



Correlation Between Intraoperative Frozen and Final Dural Margins In Sinonasal and Ventral Skull Base Malignancies

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LIFE CHANGING MEDICINE

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Key Points

1. The rate of discordant dural frozen-final margin status (indeterminate or nondiagnostic) is 9.65%
2. Indeterminate frozen margins had a 31.25% positive final margin rate
3. Individual specimen and overall tumor frozen margins have high specificity (low false positive rate)

Introduction

Sinonasal and ventral skull base malignancies can abut or invade adjacent dura. Dural involvement and positive dural margins portend negative oncologic outcomes. (1-2) Even malignancies that encroach the skull base without radiographic involvement, occult dural invasion remains high. (3) The extent of dural resection in gross or suspected dural involvement must be balanced against the increased risk to critical structures, reconstructive complexity, and cerebrospinal fluid leaks.

Intraoperative frozen margins are used to guide decision making. Discordances between frozen and final pathology occur and have been demonstrated in other settings. (4-5) To date, no data characterizes the diagnostic characteristics of intraoperative frozen assessment for dural margins in sinonasal and ventral skull base malignancies.

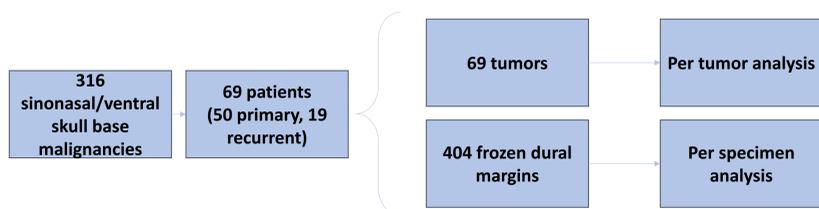
Methods and Materials

This was a single institution retrospective chart review of all sinonasal and ventral skull base malignancies treated surgically at a single center from 2010-2025 were reviewed

Eligibility criteria included

- Adult patients (≥ 18 yo), pathologic diagnosis of sinonasal or anterior skull base malignancies, treated via endoscopic endonasal approach (EEA) or combined (open/endoscopic) approach involving dural resection, complete frozen and final pathology data

Patient, tumor, treatment, and pathology data were extracted. Individual dural frozen and final specimens (per specimen analysis) as well as tumor dural frozen and final margin statuses (per tumor analysis) were compared to determine diagnostic test characteristics using a 2x2 table. Predictors of indeterminate frozen status was assessed using a stepwise multivariable binary logistic regression model.



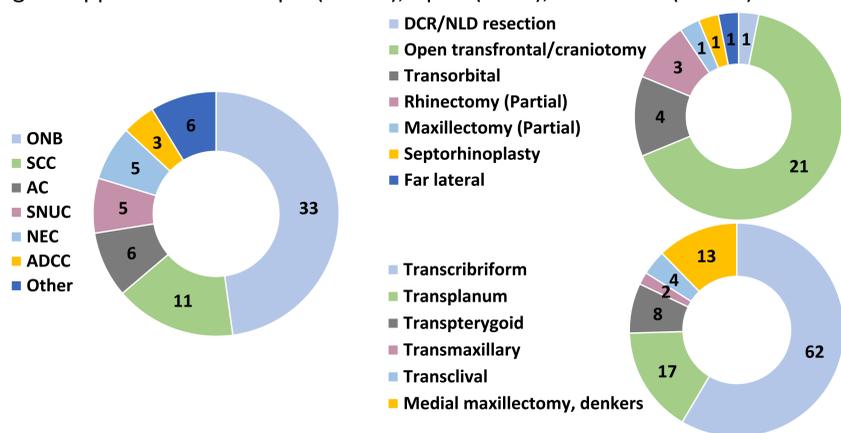
Characteristics

88.4% locally advanced stage (T3/4)

Most common sites of adjacent dura: ACF (broad), ACF (limited), frontal posterior table, planum. 29 unilateral, 40 bilateral

Radiographic involvement: 16% encroachment, 13% bone erosion, 71% dural invasion

Surgical Approach: Endoscopic (62.3%), open (4.3%), combined (33.3%)



Indeterminate Results

39 discordant results



Per Tumor

	Final (+)	Final (-)		Indeterminate Positive	Indeterminate Negative
Frozen (+)	5	3	Sensitivity	55.6%	70.6%
Frozen (-)	4	43	Specificity	93.5%	86%
Indeterminate	11		PPV	62.5%	63.2%
			NPV	91.5%	89.6%

Per Specimen

	Final (+)	Final (-)		Indeterminate Positive	Indeterminate Negative
Frozen (+)	36	10	Sensitivity	78.3%	78.9%
Frozen (-)	2	317	Specificity	99.3%	92.7%
Indeterminate	34		PPV	94.7%	64.3%
			NPV	96.9%	96.4%

Predictors of Indeterminate Frozen Margins

Binary regression model found that 7 variables were independent predictors of indeterminate specimen frozen margins ($R^2=0.386$)

- Other variables: gender, history of (CRS, connective tissue/autoimmune disease, sinonasal surgery, previous oncologic sinonasal surgery, head and neck RT, systemic therapy), neoadjuvant therapy, adjacent dura location, pathology, and primary/recurrent disease, surgical approach

Variable	Exp(B)	[95% CI]	P-value
Connective tissue/autoimmune disease	16.17	[4.25-47.38]	0.000
Adjacent sella dura	0	[4.02-138.69]	0.997
Adjacent less common dura sites (MCF/supraorbital/CS/CC)*	482.79	[35.82-13993.25]	0.000
Recurrent disease	0.07	[0.03-0.52]	0.016
SCC	7.26	[9.51-183.75]	0.002
Combined approach	4.63	[4.63- 1.812]	0.001

*Individual site EPV<10

Discussion

Frozen-final discordance in head and neck mucosal margins has been reported at 4%. (4) This study demonstrated that dural margins have a much higher discordance rate at 9.65%.

Indeterminate frozen margins were secondarily reviewed by an independent pathologist. Reasons leading indeterminate calls included

- Crush artifact requiring IHC for clarification
- Conservative reporting
- Margin may have been definitively called if more experience with rare pathologies or with second pathologist opinion

An algorithm for revising margins was not standardized. When indeterminate margins were clarified, an additional frozen (50%) or final (50%) margin was used. Both frozen or final margins clarified the final tumor margin status in 75% of cases.

Conclusions

- Frozen dural margins have high specificity in the setting of individual specimens and overall tumor margins.
- A negative and indeterminate frozen margin should be interpreted as a supplement to other pre/intraoperative factors during surgical decision making.
- Surgeons and pathologists should be cognizant of the limitations of dural frozen margins due to inaccuracy, indeterminate results, and tissue processing limitations.

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