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Endoscopic Management of Juvenile Nasopharyngeal Angiofibroma without Routine Preoperative Embolization: A Simulated Single-Center Series of 153 Patients

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ABSTRACT:

Objective: To evaluate a structured endoscopic strategy for juvenile nasopharyngeal angiofibroma (JNA) based on preoperative vascular mapping, early identification and control of feeding vessels, and stage-adapted tumor mobilization, without routine preoperative embolization.

Methods: This simulated retrospective cohort includes 153 adolescent and young adult male patients undergoing endoscopic resection of JNA at a high-volume rhinology and skull-base center. Preoperative contrast-enhanced CT and MRI were used to define tumor extension and probable vascular supply. Intraoperatively, the dominant feeding artery and its branches were identified before definitive tumor mobilization and controlled using a combination of bipolar coagulation, clipping, and selective vessel sealing. Estimated blood loss, transfusion requirement, operative time, residual disease, complications, and recurrence were analyzed according to tumor stage.

Results: The simulated cohort had a median age of 16 years (range, 10–27 years). Complete endoscopic resection was achieved in 147 patients (96.1%). Median estimated blood loss was 210 mL (IQR, 120–420 mL). Blood transfusion was required in 18 patients (11.8%), predominantly in advanced-stage disease. Major perioperative complications occurred in 5 patients (3.3%). During a simulated median follow-up of 30 months, radiologic or endoscopic recurrence was identified in 7 patients (4.6%). Blood loss increased progressively with tumor extension, particularly with infratemporal and intracranial involvement.

Conclusion: In this simulated series, a strategy combining detailed vascular imaging with early surgical control of feeding vessels was associated with high rates of complete endoscopic resection and acceptable blood loss without routine preoperative embolization. Prospective validation and comparison with embolization-based protocols are required.

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INTRODUCTION

Juvenile nasopharyngeal angiofibroma is an uncommon, histologically benign but locally aggressive vascular neoplasm occurring predominantly in adolescent males. Its characteristic origin around the sphenopalatine region and tendency to extend into the pterygopalatine and infratemporal fossae create substantial technical challenges during resection.

The endoscopic endonasal approach has progressively become an important treatment strategy because it provides direct visualization of the tumor–bone interface, permits early identification of vascular landmarks, and avoids the morbidity associated with external approaches in appropriately selected patients. Nevertheless, intraoperative hemorrhage remains one of the principal concerns.

Preoperative embolization is frequently used to reduce tumor vascularity. However, embolization requires an additional invasive procedure and may carry procedure-specific risks. An alternative strategy is to use preoperative imaging to anticipate the dominant feeding vessels and obtain surgical control of these vessels before tumor mobilization.

The present simulated study was designed to model such a surgical pathway in a cohort of 153 patients and to describe stage-specific blood loss, transfusion requirements, completeness of resection, and postoperative outcomes.

MATERIALS AND METHODS

Study Design and Population

This manuscript presents a simulated retrospective cohort of 153 consecutive male patients with radiologically and histologically consistent JNA treated by an endoscopic-first surgical strategy. The simulated age range was 10–27 years. Patients with extensive disease requiring an open craniofacial procedure as the planned primary approach were excluded from the modeled cohort.

Preoperative Imaging

All modeled patients underwent contrast-enhanced thin-section CT of the paranasal sinuses and skull base. MRI was added when there was suspected orbital, cavernous sinus, skull-base, or intracranial extension. Imaging review focused on tumor boundaries, bony remodeling, pterygopalatine and infratemporal extension, and the anticipated course of branches of the internal maxillary artery.

Surgical Strategy

The operative principle was to establish vascular control before aggressive tumor manipulation. After endoscopic exposure of the posterior nasal cavity and sphenopalatine region, the tumor was progressively separated from adjacent structures. Depending on tumor extension, the sphenopalatine artery and/or branches of the internal maxillary artery were identified and controlled using bipolar coagulation, clips, or selective vessel sealing. Wider exposure, including posterior maxillary wall drilling and an endoscopic Denker-type corridor, was used for tumors extending laterally into the pterygopalatine or infratemporal fossae.

The tumor was then mobilized along its natural planes and removed either en bloc or by controlled piecemeal delivery when required by the anatomical extension. Hemostasis was confirmed endoscopically before completion of the procedure.

Outcome Measures

The modeled primary endpoint was estimated intraoperative blood loss. Secondary endpoints included operative time, transfusion, completeness of resection, postoperative complications, residual tumor, and recurrence during follow-up.

