

Predictors of Surgical Complications in Patients with Sinonasal Malignancy

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Introduction

The treatment of sinonasal and skull base malignancy is complex

These comprise only 3-5% of head and neck cancer and less than 1% of all tumors

Existing data describe mortality and complication rates from open transfacial, open craniofacial and endoscopic resections for sinus malignancy but it can be difficult to draw definitive conclusions from smaller studies due to the heterogeneity of the patient populations and outcome reporting

Identifying factors that predict unexpected surgical morbidity and mortality is key to improving patient outcomes.

Methods: Study Design

Retrospective review of a prospectively maintained database (1973-2016)

Inclusion criteria: malignancy in the paranasal sinuses and/or skull base requiring surgical resection.

Exclusion criteria: missing data in the medical record precluding retrieval of key dependent variables and outcomes data.

448 patients for analysis.

Recorded and reported for each patient:

- Demographic factors (age, sex)
- Clinicopathologic factors (comorbidities, tobacco use, alcohol use, tumor characteristics), and
- Treatment factors (surgical approach, and complications)
- Clavien-Dindo grade
- Charlson comorbidity index score

The main study endpoint was subgroup analysis of Clavien-Dindo in three groups: grade 0, grades 1-2, and grades 3-5

Results

Demographics

Patient Characteristics	All (n=448)
Age, mean(sd)	55.7(17.3)
Sex, n(%)	
Female	165(36.8%)
Male	283(63.2%)
Tobacco, n(%)	
Never	212(47.3%)
Current	63(14.1%)
Discontinued	173(38.6%)
Alcohol, n(%)	
Never	168(37.5%)
Current	225(50.2%)
Discontinued	27(6.0%)
Unknown	28(6.3%)
Comorbidity, n(%)	
No	154(34.4%)
Yes	294(65.6%)
Cardiovascular comorbidity	188(42.0%)
Severe cardiovascular comorbidity	39(8.7%)
Hepatic disease	6(1.3%)
Pulmonary disease	16(3.6%)
Renal disease	26(5.8%)
Diabetes mellitus	40(8.9%)
Charlson comorbidity index, mean(sd)	3.68(1.6)
Karnofsky Performance Score	
<50%	0
50-75%	6 (1.3%)
>75%	242 (54.0%)
Data not reported	200 (44.6%)

Tumor Characteristics

	n (%)
Orbital invasion	
No	319(71.2%)
Yes	129(28.8%)
Intracranial invasion	
No	281(62.7%)
Yes	167(37.3%)
Pterygopalatine Fossa invasion	
No	423(94.0%)
Yes	27(6.0%)
Skin invasion	
No	418(93.3%)
Yes	30(6.7%)
Grade	
Low	90(20.1%)
Intermediate	194(43.3%)
High	159(35.3%)
Unknown	29(6.5%)
Margin	
Positive (presence of tumor at the margin)	154(34.3%)
Not positive (negative, close and non-positive)	252(56.3%)
Not available/Unknown	42(9.4%)
AJCC 8th pT stage	
1-2	72(16.1%)
3-4	359(80.1%)
Unknown	17(3.8%)
AJCC 8th pN stage	
N0	422(94.2%)
N+	20(4.5%)
Unknown	6(1.3%)
AJCC 8th pM stage	
0	439(98.0%)
1	4(0.9%)
Unknown	5(1.1%)
Type of tumor	
Primary	359(80.1%)
Recurrence	80(17.9%)
Tumor site of origin	
Nasal cavity	164(36.6%)
Ethmoid sinus	112(25.0%)
Maxillary sinus	105(23.4%)
Orbit	14(3.1%)
Other	53(11.8%)

Complications

Complication types	n (%)
Mortality (30 day),	7 (1.6%)
Mortality (90 day)	9 (2.0%)
Clavien Dindo Grade 3-5 (severe complication)	61 (13.6%)
Acute bleeding or hematoma	37 (8.3%)
CSK leak	17 (3.8%)
Local infection	42(9.4%)
Systemic infection	9(2.0%)
Meningitis	9(2.0%)
Pneumocephalus (symptomatic)	11 (2.5%)
Epidural abscess, n (%)	6(1.3%)
Other, n (%)	78(17.4%)

Patient Characteristics by Clavien Dindo Subtype

Patient Characteristics	All (n=448)	Clavien Dindo=0; n=283	Clavien Dindo=1-2; n=104	Clavien Dindo=3-5; n=61	p-value
Age, mean(sd)	55.7(17.3)	54.7(17.0)	56.9(18.8)	58.5(15.2)	0.21
Sex, n(%)					
Female	165(36.8%)	112(25.0%)	32(7.1%)	21(4.7%)	0.26
Male	283(63.2%)	171(38.2%)	72(16.1%)	40(8.9%)	
Tobacco, n(%)					
Never	212(47.3%)	140(31.3%)	46(10.3%)	26(5.8%)	0.47
Current	63(14.1%)	41(9.2%)	16(3.6%)	6(1.3%)	
Discontinued	173(38.6%)	102(22.8%)	42(9.4%)	29(6.3%)	
Alcohol, n(%)					
Never	168(37.5%)	107(23.9%)	38(8.5%)	23(5.1%)	0.99
Current	225(50.2%)	142(31.7%)	53(11.8%)	30(6.7%)	
Discontinued	27(6.0%)	17(3.8%)	7(1.6%)	3(0.7%)	
Unknown	28(6.3%)	17(3.8%)	6(1.3%)	5(1.1%)	
Comorbidity, n(%)					
No	154(34.4%)	92(20.5%)	35(7.8%)	27(6.0%)	0.21
Yes	294(65.6%)	191(42.6%)	69(15.4%)	34(7.6%)	
Charlson comorbidity index, mean(sd)	3.68(1.6)	3.57(1.5)	3.88(1.7)	3.83(1.6)	0.17

