



# TREATMENT MODALITIES AND OUTCOMES IN EARLY-STAGE OLFACTORY NEUROBLASTOMA: Extent of Resection and Postoperative Radiotherapy



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## Abstract

### Background

Olfactory neuroblastoma (ONB) is conventionally treated with surgical excision followed by adjuvant radiotherapy (RT), but there still are controversies regarding the optimal management, especially for early-stage ONB.

### Methods

Patients diagnosed with ONB at two tertiary academic centers from 1992 to 2023 were retrospectively reviewed. Patients without definite dural or orbital invasion or cervical lymph node metastasis were included.

### Results

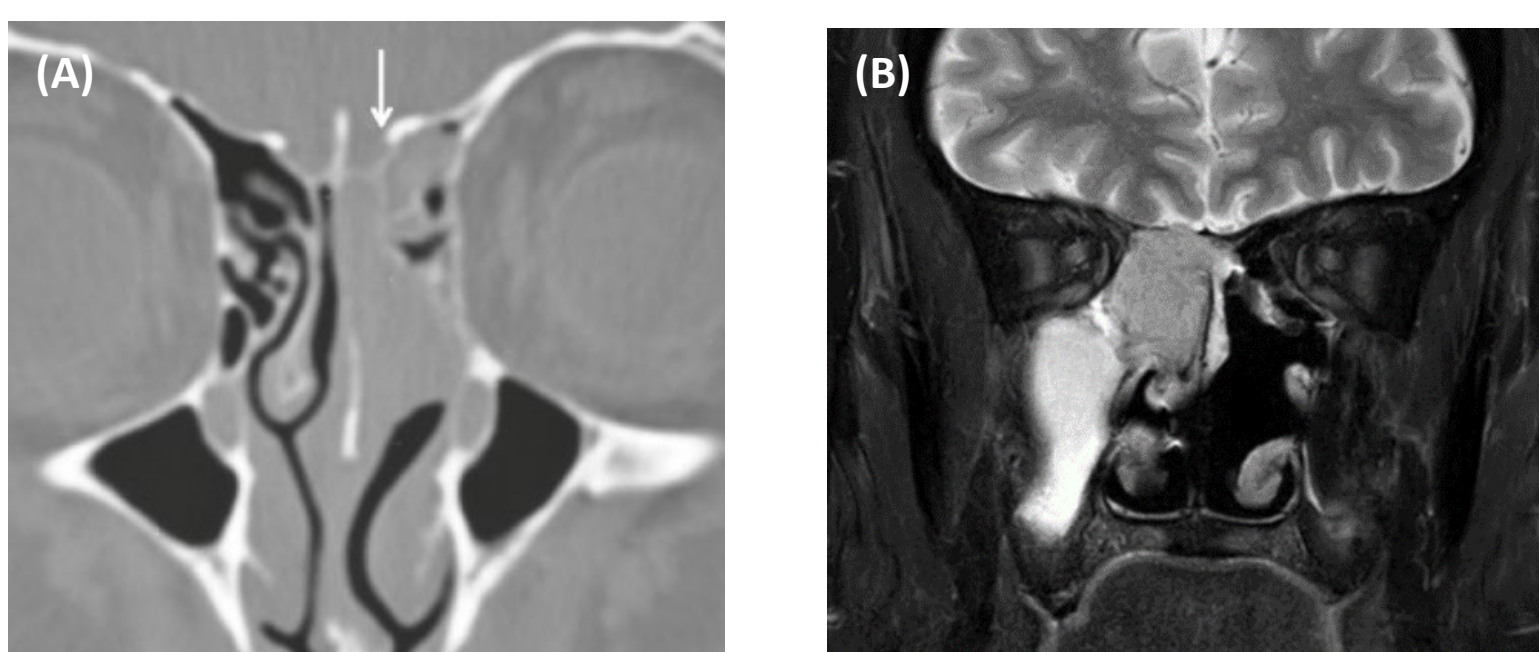
A total 38 patients were included in the study. The 5-year and 10-year DFS rates were 78.4% and 42.3%, respectively. Local recurrence-free survival (LFS) differed significantly between different treatment modality groups (log-rank  $p = 0.004$ ). Among patients who underwent extradural resection, those who received adjuvant RT had better LFS compared to those who did not. No local recurrences were observed in patients who underwent transdural resection during the follow-up period. DFS did not significantly differ between different treatment modality groups (log-rank  $p = 0.203$ ).

