

Hyperoxia: Current Practice of Oxygen Delivery During General Anesthesia

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Background

While supplemental oxygen is routinely administered during anesthesia to prevent oxygen desaturation and optimize tissue oxygenation, oxygen delivery practices after intubation are largely unknown. Compiled evidence suggests limiting intraoperative fraction of inspired oxygen (FiO2) to below 60%. The deleterious effects of hyperoxia and the mortality benefit of conservative oxygen administration are being demonstrated in contemporary critical care literature. The lack of consensus guidelines and high level evidence on the topic of intraoperative oxygen delivery begs the question to what degree are patients being exposed to hyperoxia during general anesthesia.

The purpose of this evidence-based practice project was to better understand oxygen administration practices during general anesthesia and assess independent risk factors for hyperoxia for patients at Providence Sacred Heart Medical Center.

Methods

- A comprehensive literature review was conducted
- Institutional approval and IRB exemption determination granted
- Relevant de-identified patient data was extracted from electronic health record
- Encrypted data was stored in a HIPAA compliant REDCap database
- Inclusion criteria: Adults 18 years of age or older who received general anesthesia at PHSMC during 2018
- Patients must have been intubated with an ETT or LMA and extubated at the end of the case
- Additional exclusion criteria: ENT, thoracic, cardiac, pulmonary service lines and emergent procedures
- Median FIO2 and SpO2 from intubation to extubation were measured and analyzed
- Binary logistic regression analyzed the independent effects of hyperoxia (median FiO2 in excess of 60% while under anesthesia)
- Level of significance set to 0.05

Findings

Table 1: Baseline Demographic and Procedural Characteristics (N=10,508)

	n	%
Male	4,339	41%
Female	6,169	59%
Age (years)		
18-30	772	7%
31-50	2,365	23%
51-70	4,732	45%
>70	2,639	25%
ASA status		
1	496	5%
2	4,593	44%
3	4,512	43%
4/5	404	4%
Undetermined	503	5%
BMI (kg/m²)		
<25	2,619	25%
25-30	3,263	31%
>30	4,416	42%
Undetermined	210	2%
Comorbidities		
COPD/Emphysema	986	9%
Smoker	4,810	46%
Surgical Service (top 5)		
Orthopedics	2,184	21%
General	1,984	19%
Obstetrics/ Gynecology*	1,668	16%
Neurosurgery	1,278	12%
Urology	996	9%
	Mean	SD
Age (years)	58	16
	Median	IQR
Duration of surgery (min)**	104	68-154

*Includes gynecology oncology
**From intubation to extubation



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Findings (cont.)

Figure: 1 Median FiO2 from Intubation to Extubation (N=10,508)

