Offer Reassurance



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## BAR Correlation with Active Movement Scale

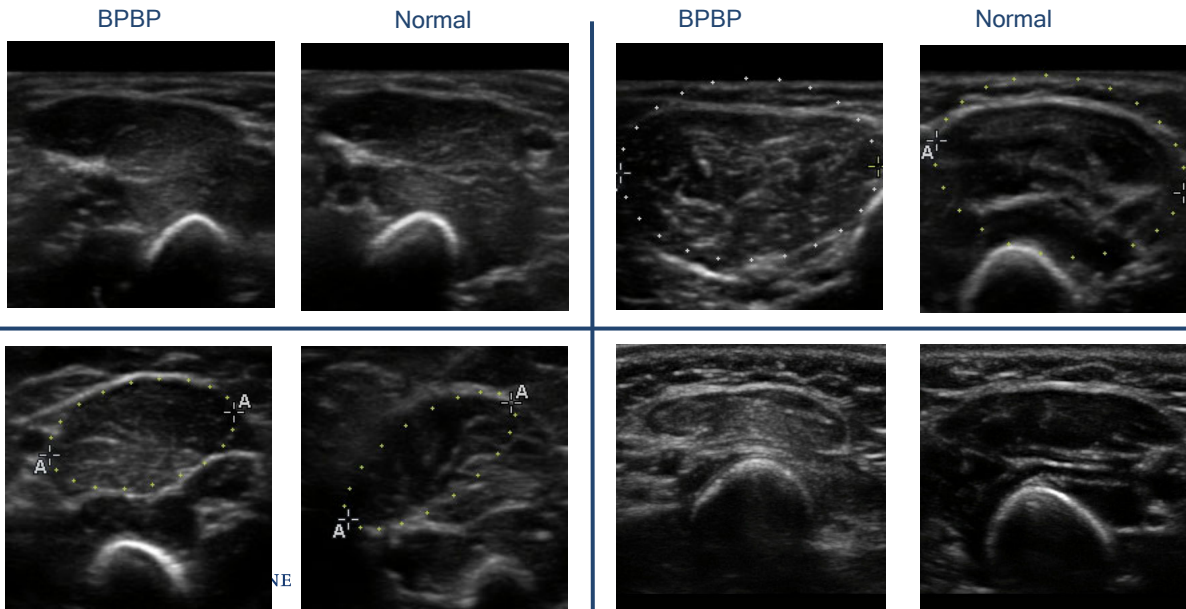


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## Biceps Echogenicity



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## Future Directions

### Refine technique

- Where on the arm to place probe
- Elbow flexed or extended
- How much pressure to apply with probe to the biceps?

### Consider other types of measurements

- Different muscles? Have tried SS
- Echogenicity

### More patients

### End goal

- Define criteria based on ultrasound examination to:
  - Indicate patients for surgery
  - Guide surgical decision making. Can we tell the difference between good partial recovery and those that should be excised and grafted?

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## Thank you!

If anyone wants to make this a multicenter, please talk to me

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