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Endovascular Techniques for Safe Pre-operative Embolization of Juvenile Angiofibroma – Avoiding the Pitfalls of ECA-ICA Anastomosis, Increasing Extent of Embolization, and Reducing Intra-Operative Blood Loss.

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Introduction

Juvenile-nasopharyngeal-angiofibroma (JNA) is a rare benign neoplasm of the nasopharynx most commonly presenting in adolescent males. Surgical resection of this hyper-vascular tumor is facilitated by pre-operative embolization to minimize surgical blood loss – avoiding complications, and increasing the extent of resection. Embolization is complicated by multiple ECA-ICA anastomosis, and failure to address these anastomosis with safe technique can result in embolic stroke and suboptimal embolization results. We describe a sophisticated balloon assisted embolization technique in which a balloon (Hyperglide 5X30mm) is inflated in the ICA from C2-C4 during Onyx-34 injection through ECA tumor feeders, effectively sealing the ICA circulation from embolic material.

Methods

13 consecutive cases who underwent JNA embolization between 2008-2015 were identified. Demographic, clinical, and outcome data were reviewed for analysis.

Results

All patients in the study were males aged 9-29 yrs. (mean 14.9yrs.). All tumors were embolized with Onyx-34 in a single session. Selective embolization of multiple vessels was required in all cases to achieve maximal result. An average 81% embolization (60-100%) was achieved overall, with >80% embolization in 6 cases and >90% embolization in 4. There were no complications or morbidities secondary to embolization. Gross-total and Near-total resection was achieved in 33.3% of cases, minimal residual (10%) in 41.7 %, and partial resection in 25%. Average total surgical blood loss was 1500ml (250-4500ml). All but one case required blood derivative or colloid resuscitation. Average surgical resection time was 290 min. (127-535min.). There were no surgical complications with exception of one case requiring repeat embolization for excessive bleeding. One patient experienced mild delayed onset facial weakness, otherwise no surgical morbidities were noted.

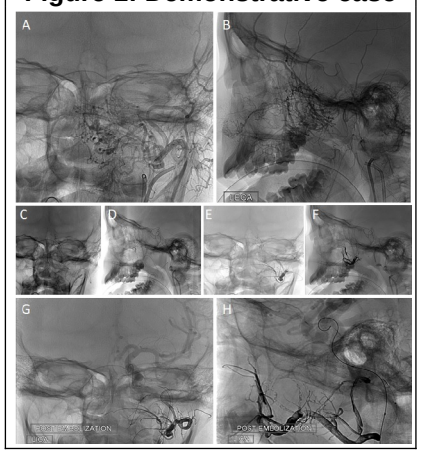
Table 1

CASE	AGE (YRS)	SEX (M/F)	PATHOLOGY	PRESENTING SYMPTOMS	RADKOWSKY STAGE	SIZE (CM)	ARTERIAL FEEDERS
1	14	M	Juvenile Nasal Angiofibroma	epistaxis, snoring, nasal obstruction	2b	3.4x2.9x4.2	Sphenopalatine, IMAX, Ipsilateral pterdaid. Vidian, Facial
2	14	M	Juvenile Nasal Angiofibroma	epistaxis	2c	3.0x4.2x3.5	Sphenopalatine, IMAX, Descending palatine, Jaffe-orbital
3	18	M	Juvenile Nasal Angiofibroma	epistaxis, nasal obstruction	2b	5.1x3.4x3.5	Sphenopalatine, IMAX, Descending palatine
4	10	M	Juvenile Nasal Angiofibroma	epistaxis, multiple OE for tumor removal	3	4x2x3.5	Facial, IMAX
5	10	M	Juvenile Nasal Angiofibroma	epistaxis, nasal obstruction	2b	4.1x3.1x3.2	Superior pharyngeal, IMAX
6	19	M	Juvenile Nasal Angiofibroma (residual)	residual tumor	2b	4.1x3.1x3.2	IMAX, Accessory meningeal, Vidian, ascending
7	14	M	Juvenile Nasal Angiofibroma	epistaxis, nasal obstruction	2b	4x2.8x3.4	Ascending pharyngeal, IMAX, Sphenopalatine, Vidian,
8	29	M	Juvenile Nasal Angiofibroma	epistaxis	2c	4.7x3.1x4.3	Vidian, ET, IMAX, Sphenopalatine, Deep temporal
9	19	M	Juvenile Nasal Angiofibroma	facial swelling, blurry vision, epistaxis, epistaxis	2c	5.7x4.9x4.7	IMAX, Posterior auricular, Ascending pharyngeal, Ascending palatine artery, Meningohypophyseal trunk
10	11	M	Juvenile Nasal Angiofibroma	epistaxis, nasal obstruction	2c	5.4x2.9x4.5	IMAX, Posterior auricular, Ascending pharyngeal, Ascending palatine artery, Meningohypophyseal trunk
11	19	M	Juvenile Nasal Angiofibroma (residual)	residual tumor	2c	4.6x4x4.6	Vidian, Deep temporal, Sphenopalatine
12	9	M	Juvenile Nasal Angiofibroma	epistaxis	2b	5.6x4.7x4.8	Sphenopalatine, Accessory meningeal, Vidian, Ascending pharyngeal, ET, Vidian
13	17	M	Juvenile Nasal Angiofibroma	epistaxis	2b	3.7x3.8x2.3	Sphenopalatine, IMAX, Vidian,

