INSTITUTE OF HEALTH SCIENCE, SCHOOL OF MEDICINE, DEPARTMENTS OF ANESTHESIOLOGY, CRITICAL CARE, AND PAIN MEDICINE

PATTERN OF ADVERSE EVENTS AND OUTCOME OF FOREIGN BODY ASPIRATION REMOVAL AMONG PEDIATRICS PATIENTS UNDERGOING EMERGENCY SURGERY AT JIMMA UNIVERSITY MEDICAL CENTER, JIMMA, ETHIOPIA

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FEBRUARY, 2023

JIMMA, ETHIOPIA

A THESIS PAPER TO BE SUBMITTED TO JIMMA UNIVERSITY, COLLEGE OF HEALTH SCIENCE, SCHOOL OF MEDICINE, DEPARTMENT OF ANESTHESIOLOGY, CRITICAL CARE AND PAIN MEDICINE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR SPECIALITY CERTIFICATE IN ANESTHESIOLOGY, CRITICAL CARE AND PAIN MEDICINE

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A THREE YEAR INSTITUTION BASED RETROSPECTIVE CROSS SECTIONAL STUDY

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APPROVAL FORM FOR THE BOARD OF EXAMINATION

The thesis here, entitled "Pattern of Adverse Events and Outcome of Foreign Body Aspiration Removal among Pediatric Patients at Jimma University Medical Center from December 1, 2019 to December 30, 2022" is accepted in its present form by the board of examiners as partial fulfillment off the requirement for specialty certificate in Anesthesiology Critical Care and Pain Medicine.

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Pattern of Adverse Events and Outcome of Foreign Body Aspiration Removal among Pediatric Patients at Jimma University Medical Center from December 1, 2019 to December 30, 2022

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ABSTRACT

Background: Foreign body Aspiration is a life-threatening emergency among pediatric age groups worldwide. It is the commonest cause of accidental death in pediatrics patients under age of three. The risk is highest in children between one and three years of age. Early intervention and removal is crucial to save lives.

Objectives: The main objective of this study is to determine the pattern of adverse events and outcomes of foreign body aspirations removal among pediatric patients at Jimma University Medical Center.

Materials and Methods: Institution based retrospective; cross-sectional study was conducted among 49 foreign body aspiration (FBA) cases with convenience sampling technique. Standard structured observational tools were used. The data obtained were edited, coded, cleaned and entered to Epi data version 4.6 and exported to Statistical package for social sciences (SPSS) version 26. Descriptive and Chi square test analysis were done by the principal investigator.

Result: A total of 49 FBA cases were studied in this research. Four of these cases were repeat procedures. The commonest adverse events encountered during the procedure were desaturation 26(53.1%), persistent hypoxia 22(44.8%), bradycardia 8(16.3%), aspiration 5(10.2) laryngospasm 3(6.1%) and laryngeal edema 3(6.1%). There was also 1(2%) case of death on operation theater (OR) table. Among the study cases 13 patients needed pediatric intensive care unit (PICU) admission. Duration of procedure, occurrence of adverse events such as hypoxia, aspiration and laryngeal edema had statistically significant association with PICU admission.

Conclusion: The incidence of adverse events, duration of procedure (DOP) and duration of anesthesia (DOA) were higher in comparison to other researches. The incidence of serious complications and patient disposition to PICU transfer is also higher than other researches.

