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Can prophylactic Dexamethasone play a role in reducing extubation failure? A retrospective observational study conducted among PICU patients in King Saud Medical City, Riyadh, Saudi Arabia, 2022

Rasha K Almubarak[1], Abdullah K Albahrani[1], Reem S Alshail[2], Aseel E Alghonimy [2], Abdulhadi N Alhaiz [3], Abdulaziz S Alaqil[3]

[1]Pediatric Intensive Care Fellow, King Saud Medical City, Riyadh, Saudi Arabia

[2]Pediatric Resident, King Saud Medical City, Riyadh, Saudi Arabia

[3]Respiratory Therapist, King Saud Medical City, Riyadh, Saudi Arabia

RESERACH

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Corresponding Author:
Rasha K Almubarak
Department of Pediatric Intensive Care
King Saud Medical City,
Riyadh, Saudi Arabia
AHSAR@windowslive.com

ABSTRACT

Background

Endotracheal intubation is an essential life-saving resuscitative procedure.

Aims

Our research seeks to establish whether the prophylactic use of Dexamethasone before removing a breathing tube is associated with a reduced risk of extubation failure.

Methods

A retrospective observational study was conducted at the Pediatric Intensive Care Unit (PICU) of King Saud Medical City, a tertiary center in Riyadh, Saudi Arabia. Children aged between 0 and 14 years who underwent mechanical ventilation for 48 hours were given Dexamethasone 0.5mg/kg every 6 hours beginning 12-24 hours prior to plan extubation. Patients were monitored for extubation failure and the appearance of stridor.

Results

74 patients enrolled in the study. There was no significant association found between the use of Dexamethasone and prevention failure of extubation with a p-value of 0.8 .

Conclusion

We found that the prophylactic use of Dexamethasone failed to prevent extubation failure.

Key Words

Dexamethasone, Extubation failure, Reintubation, Postextubation stridor

What this study adds:

1. **What is known about this subject?**

There is a common worldwide practice of using dexamethasone as a prophylactic measure for post-extubation stridor.

2. **What new information is offered in this study?**

No significant association was found between the use of dexamethasone and the occurrence of post-extubation stridor

3. **What are the implications for research, policy, or practice?**

We need more studies addressing this subject in order to identify the benefit of steroid use as a pre-extubation measure, and whether it plays a role in the severity of post-extubation stridor.

Background

Endotracheal intubation is a pivotal life-saving resuscitative procedure commonly indicated in various clinical scenarios. Its indications encompass a spectrum of critical conditions, such as compromised respiratory drive, uncertain airway patency, hypoxia, and hypercarbia.

The patient's mental condition, potential airway issues, consciousness level, breathing rate, respiratory acidosis, and oxygenation level are all examined to assess these signals[1].

All invasive procedures have some complications. Complications post-intubation include laryngeal edema, vocal cord paralysis, tracheal stenosis, and laryngeal granuloma. Laryngeal edema, a frequently encountered complication, tends to occur more regularly when endotracheal intubation exceeds 36 hours[2].

Using an Endotracheal Tube (ETT) makes it challenging to directly see the upper airway and identify swelling caused by laryngotracheal injury. Nevertheless, a cuff leak test can indirectly evaluate upper airway blockages in intubated patients. A decrease in Cuff Leak Volume (CLV) can predict the development of laryngotracheal edema in high-risk individuals[3-5]. These complications could result in extubation failure, characterized as the inability to maintain independent breathing after removing an endotracheal tube. Extubation failure is connected to an increased risk of nosocomial pneumonia, extended stays in the intensive care unit, potential mortality, and heightened morbidity.

Studies have shown that reintubation has been linked to a mortality rate that has been estimated to range from 30% to 40% [6,7]. According to reports, a range of 1% to 17% of patients in the Intensive Care Unit (ICU) experience post-extubation airway obstruction, necessitating the need for reintubation[8-11].

Therefore, any intervention that increases the chances of successful extubation is of great interest.

Prophylactic steroid treatment, mainly using Dexamethasone, has been suggested as a potential intervention to lower the incidence of post-extubation failure. Nevertheless, the effectiveness of prophylactic dexamethasone administration remains a topic of on-going debate, with conflicting findings reported in the literature. Only a few randomized trials involving adults have examined the advantages of corticosteroid treatment before extubation[12,13]. Some studies found it helpful [14-16], while others did not [17,18].

To shed further light on this matter, our study aimed to determine whether prophylactic administration of Dexamethasone before extubation was associated with a decreased risk of extubation failure in pediatric patients.

Additionally, we aim to evaluate the incidence of reintubation due to upper airway obstruction in ventilated pediatric patients.

Data collection and analysis

Our retrospective observational study occurred within the Pediatric Intensive Care Unit (PICU) of King Saud Medical City, a tertiary center in Riyadh, Saudi Arabia. The study population includes all pediatric patients aged between 0 and 14 years who were admitted to the PICU and underwent endotracheal intubation with mechanical ventilation for at least 48 hours. We focused on patients experiencing their first elective extubation from 1 January 2022 to 30 December 2022.

Inclusion Criteria

The inclusion criteria encompassed patients aged 0 to 14 years who received endotracheal intubation and mechanical ventilation for at least 48 hours and were scheduled for their first elective extubation. Moreover, patients were included if they received prophylactic Dexamethasone at a dosage of 0.5mg/kg every 6 hours, commencing 12-24 hours before extubation.

Exclusion Criteria

Patients recently treated with steroids, those intubated for laryngotracheal disease, or patients who have experienced unsuccessful extubation in the past due to upper airway blockage were excluded from the study. Furthermore, cases of accidental extubations and patients with an intubation and mechanical ventilation duration of less than 24 hours were excluded.

