# Predictors of Survival Following Carotid Blowout Syndrome

# Abstract

**Objectives:** Carotid blowout syndrome (CBS) is a rare, lifethreatening complication for patients with head and neck cancer (HNC). The primary objective was to identify factors associated with survival following CBS.

Materials and Methods: A retrospective analysis of HNC patients treated at a single tertiary care hospital with CBS between 2016 to 2020 was performed. A multivariate Cox proportional-hazards model identified independent predictors of survival. A p value of < 0.05 was considered significant. Kaplan-Meier survival analysis was performed.

**Results:** 45 patients were identified. The majority were male (80.0%) with a mean age of 64 years at time of blowout. Oropharynx was the most common primary site (48.9%) and 73.3% of patients had stage IV disease. 35 (77.7%) patients had active tumor at time of CBS. 80.0% of patients previously received RT with a mean total dose of  $62.5 \pm 14.8$  Gy. Threatened/type I, impending/type II, and acute/type III CBS occurred in 6.7%, 62.2%, and 31.1% of cases, respectively. Patients underwent either embolization (80.0%) or endovascular stent placement (20.0%). The 30day and 1-year OS rates were 70.1% and 32.0%, respectively. Primary oropharyngeal tumors (adjusted hazard ratio [aHR], 4.31 [1.30-15.15 95% confidence interval]), active tumor at time of CBS (aHR 8.21 [2.10-54.95]), ICA or CCA rupture (aHR 5.81 [1.63-21.50]), and acute/type III CBS (aHR 2.98 [1.08-7.98]) were independent predictors of survival.

**Conclusion:** Primary oropharyngeal tumors, active tumor at time of CBS, ICA or CCA rupture, and acute/type III hemorrhage were independent predictors of survival. Multidisciplinary management and prompt intervention at experienced treatment centers may improve outcomes following CBS.

# Introduction

- CBS is a devastating complication of HNC
- CBS incidence: 2.9 4.5%; mortality approx. 80%
- CBS classification: threatened (type I), impending (type II), or acute hemorrhage (type III)
- Risk factors: total RT dose  $\geq$  70 Gy, radical neck dissection, wound infection/fistula, oropharyngeal tumors
- Management includes endovascular procedures (e.g. stenting/coiling) and open surgical approach
- Predictors of survival poorly understood

