Peripheral Nerve Surgery with Processed Human Umbilical Cord: Clinical Case Series

Bauback Safa 1, Andrew Watt 1, Paul Sibley 2, Robert Hagan 3, Mark S Rekant 4, Harry Hoyer 5, Brendan Mackay 6, Gregory Buncke 1

1 The Buncke Clinic, San Francisco, USA; 2 Hand and Upper Extremity Surgery, Allentown, USA; 3 Neuropax Clinic, St Louis, USA; 4 The Philadelphia Hand Center, Philadelphia, USA; 5 MetroHealth System, Cleveland, USA; 6 Texas Tech University, Lubbock, USA

Introduction

Inflammation, scar formation, and adhesions are inherent following injury or surgical intervention. When peripheral nerves are involved, resultant scarring and inflammation around nerves can lead to poor outcomes and make re-access difficult in the event of additional procedures. Placental membranes, historically used as wound dressings and coverings, lack qualities ideal for surgical applications. Human umbilical cord is a naturally resorbable and permeable membrane that has shown to modulate inflammation, separate tissue layers, and contain essential extracellular matrix molecules and endogenous growth factors. Avive® Soft Tissue Membrane (AxoGen Inc, Alachua FL) is processed human umbilical cord membrane intended for use as a soft tissue covering (Figure 1). This material is designed to overcome specific shortcomings of placental membranes and remains intact at least 16 weeks making it ideal for use during the critical time of scar formation and maturation. Here we report on the use of cord membrane as an interpositional barrier for exposed peripheral nerves.

Methods

Evaluation of the utilization of cord membrane was conducted. Following relevant consents, data was collected in cases where cord membrane was used during a surgical procedure on an exposed nerve. Information on injury, placment, and outcomes were collected. Data was reviewed to evaluate clinical application and outcomes after use in peripheral nerve surgery.

Results

This series included 13 patients undergoing surgical procedures with exposed nerve in the zone of injury. The average age was 45 (range 11-62) years. Pre-operative and surgical procedures were based on institution's standard of care. These included decompression, traumatic and planned reconstructive procedures. A majority of these nerves were in the upper extremity (Table 1).

After exposure and neurolysis, cord membrane was hydrated and placed as a covering over the nerve. In eight cases, sutures (6-0/8-0) were used to secure in place. The average follow-up was 6 months. All surgeons reported the membrane conformed well, easily positioned, and remained intact. There were no reported complications /revisions and patients are recovering as expected.

<table>
<thead>
<tr>
<th>Injury Type</th>
<th>Surgical Procedures</th>
<th>Effective Nerve Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trunk crush injury to the forearm</td>
<td>Secondary neurolysis and neurolysis 1 year post injury</td>
<td>Median at wrist 3 x 6 cm</td>
</tr>
<tr>
<td>Blunt trauma to the back of wrist</td>
<td>Primary neurolysis 4 months post injury</td>
<td>Dorsal radial sensory 2 x 2 cm</td>
</tr>
<tr>
<td>Closed distal radial fracture</td>
<td>Tenolysis of flexor tendons and neurolysis of median nerve 7 weeks post injury</td>
<td>Median at wrist 3 x 4 cm</td>
</tr>
<tr>
<td>Ulnar nerve compression fracture</td>
<td>Ulnar nerve decompression and neurolysis</td>
<td>Ulnar nerve at elbow 3 x 6 cm</td>
</tr>
<tr>
<td>Carpal tunnel syndrome</td>
<td>Carpal Tunnel release and neurolysis of median nerve</td>
<td>Median at wrist 2 x 4 cm</td>
</tr>
<tr>
<td>Grasstound wound to the wrist</td>
<td>Repair ulnar, index, and ulnar neurolysis and median nerve neurolysis</td>
<td>Median at wrist 2 x 4 cm</td>
</tr>
</tbody>
</table>

ACUTE TRAUMA

CLINICAL HISTORY

An 11-year old male suffered from a gunshot wound to the left carpal tunnel, resulting in injuries to the soft tissues including transection of the median nerve and the FDP and FPS of the index finger.

SURGICAL PROCEDURE

The FDP and FDS tendons were repaired and covered with a 2 x 4 cm of processed human umbilical cord membrane trimmed to size. The median nerve was repaired with 50mm of processed nerve allograft and two nerve connectors to reinforce the coaptation sites. Processed human umbilical cord membrane (2x4cm) was then placed without sutures around the repaired nerve as a separating barrier from the concomitant soft tissue injuries caused by the bullet and tendon repairs. The surgeon reported membrane was easy to handle and conformed well.

At 8 weeks post-op, patient is reporting significant reduction in pain, has discontinued use of a splint and begun early active motion protocol with therapy. There were no complications or revisions.

DELAYED REPAIR

CLINICAL HISTORY

A 32 year old male presented with a crush injury after his left forearm became caught in a cotton gin. Symptoms of median nerve entrapment and adhesion persisted and he underwent exploration Approximately one year post injury.

SURGICAL PROCEDURE

The distal forearm was explored and tenolysis of the flexor tendons along with neurolysis of the median nerve. The median nerve appeared to be inflamed. Processed human umbilical cord membrane was used to cover the median nerve in situ to separate surrounding soft tissues. No sutures were required and the cord membrane conformed well around the median nerve.

Conclusions

Processed human umbilical cord membrane can be used as a soft tissue covering during nerve surgery. This series included multiple injury types where the potential of post-operative scar and inflammation were a concern. Placement as an interpositional barrier was successful in all cases. There were no reported complications or revisions, and patients continue to recover as expected.

Disclosure: This study was supported through a research grant by AxoGen Corp.