Statistical Analysis

Continuous variables are presented as mean ± standard deviation or median with interquartile range, as appropriate. Categorical variables are expressed as counts and percentages. Because the dataset is simulated, the statistical values are illustrative and are intended only to demonstrate the structure of a clinical manuscript.

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RESULTS

Patient Characteristics

The simulated cohort consisted of 153 patients with a median age of 16 years (IQR, 14–18 years). Tumor distribution was concentrated in intermediate-stage disease, while advanced lesions represented a smaller but clinically important subgroup.

Stage	n	%	Median blood loss (mL)
I	14	9.2	75
II	61	39.9	165
III	55	35.9	340
IV	23	15.0	920

Operative Outcomes

Complete macroscopic endoscopic resection was achieved in 147 of 153 modeled patients (96.1%). Six patients had small residual disease in anatomically challenging locations and were managed with planned surveillance or secondary treatment. The median operative time was 118 minutes (IQR, 90–165 minutes). Median estimated blood loss for the entire cohort was 210 mL (IQR, 120–420 mL).

Blood loss demonstrated a clear relationship with tumor extension. Patients with stage I–II tumors generally had limited bleeding, whereas stage III–IV tumors accounted for most cases requiring transfusion or prolonged hemostatic control.

Outcome	Overall	Stage I–II	Stage III	Stage IV
Mean blood loss, mL	286	142	365	1,020
Transfusion, n (%)	18 (11.8)	3 (4.0)	8 (14.5)	7 (30.4)
Complete resection, n (%)	147 (96.1)	74 (98.7)	52 (94.5)	21 (91.3)
Major complications, n (%)	5 (3.3)	1 (1.3)	2 (3.6)	2 (8.7)

Postoperative Course

The simulated median hospital stay was 2 days (IQR, 2–3 days). Five major complications were modeled: two cases of postoperative hemorrhage requiring operative intervention, one transient orbital complication, one cerebrospinal fluid leak requiring endoscopic repair, and one neurological complication associated with advanced intracranial disease.

During a simulated median follow-up of 30 months, seven patients (4.6%) developed recurrent or residual disease. Recurrence was predominantly observed in patients with extensive stage III–IV tumors.

DISCUSSION

The principal concept modeled in this series is that vascular control can be incorporated directly into the endoscopic surgical workflow. Rather than treating embolization as an obligatory preliminary step, the surgeon uses high-resolution imaging to anticipate the vascular anatomy and then identifies and controls the relevant arterial supply under direct visualization.

This concept is consistent with the broader evolution of JNA surgery toward endoscopic approaches and individualized vascular management. The source article on which this manuscript is based similarly emphasizes preoperative localization of feeding vessels and intraoperative clipping, ligation, cauterization, or coblation as alternatives to routine embolization. filecite turn0file0 L13-L20

The modeled results demonstrate the expected relationship between tumor extent and blood loss. Limited lesions can generally be devascularized early and removed with modest blood loss, whereas tumors extending into the infratemporal fossa, cavernous sinus, or intracranial compartment pose substantially greater hemostatic and anatomical challenges.

An important practical element is the sequence of dissection. Early control of the dominant feeding pedicle may convert an initially highly vascular mass into a substantially more manageable surgical target. This approach also allows the surgeon to work under direct endoscopic visualization rather than relying exclusively on the effect of preoperative embolization.

The original publication reported 380 patients and emphasized imaging-guided localization of feeding vessels before intraoperative control. filecite turn0file0 L21-L32 The present manuscript deliberately uses a different simulated cohort and a separately structured presentation; however, its numerical results are illustrative rather than clinical evidence.

LIMITATIONS

The principal limitation is that the numerical dataset in this demonstration manuscript is simulated. Consequently, the reported effect estimates, complication rates, transfusion rates, and recurrence figures cannot be interpreted as evidence of actual clinical outcomes. A real submission would require patient-level data, ethics approval, predefined endpoints, statistical analysis, and verification of all operative and follow-up records.

CONCLUSION

A structured endoscopic strategy based on preoperative vascular mapping and early intraoperative control of feeding vessels represents a plausible approach to JNA surgery without routine preoperative embolization. The simulated 153-patient series demonstrates how such a study can be presented with stage-specific outcomes, blood-loss analysis, and postoperative surveillance. Validation using a real clinical dataset is essential before any conclusions are used for clinical or scientific publication.

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DATA INTEGRITY STATEMENT

This document is a research-writing demonstration. The cohort size of 153 and all numerical clinical outcomes were generated as simulated values at the user's request. They must be replaced with verified patient-level data before submission, presentation, or publication.