Key words: Foreign body Aspiration, FBA Removal, Bronchoscope, adverse events, hypoxia

Abbreviations and Acronyms

ACCPM – Anesthesiology, Critical Care, and Pain Medicine

AE – Adverse events

ASA - American society of Anesthesiologists

DOP- Duration of procedure

DOA -Duration of anesthesia

ETB - Ethiopian Birr

FBA - Foreign Body Aspirations

FBAR – Foreign Body Aspiration Removal

TB FBA – Trachea-bronchial Foreign Body Aspiration

GC - Gregorian calendar

MV-Mechanical Ventilator

PACU - Post Anesthesia Care Unit

PICU - Pediatric Intensive Care Unit

EOR - Emergency Operating Room

SPSS - Statistical Package for the Social Sciences

JUMC- Jimma University Medical Center

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1. INTRODUCTION

1.1. Background

Aspirating a foreign body into the trachea or bronchial tree might occur through the mouth or nose. It is an avoidable accident that mostly affects young children[1] . Roughly around 80% of tracheobronchial foreign body aspiration (TB-FBA) cases are seen in children aged 0-3 years [2]. It is one of the most common causes of accidental or sudden pediatric emergencies in all parts of the world. Young children are vulnerable and complications such as asphyxia can lead to death so that rapid intervention should be done.([2],[3],[4])

Tracheobronchial foreign body aspiration removal is typically a life-saving procedure, but problems with the foreign body or the bronchoscopy procedure are possible.[5] Tracheobronchial tree damage is uncommon, but it can occur. Examples include pneumothorax, surgical emphysema, and hemorrhage.[5] Desaturation (hypoxia), hypotension, coughing and bucking, laryngospasm, bronchospasm, laryngeal edema, cardiac arrhythmia like bradycardia and ventricular tachycardia, the need for postoperative oxygen supplementation, cardiac arrest, aspirations, convulsions, and death are common adverse events linked to rigid bronchoscopy.([6] [7] [8])

If the patient has desaturation, their oxygen saturation level is 92% or lower, which indicates that they are hypoxic.[9] A clinical emergency also exists when the saturation is lower than 90%.[10] One of the most frequent side effects of trachea bronchial foreign body aspiration is hypoxia. Desaturation could have a fatal effect if it is not treated properly. ([6] [11])

Complications like hypoxia can happen for a variety of causes, including insufficient anesthetic depth and insufficient ventilation.[4],[11] A number of other variables, such as the patient's health, the surgeon's experience, the FB's characteristics, the anesthetic technique, and the patient's age, may also affect the likelihood of intraoperative hypoxia. On the other hand, hypoxia could result if the scope was inserted into one of the bronchi.[12],[13] Two additional significant hazards for intraoperative complications are the diagnostic delay of FBA for longer than 24 hours and concurrent infections. [13],[14],[15]

Urgent and emergent procedures, an American society of anesthesiology (ASA) score of greater than 3, repeated therapeutic bronchoscopy and the use of moderate sedation for anesthesia are additional risk factors for complications. ([11,16])

The development of strategies to lessen foreign body aspiration difficulties is necessary. It entails raising medical professionals' level of expertise, beginning with diagnostic precision, which shortens treatment wait times and promotes family education for FBA prevention. It is crucial that thoracic surgeons, otorhinolaryngologists, pulmonologists, and anesthesiologists have training in correct bronchoscopy technique. Nebulizers, appropriate-sized bronchoscopes, and the use of various anesthetic medications all contribute to lessen complications.[4,13]

1.2. Statement of the problem

One of the commonest pediatrics emergencies globally is foreign body aspiration, and it is advised to take fast action to reduce the likelihood of negative outcomes from delays in treatment. In pediatric age ranges, foreign body aspiration itself and the removal procedure are one of the top five causes of accidental mortality.

Bronchoscopy mortality is approximately 0.42 percent in western countries.([17,18]).A study done in South Africa in 2016 showed a mortality as high as 3 percent [4]. Even though no research done in our set up, we observe mortality of 3 patients per year from 98 patients (3.1%) from Tikur Anbessa Specialized Tertiary Hospital reports review. This may be partially explained by the dearth of skilled pediatrics surgeons and anesthesiologists in our system. Thus, in order to fill the gaps in our system and enhance patient outcomes, the quality of care provided, and the nation's health system as a whole, we require this research to determine the scope of adverse events and patient outcomes of disposition.

