



Avive Soft Tissue Membrane Improves Outcomes After Revision Upper-Extremity Nerve Decompression Surgery: A Retrospective Review

Joash R. Suryavanshi, BA¹; Christian Douthit, MD¹; Cameron Cox, BBA¹; Ashley Maveddat, BA¹; Desirae McKee, MD^{1,2}; Brendan J. MacKay, MD^{1,2}

¹Texas Tech University Health Sciences Center, Lubbock, TX, USA

²University Medical Center, Lubbock, TX 79415, USA



Introduction

Carpal and cubital tunnel syndrome are the most frequently treated compressive neuropathies of the upper extremities.¹ Failure rates as high as 25% in primary carpal tunnel and 19% in primary cubital tunnel release have been reported in the literature.²⁻⁴ When primary decompression fails, revision surgery is commonly recommended. Various surgical procedures have been employed in revision decompression, including: external and internal neurolysis, endoscopic release, flap techniques, and vein wrapping.⁵ However, recurrent compressive neuropathy remains a challenge for surgeons, and the literature has not adequately addressed long-term outcomes of recurrent carpal, cubital, and radial tunnel decompression techniques.⁶ Unfortunately, these revision procedures rarely lead to complete resolution of symptoms, with up to 40% of patients reporting unfavorable outcomes in revision carpal tunnel surgery and 25% with no improvement or worsened symptoms after revision cubital tunnel surgery.^{2,3} Given the frequent need for revision procedures and apparent shortcomings of current treatment modalities, additions to traditional treatment algorithms have recently come under consideration. Synthetic nerve conduits have been used in revision decompression procedures with variable success reported in the literature.⁵ While some have shown promise, data is limited and studies with long-term follow up have not been published. More recently, human amniotic membrane products have demonstrated utility in a variety of surgical applications including: wound coverage, tissue separation, nerve wrapping, soft tissue regeneration, and tendon repair.⁷ Avive® Soft Tissue Membrane (AxoGen Inc, Alachua, FL) is a processed human umbilical cord membrane (PCM) indicated for use as a soft tissue barrier. Avive® reduces inflammation and scarring, resulting in improved tissue gliding. Human umbilical cord is a naturally resorbable, permeable membrane that contains growth factors, mesenchymal stem cells, and collagen, with unique properties of both embryonic and adult stem cells.⁷ While Avive® is commonly used to wrap nerves, its role in revision carpal, cubital, and radial tunnel release has not been extensively studied.

Methods

We performed a retrospective review of patients that underwent revision surgeries for nerve decompression procedures in the upper extremity, including: carpal, cubital, and radial tunnel revision procedures. In all cases, Avive® was wrapped around the respective nerves. (Figures 1 & 2)

Patients were excluded if age <18, significant peri-operative complications were encountered, or if the patient had a previous trauma or medical condition that significantly damaged the nerve of interest.

Demographic data, including patient age, sex, and time to revision surgery were collected. Average time from revision to most recent follow up was recorded, as well as site of placement and outcomes data including: VAS pain scores, static 2-point discrimination, Semmes-Weinstein, Tinel's sign, grip & pinch strength, range of motion (ROM), and subjective patient satisfaction.

Descriptive statistics were performed on all data points and post-operative outcomes were compared to pre-revision scores when available to quantify improvement in symptoms.

Results

Thirty-five patients met inclusion criteria for our study. Average age of patients was 56.9 (36-81). 37.1% of patients were male. Average time to revision surgery was 3.4 years and average time to follow up was 5.8 months. Avive® placement was distributed in our cohort as follows: 26 (72%) median nerve, 9 (25%) ulnar nerve, and 1 (3%) radial nerve.

Average pre-operative pain score was 5.2 (n = 33). Average pain at the most recent follow up was 2.8 (n = 19). DASH scores have been obtained for 10 patients at this time. Patients with greater than 3 months follow up (n = 6, average 4.2 months) had an average of 30.5% disability score.

One or more quantitative parameters (ROM, Static 2-Point discrimination, Semmes-Weinstein, or Grip & Pinch Strength) improved in 24 patients (88%). 26 patients (96%) reported subjective improvement of preoperative symptoms at their most recent visit. One patient (4%) noted no improvement at 6 month follow-up. No complications were noted in our study cohort. Patients will continue to be followed and evaluated up to 2 years post-revision.

Discussion

Revision nerve decompressions in the upper extremity present with variable success, with some studies reporting unresolved symptoms in up to 95% of patients.² Success is difficult to define in these cases as failure rates of primary repairs are also relatively high. In practice, patient satisfaction is often the hallmark of success in revision decompression surgery.

In this study, we report the effective use of Avive® Membrane in revision nerve procedures of the upper extremity. as documented by improvement in 96% of patients' preoperative symptoms. Outcomes in our cohort compare favorably to those of primary nerve decompression procedures.²⁻⁴

While these preliminary results are promising, patients continue to be followed to assess long-term outcomes. This data may allow comparisons to other adjuncts such as synthetic and xenograft conduits in revision procedures. Future studies are needed to more directly compare the technique we describe to outcomes of common primary decompression techniques.

References

- Osei DA, Groves AP, Bommarito K, Ray WZ. Cubital Tunnel Syndrome: Incidence and Demographics in a National Administrative Database. *Neurosurgery*. 2017;80(3):417-420.
- Mosier BA, Hughes TB. Recurrent Carpal Tunnel Syndrome. *Hand Clin*. 2013;29(3):427-434.
- Boone S, Gelberman RH, Calfee RP. The Management of Cubital Tunnel Syndrome. *J Hand Surg Am*. 2015;40(9):1897-1904; quiz 1904.
- Zhang D, Earp BE, Blazar P. Rates of Complications and Secondary Surgeries After In Situ Cubital Tunnel Release Compared With Ulnar Nerve Transposition: A Retrospective Review. *J Hand Surg Am*. 2017;42(4):294.e291-294.e295.
- Soltani AM, Allan BJ, Best MJ, Mir HS, Panthaki ZJ. Revision decompression and collagen nerve wrap for recurrent and persistent compression neuropathies of the upper extremity. *Ann Plast Surg*. 2014;72(5):572-578.
- Grandizio LC, Maschke S, Evans PJ. The Management of Persistent and Recurrent Cubital Tunnel Syndrome. *J Hand Surg Am*. 2018;43(10):933-940.
- Riboh JC, Saltzman BM, Yanke AB, Cole BJ. Human Amniotic Membrane-Derived Products in Sports Medicine: Basic Science, Early Results, and Potential Clinical Applications. *Am J Sports Med*. 2016;44(9):2425-2434.

Figure 1



Avive® placement in the carpal tunnel during a revision procedure involving the median nerve.

Figure 2



Avive® placement in the cubital tunnel during a revision procedure involving the ulnar nerve.