Race and perioperative critical airway complications in children undergoing Ear, Nose and Throat procedures

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Background

- Perioperative critical airway obstruction (CAO) including laryngospasm or bronchospasm is a potentially devastating complication of pediatric anesthesia (1). Occurrence of laryngospasm and or bronchospasm in children is frequently associated with rapid escalation of care in the perioperative period. Risk factors for these serious complications are poorly elucidated.
- Race is a well-known factor in the distribution and management of diseases (2). Indeed, many of the common risk factors for CAO appear to disproportionately affect minority children. For example, black children have higher rates of bronchial asthma, sleep disordered breathing (SDB) and obesity compared to their white peers (3). Furthermore, even in the steady state, black children often have poorly controlled disease symptomatology which puts them at higher risk for CAO (4).
- To our knowledge, no study to date has examined specific factors that may mediate racial disparities in the incidence of CAO. For example, black children have higher rates of bronchial asthma (BA), sleep disordered breathing (SDB) and obesity compared to their white peers. These preoperative respiratory disease burden may affect the racial predilection to perioperative CAO
- To date, the association of race with perioperative CAO has not been comprehensively examined (5).

Objectives

To determine the frequency of perioperative CAO and to test its association with self-reported racial category in children. We also examined differences along racial categories, the prevalence of preoperative respiratory comorbidities (PRC), such as bronchial asthma and sleep disordered breathing (SDB).

Hypothesis: Black children would experience significantly more CAO compared with their white peers. We also hypothesized that black children have higher rates of PRC than their white peers and that PRC would increase the odds of CAO.

Methods

Children aged 2-17yr (N= 7242) who underwent various ENT procedures were the subjects of this retrospective analyses.

- Documentation of laryngospasm or bronchospasm in the anesthetic record was collapsed into a dummy variable (CAO 1 = yes; 0 = no).
- Presence of SDB (habitual snoring and history of witnessed apnea) and bronchial asthma were also combined to form the PRC variable.
- Multivariable logistic regression analysis was used to calculate adjusted odds for CAO using age, gender, body mass index (BMI) category, sleep disordered breathing (SDB), bronchial asthma (BA), recent upper respiratory tract infection and use of endotracheal tube as covariates.

Results

- Among the 7242 subjects, 13.0% were black. Perioperative CAO occurred in 5.6%, laryngospasm in 4.2% and bronchospasm in 1.2% of patients.
- Being black was significantly associated with increased odds ratio (OR) of laryngospasm (OR 1.75; 95% CI = 1.33-2.29); bronchospasm (OR 3.92; 95% CI = 2.72-5.65); and CAO (OR 2.09; 95% CI = 1.68-2.61) – Fig1a.
- Notably, these associations with black race remained significant for bronchospasm (OR 4.40; 95% CI = 1.92-10.13) and CAO (OR 1.72; 95% CI = 1.04-2.83) but not for laryngospasm (OR 1.29; 95% CI = 0.69-2.39) when children with PRC were excluded (Fig.1b).
- On multivariable analysis, being black remained independently associated with increased odds of perioperative CAO (Table 1). Other factors independently associated with CAO include decreasing age, male sex, obesity, increasing ASA status and use of ETT.
- Of interest, recent URI, duration of surgery and surgical procedure groups were not independently associated with CAO.

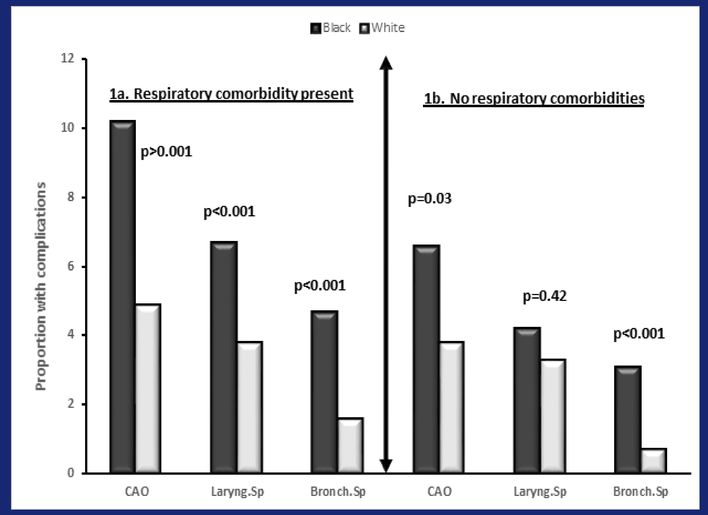

Fig 1. Percentage of patients by race by perioperative airway complications. Panel 1b shows patients without preoperative history of bronchial asthma or sleep disordered breathing. Black children were more likely to suffer perioperative airway complications even among those without preoperative respiratory comorbidities. **Abbreviations:** CAO = critical airway obstruction; Laryng.Sp = laryngospasm; Bronch.Sp = bronchospasm

Table 1. Logistic regression results for the adjusted probability of CAO among 7222 children undergoing elective ENT procedures

Variables	AOR	95% CI	*p-value*
Age (years)	0.92	0.88-0.96	<0.001
Male sex	1.53	1.13-2.08	0.006
Black Race	3.76	1.94-7.31	<0.001
BMI groups			0.098
Normal	*reference*		
Overweight	1.18	0.78-1.82	0.447
Obese	1.47	1.03-2.08	0.032
Recent URI	0.88	0.61-1.29	0.528
PRC present	1.39	0.92-2.12	0.116
PRC*Race	0.76	0.36-1.6	0.469
ASA status			0.022
ASA 1	*reference*		
ASA 2	1.39	0.91-2.11	0.125
ASA 3	2.05	1.22-3.44	0.006
Intubated yes/no	2.05	1.2-3.39	0.005
Anesthesia time (min)	1.00	1.00-1.00	0.121
Surgical procedure groups			0.476
Audiologic	*reference*		
Pharyngeal	2.05	0.79-5.34	0.138
Airway	1.33	0.68-2.58	0.399
Sino-nasal	1.31	0.57-2.96	0.521
Others	0.98	0.53-1.81	0.957
H-L test = χ^2 = 10.68, df=8; p=0.22			

Abbreviations: ENT = Ear, Nose and Throat; PRC = preoperative respiratory comorbidities; AOR = adjusted odds ratio; CI = confidence interval; H-L = Hosmer-Lemeshow test; χ^2 = Chi- square; BMI = body mass index; URI = upper respiratory tract infection; ASA = American Society of Anesthesiologists physical status.

Conclusion

- Black children were significantly more likely to suffer perioperative CAO than their white peers even among those without preoperative respiratory disorders like asthma and/or SDB.
- Mechanisms underlying this racial susceptibility to serious perioperative complications deserve further elucidation. Increased preoperative respiratory disorders in black children should alert care-givers to be more vigilant when caring for these patients.

Strengths and Limitations

- Use of data from a large cohort of patients who underwent a wide variety of common ENT procedures, which increases the statistical power needed to detect racial differences in the distribution of several variables. This also increases the clinical applicability and external validity of our findings.
- Choice of two categorical outcome variables (laryngospasm and bronchospasm) that are easily recognized by practitioners which increases the general applicability of our prediction model in routine clinical practice.
- Retrospective, observational study. Non-standard definition of outcome variables. Confounders, especially unmeasured cannot be fully excluded. Race may simply be a marker for other unmeasured factors associated CAO.

References

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