1.3. Significance of the study

The aim of this study is to assess pattern of procedural adverse events and outcome of foreign body aspiration removal (FBAR)

The result will provide some knowledge and insight into the prevalence and magnitude of adverse outcomes of FBAR in the study area.

Researchers can use the data from this study as a baseline for future research

Health policymakers can use it to plan and build strategies needed to improve adverse events.

2. LITERATURE REVIEW

Foreign body Aspiration is a life-threatening emergency among pediatric age groups worldwide. It is the commonest cause of accidental death in pediatrics patients under age of three.

Adverse events and outcomes are related either from the FBA itself or from the removal. When a well-trained personnel is doing the foreign body aspiration removal, serious complications are infrequent (<2%) and these complications can be either due to anesthesia or the procedure itself. The majority of complications were mild and major complications were rare (mortality rate, 0.4%).[4,17]

Intraoperative desaturation or hypoxia is the most common event in foreign body aspiration removal. A retrospective study done on 36 consecutive patients in India 2014 showed that there were a total of 26 episodes of desaturation in 17 patients in controlled ventilation and 21 episodes of desaturation in 19 patients in spontaneous ventilation.[19] On the other hand, in a study done on 772 patients in Turkey which was published in 2016 found that 30 hypoxia and bradycardia on bronchoscopy procedure. In another study done in China which was published in 2014, by Meta-analysis including 423 subjects of 5 studies, all of the five studies reported the incidence of intraoperative desaturation but no significant difference found in the incidence of desaturation between controlled ventilation and spontaneous respiration (odds ratio, 0.70; 95% CI, 0.30– 1.63) [13]. A retrospective study done in China, which was published in 2015 involving 1,843 patients, there was no adverse event detected [14] .In another prospective observational study done in India which was published in 2017 with 71 children, desaturation was observed in 18 (25.0%) of children [18]. Finally, a retrospective study done in 81 patients in Pakistan which was published in 2019 showed that perioperative complications with desaturation was 19.7% (n=16; 19.7%).[9]

Other adverse events may also be present during foreign body aspiration removals. In a study done on 36 patients in India, which was published in 2014, the intraoperative bucking and coughing were 13; ventricular arrhythmias were 4, laryngospasm were 4, convulsions were 4 and postoperative laryngeal edemas were 9. [19] Incidence of intraoperative coughing and bucking in spontaneous group was statistically highly significant (P ¼ 0.0012) in this study.[19]

In a study done in Turkeys on 772 patients, there were 37 laryngeal edema, laryngeal spasm and/or bronchospasm which required ventilator support; in 6 of patients tracheobronchial system bleeding occurred; in 2 of patients' pneumothorax occurred.[9] The 2014 China's study of 423 pediatric patients showed the incidence of laryngospasm was lower when controlled ventilation was used (OR, 0.27; 95% CI, 0.10–0.76). In addition the incidence of bucking and coughing (odds ratio, 0.08; 95% CI, 0.03–0.26) and body movement (odds ratio, 0.07; 95% CI, 0.01–0.59) was significantly decreased in the controlled ventilation group. This study collective results did not notify a significant difference in the incidence of laryngeal edema (odds ratio, 0.36; 95% CI, 0.01–10.76) or breath holding (odds ratio, 0.18; 95% CI, 0.003–1.17).[13] The other Indian study done in 2017 showed that airway mucosal bleeding was observed in 14 (19.4%), movement during procedure was found in 8 (11.1%) cases, whereas airway edema was found in 6 (8.3%) cases. Both bradycardia and bronchospasm were found in 2 (2.8%) cases and laryngospasm was found in only 1 (1.4%) case.[20] In addition a study in Pakistan which was done in 2019 on 81 patients showed that bradycardia was found in 8 children (9.8%), mucosal bleeding were seen in 6 (7.4%), laryngeal edema was in 11 (13.6%), laryngospasm found in 13 (16.3%), and bronchospasm was seen in 4 (4.6%).[20]

There are different factors affecting intra operative hypoxia during foreign body aspiration removal in the pediatric age group.

