Association of Preoperative Embolization and Vascularization Patterns with Outcomes in Juvenile Nasopharyngeal Angiofibroma Resection

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Background

Preoperative vascular embolization (PVE) is commonly used in managing juvenile nasopharyngeal angiofibroma (JNA) to improve outcomes. However, few studies have evaluated how embolization patterns and vascular features affect JNA prognosis.

Introduction

- JNA is a rare, highly vascular tumor that arises from the PPF and extends to the nasopharynx.

- PVE performed 24–48 hours before surgery reduces intraoperative blood loss, recurrence rates, transfusion requirements, and hospital length of stay.

- **Objective:** To assess angiographic and embolization patterns and their impact on intraoperative, postoperative, and recurrence outcomes after JNA resection.

Methods and Materials

- Retrospective chart review of pediatric and adult patients with JNA who underwent surgical resection at Mayo Clinic between January 2010 and January 2025.

- Patients were stratified by embolization extent (≤2 vs ≥3 vessels), internal carotid artery (ICA) tumor contribution (present vs absent), and post-embolization tumor blush (present vs absent).

- Tumor characteristics, embolization patterns, intraoperative outcomes, postoperative outcomes, and recurrence rates were compared between groups (Tables 1–3).

- Statistical analysis utilized t-tests, Mann–Whitney U tests, and chi-square tests, with significance defined as $p < 0.05$.

Results

- ICA tumor contribution was strongly associated with advanced-stage disease, more extensive embolization, and residual post-embolization blush, without affecting intraoperative, postoperative, or recurrence outcomes (Table 1).

- Post-embolization tumor blush correlated with advanced-stage disease and ICA supply but did not impact intraoperative, postoperative, and recurrence outcomes (Table 2).

- Patients with ≥3 vessels embolized were more likely to have ICA or bilateral ECA tumor supply and present with recurrent disease, but intraoperative and postoperative outcomes were similar (Table 3).

Table 1: Comparison by ICA Contribution

Outcome	No ICA contribution (n=28)	ICA contribution (n=15)	p-value
UPMC stage (stages 4–5) (n, %)	**13 (48.1%)**	**15 (100.0%)**	**<0.001**
Presented for recurrent disease (n, %)	4 (14.3%)	3 (20.0%)	0.68
Bilateral ECA contribution to tumor (n, %)	1 (3.6%)	3 (20.0%)	0.114
Vessels embolized (≥3) (n, %)	**3 (10.7%)**	**7 (46.7%)**	**0.009**
Post-embolization blush (yes) (n, %)	**13 (46.4%)**	**15 (100.0%)**	**<0.001**
Post embolization blush percentage, % (median [IQR])	**0.0 (0.0–5.0)**	**5.0 (2.0–10.0)**	**0.033**
Surgical time, min (median [IQR])	364.5 (300.0–466.8)	362.5 (287.0–568.8)	0.578
Surgical approach (endoscopic) (n, %)	23 (82.1%)	12 (80.0%)	1.000
Intraoperative blood loss (mL, median [IQR])	200.0 (62.5–390.0)	337.8 (73.8–500.0)	0.678
Length of stay (≥2 days) (n, %)	7 (25.0%)	3 (20.0%)	1.000
Postoperative transfusions required (n, %)	2 (7.1%)	3 (20.0%)	0.324
Postoperative residual disease (n, %)	1 (3.6%)	2 (13.3%)	0.275
Recurrence after resection at Mayo Clinic (n, %)	3 (10.7%)	0 (0.0%)	0.54

Table 2: Comparison by Post-Embo Blush (Yes vs No)

Outcome	No post-embolism blush (n=15)	Post-embolism blush (n=28)	p-value
UPMC stage (stages 4–5) (n, %)	**1 (6.7%)**	**27 (100%)**	**<0.001**
Presented for recurrent disease (n, %)	2 (13.3%)	5 (17.9%)	1.000
ICA contribution to tumor (n, %)	**0 (0.0%)**	**15 (100.0%)**	**<0.001**
Bilateral ECA contribution to tumor (n, %)	1 (6.7%)	3 (10.7%)	1.000
Vessels embolized (≥3) (n, %)	1 (6.7%)	9 (32.1%)	0.127
Surgical time, min (median [IQR])	337.0 (235.5–364.5)	392.0 (306.0–568.0)	0.099
Surgical approach (endoscopic) (n, %)	14 (93.3%)	21 (75.0%)	0.226
Intraoperative blood loss (mL, median [IQR])	200.0 (50.0–225.0)	325.0 (81.3–500.0)	0.391
Length of stay (≥2 days) (n, %)	4 (26.7%)	6 (21.4%)	0.719
Postoperative transfusions required (n, %)	1 (6.7%)	4 (14.3%)	0.643
Postoperative residual disease (n, %)	1 (6.7%)	2 (7.1%)	1.000
Recurrence after resection at Mayo Clinic (n, %)	2 (13.3%)	1 (3.6%)	0.275

Table 3: Comparison by Number of Vessels Embolized

Outcome	≤2 vessels (n=33)	≥3 vessels (n=10)	p-value
UPMC stage (stages 4–5) (n, %)	20 (60.6%)	8 (88.9%)	0.230
Presented for recurrent disease (n, %)	**3 (9.1%)**	**4 (40.0%)**	**0.04**
ICA contribution to tumor (n, %)	**8 (24.2%)**	**7 (70.0%)**	**0.019**
Bilateral ECA contribution to tumor (n, %)	**1 (3.0%)**	**3 (30.0%)**	**0.034**
Post-embolization blush (yes) (n,%)	19 (57.6%)	9 (90.0%)	0.127
Post embolization blush percentage, % (median [IQR])	2.0 (0.0–10.0)	5.0 (2.0–8.8)	0.406
Surgical time, min (median [IQR])	364.5 (283.5–466.8)	447.0 (308.0–565.0)	0.714
Surgical approach (endoscopic) (n, %)	27 (81.8%)	8 (80.0%)	1.000
Intraoperative blood loss (mL, median [IQR])	200.0 (61.2–512.5)	250.0 (100.0–350.0)	0.506
Length of stay (≥2 days) (n, %)	6 (18.2%)	4 (40.0%)	0.206
Postoperative transfusions required (n, %)	4 (12.1%)	1 (10.0%)	1.000
Postoperative residual disease (n, %)	3 (9.1%)	0 (0.0%)	1.000
Recurrence after resection at Mayo Clinic (n, %)	2 (6.1%)	1 (10.0%)	0.56

Conclusions

- Number of vessels embolized, residual blush, or ICA involvement were not associated with operative time, blood loss, transfusions, complications, or recurrence.

- Adequacy and quality of embolization, rather than complete angiographic devascularization, drive favorable surgical outcomes, even in complex vascular cases.

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References

1. Alimli, A.G., et al., Juvenile nasopharyngeal angiofibroma: magnetic resonance imaging findings. Journal of the Belgian Society of Radiology, 2016. 100(1): p. 63.
2. Giorgianni, A., et al., Twenty years of experience in juvenile nasopharyngeal angiofibroma (JNA) preoperative endovascular embolization: an effective procedure with a low complications rate. Journal of Clinical Medicine, 2021. 10(17): p. 3926.
3. Diaz, A., et al., Embolization in juvenile nasopharyngeal angiofibroma surgery: A systematic review and Meta-Analysis. The Laryngoscope, 2023. 133(7): p. 1529-1539.