

# Chronic Shoulder Tendon Adaptations Across a Paralympic Cycle in Elite Wheelchair Rugby Athletes

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## Summary

This study examined chronic adaptations in the biceps and supraspinatus tendons of elite wheelchair rugby players over a four-year period prior to the Paralympics. Ultrasound imaging demonstrated increased biceps tendon thickness and decreased supraspinatus echogenicity in the non-dominant shoulder, suggesting tendinopathy. However, individual changes varied widely, with notable asymmetry developing over time. These findings emphasize the complexity of chronic tendon adaptations in this population and highlight the need for personalized assessments and targeted interventions.

## Introduction

Wheelchair rugby, a high-intensity sport requiring propulsion, ball handling, and overhead movements, places significant demands on the shoulder's stabilizing muscles and tendons. These repetitive forces, combined with scapular movements that reduce subacromial space, may contribute to tendon degeneration, particularly in the biceps and supraspinatus tendons which are common sites of injury in manual wheelchair users. However, it remains unclear how these tendons change over time in elite wheelchair athletes. This study examines tendon changes in wheelchair rugby players over four years leading to the Paris 2025 Paralympics, hypothesizing there will be signs of degeneration.

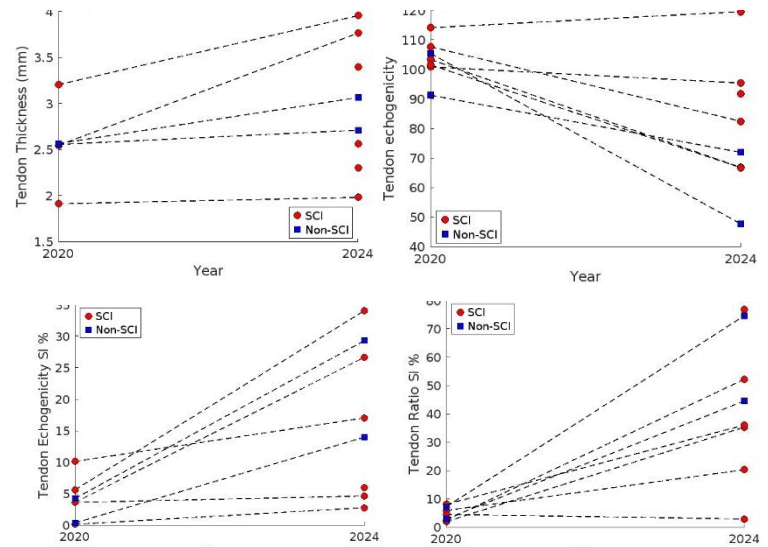
## Methods

Quantitative Ultrasound Protocols (QUS) [1] were taken from 7 male elite wheelchair rugby players (Spinal cord injury SCI: n=5, NSCI: n=2) in January 2020 and January 2024. QUS assesses supraspinatus and biceps tendon thickness, echogenicity, and echogenicity ratio for the dominant (D) and non-dominant (ND) shoulders [2]. Symmetry indices were calculated between D and ND sides. Paired sample t-tests were used to compare data between time points ( $\alpha=0.05$ ).

## Results and Discussion

Between 2020 and 2024, the ND shoulder presented a significant increase in Biceps tendon thickness ( $2.6 \pm 0.5$  mm vs.  $3.1 \pm 0.8$  mm,  $p=0.031$ ) and a significant decrease in Supraspinatus tendon echogenicity ( $103.5 \pm 7.0$  vs.  $78.6 \pm 23.3$ ,  $p=0.010$ ) (Fig. 1). No other measures showed significant changes over time, but individual changes varied widely. For example, biceps tendon thickness changes ranged from -9.8% to 28.7%, and supraspinatus tendon thickness changes ranged from -62.8% to 30.7%. Echogenicity and echogenicity ratio changes in the supraspinatus tendon also varied (SCI: -74.4%

to 5.5% and -14.4% to 33.3%; NSCI: -121.4% to 1.4% and -45.5% to 74.5%). Greater asymmetry, reflected by increased changes in the symmetry index of supraspinatus tendon echogenicity and echogenicity ratio, was observed progressively from 2020 to 2024.



**Figure 1:** Biceps and Supraspinatus tendon changes for the ND shoulder between 2020 and 2024. SI represents the symmetry index.

## Conclusions

This study demonstrates significant variability in chronic tendon adaptations among elite wheelchair rugby players. The ND shoulder exhibited increased biceps tendon thickness, decreased supraspinatus echogenicity (both indicating more fluid and tendinopathy), and considerable individual variation in tendon dimensions, echogenicity, and symmetry. The lack of changes in the D shoulder suggests that despite increased strain from ball handling, this shoulder may be more resistant to degenerative changes. These findings highlight the value of tailored assessments and interventions to address unique adaptations, enhance performance, and prevent injuries.

## Acknowledgments

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## References

- [1] Collinger et al. (2010). *AJPMR*, **89**:390-400.
- [2] Bossuyt et al. (2022) *Front Rehab Sc*, **2**:755466.