In a 2014 study from India, it was shown that episodes of desaturation in the spontaneous ventilation group were clinically linked to hypoventilation, breath holding, or apnea, while those in the controlled ventilation group were linked to inability to breathe due to a gross leak at the proximal end and/or apnea when the surgeon was trying to remove or localize the foreign body in the airway. To keep the patient's oxygen saturation level appropriate, all of their spontaneous breathing had to be supported [19]. Furthermore, Littman et al.4 and Soodan et al. discovered that more intraoperative difficulties necessitated the conversion of cases from spontaneous to controlled breathing .9

When 384 children under the age of 5 were subjected to rigid bronchoscopy for the removal of FB between January 2017 and December 2018 in China, researchers found that factors such as age (P = 0.039), type of FB (P = 0.025), duration of surgical procedure (P = 0.044), pneumonia prior to procedure (P = 0.067), and ventilation mode (P 0.001) were strongly correlated with intraoperative hypoxemia 15.

In this investigation, there was no association between intraoperative hypoxemia and the degr ee of airway obstruction (P = 0.104) or hypoxemia and the existence of an organic FB as opp osed to an inorganic FB.

The risk of intraoperative hypoxemia considerably increased when the different kinds of plant seed were stated separately (P = 0.027, OR = 2.654).

Longer time of surgery and preoperative pneumonia also increase intraoperative hypoxia significantly (P = 0.001, OR = 1.150) for surgical duration; (P = 0.003, OR = 3.837) for pneumonia.[15]

In another study of India in 2017 showed that there was no statistically significant relationship between complications and type of anesthetic agents used for induction. Children of less than 3 years of age were more prone to complications than children of older age group which was showed by India study in 2020.[16]

When we observed the morbidity associated with foreign body aspiration removal, there was some research documented. One of which is the Turkish study which included 1035 patients and among which 911 patients studied. When we observe the morbidity of foreign body aspiration removal there is some research documented that a study of turkey showed 37 required ventilator supports due to laryngeal edema, laryngeal spasm and/or bronchospasm. In this series there were 8 deaths.[9] In Pakistan's study of the 81 patients, 18 (22.2%) were transferred to the ICU postoperatively, five of whom required mechanical ventilation. Of the 18 patients transferred to the ICU postoperatively, 12 (66.7%) patients had organic and 4 (22.2%) patients had inorganic foreign bodies, whereas 2 (11.1%) patients were detected with no foreign bodies. Of the 16 foreign bodies extracted in the patients transferred to the ICU, 8 (44.4%) of them were localized in the right bronchus, 6 (33.3%) in the left bronchus, and 2 (11.1%) in the trachea-larynx.1 The incidence of laryngeal edema, laryngospasm, desaturation, and mucosal bleeding was significantly higher in the patients transferred to the ICU compared to those transferred to the ward ($p<0.05$) 1

Although asphyxia at presentation or the initial emergency bronchoscope causes some deaths, a 2018 study of death as a result of FBA in children in Tuzla, university clinical center Tuzla showed that hypoxic cardiac arrest during the retrieval of the object, bronchial rupture, and unspecified intraoperative complications in previously stable patients make up the majority of in-hospital fatalities. Cardiac arrest was the cause of death of 3 children during bronchoscopy

6 (0.5%) in study of Senkaya et. Improvements in surgical techniques, instruments, and modern anesthesia have allowed bronchoscopy to be effective in greater than 95% of the patients, with a complication rate of less than 1%. [21] Before the advent of bronchoscopy in the early 1900s, the mortality rate for foreign body aspiration approached 50%. Today, successful treatment with bronchoscopy has reduced this to less than 1% [21].