### Conclusions

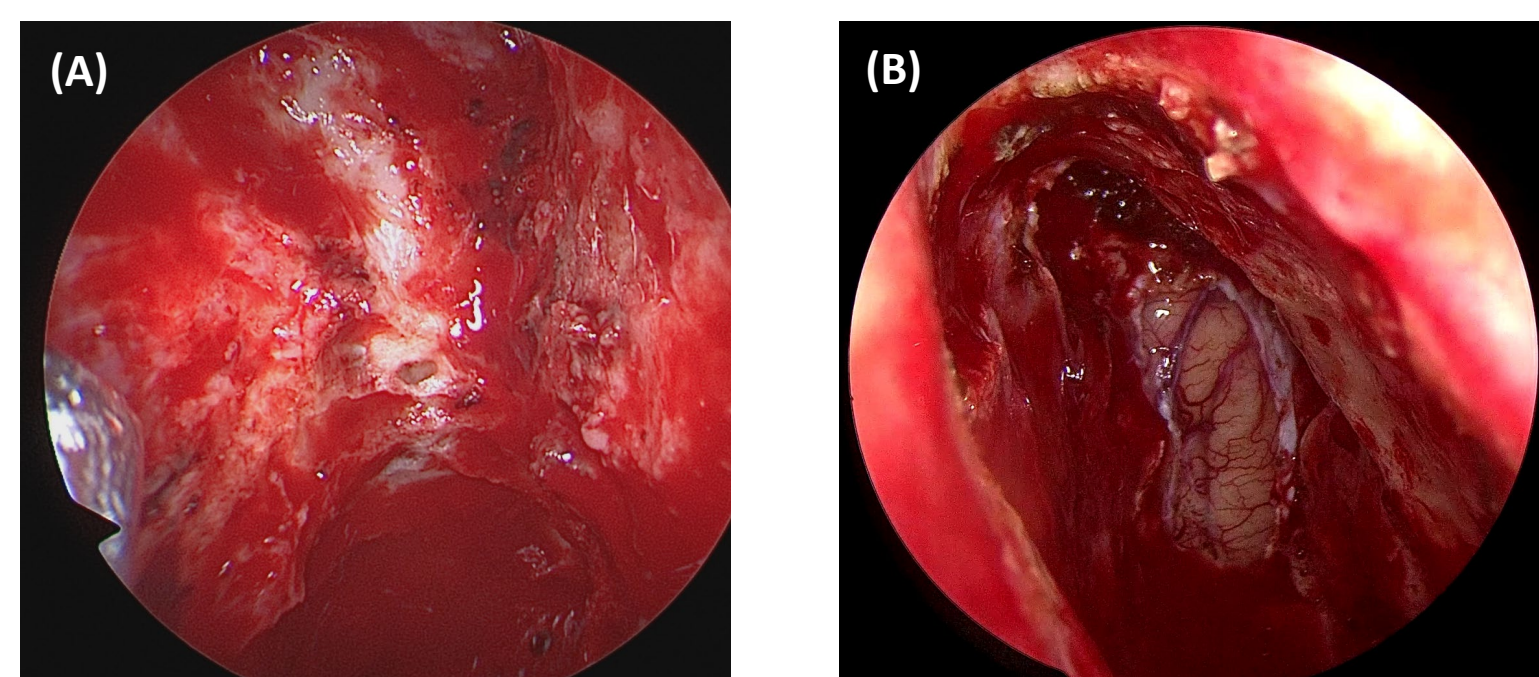
In early-stage ONB, overall survival seems favorable regardless of the chosen treatment modality. Transdural resection may mitigate the necessity of adjuvant RT.

