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APNEIC OXYGENATION BY NASAL CANNULA AND SAFE APNOEA TIME DURING AIRWAY MANAGEMENT IN PEDIATRIC PATIENTS BY ANAESTHETIC TRAINEES.

Anaesthesiology

Dr. Natasha Saha* Post Graduate Trainee, Department of Anaesthesiology, Assam Medical College and Hospital, Dibrugarh, Assam, India. *Corresponding Author

Dr. Diganta Saikia M.D., FIAPA(Hons), Professor, Department of Anaesthesiology, Assam Medical College and Hospital, Dibrugarh, Assam, India.

Dr. Karuna Kumar Das M.D., Professor and Head, Department of Anaesthesiology, Assam Medical College and Hospital, Dibrugarh, Assam, India.

ABSTRACT

Background- Apnoeic nasal oxygenation prolongs the time until desaturation during intubation of patients but there is less evidence in children. The aim was to determine if apnoeic oxygenation during intubation of children by anesthetic trainees will prolong the interval before desaturation. **Methods-** This retrospective observational study done in patients over 2 years old in Pediatric Surgery department in Assam Medical College compared intubation data for 30 patients intubated by anesthetic trainees under baseline practice (no nasal cannula) to 30 patients enrolled after adoption of routine apneic nasal cannula oxygenation at 5L/min. **Results-** The median elapsed time to cross threshold of SpO2 95% in no cannula group was 151.6 seconds (CI: 136-180) and 269.97 seconds (CI: 236-290) in cannula group. SpO2 95% or below was in 10% cases in cannula vs 47% cases in no cannula group. SpO2 90% or below was 3% cases vs 23% in no-cannula group. Apnoeic oxygenation reduced attending anesthesiologist intervention in 10% cases in cannula and 33% cases in no cannula group. **Conclusion-** Apneic oxygenation via nasal cannula during intubation of pediatric patients reduces the occurrence of hypoxemia and prolongs the time before desaturation, therefore extending the safe interval for airway management by anesthetic trainees.

KEYWORDS

Children, Intubation, Desaturation.

INTRODUCTION

Children have critically-important physiologic differences from adults and have reduced apnea tolerance which increases the risk for desaturation[1] .Oxygen saturation gradually decreases as apnea period during the airway management is prolonged [2]. In this study, apneic oxygenation was carried out via nasal cannula at the rate of 5L/min flow rate during intubation of the patients.

OBJECTIVE

The objective of the study is to compare and determine if apneic oxygenation during intubation of children by anaesthetic trainees will prolong the interval before desaturation.

LACUNAE

- Observer bias.
- Small sample size.

MATERIALS AND METHODS

- **Study type**- Hospital based prospective observational study.
- **Place of study-** Department of Anaesthesiology, Assam Medical College.
- **Study population-** Children aged 2 years to 10 years.
- **Study period:** 6 months
- **Sample size:** 30 in each of two groups.
- **Ethical clearance:** Obtained from Institutional Ethics committee of AMC&H.
- **Consent**: Written and informed consent were taken from parents of all children

Inclusion Criteria

1. Patients aged 2 years to 10 years.
2. Patients scheduled for elective surgery under general anaesthesia.
3. Patients with ASA I and II and only without respiratory diseases.
4. Patients with normal cardiorespiratory function

Exclusion Criteria

1. Patients at risk of gastric aspiration and known difficult airway.
2. Patients with active disease process, such as active RTI, or exacerbated asthma or cystic fibrosis etc.

Sample Size Estimation

- Assuming level of significance (α) as 0.05 and the power of the study as 0.80 (β= 0.20) and in an attempt to detect an effect size of 0.6, concerning the primary study outcome variable (PAED score), we found that 26 patients will be needed to answer our research question.
- Considering a 10 % chance of loss to follow up, we will include 60 patients with 30 in each group by rounding off our study population.

Methodology Proper

- Participants were enrolled after evaluation in the preoperative area and study eligibility determination by the attending anesthesiologist.
- The same Datex Ohmeda workstation was used in all children with the same circuit volume.
- Upon arrival to the operating room suite, standard ASA monitors were applied and oxygen saturation was monitored.
- Basic demographic information and vitals were recorded before premedication with midazolam..
- Propofol, fentanyl, and atracurium were used at the attending anesthesiologist's discretion to induce apnea and facilitate tracheal intubation**.**
- All patients underwent oral tracheal intubation.
- Baseline (no nasal cannula) group patients: were preoxygenated via face mask with 100% O2 at 10 L/min.
- Apneic Oxygenation group patients: nasal cannula were placed after removal of the mask and oxygen delivered at a rate of 5 L/min.
- Peripheral blood oxygen saturation percentage (SpO2) was recorded after the patient became apneic.
- Apnoea was judged by lack of respiratory effort by the attending anesthesiologist, just before mask removal

Primary Outcome Measure

- The elapsed time to either successful intubation or SpO2 = 95 %, whichever occurred first, was recorded simultaneously with the procedure.
- It was left to the attending anesthesiologist's discretion to intervene as clinically necessary e.g.
  - apparent inability of trainee to intubate,
  - concerning oxygen desaturation,
  - time pressure to start the procedure, and
  - concern for tissue trauma, etc.

