Pediatric Procedural Sedation and Laryngospasm: How Much Should I Worry?

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Laryngospasm, although rare, is one of the most feared sedation-related adverse events facing clinicians performing procedural sedation in the emergency department (ED). Airway obstruction caused by involuntary and sustained closure of the vocal cords is an acute, potentially life-threatening airway emergency. To date, because of its rare occurrence, even the largest ED procedural sedation cohorts have been too small to precisely quantify the prevalence and risk of laryngospasm. In this issue of *Annals,* Cosgrove et al[1] from the Pediatric Sedation Research Consortium report on the largest cohort of laryngospasm events (n=913) in children among 276,832 sedations performed outside of the operating room. The occurrence of laryngospasm was rare, with an overall prevalence of 0.33% (95% confidence interval [CI] 0.31 to 0.35) and a prevalence of 0.18% (95% CI 0.11 to 0.31) among children who were sedated in the ED. ED sedations (n=7,414, 2.7%) represented a minority of sedations performed in this multi-institution collaborative, and the procedures, patients, and medications differ from those in the ED setting. Despite these differences, the large sample size in the study by Cosgrove et al[1] allows for more precise estimates and insight into this serious adverse event for clinicians providing emergency sedation.

Patient and procedure factors with the potential to stimulate the periglottic area, such as active asthma or recent upper respiratory tract infection and airway procedures, have been shown to increase the risk of laryngospasm in patients undergoing general anesthesia, while ketamine has been the principal risk factor of concern in emergency medicine studies.[2-4] Cosgrove et al[1] found many of the same risk factors for sedations performed outside of the operating room as for general anesthesia; however, they found that ketamine administered alone did not increase the risk of laryngospasm. This surprising discovery is contrary to previous emergency sedation reports, including the 2016 meta-analysis by Bellolio et al[4] where 31 of 34 laryngospasm events occurred with ketamine alone, with an absolute risk of 4.2 in 1,000 sedations. It is possible that ED studies have contained too few non-ketamine sedations to reliably detect this rare adverse event. In the largest prospective ED sedation cohort in children (n=6,295), the most frequently administered medications after ketamine alone were propofol ± fentanyl (n=970), followed by a combination of ketamine and propofol (n=851).[5] In the study by Cosgrove et al,[1] nine medications or combinations had sample sizes of >5,000 sedations, providing more insight into medication as a risk factor for laryngospasm than that provided by any previous report. They found that the risk of laryngospasm was highest with a combination of ketamine and propofol, resulting in 2.5 times the odds compared with propofol alone (95% CI 1.4 to 4.5). Although these odds are significant, the absolute risk of laryngospasm is still low with this medication combination: approximately 1 in 200 sedations. Further, the likelihood of having to use maneuvers beyond repositioning the airway and bag-valve-mask ventilation (ie, muscle relaxant/intubation) is far lower—about 1 in 4,000 sedations. To put this into context, unpublished data from 4 pediatric EDs (annual census range 40,000 to 85,000) suggest the average pediatric emergency physician provided deep or dissociative sedation to approximately 40 children in 2021. Based on these numbers and the risk of laryngospasm reported by Cosgrove et al,[1] a physician administering procedural sedation in a pediatric ED would be tasked with managing a case of laryngospasm every 5 years, with 1 significant intervention (ie, muscle relaxant/intubation) every 100 years.

To date, the 2010 case-control study from the individual patient meta-analysis of 8,282 ketamine sedations in children by Green et al[6] has provided the best available insight into the risk factors of laryngospasm that are specific

to ED patients. The authors concluded that laryngospasm was an idiosyncratic event—no association with young age, ketamine dose/route, or oropharyngeal procedures was found. The difference between these findings and those from Cosgrove et al[1] could be because of the small number of laryngospasm events (n=22) in the study by Green et al[6] and/or because ED patients and procedures are unique. In the study by Cosgrove et al,[1] the most common indication for sedation was medical imaging (41%); 21% had significant underlying health problems (American Society of Anesthesiology [ASA] classification ≥III), and the most commonly used sedation medication was propofol alone in 52% of sedations, whereas in ED sedation cohorts, procedures were brief and painful (orthopedic reduction most common); <1% had significant underlying health problems, and propofol alone was infrequently administered (<4%).[5] Emergency physicians primarily provide sedation for short, painful procedures in healthy children, likely decreasing patient risk.

Recognizing that their overall cohort was not directly generalizable to the ED, Cosgrove et al[1] performed a sensitivity analysis of the sedations performed in an "ED-similar setting." They included patients sedated in the ED (n=7,414), radiology (n=113,564), pediatric floor, and subspecialty clinic (sample size not provided) and excluded patients assigned an ASA class of ≥III in this subanalysis. Sedations performed in radiology are systematically different from those performed in the ED; yet, they were the primary drivers of this analysis, accounting for over 90% of included patients. Greater insight into the ED-specific risks would have been gained by restricting this analysis to the 7,414 ED patients.

So what does this mean for emergency medicine sedation? We know with confidence that the occurrence of laryngospasm is rare—approximately 3 in 1,000 sedations performed outside the operating room, and this number may even be lower in the ED setting. Serious outcomes are very rare but do occur. Risk factors to be aware of are as follows: young age (<1 year), patients with upper respiratory tract infections, patients categorized as ASA class III or higher, procedures involving the upper airway, and sedation with a combination of ketamine and propofol. It is uncertain whether these factors are directly translatable to ED sedations; however, knowing these patient- and medication-related risk factors can help inform emergency physicians in sedation planning. The findings of Cosgrove et al[1] support continued confidence in ketamine as a single agent to provide safe and effective sedations for children. Laryngospasm associated with procedural sedation is a rare event regardless of the clinical setting, drug administered, or procedure performed—however, the risk is not zero—reinforcing that all sedation clinicians must be skilled in airway rescue.

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