Table 2: Patient Outcomes

Case	Percent Embolization	Intra-op blood loss	Transfusion	Extent of resection	Length of procedure (Min)	Complication
1	90	850	3 units of LR	Partial	257	None
2	80	4500	7 units of PRBC, 6 units FFP, 6 units plasma, 2 L of own blood	Partial	287	None
3	85	minimal	none	Near total	127	None
4	70	3700	3 units of LR	Partial	535	None
5	90	1500	2 units PRBC, 2 units FFP, 6 units platelets	Partial	199	None
6	-	-	-	-	-	None
7	70	2000	2 units PRBC, 2 units FFP	Partial	259	None
8	80	1000	2 units of own blood	Near total	240	None
9	80	1500	750 ml of own blood	Partial	383	Transient delayed R facial weakness
10	60	300	300 ml own blood	Near total	190	None
11	80	600	2 units PRBC	Partial	336	None
12	90	350	1 unit PRBC	Near total	269	None
13	100	250	none	Partial	403	None

Figure 1: Demonstrative case



This is a 9 yr old male with JNA presenting with epistaxis. A-B. Large left posterior nasal cavity tumor measuring 43.5 x 44.1 x 55.7 mm is present receiving blood supply from distal branches of the left sphenopalatine artery, left accessory meningeal artery, left middle meningeal artery, left inferior lateral trunk, and left vidian artery. C-F: Successive embolization of arterial feeders. A Scepter balloon microcatheter loaded with a Traxcess 014 microwire was introduced into the 5 French catheter positioned in the left external carotid artery. A 5 x 30 mm Hyperglide balloon and wire were introduced into the 5 French catheter positioned within the left internal carotid artery and using a roadmap technique, the balloon was positioned in the carotid siphon. This balloon is inflated to protect ICA circulation during injection. Selective micro-catheterization of arterial feeders with sequential vessel embolization using Onyx-34 injected under high pressure using Scepter balloon microcatheter to prevent reflux. ICA positioned balloon is inflated during injection and then deflated to allow for return of circulation G -H: 90% embolization of tumor. Note deep penetration of Onyx in ICA suppliers, as well as positioning of balloon wire in ICA. Patient underwent surgery with near total resection with 350cc of blood loss and no surgical complications.

Conclusions

Balloon protection of ICA circulation while injecting ECA branches for JNA embolization reduces procedural complications, and allows for more aggressive and complete embolization. This results in more extensive tumor resection and minimizes surgical blood loss.

Learning Objectives

By the conclusion of this session participants should be able to 1)Understand the unique vascular anatomy created by ICA-ECA anastomosis 2) Understand complications associated with JNA embolization and resection due to vascular anatomical considerations 3) Review a novel surgical technique to avoid complications 4)Apply this new information such that the experienced operator can attempt to incorporate this technique in clinical practice 5) Apply these concepts to other situations of dangerous anastomosis