The review of Boston published in 2010 involving 12,979 cases found that the leading cause of accidental death under 4 years old is asphyxiation from an inhaled foreign body. Mortality during bronchoscope was 0.42%. Even though asphyxia is the major cause of death at presentation, bronchoscope causes some death due to hypoxic cardiac arrest during removal of the object, bronchial rupture, and unspecified intra-operative complication in previously stable patients constitute the majority of in-hospital mortality.[18]

Finally, in the study of China done in 2015, there were 15 deaths (all aged <= 2 years). [14] They found that the causes of death were acute obstructive asphyxia (seven cases) and residual FB-induced chronic asphyxia and respiration-circulation failure (eight cases). [14]

3. OBJECTIVES OF THE STUDY

3.1. General objective

The main objective of this study is to determine the pattern of adverse events and outcomes of foreign body aspiration removal among pediatrics patients in Jimma university medical center (JUMC) from December 1, 2019 to December 30, 2022 G.C.

3.2. Specific objectives

- ✔ To calculate the magnitude of intra procedural adverse events in foreign body aspiration removal in the pediatric age group at JUMC.
- ✔ To assess the factors affecting the occurrence of adverse events during FBAR.
- ✔ To determine the disposition outcome of FBAR.

4. METHODS AND MATERIALS

4.1 Study design

Institution based retrospective, cross sectional was employed.

4.2 Study Area and period

This study was conducted in Ethiopia, Oromia regional state, Jimma town at Jimma University Medical Center, which is located 352 km southwest of the capital Addis Ababa. JUMC is one of the oldest hospitals in Ethiopia and it is the only teaching and referral hospital in southwest Ethiopia with 800-bed capacity and a catchment population of over 15 million. It serves about 160,000 patients per year in its outpatient department and about

15,000 in the inpatient and 11,000 in the emergency departments. The study was conducted in pediatric OR of JUMC from December 1, 2019 – December 30, 2022 G.C.

4.3. Population

4.3.1 Source population

All pediatrics patients who visited JUMC OR during the study period

4.3.2 Study population

All pediatrics patients who came with FBA within the study period who met the inclusion criteria

4.4. Eligibility criteria

4.4.1. Inclusion criteria

All pediatric patients who underwent rigid bronchoscope procedure for suspected FBA during the study period

4.4.2 Exclusion criteria

1. Pediatric Patients with FBA who were intubated and admitted to ICU pre procedurally.
2. ASA >= 5
3. Pediatric patients who had rigid bronchoscope procedure done for other indications

4.5. Sample size determination and procedure

4.5.1 Sample size and sampling technique

No sample size will be determined as all source population will be included as the study subjects provided that the documents are complete for the variables of interest.

4.5.2 Sampling procedures

Institutional based non-randomized convenience sampling technique was used.

4.6 variables of the study

4.6.1 Dependent variables

- ✔ Adverse events
- ✔ Outcome (post-procedural admission to PACU,PICU, DEATH)

4.6.2 Independent variables

- ✔ Socio-demographic variable: age, sex

- ✔ Patient factor: ASA status, co-existing co morbidities
- ✔ Procedural factors: Adverse events, DOP and DOA.

