Human Amniotic Membrane for the Prevention of Intradural Spinal Cord Adhesions: Novel Use in a Case Series of 14 Patients

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Introduction

Tethering after spinal surgery is caused by adhesions that arise from intradural tissue manipulation. Microsurgical de-tethering is the only treatment for symptomatic patients, but re-tethering occurs commonly and no treatment is widely available to prevent this complication.We applied human amniotic membrane (HAM) grafts, which are immune-privileged and known to possess anti-fibrogenic properties, in patients requiring microsurgical de-tethering. For this first-in-human use, we evaluated the safety and potential efficacy of these grafts for preventing re-tethering.

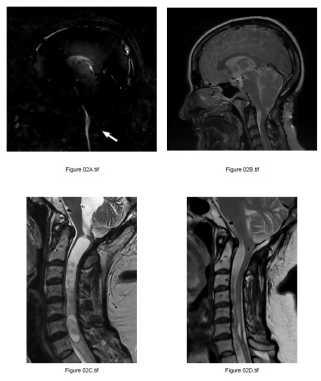
Methods

We retrospectively reviewed the medical records of all patients who required de-tethering surgery and received a HAM graft between 2013 and 2016 at our institution after various previous intradural spinal surgeries. In all 14 cases, intradural lysis of adhesions was achieved, a HAM graft was sewn in place intradurally, and a dural patch was closed in a watertight fashion over the graft.

Results

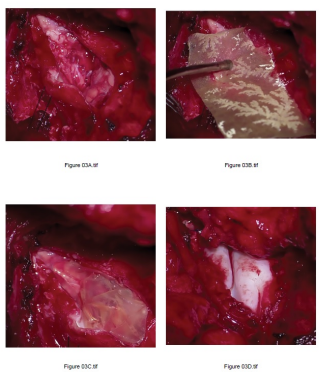
Fourteen patients had received HAM grafts to prevent re-tethering. All patients had at least 6 months of follow-up (mean follow-up, 14 months). Re-tethering was noted in only 1 patient. Surgical re-exploration showed that the re-tethering occurred caudal to the edge of the HAM graft, with no tethering underneath the original graft. No complications were attributed specifically to the HAM graft placement.

Figure 1



(A) MR image of Patient 4 showing decreased cerebrospinal fluid flow dorsally at the craniocervical junction (arrow) on sagittal cine-flow study. This area of reduced flow corresponds to a region of dorsally adhered spinal cord causing cervicomedullary kinking seen on T2-weighted sagittal MR image (B) through the midline, with (C) resultant severe cervical syrinx. (D) Postoperative T2-weighted sagittal MR image demonstrating an absence of recurrent dorsal tethering at 11 months after the second lysis of adhesions and HAM placement.

Figure 2



Microscope images of HAM placement during initial de-tethering after Chiari decompression adhesions occurred in Patient 4. (A) The neural surface is completely de-tethered using sharp dissection; then (B) the HAM graft is placed intradurally and (C) sutured into place using interrupted 9-0 polypropylene stitches. (D) Dural closure is completed over the graft using an artificial dural patch.

Table 1. Summary of Barrow Neurological Institute experience using human amniotic membrane to prevent re-tethering

Patient	Sex/age (y)	Surgeon	Etiology of tethering	No. of previous de-tethering surgeries	Length of follow-up (mo)	Subsequent re-tethering	Postoperative complications
1	F/32	P.N.	Myelomeningocele	2	31	No	None
2	F/26	U.K.K.	Myelomeningocele	1	15	No	Postoperative CSF leak requiring return to OR for closure and lumbar drain
3	F/44	U.K.K.	Myelomeningocele	0	12	No	None
4	F/43	P.N.	Craniotomy for Chiari decompression	2	26	Yes, caudal to graft	None
4	F/44	P.N.	–	–	–	No	Pseudomeningocele and fourth ventricular hydrocephalus requiring shunting
5	M/41	P.N.	Craniotomy for Chiari decompression	1	13	No	Stitch abscess treated with oral antibiotics
6	F/45	J.W.	Craniotomy for Chiari decompression	0	20	No	None
7	F/37	A.S.L.	Craniotomy for Chiari decompression	0	13	No	None
8	F/69	S.W.C.	Spontaneous ventral tethering at T5	0	6	No	None
9	F/31	U.K.K.	Spinal trauma at T10-11	1	18	No	None
10	F/73	P.N.	Cervical meningioma status postresection (×2) and radiation therapy with tethering at C6-T1	0	7	No	None
11	M/50	N.T.	Conus medullaris lipoma resection with tethering at T12	0	14	No	None
12	F/36	N.T.	Conus medullaris AVM resection with tethering at T12	0	10	No	None
13	M/53	N.T.	Cervical intramedullary cavernous malformation resection with tethering at C6-7	0	7	No	None
14	F/46	W.L.W.	Thoracic intramedullary lipoma resection (×2) with tethering at T7-10	0	7	No	None

Abbreviations: AVM, arteriovenous malformation; CSF, cerebrospinal fluid; OR, operating room.

Barrow Neurological Institute experience using human amniotic membrane to prevent re-tethering.

Conclusions

This first-in-human series provides evidence that HAM grafts are a safe and potentially efficacious method for preventing re-tethering after microsurgical intradural lysis of adhesions. These results lay the groundwork for further prospective controlled trials in patients with this difficult-to-treat pathology.

Learning Objectives

By the conclusion, participants should be able to: 1.) Describe the potential therapeutic characteristics of human amniotic membrane grafts, 2.) Understand the potential role for HAM grafts in preventing arachnoid adhesions after intradural surgery.

References

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