## Introduction

Olfactory neuroblastoma (ONB), which originates from the olfactory epithelium in the ethmoid roof of the nasal cavity, is a rare malignancy comprising only 2-6% of all sinonasal tumors. Surgical excision with negative margins, followed by adjuvant radiotherapy or chemoradiotherapy is the treatment of choice for ONB, especially in advanced cases. When determining the optimal treatment strategy for early-stage ONB, **the extent of surgical resection and the necessity of adjuvant radiotherapy** are two important factors. The extent of surgical resection involves determining whether to perform an **extradural resection or a transdural resection**. This study aimed to evaluate the long-term treatment outcomes of early-stage ONB patients who underwent surgical resection with or without adjuvant radiotherapy, and to determine the optimal treatment strategy, including the extent of resection and the use of adjuvant radiotherapy.



**Figure 1.** Imaging of early-stage ONB patients. (A) CT scan with suspicious cribriform plate erosion, and (B) MRI scan without definite dural invasion.



**Figure 2.** The extent of surgical resection. (A) Extradural resection (B) Transdural resection

## Methods and Materials

### Inclusion criteria

- Two tertiary academic centers, 1992-2023 (32 years)
- Diagnosed with ONB

### Exclusion criteria

- Definite Dural (Dulguerov T stage  $\geq T4$ ), or Orbital invasion
- Kadish D (Nodal or distant metastasis)
- No definitive treatment
- RT/CCRT only

