

A 25-year Experience in Skull Base Adenoid Cystic Carcinoma: Outcomes in Open vs. Endoscopic Approaches

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Abstract

The purpose of this study was to evaluate clinicopathologic predictors of local recurrence and survival in patients with adenoid cystic carcinoma (ACC) invading the skull base. The analysis focused on open vs endoscopic approaches and survival outcomes in anterior vs lateral skull base invasion.

We present a cohort of 46 patients who underwent treatment of skull base ACC. Three patients underwent primary chemoradiation therapy, the remaining 43 underwent definitive surgical resection with or without adjuvant therapy. The analysis includes 21 men (46%) and 25 women (54%) with a median follow up of 51 months. Specific tumor sites included the 31 sinonasal cavity and paranasal sinuses (67%) and 15 parotid lesions (33%). Skull base invasion was radiographically apparent in all patients. Resection margins were positive in 38 (82%).

Endoscopic resection was employed in 11 patients (24%) and was associated with a similar DFS and OS compared to open approaches (**Figure 1, A/C**). Patients with **lateral skull base invasion** displayed prolonged DFS intervals in comparison to anterior skull base invasion (HR=4.249, $p=.0043$) (**Figure 1, D**). Those treated with primary chemoradiation therapy experienced poor survival outcomes with decreased OS compared to both endoscopic and open surgical treatment (HR=11.43, $p=.016$) on multivariate analysis. Dural invasion was associated with increased risk of death on multivariate analysis (HR=17.014, $p=0.0014$) (**Table 2**).

Introduction

- Adenoid cystic carcinoma (ACC) is a rare salivary gland neoplasm characterized by relentless local invasion, perineural spread, frequent locoregional recurrence, and late distant metastasis^{1, 2, 3}
- Given its proximity to cranial nerves, the orbit, and skull base, sinonasal ACC is particularly challenging to treat and results in significant morbidity and mortality
- Skull base invasion has been identified as an independent predictor of survival⁴
- Site specific analyses of ACC are predictably small due to the rarity of this disease
- Endoscopic skull base surgery has emerged as a preferred treatment option in recent years and remains unstudied in ACC⁵

Methods

- Records were reviewed for 46 patients with primary sinonasal or parotid ACC with confirmed skull base invasion over a 25-year period
- Analysis was performed to evaluate for clinicopathologic predictors of overall (OS) and disease-free survival (DFS)
- Univariate and multivariate analyses were used to compare outcomes and survival was assessed via Kaplan-Meier plots

Results

Patient Characteristics	No. of Patients (%)
Cases	46
Male	21 (46)
Female	25 (64)
Parotid	15 (33)
Sinonasal	31 (67)
Endoscopic Approach	11 (24)
Positive Margins	36 (78)
Nerve Margin Positive	1 (2.2)
Bone Margin Positive	16 (34.8)
Neurosurgery Assist	22 (47.8)
Pathologic Grade	
Missing	16 (34.8)
1	9 (19.6)
2	8 (17.4)
3	13 (28.3)
Adjuvant Therapy	
None	8 (19)
Radiation	32 (74)
Chemoradiation	3 (7)

Table 1. Patient, tumor, and treatment characteristics. Margin status was derived from the pathology report of the primary surgical resection. All patients with confirmed skull base invasion by radiographic and pathologic analysis. Margin status derived from primary surgical resection. Pathologic grade determines as described by Szanto et al.⁶

Variable	Reference	Hazard Ratio	95% CI	P - Value
Primary CRT (OS)	Primary Surgery	11.430	(1.57, 83.03)	0.0160
Endoscopic (OS)	Open	1.888	(0.68, 5.28)	0.2258
Dural Invasion (OS)	No Dural Invasion	17.014	(2.98, 97.12)	0.0014
Anterior Skull Base (DFS)	Lateral Skull Base	4.249	(1.57, 11.47)	0.0043
Dural Invasion (DFS)	No Dural Invasion	3.891	(0.45, 33.85)	0.2183

Table 2. Results of multivariate analysis for notable predictors of survival and recurrence. Variables identified in univariate analysis with $p<0.10$ were entered into multivariable model. Hazard ration reports increased risk of death (OS) and recurrence (DFS).

