



# Using a Novel Exercise Protocol with Dynamic MRI for Diagnosis of Recurrent Chronic Exertional Compartment Syndrome of the Forearm in a Rock Climber: A Case Report



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## Background

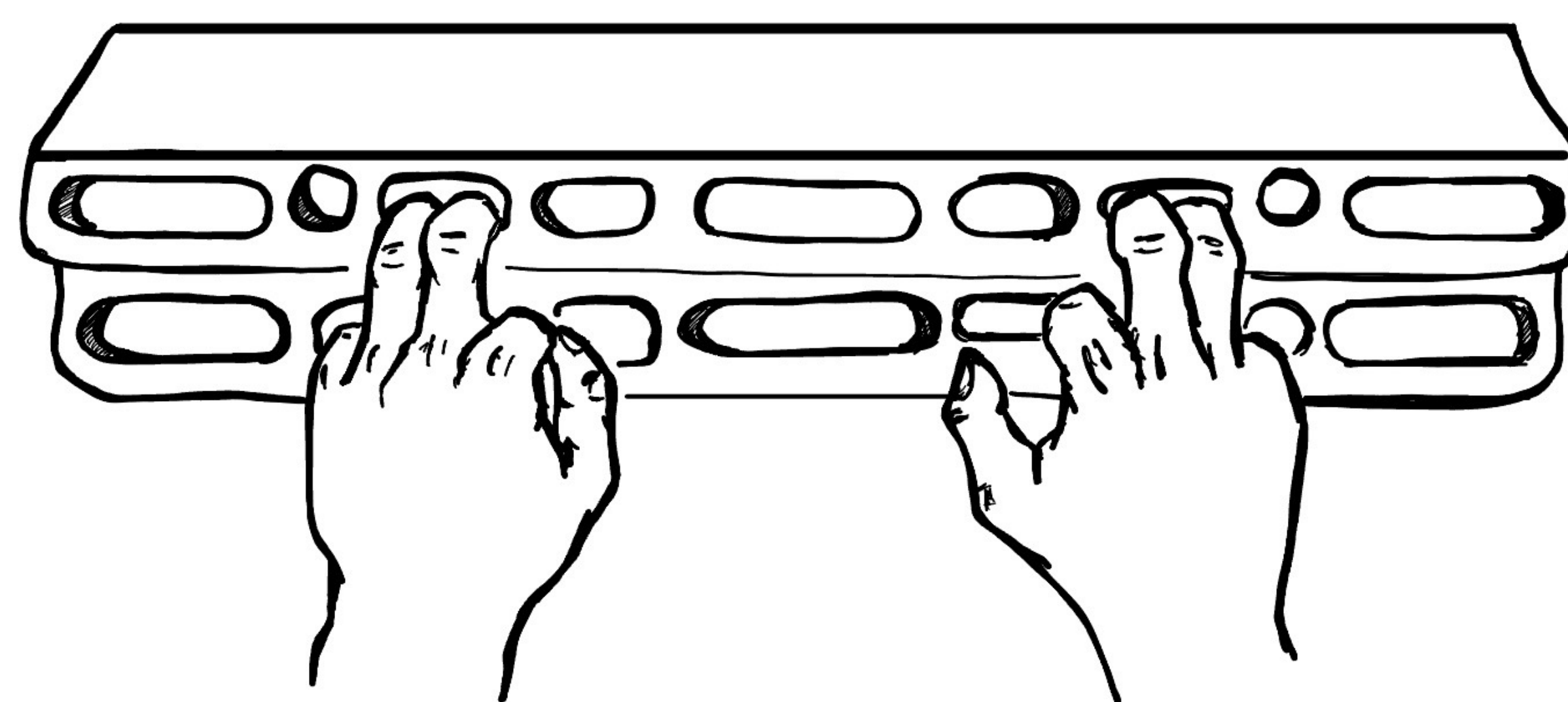
- Chronic exertional compartment syndrome (CECS) is characterized by increased intramuscular pressure during exercise leading to pain, weakness, and paresthesia that resolves with rest
- 95% of CECS cases occur in the lower extremity; upper extremity cases are more rare
- Intracompartmental measurements are the gold standard but are invasive and time consuming
- Non-invasive diagnostics such as dynamic contrast-enhanced MRI are gaining favor