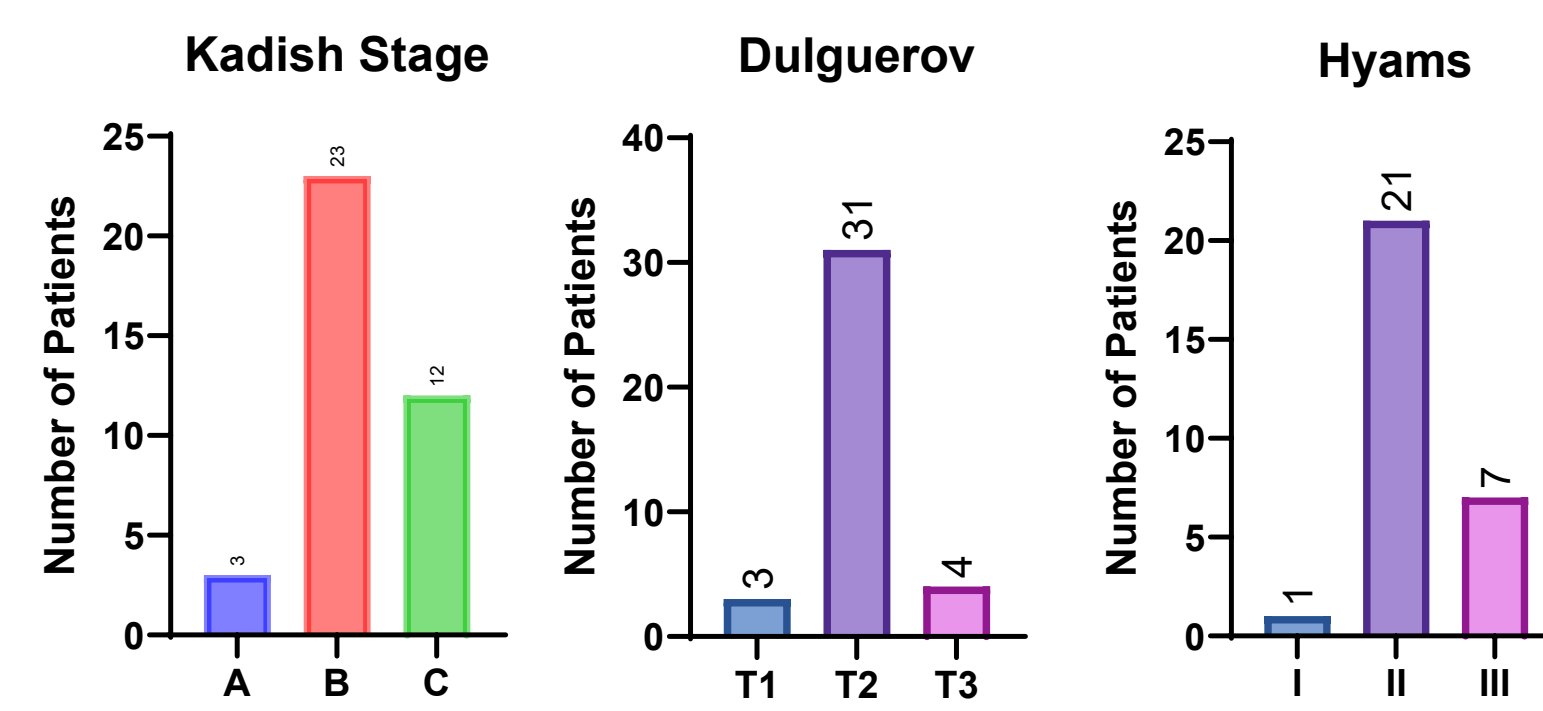
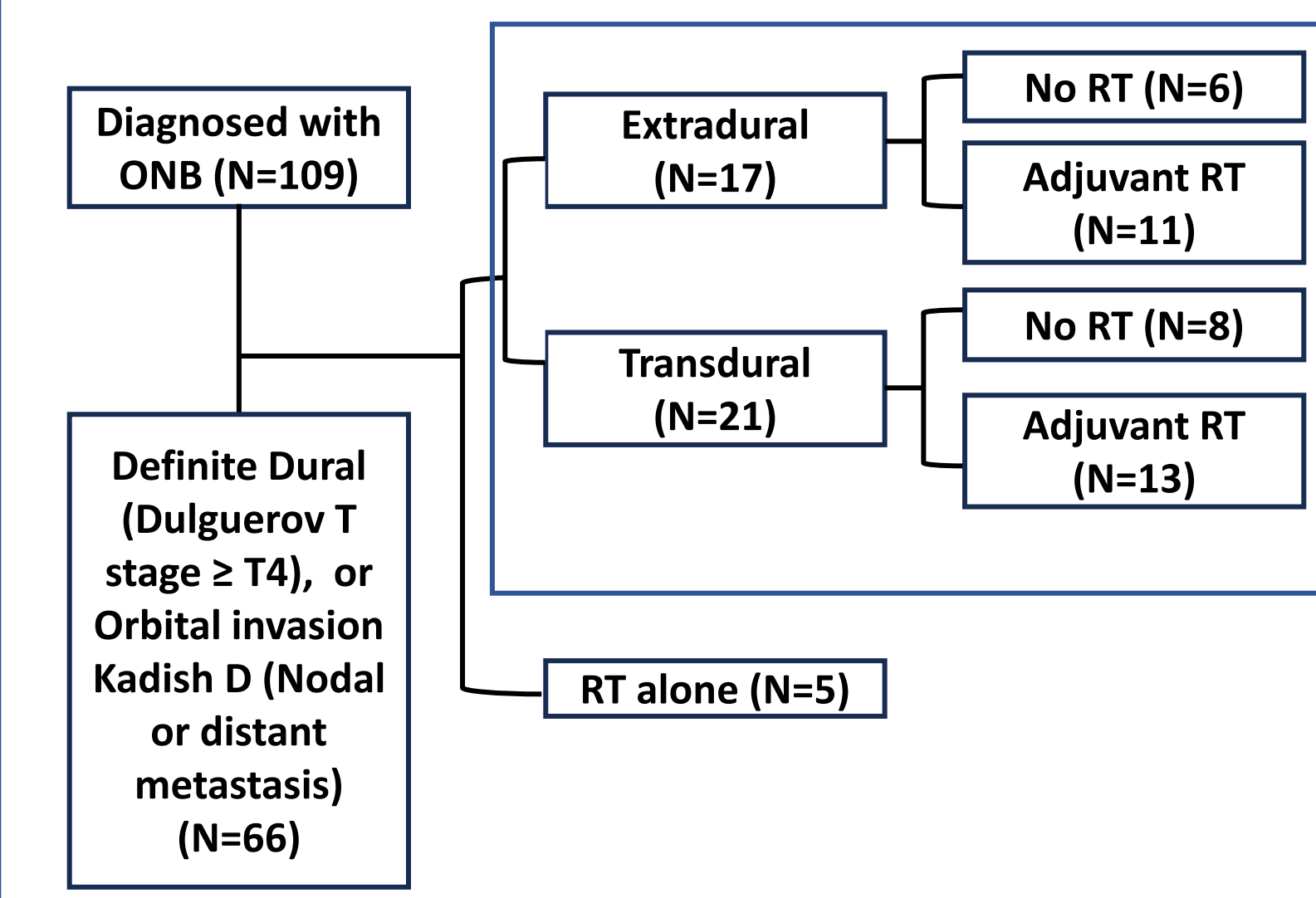
→ Evaluated **tumor stage/grade, treatment modality, survival outcomes, recurrence patterns**

