# *The Security Assessment of General Anesthesia in Children with Mild to Moderate Upper Respiratory Tract Infection*

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## Abstract

**Objectives**: To evaluate the security of general anesthesia for different class of elective surgery in children merger with mild to moderate upper respiratory infection (URI).

**Methods**: 207 cases of children who undergoing general anesthesia for elective surgery, were divided into three groups, non-URI group (unURI group, n=140), mild URI group (miURI group, n=50), moderate URI group (moURI group, n=17), according to the preoperative symptoms and signs of the upper respiratory tract infection. Monitoring and recording the respiratory-related complications of children through perioperative and postoperative period. The article compares the differences in the incidence of various complications between groups, according to hierarchical classification of surgery.

**Results**: (1) Compared with unURI group and miURI group, the incidence of secretions and cough in moURI group were increased ($P<0.05$), during perioperative and postoperative period in surgical Ⅲ-Ⅳ class children. The incidence of respiratory complications between the three groups showed no significant difference in surgical Ⅲ-Ⅳ class children during perioperative and postoperative period ($P>0.05$). (2) The incidence of laryngospasm, bronchospasm, breath holding (Time≥30s) and $SpO_2<90\%$ showed no significant difference between the three groups ($P>0.05$). (3) Compared with the perioperative period the incidence of complications in postoperative period overall downward, but no statistically significant difference between the groups ($P>0.05$).

**Conclusions**: It is relatively safe to implemented tracheal intubation general anesthesia for the children merger with mild URI or moderate URI in Ⅲ-Ⅳ surgical class. But surgical Ⅲ-Ⅳ class children with moderate URI need a comprehensive assessment between the risks and benefit relationship before general anesthesia.

**Key Words**: Upper respiratory infection; Pediatric general anesthesia; Complications; Security

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## Introduction

Whether pediatric patients who merger with upper respiratory tract infection (URI) should be delayed elective surgery anesthesia, has been one of the most contentious issues in the field of pediatric anesthesia[1]. Conventional wisdom considers that the elective surgery should be delayed more than two weeks until the URI symptoms disappear before elective surgery[2]. However, according to incomplete statistics, there is 17.6% -29.4 % of patients mergered with URI during waiting for surgery. There are 83%-92% of the children belong with mild to moderate URI. The cancellation of these children can have important social, economic, and emotional consequences for the child and the family as well as for the medical team. Recent studies suggest that blanket cancellation as performed in the past is no longer indicated[3]. However, there had little research about the security of general anesthesia for these children in domestic. The purpose of this experiment is to evaluate the security of general anesthesia for different levels of elective surgery in children merger with mild to moderate upper respiratory infection (URI), through monitoring and recording the respiratory-related complications of children through perioperative and postoperative period.

## Methods

### *General Information*

This study was a prospective, open-label study. Approved

by the ethics committee, Affiliated Hospital of Zunyi Medical College. According to the daily operation arranged collected cases, 207 pediatric patients were collected who were scheduled to undergoing elective surgery, aged 1 Month to 12 years old, weighing 3-50kg,with general anesthesia. Inclusion criteria: Age≤12 years undergoing elective surgery patients; permanent residence altitudes less than 2500 m; American Society of Anesthesiologists (ASA) physical status class Ⅰ-Ⅱ; required tracheal intubation general anesthesia. Exclusion criteria: Children with severe URI, lower respiratory tract infections or pneumonia; those whose surgical site involving respiratory tract; or combined with respiratory tumors, polyps, abscesses; those who did not sign informed consent; history of asthma, allergies, using narcotic drugs; and taking other experimental drugs or participation in other clinical trials in the inclusion within 3 months prior to the study.

### *URI Severity Level* [4]

Mild URI: Only showed nasal symptoms, such as nasal congestion, runny nose, and sneezing, dry cough. Moderate URI: The infection involving the nasopharynx, showed appear sputum, sore throat, sweating, headache, fatigue, abdominal pain, diarrhea, vomiting, tonsils swollen Ⅰ-Ⅱ degree, throat congestion, fever 37.3℃-38.0℃. Children were divided into three groups, non-URI group (unURI group, had not such symptoms and signs, n=140), mild URI group (miURI group, n=50), moderate URI group (moURI group, n=17), according to the above symptoms and signs.

### *Anesthetic management*

It needs Intravenous injection penehyclidine 0.01mg/kg before induction, selected endotracheal intubation for airway management according to the need of surgery. Anesthetic method is used to select according to the anesthesiologist with routine intraoperative dexamethasone 0.25mg/kg. The children were transported into post anesthesia care unit (PACU) after completion surgical procedures. Then the children were security back to the ward until Steward Score >4 points.