Data Collection

Patient data was meticulously recorded, and the following parameters were included in the data collection process: age, gender, weight, length of stay in the PICU, administration of corticosteroids (Dexamethasone) prior to extubation, use of post-extubation Non-Invasive Ventilation (NIV), time from the initiation of mechanical ventilation until the first extubation, incidence of post-extubation stridor, and occurrences of extubation failure leading to reintubation, see demographic date in (Table 1).

Statistical Considerations

All relevant data was entered in an Excel data sheet for systematic organization. Subsequently, our data was analyzed using the (SPSS) software. We used a chi-squared test for the qualitative analysis with a p-value < 0.05 indicating statistical significance.

Ethical Considerations

The study strictly adheres to good clinical practice standards and regulations. Ensuring the confidentiality of patient information, including names, medical records, and identification numbers, remains of utmost importance. The research has obtained approval from the Institutional

Review Board (IRB) committee, affirming the ethical integrity of the study.

Results

Seventy-four patients fulfilled our study criteria. The statistical analysis, employing the chi-squared test with a significance level of 0.05, indicated that no significant association was discovered between the use of Dexamethasone and the failure of extubation ($p = 0.8$), as well as between the use of Dexamethasone and the utilization of non-invasive ventilator support ($p = 0.14$).

However, significant findings for the relationship between the use of Dexamethasone and the occurrence of post-extubation stridor ($p = 0.047$), Results were presented in Table 2.

The p-value for the relationship between the use of Dexamethasone and prevention failure of extubation was determined to be 0.8, signifying insignificance in this association. Similarly, the p-value of 0.14 for the relationship between the use of Dexamethasone and not using a non-invasive ventilator post-extubation did not reach statistical significance.

However, we found that post-extubation stridor was higher in the dexamethasone group, which means Dexamethasone failed to prevent the occurrence of post-extubation stridor

Discussion

The findings from this retrospective observational study provide insights into the impact of prophylactic Dexamethasone administration on specific extubation-related outcomes in pediatric patients. The lack of statistical significance ($p = 0.8$) between the use of Dexamethasone and extubation failure suggests that the prophylactic administration of this corticosteroid does not appear to influence the overall rate of failed extubation attempts. This discovery is in accordance with previous research that has demonstrated varied outcomes concerning the effectiveness of Dexamethasone in reducing extubation failure rates.

Interestingly, our study did identify a statistically significant association ($p = 0.047$) between the use of Dexamethasone and the incidence of post-extubation stridor. This outcome implies that prophylactic Dexamethasone administration fails to prevent the occurrence of post-extubation stridor, a known complication that can impede extubation success and extend the duration of intensive care.

Moreover, the lack of a statistically significant relationship ($p = 0.14$) between the use of Dexamethasone and non-invasive ventilator utilization suggests that this corticosteroid might not be a decisive factor in preventing the need for post-extubation respiratory support with non-invasive ventilation.

Our study's nuanced and contrasting outcomes emphasize the multifaceted nature of extubation-related variables and the potential variability in patient responses to prophylactic interventions such as Dexamethasone. Our findings underscore the importance of individualized patient assessment and clinical judgment in determining the most suitable extubation strategies, accounting for factors beyond the use of Dexamethasone alone.

Our study carried a few limitations such as a small sample size and a single center experience, however, considering the fact that it is the first study discussing this topic in Saudi Arabia, these limitations can be overcome by conducting future studies on a larger population and including multiple centres.

Conclusion

In conclusion, our retrospective observational study provides valuable insights into the effects of prophylactic Dexamethasone administration on extubation-related outcomes in pediatric patients.

No significant association was observed between the use of Dexamethasone and the prevention of extubation failure.

Given the limitations inherent to retrospective studies and the potential confounding variables, further prospective investigations are warranted to comprehensively elucidate the role of prophylactic Dexamethasone in enhancing extubation outcomes. Clinicians should consider these findings within the broader context of patient characteristics, underlying conditions, and extubation protocols when making informed decisions regarding the prophylactic use of Dexamethasone in pediatric patients undergoing extubation.

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PEER REVIEW

Mohammed Hassan Alqahtani
NICU consultant
Alyamamah hospital, Riyadh, Saudi Arabia
Alqahtani770@gmail.com
Tareq Jamal Alenezi
PICU consultant, Prince Sultan military medical city, Riyadh, Saudi Arabia
Tjalanezi@gmail.com
Abdulrahman Eid Alhowaiti
PICU consultant, King Saud Medical City, Riyadh, Saudi Arabia
Dr.alhowaiti85@gmail.com

CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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Not applicable

ETHICS COMMITTEE APPROVAL

This study has been approved by the institutional review board committee of King Saud Medical City, Riyadh, Saudi Arabia.

Tables

Table 1: Demographic data for the study population

Demographics		Participants [N (%)]
Gender	Male	53 (71.6%)
	Female	21 (28.3%)
Nationality	Saudi	68 (91.8%)
	Non Saudi	6 (8.1%)
Age	0-11M	49 (66.2%)
	1Y – 5 Y	19 (25.6 %)
	> 5Y- 14 y	6 (8.1%)
Weight	< 5 KG	36 (48.6%)
	5- 10 KG	21 (28.37%)
	>10	17 (22.9%)
	KG	
stay in PICU	2 D –5 Days	29 (39%)
	>5 Days	19 (25.6%)
	>10 Days	26 (35%)

Table 2: Results of the study population.

Variables	Cases (n=49)	Control (n=25)	p value
Failure of extubation (reintubation)	14%	12%	0.8
Post extubation stridor	14%	0%	0.047
Use of NIV post extubation	37%	20%	0.14

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