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Does Pre-Extubation Nasal Air Flow Attenuate Emergence Delirium Among Pediatric Surgical Patients? A Worth Exploring Envisaged Randomized Controlled Trial

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Origin Of Hypothesis

The role of air flow across nasal passage and paranasal sinuses in relation to keeping the brain cool is often debated [1]. Similarly, the role of brain temperature in relation to cognition, sleep and delirium is also debated [2-4]. Therefore, anesthesiologists have a simple opportunity to explore, investigate and document whether there is any concrete evidence to settle this debate [5-9]. This opportunity lies in the fact that (a) intubated and anesthetized patients have their faces and heads covered with plastic sheets of forced-air warming blankets to counter hypothermia due to anesthesia medications inducing thermoregulatory changes; (b) emergence from anesthesia leads to resetting of thermoregulation with a rise in temperature back to normalcy; (c) there is a window during emergence from anesthesia when patients have not yet been extubated but are consciously awakening; and (d) as emergence delirium often happens when patients are emerging from anesthesia, the respiratory needs are being met by the endotracheal tube in situ but the brainsâ€™ needs are still interrupted with no air flowing across their noses and paranasal sinuses.

Here are some questions:

- Do awake but intubated patients agitate against plastic sheets of upper body forced-air warming blankets covering their faces?
- Does anesthesia/sedation interfere with patientsâ€™ awareness to the non-physiological environments created under plastic sheets of upper body forced-air warming blankets covering faces of intubated patients until patients are emerging at the end of anesthesia or during sedation vacation periods in the intensive care units?
- Is obstruction to passive heat loss from face/brain one of the reasons why awake intubated patients become more uncomfortable if plastic sheets of upper body forced-air warming blankets covering their faces appear to be interfering with thermoregulation in the scenario of already absent nasal air-flow due to endotracheal tube in situ-based ventilation?
- Do anesthetized brains generate less heat than awake brains thus preventing poor neurological outcomes in intubated anesthetized patients despite obstructed passive heat loss from face/brain?

Moreover, there can be some concerns whether artificial nasal air flow will be intolerable to patients. However, nasal air flow may never be intolerable naturally unless nasal air flow is delivered within enclosed spaces like facemasks which create non-physiological hot and humid in-mask microclimates [10]. Therefore, the only concern about nasal air flow delivered by nasal prongs may be related to the nasal prongs themselves touching and thus irritating oversensitive intranasal skin and mucosa. Similarly, already administered anesthetics and sedatives like opioids, benzodiazepines, propofol and dexmedetomidine may themselves decrease the incidence of emergence delirium thus confounding the true incidence of emergence delirium and true efficacy of physiological nasal air flow in countering emergence delirium. In palliative medicine and hospice care, oxygen and even air flowing to patients' noses and evenÂ patients' faces have been used to calm terminally ill patients demonstrating terminal agitation and terminal restlessness [11].

Therefore, the envisaged null hypothesis can be that with or without pre-extubation nasal air flow via nasal prongs, there may be no difference in the incidence of emergence delirium among intubated pediatric surgical patients during emergence from anesthesia. Hence, the purpose of the envisaged randomized controlled trial can be to ascertain if pre-extubation nasal air flow via nasal prongs can decrease the incidence of emergence delirium among intubated pediatric surgical patients during emergence from anesthesia.

Envisaged Materials And Methods

The study can be a randomized controlled trial among 120 pediatric surgical patients aged 6 years and younger emerging from anesthesia after undergoing general endotracheal tube anesthesia wherein upper

body forced-air warming blanket placement is feasible [12]. Exclusion criteria can be (a) patients aged 7 years and older, (b) premorbid unilateral or bilateral nasal obstruction, (c) surgeries planned in prone or lateral position, and (d) surgeries wherein upper body forced-air warming is infeasible.

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Per inclusion criteria, pediatric patientsâ€™ parents/guardians can be consented for enrolling their wards into the study. After consent, induction and maintenance of anesthesia can be as per standard protocol. At emergence of anesthesia, patients can be divided into two groups based on computerized randomization:

Intervention group: Patients can receive nasal cannula pre-extubation and medical air can flow intranasally at 2 L/min until extubation

Control group: Patients can receive nasal cannula pre-extubation and medical air can flow intranasally at 0 L/min until extubation

After extubation, oxygen can flow intranasally at 2 L/min in all the patients [13].

Following parameters can be recorded:

- Age in months
- Sex
- Height/Length in cm
- Weight in kg
- Time A: Anesthesia start time (Room-In Time)
- Time B: Surgery end time (Time When Pre-Extubation Nasal Cannula Inserted)Â
- Time C: Extubation time in operating room (excluded if extubation postponed to post-anesthesia care unit)
- Delirium emergence score during period between Time B and Time C
  - Whether thrashing around that is requiring restraint [14]
- Any Residual Neuromuscular blockade
- Dose of Rescue Dexmedetomidine Given
- Thermal image of face and temperature readings at right aural canal, right temple and right superiomedial orbital area [15]
  - First Image and three readings before pre-extubation nasal cannula attachment
  - Second image and three readings after extubation and nasal oxygen ongoing
- Total Dose of preoperative and intraoperative opioids
- Total Dose of preoperative and intraoperative anxiolytics
- Total Dose of intraoperative anesthetics
- Total Dose of intraoperative muscle relaxants
- Total Dose of preoperative and intraoperative crystalloids
- Total Dose of intraoperative colloids
- Total Dose of intraoperative blood products
- Bladder Scan for postoperative bladder volume [16]

Statistical Analysis

Assuming incidence of emergence delirium is 50% in pediatric population [17] and pre-extubation nasal air flow may decrease it to 25%, 58 patients may be needed in intervention group as well as in control group (Power=0.80; alpha error < 0.05) [18]. Thus, rounding the numbers, total 120 patients can be enrolled in the study. Data can be analyzed and compared for the incidence of emergence delirium and need for rescue dexmedetomidine doses, and changes in thermal image of face and infrared temperature at right aural canal, right temple and right superomedial orbital areas among the patients in the intervention group vs. in the control group. Proportions can be compared with Chi Square test (Fisher Exact Tests). Means can be compared with ANOVA. A p value of < 0.05 can be considered significant.Â

Expected Line Of Results

Assuming that the envisaged null hypothesis may get rejected with the results of the envisaged study, the expected line of results can be that the incidence of emergence delirium (thrashing around requiring restraint) among those who may receive pre-extubation nasal air flow intranasally at 2 L/min may be significantly less as compared to among those who may receive pre-extubation nasal air flow intranasally at 0 L/min. Moreover, the incidence of rescue dexmedetomidine administration as well as total doses of rescue dexmedetomidine administered among those who may receive pre-extubation nasal air flow intranasally at 2 L/min may be significantly less as compared to among those who may receive pre-extubation nasal air flow intranasally at 0 L/min. Finally changes in thermal image of faces as well as changes in temperature at right aural canal, right temple and right superiomedial orbital area among those who may receive pre-extubation nasal air flow intranasally at 2 L/min may be significantly less thus temperature readings overall remaining significantly lower and cooler as compared to among those who may receive pre-extubation nasal air flow intranasally at 0 L/min.

Conclusion

Summarily, this simple pharmacological intervention-based study envisaged as a follow-up to another envisaged study with non-pharmacological

intervention [19] may validate or refute the envisaged incidence of patientsâ€™ temperature readings remaining lower (meaning patientsâ€™ brains remain cooler) with pre-extubation nasal air flow with less demonstration of pre-extubation emergence delirium (meaning less thrashing around) requiring less administrations of rescue dexmedetomidine.

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