### *Monitoring indicators*

Monitoring and recording the occurrence of anesthesia-related respiratory system complications, such as secretions (Suction≥3 times), cough, breath-hold (Time≥30s), $SpO_2$<90% (Oxygen≥2L/min), laryngospasm, bronchospasm, fever (Body temperature≥38℃) during perioperative and postoperative period. Perioperative period which were definited the time from enter operating room to leave PACU. Postoperative period were definited the time from back to the ward to leave hospital. This study did not collection biological specimens. All the experimental data derived from information provided by children and their families and real-time monitoring from doctors and nurses. Therefore, it will not increase the additional economic burden or pain for the patients. Experimental implementation center was equipped with pediatric anesthesia management supporting measures, such as anesthesia intubation suite, pediatric laryngoscope, pediatric anesthesia machines, monitors, emergency medicine, and etc, to ensure the safety of children with surgical anesthesia. And that the experiment does not interfere with anesthesiologists and surgical treatment of choice for children.

### *Statistical analysis*

Application SPSS17.0 statistical package, segment information is expressed as a percentage. Differences between groups using chi-square test, chi-square division, Fisher's exact method, and hierarchical data using the chi-square test stratified data. Measurement data were expressed as mean ± standard deviation (x±s) expressed. Multi- homogeneity of variance between groups of data use analysis of variance. P≤0.05 was considered statistically significant.

**Table 1 The general situation of children in three groups(`x±s)**

| Group | Number | Age (y) | Sex (M/F) | Weight (kg) | Anesthesia time (min) | Operation time (min) |
|---|---|---|---|---|---|---|
| unURI | 140 | 5.6±3.8 | 115/25 | 19.3±8.7 | 93.9±58.7 | 66.9±53.2 |
| miURI | 50 | 4.9±3.6 | 42/8 | 17.9±9.4 | 86.3±44.0 | 60.9±39.0 |
| moURI | 17 | 3.9±3.1 | 16/1 | 15.7±6.4 | 76.5±32.4 | 55.8±31.3 |

**Table 2 The children's surgical class composition ratio in three groups**

| Group | Number | Surgical class Ⅰ-Ⅱ | Surgical class Ⅰ-Ⅱ |
|---|---|---|---|
| unURI | 140 | 46（32.9%） | 94（67.6%） |
| miURI | 50 | 13（26.0%） | 37（74.0%） |
| moURI | 17 | 10（58.8%）[ab] | 7（41.2%）[ab] |

[a]P<0.05 versus unURI; [b]P<0.05 versus miURI; Data are presented as n(%).

## Results

General situation:In this study, according to the daily operation of Zunyi Medical College Hospital arrange the order of pediatric surgery,the 303 cases of elective surgery patients were assessed preoperatively URI extent. 67 patients (22.1%) who undergoing elective surgery were delayed surgery or surgical treatment proposed transfer (excluding the experiment). Of which 17 cases were due to inadequate preoperative preparation; 7 cases were due to a diagnosis of severe URI, department of Pediatrics recommends transferred for treatment; 43 cases were due to merger with mild to moderate URI, anesthesiologist or surgeon recommends delay surgery based on their own experience. 236 cases of patients undergoing elective surgery schedule, including 19 cases of non-implementation of endotracheal intubation general anesthesia, 6 cases of non-implementation of general anesthesia (both excluding the experiment), the final completion the data collection of 207 cases of elective surgery patients implement endotracheal intubation general anesthesia. The difference of age, weight, anesthesia time and operative time in each group were no significant difference (P>0.05, Table 1).

Surgical class composition ratio: (1) Children with surgical class Ⅲ-Ⅳ in moURI group were less than unURI group and miURI group (P<0.05). (2) Children with surgical class Ⅰ-Ⅱ in moURI group were more than unURI group and miURI group (P<0.05, Table 2).

The incidence of respiratory complications during perioperative period: (1) Surgical class Ⅲ-Ⅳ children: compared with unURI group and miURI group, the incidence secretions in moURI group increased (P<0.05); compared with miURI, incidence of cough in moURI group increased(P<0.05); compared with unURI group and miURI group, incidence of breath holding, $SpO_2$<90% in moURI group were higher than other, but the difference was not statistically significant (P>0.05); except 1 case bronchospasm after extubation bronchospasm in miURI group, unURI group and moURI group had no occurs; three groups of children had no laryngeal spasm occurred. (2) Surgical class Ⅰ-Ⅱ children: compared with unURI group and miURI group, incidence of secretions, cough, breath holding, $SpO_2$ <90% in moURI group were higher than other, but the difference between the groups was not statistically significant (P>0.05); three groups of children had no laryngospasm, bronchospasm, fever occurred. (3) Compared with surgical class Ⅰ-Ⅱ children, incidence of respiratory complications in surgical class Ⅲ-Ⅳ children was higher, but not statistically significant difference between the groups (P>0.05, Table 3).

