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Original Article

Comparison Between I-Gel And Endotracheal Tube For Peak Airway Pressure During General Anesthesia In Pediatric Inguinal Hernia Surgeries

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ABSTRACT

Objective: To compare I-gel and Endotracheal tube for peak airway pressure during general anesthesia in pediatric inguinal hernia surgeries

Study Design: Quasi experimental study.

Place and Duration of Study: Anesthesia/surgical department, Pak Emirates Military Hospital Rawalpindi, Pakistan Jun to Nov 2021.

Methodology: A Quasi experimental study was conducted on 250 children. Patients were randomly assigned into two groups. Group-A received the I-gel after induction with sedative agents while Group-B received the Endotracheal tube with routine induction and muscle paralysis. Peak airway pressure was monitored by the consultant anesthetist on anesthesia workstation throughout the surgery.

Results: Out of 250 pediatric patients undergoing hernia repair randomized into two groups, 136(54.4%) were categorized into Group-A and 114(45.6%) were categorized into Group-B. Mean age of patients in our study was 3.35±2.454 years. 159(63.6%) children included in the study were male while 91(36.4%) were female. Out of 250, 202(80.8%) patients had normal peak airway pressure during the surgery while 48(19.2%) had raised pressure during the surgery. Use of Endotracheal tube was found statistically significantly associated with raised peak airway pressure during the surgery (p-value<0.05).

Conclusion: Use of I-gel was found better in relation to maintenance of peak airways pressure as compared to Endotracheal tube in pediatric patients undergoing hernia repair under general anesthesia.

Keywords: Endotracheal tube; I-gel; inguinal hernia; Peak airway pressure

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INTRODUCTION

Pediatric surgery and anesthesia are emerging specialties in our part of the world with very few trained experts.[1,2] Management of airway during the surgery is primary job of anesthetist and become difficult in case of pediatric population. Number of traditional and new methods have been used by anesthetists across the globe to secure the airway during pediatric surgeries and maintain airway pressures in normal range.[3]

Inguinal hernia has been one of the most commonly encountered surgical pathologies in children of very young age group.[4] Sometimes it may be bilateral or part of some syndromic illness and make clinical picture more difficult for the treating team.[5] Last few years have been very promising regarding evolution of pediatric anesthesia as a specialty enabling the pediatric surgeon to carry out these complex procedures with much ease.[6]

Multiple methods have been used for years to manage the airway among the pediatric patients undergoing various elective or emergency surgeries. A review of 230 cases published by Hipolito et al. in 2020 concluded that I gel TM method of intubations was a better method from all aspects in terms of airway management for hernia repair surgery via laparoscopic methods.[7] Su et al. in 2021 revealed that laryngeal mask airway was a better option in non-complex cases but ETT may be used in complex cases.[8] Kohli et al. in 2019 studied Indian pediatric patients undergoing laparoscopic inguinal hernia repair for comparison of I-gel vs. Endotracheal intubation for adequacy of ventilation. They came up with the findings that I-gel was a better option for the task in terms of adequacy of ventilation, increase in peak airway pressure and other postoperative complications.[9]

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Pediatric anesthesia is still not a separate specialty in Pakistan and adult anesthetist usually manage the pediatric surgery cases. Burden of pediatric surgery is enormous in Pakistan. A recent study highlighted the epidemiological findings relevant to pediatric inguinal hernia surgeries and suitable methods of herniotomy.[10] Limited local data has been generated regarding best choice for airway maintenance during general anesthesia for various pediatric surgeries. We therefore planned this study with the rationale to compare I-gel and Endotracheal tube for peak airway pressure during general anesthesia in pediatric inguinal hernia surgeries performed at Pak Emirates Military Hospital Rawalpindi.

METHODOLOGY

This Quasi experimental study was conducted at the anesthesia/surgical department of Pak Emirates Military hospital Rawalpindi from Jun to Nov 2021. Sample size was calculated by WHO Sample Size Calculator by keeping confidence Interval at 95%, margin of error at 6% and using population proportion of airway problems during general anesthesia in inguinal hernia surgeries 35.5%.[11] Sample size was calculated to be 250 patients.Non probability Consecutive sampling technique was used to gather the sample and then all the patients were randomized into two groups.