Secondary Outcome Measures

- Secondary outcomes in this study were the number of patients whose SpO2 dropped below 95% and 90% and the lowest SPO2 observed.
- The number of patients who needed intervention of attending anaesthesiologist.

Statistical Analysis

- Data were recorded and tabulated using MS EXCEL.
- Statistical analysis was done using SPSS software .
- Binary demographic and perioperative variables were compared between groups with Fisher's Exact test, and other categorical variables with chi.square test.
- The primary outcome, elapsed time before SpO2 fell to 95% was expressed as mean and standard deviation.
- The binary secondary outcomes (attending.physician intervention, and whether SpO2 fell to defined thresholds) were analyzed with Fisher's Exact test and relative risk calculation.

The p value of less than 0.05 was considered statistically significant

RESULTS

Table 1: Demographic Variables

Variable	No.cannula	Cannula (ApOx)
ASA: I, II, III	9,14,7 29,45,26 %	8,17,5 26,56,18%
Emergent status: yes, no	1, 29 Yes=3%	1 Yes=1%
Age, years	5(2.4,10)	4(2.8,9.9)
Gender: f, m	13(f), 17(m) 44%(f)	12(f), 18(m) 42%(f)
Weight, kg	13.5(10.5,19)	14.7(10.3,19.9)
Height, cm	96.2(87.2,113)	95.8(85,106.8)

Continuous variables are reported as median and (interquartile range). Categorical variables are reported in counts and as percentages.

Table 2: Perioperative Variables

Variable	No.cannula	Cannula (ApOx)
Room air SpO2, %	97(95-99)	97(95-99)
Pre-oxygenation SpO2, %	100 (100, 100)	100 (99, 100)
Premedication type: none, midazolam, other	10, 19, 1	11,19,0 37%, 63%,0%
Fentanyl at induction, µg	15(10,20)	15(10,20)
Propofol at induction, mg	30 (20, 50)	30 (20, 50)
Sevoflurane at induction, %	5.9(4.6,7.2)	6(5,6.5)
N2O used at induction: y, n	10,20 33%yes	7,23 23% yes
Atracurium used at induction: y, n	5, 25 15% yes	7,23 23% yes

Continuous variables are reported as median and (interquartile range). Categorical variables are reported in counts and as percentages.

Table 3 : Results For Primary Outcome

Patients Group	Elapsed time(sec)	SD	p value
Cannula	269.9	14.09	<0.0001
No cannula	151.6	13.41	

Primary outcome, the elapsed time before SpO2 fell to 95% was expressed as mean and SD, p value < 0.0001 indicating statistical significance between the two groups.

Table 4: Results For Secondary Outcome

	NO CANNULA	CANNULA (ApOx)	p value (95% CI)
Did SPO2 fall to 95%? Yes, No	14 ,16 47% Yes	3,27 10 % Yes	0.0042 (CI: 0.04 -0.69)
Did SPO2 fall to 90%? Yes, No	7,23 23% Yes	1,29 3% Yes	0.022 (CI: 0.01-0.461)
Intervention needed by attending anesthesiologist? Yes, No	10,20 33% Yes	10,20 33% Yes	0.028 (CI: 0.01-0.53)
Lowest SpO2 observed, %	95 (89, 99)	97 (88,100)	< 0.0001

Binary outcomes are reported in counts and percentages. Lowest observed SpO2 is reported as median with (interquartile range).p value <0.05 is considered statistically significant

DISCUSSION

- The median elapsed time to cross threshold of SpO2 95%:
  - in no cannula group was 151.6 seconds (CI: 136-180),
  - in cannula group 269.97 seconds (CI: 236-290).
- SpO2 95% or below: in 10% cases in cannula vs 47% cases in no cannula group.
- SpO2 90% or below: in 3% cases vs 23% in no-cannula group.
- Apnoeic oxygenation reduced attending anesthesiologist intervention:
  - in 10% cases in cannula, and
  - 33% cases in no cannula group.
- Our patients didn't experience observable SpO2 decline during intubation by anesthetic trainees.
- This study is similar to another pediatric study by Vukovic and colleagues with 4 L/min for patients under 2 years of age and 6 L/min for ages 2.12. [1]
- Studies among adults (or mostly adults) have reported flow rates up to 15 L/min with simple nasal cannula as safe. [3]
- High.flow humidified oxygen delivery has been studied, with reported flow rates from 10 to 50 L/min depending on age and delivery modality.

Confounding Factors

- Patients' clinical status might affect oxygenation or contribute to increased oxygen consumption rate,
- Differences in demographics and baseline SpO2 between the two groups might also affect the result, and
- The reliability of the pulse oximeter used might affect the detection of hypoxemia.

CONCLUSION

- From our study, it has been observed that apneic oxygenation via nasal cannula at the rate of 5L/min during intubation of pediatric patients:
  - reduces the occurrence of hypoxemia,
  - prolongs the time before desaturation, and therefore extends the safe interval for management by anesthetic trainees.
- Thus, this technique may be useful during airway management by trainees as it
  - allows more time,
  - reduces stress on the trainee and the attending anesthesiologist, while
  - maintaining the saturation and hopefully the safety of the patient.

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