## Results

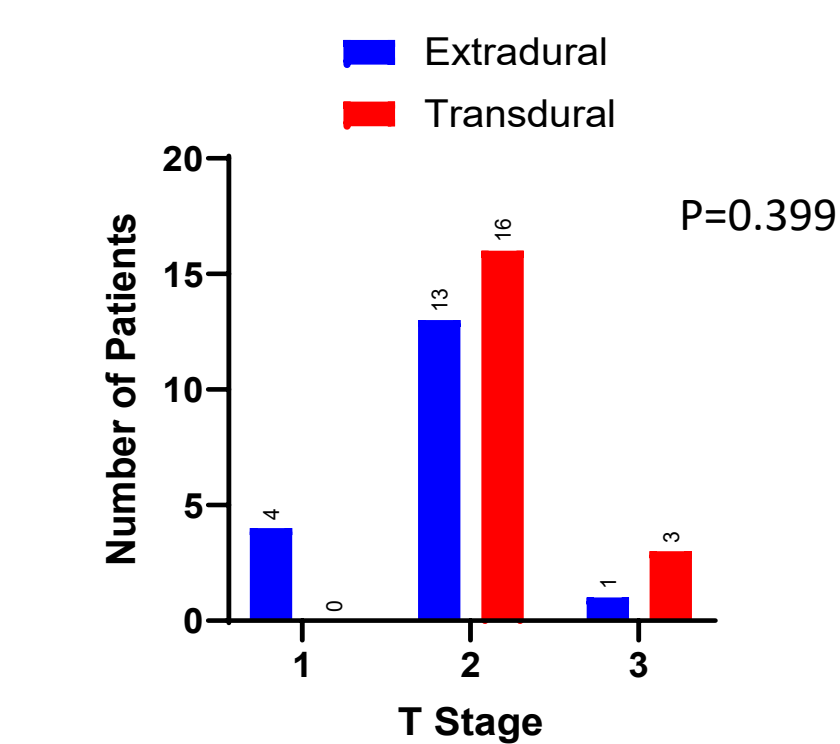
### Patient Demographics

- N = 38 (M:F ratio = 24:14), Age =  $40.6 \pm 12.9$  (years)
- Mean duration of follow up :  $102.2 \pm 82.3$  (months)