The incidence of respiratory complications during

**Table 3 The incidence of respiratory complications during perioperative period**

| | Secretions | Cough | Breath holding | $SpO_2$<90% | Laryngospasm | Bronchospasm | Fever (>38℃) |
|---|---|---|---|---|---|---|---|
| Surgical class Ⅰ-Ⅱ (n=69) | | | | | | | |
| unURI (n=46) | 9(19.56%) | 6(13.0%) | 1(2.2%) | 1(2.2%) | 0(0.0%) | 0(0.0%) | 0(0.0%) |
| miURI (n=13) | 2(15.4%) | 2(15.4%) | 1(7.7%) | 1(7.7%) | 0(0.0%) | 0(0.0%) | 0(0.0%) |
| moURI (n=10) | 3(30.0%) | 4(40.0%) | 1(10.0%) | 1(10.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) |
| Surgical class Ⅰ-Ⅱ (n=138) | | | | | | | |
| unURI (n=94) | 18(19.1%) | 14(14.9%) | 3(3.2%) | 2(2.1%) | 0(0.0%) | 0(0.0%) | 0(0.0%) |
| miURI (n=37) | 8(21.6%) | 4(10.8%) | 2(5.4%) | 2(5.4%) | 0(0.0%) | 1(2.7%) | 0(0.0%) |
| moURI (n=7) | 5(71.4%)ab | 3(42.9%)b | 1(14.3%) | 1(14.3%) | 0(0.0%) | 0(0.0%) | 0(0.0%) |

[a]P<0.05 versus unURI; [b]P<0.05 versus miURI; Data are presented as n(%).

**Table 4 The incidence of respiratory complications during perioperative period**

| | Secretions | Cough | Breath holding | $SpO_2$<90% | Laryngospasm | Bronchospasm | Fever (>38℃) |
|---|---|---|---|---|---|---|---|
| Surgical class Ⅰ-Ⅱ (n=69) | | | | | | | |
| unURI (n=46) | 1(2.2%) | 6(13.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 7(15.2%) |
| miURI (n=13) | 2(15.4%) | 3(23.1%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 2(15.4%) |
| moURI (n=10) | 2(20.0%) | 3(30.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 2(20.0%) |
| Surgical class Ⅰ-Ⅱ (n=138) | | | | | | | |
| unURI (n=94) | 5(5.3%) | 15(15.9%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 19(20.2%) |
| miURI (n=37) | 7(18.9%) | 11(29.7%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 8(21.6%) |
| moURI (n=7) | 3(42.9%)[a] | 3(42.9%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 4(57.1%)[a] |

[a]P<0.05 versus unURI; Data are presented as n(%).

postoperative period: (1) Surgical class Ⅲ-Ⅳ children: compared with unURI group, the incidence secretions and fever in moURI group increased (P<0.05); three groups of children had no breath holding, $SpO_2$<90%, laryngospasm, bronchospasm occurred. The incidence of respiratory complications between the unURI group and miURI group showed no significant difference (P>0.05). (2)Surgical class Ⅰ-Ⅱ children: compared with unURI group and miURI group, incidence of secretions, cough, fever in moURI group were higher, but no significant difference between the groups (P>0.05); three groups of children had no breath holding, $SpO_2$<90%, laryngospasm, bronchospasm occurred. (3)Compared with surgical class Ⅰ-Ⅱ children, incidence of respiratory complications in surgical class Ⅲ-Ⅳ children was higher, but not statistically significant difference between the groups (P>0.05). (4) Compared with perioperative period, incidence of respiratory complications in perioperative period was decreased, only the incidence of fever was significantly higher (Table 4).

## Discussion

In recent years, as the global air pollution increased, the number of times each year and proportions of URI in children are on the rise. Especially in the haze throughout winter, the problem is particularly prominent in China who is a relative shortage of medical resources populous country. Zunyi Medical College Hospital who is one of the three levels of first-class hospital, each year there will have about 4,500 sets pediatric surgery, average of about 18 sets every weekday. Every day Anesthesiologists will encounter at least 3-5 cases of elective surgery pediatrics merger with URI. Anesthesiologists usually based on their own clinical experience choose to delay elective surgery. Because traditional experience believes that children's respiratory tract will at a high stress levels when combined with URI. In particular, the implementation of endotracheal intubation general anesthesia children, it will increase the incidence of respiratory complications. So in order to ensure the safety of children, they chose to postpone surgery. The cancellation of these children can have important social, economic, and emotional consequences for the child and the family as well as for the medical team.