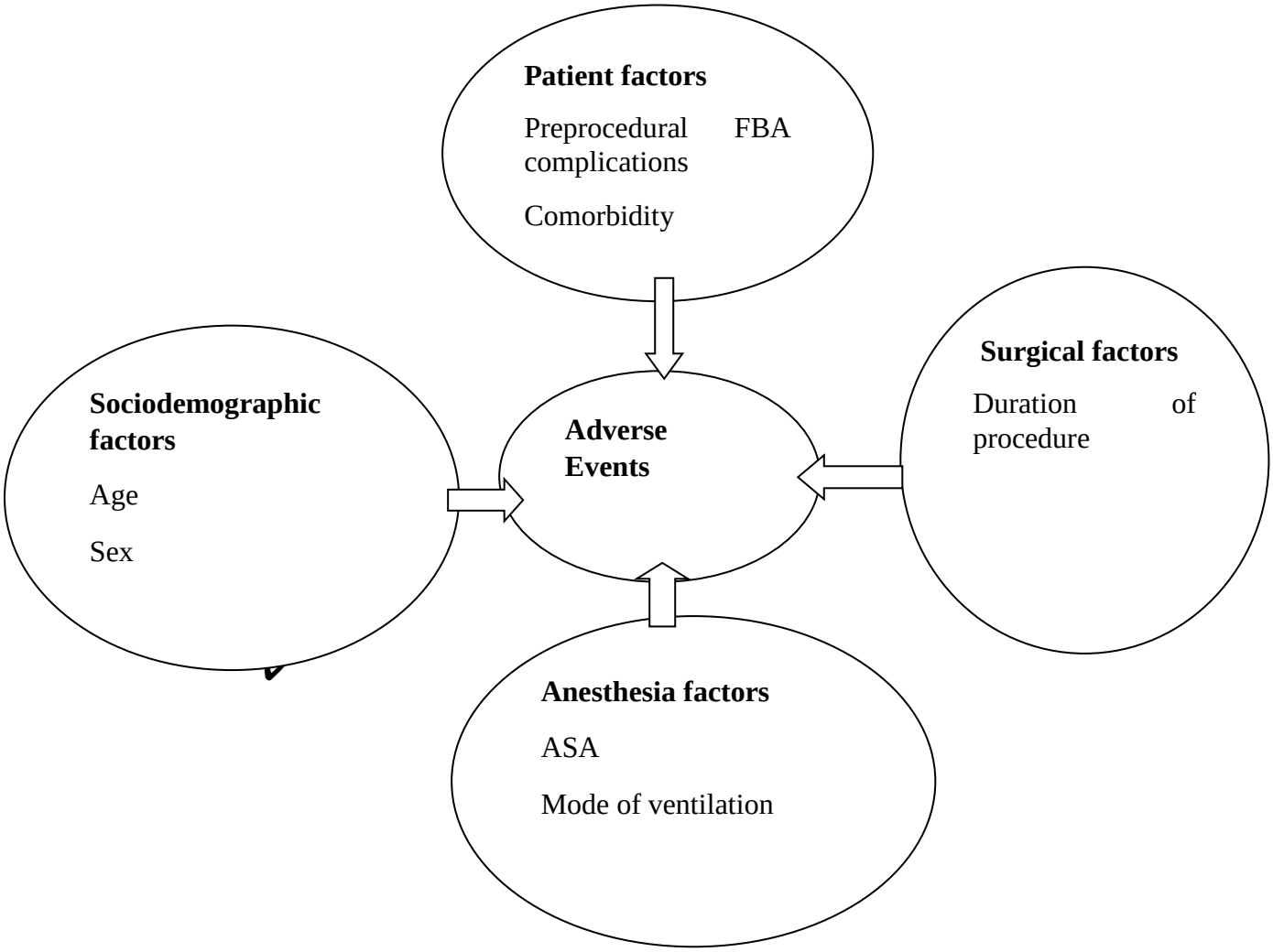

Figure 1: Conceptual framework of pattern of adverse events and outcome of FBAR in JUMC from December 1, 2019 –December 30, 2022

4.7. Operational Definitions

1. **Clinical Pattern:** Any regularly repeated arrangements

2. **Clinical outcome**: Indicates either a patient discharged to the PACU, ward, ICU or died on OR table.

3. **Adverse events**: Any untoward or unfavorable medical occurrence in a patient during and/or after the procedure.

4. Pediatric patients: all patients less than 14 years of age.

5. Type of ventilation: is the ventilation that we use during general anesthesia. It can be

a. Spontaneous ventilation a patient is breathing spontaneously without neuromuscular blocking agents (NMBA) and clinician assistance to breathing)

b. Assisted ventilation is patient is not on NMBA but needs clinician assistance on breathing

c. Controlled ventilation a patient is on NMBA and need clinician or machine full support

***6. Duration of anesthesia*:** defined as the time from the transfer of the patient to the OR and put on monitors to the transfer of the patient to post anesthesia care unit (PACU) or ICU.