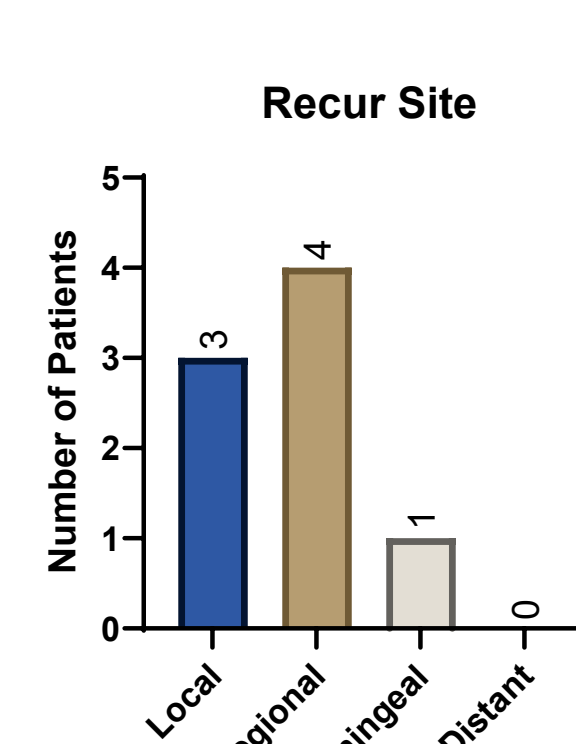
### Extent of Resection



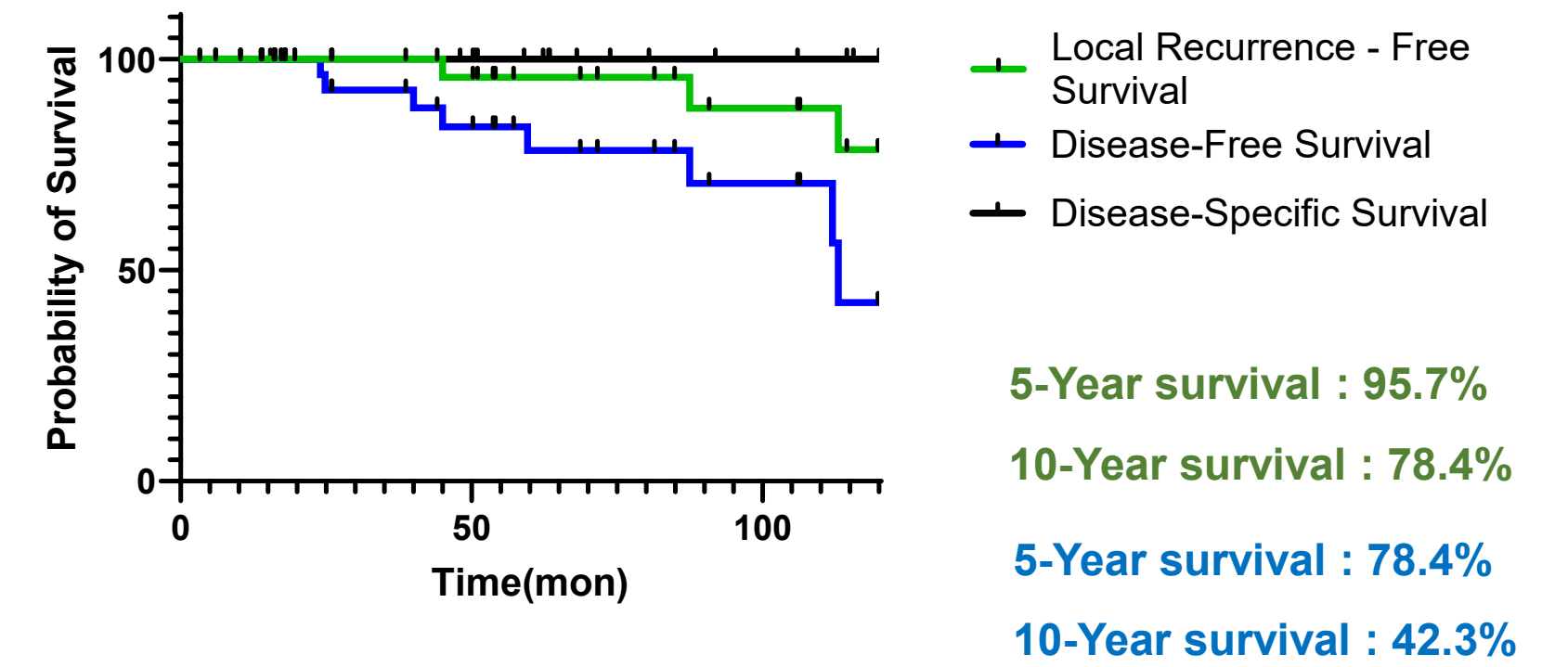
**Figure 3.** Clinical and pathological stages of patients