## Case Presentation

- Pt:** 41-year-old male rock climber with bilateral forearm pain, weakness, and paresthesia exacerbated by rock climbing
- Hx:** Underwent bilateral endoscopic volar compartment release 10 years ago
- Physical exam:** volar forearm swelling and tenderness to palpation, positive elbow flexion test
- Plan:** Bilateral upper extremity EMG/NCS, dynamic MRI, over the counter NSAIDs for pain, bilateral compressive elbow splints

## Diagnostic Assessment

- EMG and NCS consistent with bilateral carpal tunnel syndrome**
  - Motor:** Increased take-off latency for APB, bilaterally, peak amplitude decreased for left APB
  - Sensory:** increased peak latency in bilateral median, and left ulnar nerves; reduced peak amplitude in bilateral median nerves
- MRI consistent with bilateral CECS**
  - T2 MRI of bilateral forearms obtained before and after patient performed hangings grips on self-made climbing apparatus (figure 1)
  - Showed diffuse muscular enhancement and edema in bilateral volar forearm musculature (figure 2)
  - Primarily FDP, FDS, PT but also EDC, ECRL, ECRB, and APL



**Figure 1.** Schematic of patient-made climbing apparatus that was used to perform the simulated climbing exercise protocol in between pre- and post-contrast MRI studies.



**Figure 2.** MRI with axial (top) and coronal (bottom) slices of bilateral forearms pre- (left) and post-exercise, post-contrast (right) demonstrating diffuse muscular enhancement and edema in the bilateral volar, and less so, dorsal compartment musculature.



**Figure 3.** Intraoperative photographs showing A) incomplete release of superficial compartment from prior surgery, B) full open release of the superficial compartments, and C) open release of the deep compartments.

**Table 1.** Case Timeline

|          |   |
|----------|---|
| 11/24/21 | Initial clinic visit  |
| 1/21/22  | EMG/NCS and Dynamic MRI studies - findings consistent with CECS and CTS                 |
| 1/26/22  | Clinic visit to review results, CECS and CTS diagnosed                                  |
| 2/8/22   | Surgery #1, R side CTR, R volar and dorsal fasciotomy                                   |
| 2/24/22  | Two-week postop clinic visit, patient healing well, no complications                    |
| 3/1/22   | Surgery #2, L side CTR, L volar and dorsal fasciotomy                                   |
| 3/16/22  | Two/five-week postop clinic visit, patient continues to do well, performed one climb    |
| 5/11/22  | Telehealth visit, patient has returned to climbing, symptoms resolved, no complications |

## Treatment and Outcome

- Right** carpal tunnel release with volar & dorsal open compartment release followed by repeat procedures on the **left** 1 month later
- Follow-up: Significant improvement in symptoms with no evidence of complications. Able to resume climbing 1 month after R-sided operation reaching previous level of sport 2 months after both procedures

## Discussion

- No universally agreed upon MRI protocol, exercise protocol, or revision operative technique
- To our knowledge, this is the first case to use a sport-specific exercise protocol in line with the exacerbating activity (ie, rock climbing)
- While surgical treatment is often effective, up to 3-11% of patients may experience symptom recurrence
- When revision surgery may be necessary in refractory CECS, this case demonstrates that an open revision may be effective following an initial endoscopic approach
- Other technique options include repeat endovascular release and mini open

## Conclusions

- Utilization of a novel exercise protocol coupled with dynamic contrast-enhanced MRI may facilitate accurate diagnosis of forearm CECS, even in patients who are re-presenting after initial surgery**
- Further research is warranted to validate the accuracy of this pre- and post-exercise MRI protocol, and the efficacy of various surgical approaches to forearm fasciotomies for CECS in larger cohorts

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