Inclusion criteria: All patients between the age of 01 and 08 years who underwent surgery for inguinal hernia repair were included in the study.

Exclusion criteria: Patients with less than one year of age or those with any syndromic features or comorbids. Those who had any complications during the surgery or excessive bleeding or prolonged surgery were not included. Patients suffering from any respiratory complications before surgery or those who were ASA II, III or IV were excluded as well.

After ethical approval from the ethical review board committee (IREB Letter no: A/28/EC/383/2022) patients fulfilling the criteria set for study were recruited. Written informed consent was taken from primary care givers which were usually one of the parents. Routine antibiotics and other pre-anesthetic medications were given to each patient as per the hospital protocol and condition of the patient. Patients were randomly divided into two groups via lottery method. Group-A received the I-gel after induction with sedative agents while Group-B received the Endotracheal tube with routine induction and muscle paralysis. Sedation was achieved by injection Propofol 1-2.5mg/kg and muscle paralysis was achieved with injection Atracurium 0.5mg/kg. Peak airway pressure was monitored by the consultant anesthetist on workstation throughout during the surgery. For the purpose of blinding the health professional who assessed the peak airway pressure and the person who assessed the data did not know regarding the group of the patient and details that which mode was used for the patient they have been assessing for the peak airway pressure. Patients also did not know about this information. Hernia repair in all the patients was performed by consultant pediatric surgeon via routine protocol.[12]

Endotracheal intubation with sedation and muscle paralysis was performed by consultant anesthetist. I-gel was used according to manufacturer recommendations. Normal peak airway pressure was taken as 20-25 cmH20. [13,14]

Frequency and percentages for gender and the type of airway used was calculated. Mean and standard deviation for age of the children included in study was calculated as well. Chi-square analysis was performed to look for any significant association between various socio-demographic variables and high peak airway pressure. The *p*-value less than or equal to 0.05 was considered as significant. Statistical Package for Social Sciences (SPSS 23.0) was used for all the above mentioned analysis.

RESULTS

Out of 250 pediatric patients undergoing hernia repair randomized into two groups, 136(54.4%) were categorized into Group-A and 114(45.6%) were categorized into Group-B. Mean age of patients in our study was 3.35±2.454 years. 159(63.6%) children included in the study were male while 91(36.4%) were female. Table-I summarizes the general characteristics of study participants. Out of 250, 202(80.8%) patients had normal peak airway pressure during the surgery while 48(19.2%) had raised pressure during the surgery. 193(77.2%) had weight within range while 57(22.8%) babies did not fall in range for weight for age. 231(92.4%) had unilateral hernia while 19(7.6%) had bilateral hernia.

Table-II summarized the findings of statistical analysis. Use of Endotracheal tube was found statistically significantly associated with raised peak airway pressure during the surgery (*p*-value<0.001) while age (*p*-value-0.181), gender (*p*-value-0.402) and weight for age of babies included in the study (*p*-value-0.252) had no significant association with raised peak airway pressure during the surgery in pediatric patients managed surgically for inguinal hernia.

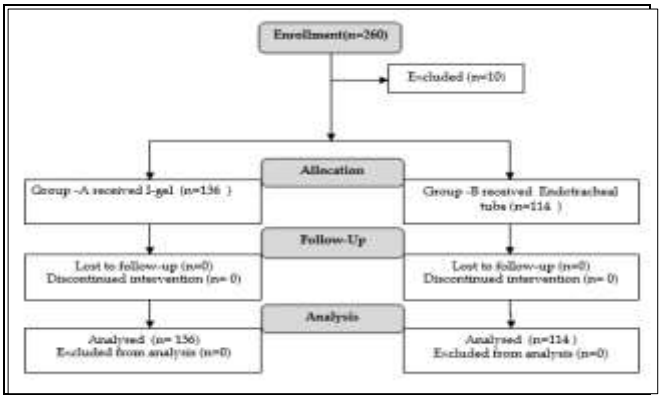

Figure: Patient Flow Diagram

Table-I: Characteristics of Study Participants (n=250)