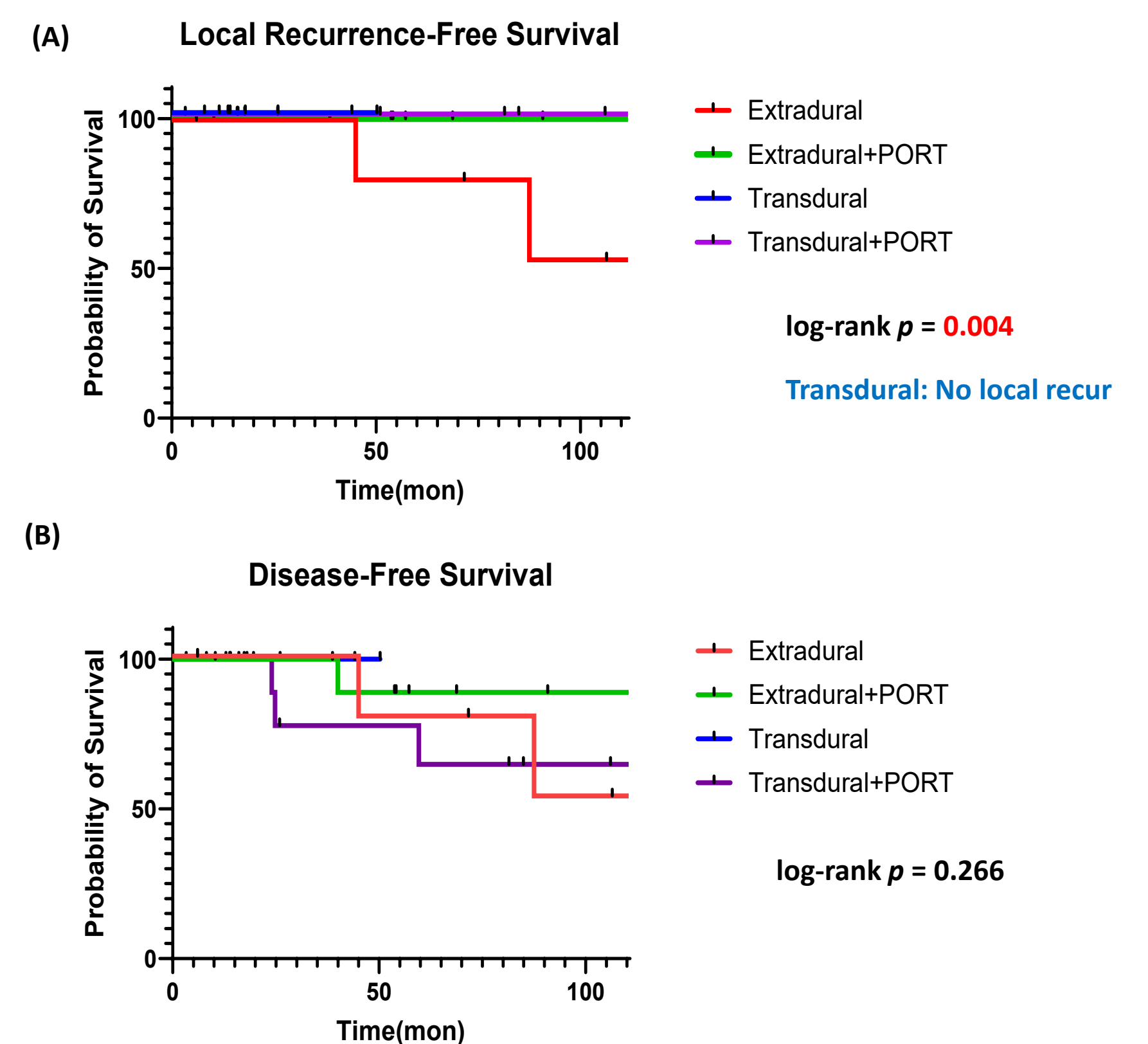
**Figure 4.** The extent of resection based on T-stages