## Contact

## Nolan B. Seim, MD

Characteristics         Number of Patients (%)         Characteristics         Number of Patients (%)         Characteristics           Set         Not. Description         No					esults			
<ul> <li>&gt; 60</li> <li>19 (42.2%)</li> <li>Yes</li> <li>12 (26.7%)</li> <li>No</li> <li>33 (73.3%)</li> <li>Yes</li> <li>We to the field Date</li> <li>We to the field Date</li> <li>We to the field Date</li> <li>Yes</li> <li>We to the field Date</li> <li>Yes</li> <li>We to the field Date</li> <li>Yes</li> <li>Yes<!--</th--><th>Characteristics</th><th>Number of Patients (%</th><th>) Chara</th><th>acteristics</th><th>Numb</th><th>er of Pat</th><th>ients (%)</th><th>Characteristics</th></li></ul>	Characteristics	Number of Patients (%	) Chara	acteristics	Numb	er of Pat	ients (%)	Characteristics
210     19/12-29)     Yes     12 (26, 73)     Yes     12 (26, 73)     Yes       Set     With     36 (20, 73)     No     33 (23, 35)     Yes       Set     9 (20, 95)     270 (5y     11 (46, 75)     Yes       Set     9 (20, 95)     270 (5y     15 (33, 35)     No       Set     31 (68, 95)     Yes     21 (46, 75)     Yes       Set     31 (43, 95)     Yes     21 (46, 75)     Yes       Set     31 (41, 15)     Time to Intervention     16 (33, 35)     Yes       Set     Set (11, 15)     Time to Intervention     400 (13, 16)     21 (46, 75)       Set     Set (11, 15)     Time to Intervention     14 (31, 16)     210 tors     23 (51, 15)       Set (11, 15)     Set (11, 15)     Set (11, 15)     212 barrs     23 (51, 15)       Set (11, 15)     Reptore Site     (11, 15)     Set (11, 15)       Transmal     4, 10, 25)     ICCA     7 (15, 65)       Set (11, 15)     Reptore Site     24, 453     Yes       Transmal     14 (25, 5)     ICCA     7 (16, 07)       Nonebarration     14 (25, 5)     ICCA     7 (16, 07)       Nonebarration     14 (25, 5)     ITerve Interve I	lge		Neck	Dissection?				Current Tumor et Time
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Set Image         Total Dose         Image	$\leq 60$	26 (57.8%)	No			,		
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Dad Cavity     5 (11.1%)     Proce Differentian     Admission Hgb       OpdiArymx     22 (48.9%)     -2 hours     8 (17.8%)     2 (10.1%)       Dipporting     2 (17.8%)     -2 hours     2 (51.1%)     2 10       Strinnaad     4 (8.9%)     Rupture Site     2 (61.7%)     2 10       Diprod     2 (4.4%)     CCA     7 (15.6%)     Steel       Obler     4 (8.9%)     Parach of ECA     27 (60.0%)     Steel       Nonchobersation     2 (4.4%)     Branch of ECA     27 (60.0%)     No       Stagery     1 (2.2%)     Rupture Type/Grade     No     No       Nonchobersation     2 (4.4%)     Rupture Type/Grade     No     No       Stagery / CRT     18 (40.0%)     Rupture Type/Grade     No     No       Table 1: Baseline Patient Characteristics     (continued)     Yes     No       Stagery / CRT     18 (40.0%)     1/36 (052-3.05)     0.51     Age, years     Age/disted Hazard     pratient (365% C1)     No       Yes     Stager / Refl     1.65 (0.52-3.05)     0.51     Age, years     Stager / Patient (2.2%)     No       Sono     (Refl     0.57 (0.271.20)     0.14     Continued     Image / Patient (2.2.5)     No       Non-orophytary     (Refl     0.57 (0.271.20) <td></td> <td></td> <td>No</td> <td></td> <td>15 (33</td> <td>.3%)</td> <td></td> <td>No</td>			No		15 (33	.3%)		No
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Iter         Iter (18 (40.0%))         Type (II/A cute         Id (3.11%)         Yes           Fable 1: Baseline Patient Characteristics         (continued)         Yes         (continued)           Patient Variable         Adjusted Hazard p value Ratio (95% CI)         Adjusted Hazard p value Ratio (95% CI)         Adjusted Hazard p value Ratio (95% CI)         Yes         (continued)           Sex         Male         [Ref]         Adjusted Hazard p value Ratio (95% CI)         Adjusted Hazard p value Ratio (95% CI)         If (a)	Surgery + CRT	18 (40.0%)	Type	I/Threatened	3 (6.79	2⁄0)		Mortality within 30 Day
Fable 1: Baseline Patient Characteristics       (continued)       (continued)         Patient Variable       Univariate Ratio (95% C1)       Multivariate Patient Variable       (continued)         Sex       Male       [Ref]       Adjusted Hazard       Pvalue         Hale       [Ref]       0.51       Adjusted Hazard       Pvalue         Sex       [Ref]       0.68 (0.31-1.40)       0.30	RT	1 (2.2%)	Type	II/Impending/Sentinel	28 (62	.2%)		No
Fable 1: Baseline Patient Characteristics       (continued)       (continued)         Patient Variable       Univariate Ratio (95% C1)       Multivariate Patient Variable       (continued)         Sex       Male       [Ref]       Adjusted Hazard       Pvalue         Sex       [Ref]       0.51	CRT	18 (40.0%)	Type	III/Acute	14 (31	.1%)		Yes
Univariate         Multivariate           Adjusted Hazard <i>p</i> value         Adjusted Hazard <i>p</i> value           Ratio (95% CI) <i>p</i> value         Adjusted Hazard <i>p</i> value           Sex         [Ref] <i>p</i> value <i>Ratio</i> (95% CI) <i>p</i> value           Age. years         Sec         [Ref] <i>s</i> 60         [Ref] <i>s</i> 60         [Ref] <i>s</i> 60         [Ref] <i>s</i> 60         [Ref] <i>s</i> 60 <i>s</i> 60 <i>s</i> 60         [Ref] <i>s</i> 60 <i>s</i> 70	<b>Fable 1:</b> Baseline Patient	Characteristics		tinued)				(continued)
