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
- Intracompartamental 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 NSAID 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.

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

References

[Provide references here]