**Figure 5.** Pattern of recurrences.



**Figure 6.** Overall local and disease-free survival.



**Figure 7.** (A) Local and (B) disease-free survival according to treatment modalities.

## Discussion

- The optimal treatment for early-stage ONB remains controversial, but overall survival tends to be favorable regardless of the treatment modality.
- Patients who underwent transdural resection showed no local recurrence during the follow-up period, and DFS did not differ based on the use of adjuvant RT. These findings suggest that adequately performed transdural resection with negative margins may reduce the necessity for adjuvant RT in early-stage ONB.
- Endoscopic resection can potentially leave microscopic tumor foci along the olfactory fibers and or adjacent dura, and adjuvant RT could help achieve local control in cases with extradural resection
- Further research with larger cohorts is necessary to validate these findings and provide more definitive guidelines regarding the extent of resection and the use of adjuvant therapy in ONB

## Conclusions

- In early-stage ONB, Transdural resection may reduce the need for adjuvant radiotherapy by guaranteeing local control.
- Adjuvant radiotherapy has been shown to decrease local recurrence, particularly in patients who undergo extradural resection.

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## References

1. Thompson LD. Olfactory neuroblastoma. *Head Neck Pathol* 2009;3(3):252-9.
2. Kuan EC, Wang EW, Adappa ND, et al. International Consensus Statement on Allergy and Rhinology: Sinonasal Tumors. *Int Forum Allergy Rhinol*. 2024;14(2):149-608.
3. Rimmer J, Lund VJ, Beale T, Wei WI, Howard D. Olfactory neuroblastoma: a 35-year experience and suggested follow-up protocol. *Laryngoscope* 2014;124(7):1542-9.
4. Snyderman CH, Gardner PA. "How much is enough?" endonasal surgery for olfactory neuroblastoma. *Skull Base* 2010;20(5):309-10.
5. Wang EW, Zanation AM, Gardner PA, Schwartz TH, Eloy JA, Adappa ND, et al. ICAR: endoscopic skull-base surgery. *Int Forum Allergy Rhinol* 2019;9(5):S145-S365.
6. Abdelmeguid AS, Bell D, Roberts D, Ferrarotto R, Phan J, Su SY, et al. Long-Term Outcomes of Olfactory Neuroblastoma: MD Anderson Cancer Center Experience and Review of the Literature. *Laryngoscope* 2022;132(2):290-7.
7. Geltzeiler M, Choby GW, Ji KSY, JessMace C, Almeida JP, de Almeida J, et al. Radiographic predictors of occult intracranial involvement in olfactory neuroblastoma patients. *Int Forum Allergy Rhinol* 2023;13(10):1876-88.
8. Mays AC, Bell D, Ferrarotto R, Phan J, Roberts D, Fuller CD, et al. Early Stage olfactory neuroblastoma and the impact of resecting dura and olfactory bulb. *Laryngoscope* 2018;128(6):1274-80.
9. Geltzeiler M, Choby GW, Ji KSY, et al. Radiographic predictors of occult intracranial involvement in olfactory neuroblastoma patients. *Int Forum Allergy Rhinol*. 2023;13(10):1876-1888.