Patient Variable Ratio (95% CI)         Adjusted Hazard Ratio (95% CI) <i>p</i> value Ratio (95% CI)           Sex Male         [Ref]			1	/	ate			
Ratio (95% CI)         Ratio (95% CI)         Ratio (95% CI)         Ratio (95% CI)           Male         [Ref]         1.35 (0.52-3.05)         0.51           Age, years         1.35 (0.52-3.05)         0.51         0.60         0.68 (0.31-1.40)         0.30           BMI, kg/M2         [Ref]         1.16 (0.53-2.41)         0.70         0.70         70         70           Primary Tumor Site         [Ref]         0.85 (0.40-1.78)         0.66         4.31 (1.30-15.15)         0.001         70           Oropharynx         [Ref]         0.85 (0.40-1.78)         0.66         4.31 (1.30-15.15)         0.001         70           Charlson/Decyo Comorbidity Score         [Ref]         0.57 (0.27-1.20)         0.14         70         70           Current Tumor at time of CBS         [Ref]         0.57 (0.27-1.20)         0.14         70         70           Yee         5.13 (1.79-21.63)         0.001         8.21 (2.10-54.95)         0.001         70           Yee         5.13 (1.79-21.63)         0.001         8.21 (2.10-54.95)         0.001         70           Total Radiation Dose, Gy          5.13 (1.62-21.50)         0.007         70         70           Rupture Type/Grade         [Ref]         2.03 (0.944	Patient Variable						90	l
Male         [Ref]         [Ref] <th]< td=""><td></td><td>•</td><td></td><td>•</td><td></td><td></td><td></td><td>*p = 0</td></th]<>		•		•				*p = 0
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Age, years       IRef       IRef <td></td> <td></td> <td>0.51</td> <td></td> <td></td> <td></td> <td>80</td> <td></td>			0.51				80	
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BMI, kg/M²       [Ref]       1.16 (0.53-2.41)       0.70         Primary Tumor Site       [Ref]       0.70       [Ref]       0.70         Non-oropharynx       0.85 (0.40-1.78)       0.66       4.31 (1.30-15.15)       0.001         Charlson/Deyo Comorbidity Score       [Ref]       50       50       50         2 ≥ 2       1.40 (0.64-2.90)       0.38       50       50       50         Treatment History for Primary       [Ref]       50			0.30				70	
≥ 20 < 20	BMI, kg/M <sup>2</sup>						70	
2.20       Primary Tumor Site         Non-oropharynx       [Ref]         Oropharynx       0.85 (0.40-1.78)       0.66       4.31 (1.30-15.15)       0.001         Charlson/Deyo Comorbidity Score        2       [Ref]       30 $< 2$ [Ref]        30       30         Treatment History for Primary       [Ref]       0.57 (0.27-1.20)       0.14       30         Current Tumor at time of CBS       [Ref]       0.57 (0.27-1.20)       0.14       30         Current Tumor at time of CBS       [Ref]       30       30       30         Yes       5.13 (1.79-21.63)       0.001       8.21 (2.10-54.95)       0.001         700       [Ref]       30       30       30         770       1.26 (0.56-1.78)       0.57       0.91 (0.36-2.42)       0.859         Rupture Type/Grade       [Ref]       30       30       30         III (Inpending/Sentinel)       [Ref]       3.60 (1.51-8.05)       0.005       5.81 (1.62-21.50)       0.007         Pre-Existing Tracheostomy at time of CBS       [Ref]       3.03 (0.151-8.05)       0.069       Type I         No       [Ref]       2.03 (0.94-4.20)       0.069       Type I       Type I     <								
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Treatment History for Primary No surgery       [Ref] 0.57 (0.27-1.20)       0.14         Current Tumor at time of CBS No       [Ref] Yes       0.57 (0.27-1.20)       0.14         Total Radiation Dose, Gy < 70       [Ref] 2 = 70       5.13 (1.79-21.63)       0.001       8.21 (2.10-54.95)       0.001         Rupture Type/Grade I/II (Impending/Sentinel)       [Ref] 2.43 (1.10-5.12)       0.91 (0.36-2.42)       0.859       20         Rupture Type/Grade I/II (Impending/Sentinel)       [Ref] 3.60 (1.51-8.05)       0.005       5.81 (1.62-21.50)       0.007         Pre-Existing Tracheostomy at time of CBS No       [Ref] 2.03 (0.94-4.20)       0.069       Type I         Admission Hemoglobin, g/dL $\geq 10$ [Ref] 1.03 (0.51-2.13)       0.92       0.92       0.007						tio	50	
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Surgery       0.57 (0.27-1.20)       0.14         Current Tumor at time of CBS       [Ref]         No       [Ref]         Yes       5.13 (1.79-21.63)       0.001         8.21 (2.10-54.95)       0.001         Total Radiation Dose, Gy	Treatment History for Primary					erv		
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Rupture Type/Grade       [Ref]         I/I (Impending/Sentinel)       [Ref]         III (Acute) $2.43 (1.10-5.12)$ $0.029$ $2.98 (1.08-7.98)$ $0.036$ Rupture Site		1.26 (0.56-1.78)	0.57	0.91 (0.36-2.42)	0.859		20	
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Table 2: Univariate & Multivariate Analyses of Prognostic Factors         Figure 1: Time to Intervention		1 00 (0 51 0 10)	0.00					<b>U</b>
	< 10	1.03 (0.51-2.13)	0.92					