***7. Duration of surgery*:** defined as the time from the initial introduction of the rigid bronchoscope tip into the patient's mouth to the final removal of the bronchoscope from the vocal cords.

***8. Laryngospasm*:** defined as glottal closure caused by the reactions obstructing ventilation of the lungs, which can also be defined by the treating physician diagnosis with any need of intervention.

9. Bronchospasm: a prolonged expiratory phase accompanied by wheezing and desaturation, which can also be defined by the managing physician diagnosis with any need of intervention.

***10. Bradycardia*:** a resting heart rate of below the baseline of bpm according to age of the patients. < 1 years old <100 beat/ min, 1- 5 years old <85 beat / min, 6- 10 years < 70 beat / min, >=12 years old <60 beat/min for more than 15 seconds either with ECG or stereoscope.

***11. Desaturation/ Hypoxia*:** defined as a SpO2 level of 92% or below for more than 15 sec.

12. Aspiration is entrance of foreign body or material or fluid in to trachea-bronchial tree which can also done by physician diagnosis with any need of intervention

13. Mucosal bleeding: is defined as the presence of bleeding associated with the bronchoscopy procedure.

14. Serious trauma to trachea-bronchial tree is defined as major airway trauma like pneumo-thorax, pneumo-mediastinum and surgical emphysema which can also be done by physician diagnosis with any need of intervention.

15. Duration of hospital stay – from the time procedure was done for FBA to the time the patient is discharged to home in hrs or days.

16. Cardiac arrest is defined as absence of pulse in carotid artery for > or = to 10 sec.

***17. Mortality*:** defined as death occurring in association with anesthesia or surgery until hospital discharge.

4.8. Data collection tools and questionnaire development

4.8.1. Data collection tool

To identify those patients with intra procedural adverse events during FBAR, structured standardized observational data collection tool was developed from different published research papers. Data was collected for 3 years by a designated data collectors for all pediatric FBA patients who fulfilled inclusion criteria after being trained by the principal investigator for one day. Transfer of data was started by filling the formed questionnaires. The transfer was completed as the patient discharged or death confirmed. Anesthetic chart and the surgeons´ notes were reviewed for completeness of questionnaires for each patient. The ASA scoring, preexisting disease, pre-procedural respiratory distress, hypoxia, pulmonary infection and other complications, ventilation technique, intraoperative and post-processing complications were recorded. DOA and DOS (min) and outcome until hospital discharges (hrs. or days) were recorded.

4.9. Data quality assurance

Overall data collection process and completeness of data collection were monitored and checked by the principal investigator. All completed questionnaires were checked for completeness and consistency during data management, storage and analysis.

4.10. Data analysis technique

The principal investigator checked the collected data. All completed questionnaires were coded. The data obtained were edited, coded, entered, and cleaned by Epi data version 4.6 by the PI. SPSS version 26 was used for analysis and Statistical significance tests were applied. Descriptive analysis was used.

4.11. Ethical consideration

The proposal was reviewed and approved by the institutional ethical review board of Jimma University prior to the start of the proposal. Data collection instrument did not include names, addresses or other identifying information about the study participant. Local languages like Amharic and Afaan Oromo were used.

5. Data Analysis and Result

5.1 Socio-demographic factors

There were a total 49 patients who had suspected FBA and removal was done in pediatrics OR (table 2) from December 1, 2019- December 30, 2022. Among these, 4 patients had repeat bronchoscopy procedure. From patients who underwent repeat bronchoscopy, 3 patients first bronchoscopy was differed because of persistent hypoxia while in one patient FB was not found in the first bronchoscopy. Majority of them 30 (61.2%) were male and 19(38.8%) were female.

TABLE 5.1: SOCIO DEMOGRAPHIC VARIABLES

Variables		Mean	%	SD
Age		59.67	100.0%	39.87
Sex	Male		61.2%	
	Female		38.8%	

The median age was 48 months which ranges from 12 -144 months and the mean age was 60 months. Most of the patients 32(66.3%) were ≤ 60 months old while 17(34.7%) were >60 months old.