Therefore the purpose of this experiment is to evaluate the security of general anesthesia for different levels of elective surgery in children merger with mild to moderate upper respiratory infection (URI), through monitoring and recording the respiratory-related complications of children through perioperative and postoperative period. Anesthesiologists and surgeons provide scientific basis and evidence-based indicators to delay elective surgery anesthesia of these children. In the premise of ensuring the safety of children, it requires faster, better and more effective implementation of the anesthesia. So that more children with URI will timely surgical treatment, simultaneously it can reduce medical costs and to create a good doctor-patient relationship.

In this study, we found that the surgical class composition ratio in three groups was different: Children with surgical class Ⅲ-Ⅳ in moURI group were less than unURI group and miURI group, but higher in surgical class Ⅰ-Ⅱ. It shows that anesthesiologists and surgeons had greater impact by surgical levels, when they decided to delay elective surgery for the child merged with URI [5]. They mostly chose surgical class Ⅰ-Ⅱ merged with moderate URI children to delay elective surgery; but the scale of delay surgical became enlarged in class Ⅰ-Ⅱ surgery children.

Through analysis the incidence of respiratory complications during perioperative period in three groups found that: (1) the incidence secretions and cough increased in surgical class Ⅰ-Ⅱ children merged with moderate URI. With relevant to moderate URI children the infection involving the nasopharynx, leading to increased respiratory secretions and airway hyperresponsiveness [6,7]. But the incidence of breath holding, $SpO_2$<90%, laryngospasm, bronchospasm this kind of fatal complications was no significant difference in surgical class I-II children compared with Ⅰ-Ⅱ class surgical children. Indicating that even children with moderate URI in the implementation of Ⅰ-Ⅱ class surgical anesthesia is safe and reliable. But in this experiment this conclusion need a large sample study reconfirmed, because the sample size limitations. (2) The incidence of respiratory complications was higher in the moderate URI

group compared with other groups for surgical class Ⅰ-Ⅱ children, but not statistically significant difference between the groups; and three groups were not laryngospasm, bronchospasm, and fever children for surgical class Ⅰ-Ⅱ. Indicating that merged with URI would increase the incidence of respiratory complications, but for low-class surgery, shorter operative time elective surgery, patients are able to tolerate intubation anesthesia. (3) Compared with non-URI group, incidence of respiratory complications in miURI group slightly higher, but no statistically significant difference between the groups. Considering children with mild URI the infections was lighter, adverse effects on the respiratory tract is also lighter through careful management of the anesthesiologist the implementation of intubation is relatively safe.

Through analysis the incidence of respiratory complications during postoperative period in three groups found that: (1) compared with perioperative period, the incidence respiratory complication was significantly decreased in postoperative period. Indicating that after released stimulation with endotracheal intubation, the incidence of perioperative also tends to decrease, even children with preoperative URI. For patients with moderate URI early prevention, timely detection and appropriate treatment of complications was the key. (2) Compared with perioperative period, the incidence of fever was significantly higher in postoperative period, especially in surgical class Ⅰ-Ⅱ children with moderate URI (incidence was up to 57.1%). Related studies suggest that preoperative infection children were more likely complicated by infectious diseases after high level surgery. Infectious absorb heat in younger children are more likely occurring, narcotic drug-induced fever cannot be ignored, especially in the relatively long duration anesthesia surgery [8].

Final 207 cases of children completed the study, only one case of mild URI child occured bronchospasm after extubation, who underwent groin huge inguinal hernia sac ligation. Be muscle relaxant succinylcholine before reintravenous injection, the symptoms can be relieved. Then the child safely returned to the ward after extubation. Indicates that children's condition changes quite quickly, even mild URI children will occur severe complications in extubation time point. We must be vigilant, while also recognizing that found in time and perfect preparatory work can be well treated these serious complications, not necessarily be severely affected for children.

In summary, although the incidence of anesthesia-related risks have increased for the children combined with URI during perioperative and postoperative period, but these complications can be prevented, recognition and treatment through joint cooperation and efforts of anesthesiologists and surgeons. It will not have a greater security risk in children [9]. It is relatively safe to implemented tracheal intubation general anesthesia for the children merger with mild URI or moderate URI in Ⅰ-Ⅱ surgical class. But surgical Ⅰ-Ⅱ class children with moderate URI need a comprehensive assessment between the risks and benefit relationship before general anesthesia.

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