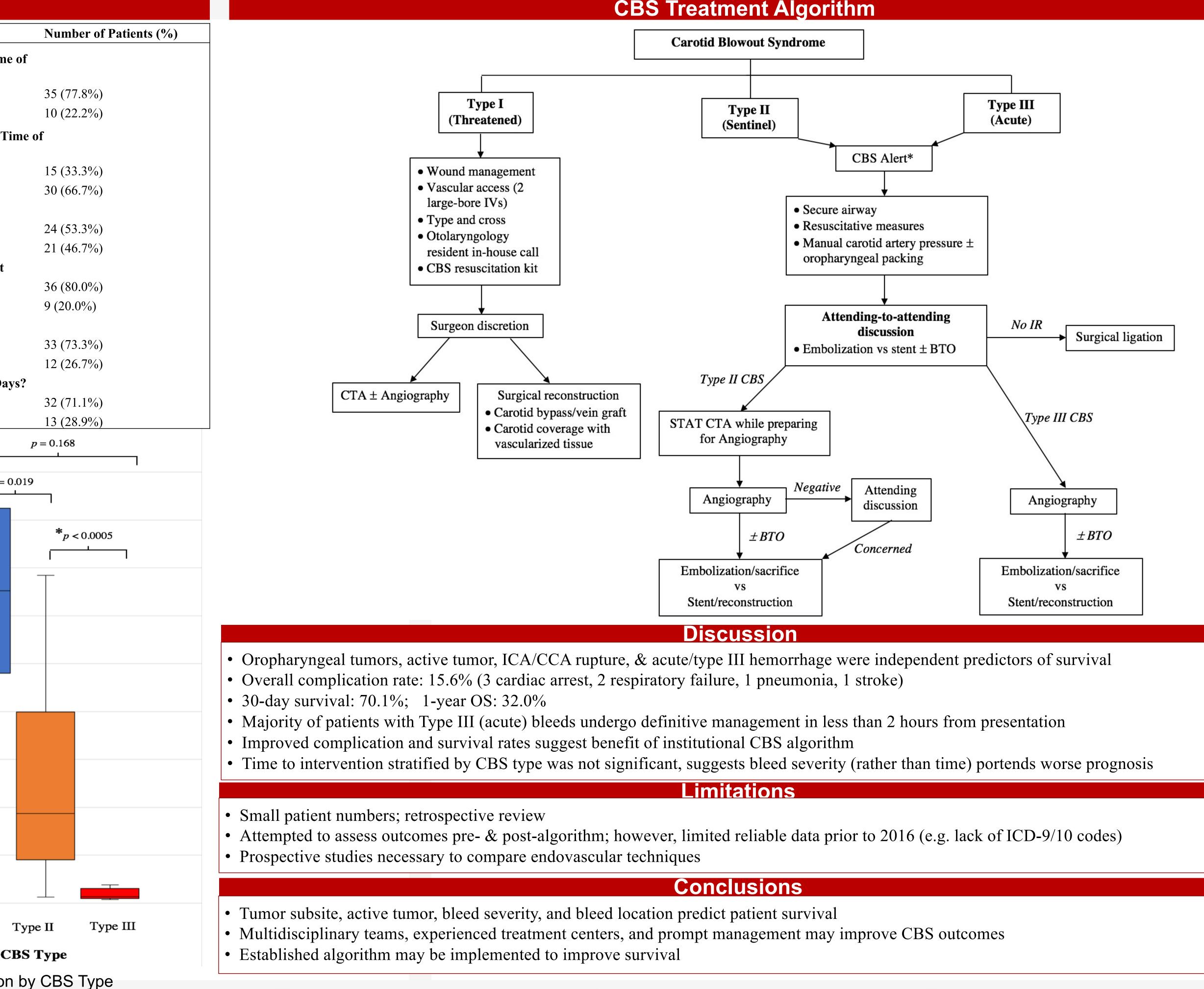
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Results

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