Parameters	n(%)
Age (years)	
Mean + SD	3.35 ±2.454 years
Range (min-max)	1 year - 8 years
Gender	
Male	159 (63.6%)
Female	91 (36.4%)
Type of airway	
I-gel	136 (54.4%)
Endotracheal intubation	114 (45.6%)
Weight for age	
Within range	193 (77.2%)
Below or more than range	57 (22.8%)
Type of hernia	
Unilateral	231 (92.4%)
Bilateral	19 (7.6%)

Table-II: Factors Associated With Increase In Peak Airway Pressure In Children Operated For Inguinal Hernia (n=250)

Factors	Normal peak airway pressure	Increased peak airway pressure	*p*-value
Age			
<4 years	154(76.2%)	32(66.7%)	0.181
4-8 years	48(23.8%)	16(33.3%)	
Gender			
Male	131(64.8%)	2 (58.3%)	0.402
Female	71(35.2%)	20(41.7%)	
Weight for age			
Within range	159(78.7%)	34(70.8%)	0.252
Blow or more than range	43(21.3%)	14(29.2%)	
Type of airway			
used			
I-gel	126(62.4%)	10(20.8%)	<0.001
Endotracheal intubation	76(37.6%)	38(79.2%)	

DISCUSSION

Repair of inguinal hernia is one of the most commonly performed pediatric surgery procedures. Airway maintenance is always a challenge for anesthetists in pediatric surgery procedures. Endotracheal intubation and supra-glottic airway devices, both have been used to maintain airway in different types of pediatric surgeries. Still there is no fix guideline to choose a specific method for this purpose as all methods have their own merits and demerits. The objective of this study was to compare I-gel and Endotracheal tube for peak airway pressure during general anesthesia in pediatric inguinal hernia surgeries.

Goyal *et al*.[15] in 2020 in their study revealed that I-gel device was a safe and effective option and provided adequate airway maintenance during the surgery. They studied number of safety parameters in their patients and found I-gel device superior to other methods used for this purpose. Our study was better in design from that of Goyal *et al*. as we compared the two methods and found out that I-gel method for airway maintenance during hernia repair under general anesthesia is better than ETT.

Dhanda *et al*.[16] in 2017 conducted a study came up with the conclusion that use of cuffed Endotracheal tube was inferior to I-gel in maintaining airway in terms of efficacy and safety.[16] Our study results supported the results generated by Dhanda et al. as use of Endotracheal tube was found statistically significantly associated with raised peak airway pressure during the surgery (p-value<0.05).

Respiratory complications were analyzed in patients undergoing laparoscopic hernia repair by Nevešćanin *et al*.[17] These complications were compared in children managed with laryngeal airway and ETT. It was concluded that laryngeal airway was associated with lesser number of complications and anesthesia time. We had similar results in our study as use of I-gel was found better in relation to maintenance of peak airways pressure as compared to Endotracheal tube in pediatric patients undergoing hernia repair under general anesthesia.

Kim *et al*. in 2015 conducted a randomized controlled trial and concluded that when air-Q SP method was compared to I-gel method, I-gel method turned out to be superior in all airway parameters and safety profile as compared to air-Q SP method.[18] Our

comparison group was slightly different but our results also supported use of I gel device.

LIMITATION OF STUDY

We encountered few limitations while we conducted this study. Only peak airway pressure was made part of the study while it is understood that various respiratory and hemodynamic parameters may get affected by use of different airway devices. Though a lot of confounding factors were taken care of in inclusion/exclusion criteria but still there were a lot of other factors which could affect the respiratory parameters among the study participants. Future studies involving multiple gynecological units with stricter methodology may generate generalizable results.

CONCLUSION

Use of I-gel was found better in relation to maintenance of peak airways pressure as compared to Endotracheal tube in pediatric patients undergoing hernia repair under general anesthesia.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MAR & BY: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

HMT & MH: Data acquisition, data analysis, approval of the final version to be published.

MMS & ASK: Critical review, concept, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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