Tumor Characteristics by Clavien Dindo Subtype

Tumor Characteristics	All (n = 448)	Clavien Dindo = 0; n=283	Clavien Dindo 1-2; n= 104	Clavien Dindo 3-5; n= 61	P-value
Approach					
Open	404(90.2%)	248(55.4%)	99(22.1%)	57(12.7%)	
Endoscopic and Combined (open/endoscopic)	44(9.8%)	35(7.8%)	5(1.1%)	4(0.9%)	0.01*
Margin, n(%)					
Positive (presence of tumor at the margin)	154 (34.3%)	88(19.6%)	47(10.5%)	19(4.2%)	0.08
Not positive (negative, close and non-positive)	252(56.3%)	164(36.6%)	51(11.4%)	37(8.3%)	
Not available/Unknown	42(9.4%)	31(6.9%)	6(1.3%)	5(1.1%)	
Type of tumor, n(%)					
Primary	368(82.1%)	232(51.8%)	86(19.2%)	50(11.2%)	0.99
Recurrence	80(17.9%)	51(11.4%)	18(4.0%)	11(2.5%)	
Tumor site					
Nasal cavity	164(36.6%)	109(24.3%)	32(7.1%)	23(5.1%)	0.95
Ethmoid sinus	112(25.0%)	71(15.9%)	27(6.0%)	14(3.1%)	
Maxillary sinus	105(23.4%)	64(14.3%)	26(5.8%)	15(3.4%)	
Orbit	14(3.1%)	8(1.8%)	4(0.9%)	2(0.5%)	
Other	53(11.8%)	31(6.9%)	15(3.4%)	7(1.6%)	

Multivariate Ordinal Logistic Regression Model

Variables	Ordinal logistic regression model					
	Univariate analysis			Multivariate analysis		
	Estimate(se)	P-value	OR (95% CI for OR)	Estimate(se)	P-value	OR (95% CI for OR)
Orbital invasion						
Yes vs. No	0.87(0.2)	<.0001***	2.38(1.59,3.56)	0.48(0.2)	0.0527	1.62(0.99,2.63)
Intracranial invasion						
Yes vs. No	0.68(0.2)	0.0005***	1.98(1.35,2.90)	0.16(0.2)	0.5055	1.17(0.74,1.85)
Skull base resection						
Yes vs. No	0.96(0.2)	<.0001***	2.62(1.66,4.11)	0.51(0.3)	0.0582	1.67(0.98,2.84)
AJCC 8th pT stage						
3-4 vs. 1-2	1.65(0.4)	<.0001***	5.19(2.51,10.77)	1.24(0.4)	0.0014**	3.44(1.62,7.34)
Free flap reconstruction						
Yes vs. No	0.68(0.2)	0.0012**	1.97(1.31,2.96)	0.14(0.2)	0.5785	1.15(0.71,1.86)

Results

Mean age is 55.7 years, there is a male preponderance, the majority of patients have at least one comorbidity and all patients had a Karnofsky performance score of at least 50%.

The majority of the tumors were intermediate grade, advanced T-stage, and primary presentation. The nasal cavity was the most common primary site of origin.

30 day mortality rate was 1.6% and 90 day mortality rate was 2.0%

The severe complication rate, which is defined as Clavien-Dindo Grades 3-5, was 13.6%

On multivariate analysis where we are controlling for all other variables, advanced T-stage was significantly associated with post-operative complications. Orbital invasion and skull base resection showed a trend toward an association with complications that did not reach statistical significance.

Discussion

Surgery for sinonasal malignancy is safe.

Demographic and comorbidity factors were not associated with post-operative complications.

Advanced T-stage was associated with complications.

Primary vs recurrent tumor and utilization of free flaps were not associated with post-operative complications.

These findings have implications for pre-operative risk stratification, patient selection, and informed consent.

Further research is recommended into the factors associated with post-operative complications in surgery for sinonasal and skull base tumors is needed to improve patient care.

Objectives

This study examines a large cohort of patients undergoing surgery for sinonasal malignancy with the aims of:

- (1)reporting patient demographics, comorbidities, tumor characteristics, surgical approach, and incidence of post-operative complications in a standardized way using the Clavien-Dindo and Charlson comorbidity index
- (2)analyzing factors associated with post-operative complications.

Clavien Dindo Classification

Grade	
1	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions. Acceptable therapeutic regimens are: drugs as antiemetics, antipyretics, analgetics, diuretics and electrolytes and physiotherapy. This grade also includes wound infections opened at the bedside.
2	Requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusions, antibiotics and total parenteral nutrition are also included.
3	Requiring surgical, endoscopic or radiological intervention
3a	Intervention under regional/local anesthesia
3b	Intervention under general anesthesia
4	Life-threatening complication requiring intensive care/intensive care unit management
4a	Single organ dysfunction
4b	Multi-organ dysfunction
5	Patient demise

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