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Results

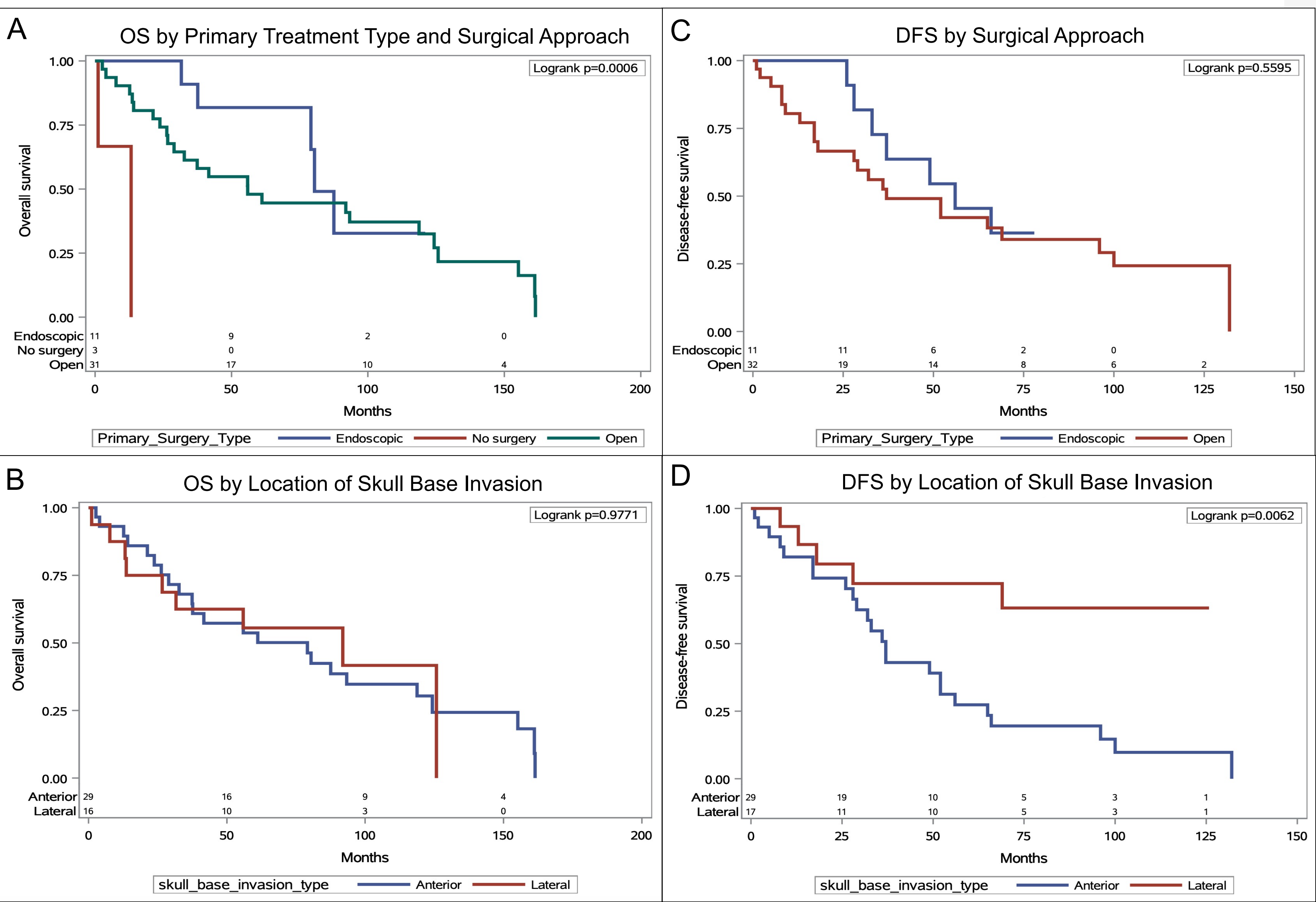


Figure 1. Kaplan-Meier Curves. A) Overall survival by primary treatment type and surgical approach. B) Overall survival by location of skull base invasion. C) Disease-free survival by surgical approach. D) Disease-free survival by location of skull base invasion.

Discussion

- Skull base ACC is exceedingly difficult to treat due to perineural spread, destruction of structures, frequent locoregional recurrence, and distant metastasis
- Skull base invasion is a key predictor of survival⁴, though independent subset analyses are rare
- Endoscopic approaches were non-inferior to open approaches in this small sample
- Non-surgical treatment resulted in significantly decreased survival, while lateral skull base invasion was associated with prolonged DFS interval.
- Further research is necessary and ongoing to assess endoscopic management of skull base ACC