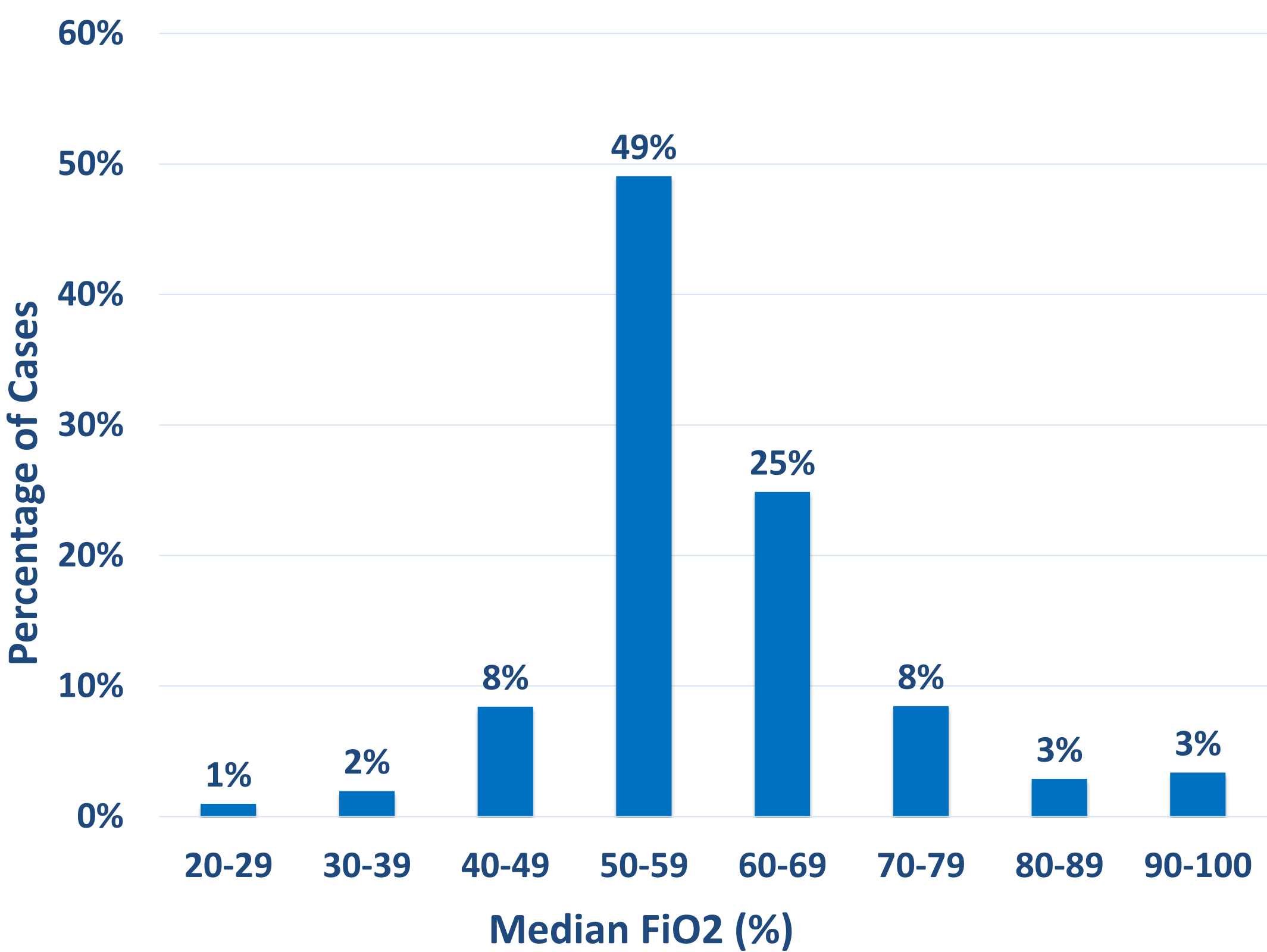


Table 2: Independent Risk Factors for median FiO2 greater than or equal to 60%

	OR	95% CI	p
Age (in decades)	1.05	1.03-1.08	<0.001
ASA 3+	1.25	1.15-1.36	<0.001
BMI 30+	1.08	0.99-1.17	0.06
Case Duration (hours)	0.68	0.65-0.7	<0.001
COPD	1.01	0.87-1.17	0.9
Female gender	1.22	1.12-1.33	<0.001
Smoker	1.08	0.99-1.17	0.07

Discussion

Of the cases reviewed for this project, 39% of the patients were exposed to median FiO2 in excess of 60% during anesthesia. Median FiO2 from intubation to extubation largely fell between 50% and 70% and SpO2 averaged 99%. Independent risk factors for median FiO2 in excess of 60% included higher ASA status, increasing age, and female gender. Case duration was inversely independently related. No effects were observed from smoking, COPD or BMI. Further studies are needed to evaluate the implications of oxygen exposure during general anesthesia and the safety and feasibility of more conservative intraoperative oxygen administration. The emerging evidence will likely prompt providers to be more mindful of oxygen delivery practices during anesthesia.

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