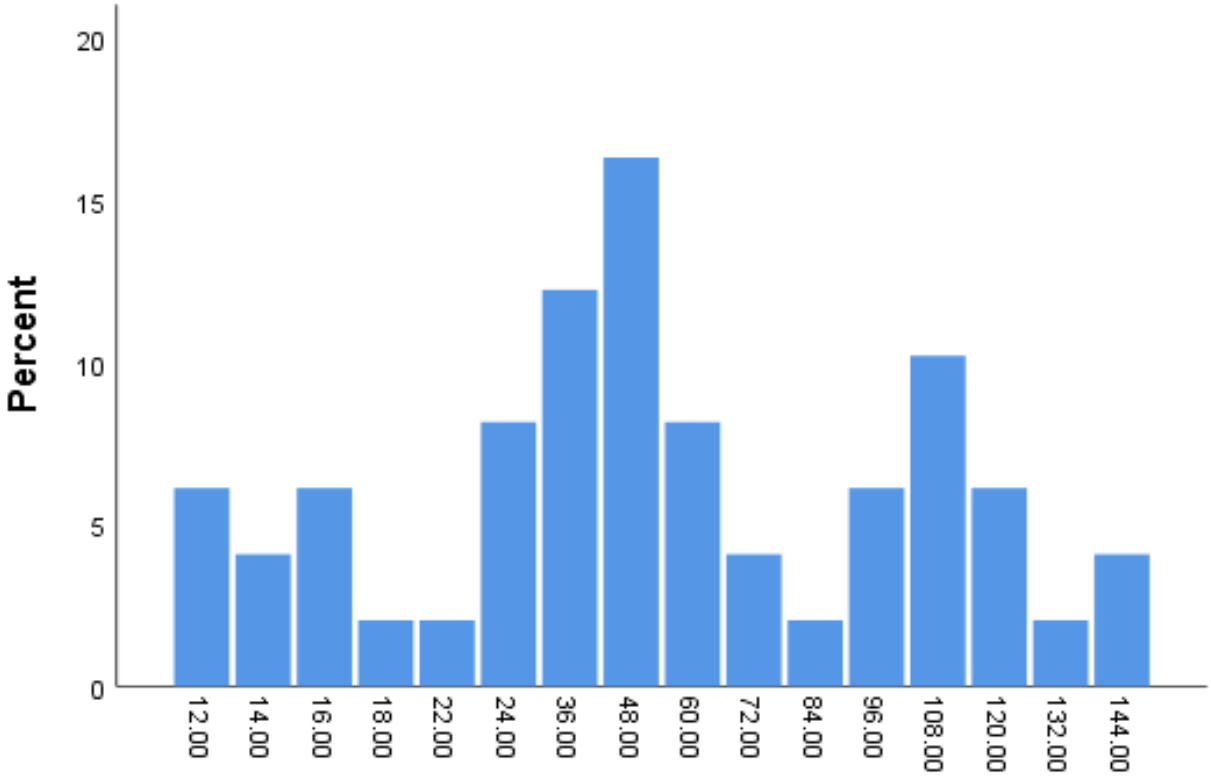

FIGURE 5.1: SHOWS AGE OF THE PATIENT IN MONTHS

5.2 Descriptive analysis

Most of the patients 29(59.2%) arrived to the hospital after 24 hrs. of foreign body aspiration while the rest 20(40.8%) arrived before 24 hours. Among those who came after 24hrs, most of them 20(69%) were delayed due to referral.

All of the patients were ASA class I and none of the cases have chronic medical illness.

When patients arrived in the waiting area of OR 37(75.5%) had respiratory complication which includes; 34(69.4%) respiratory distress and desaturation and 7(14.3%) aspiration pneumonia. Most of the patients 35(71.4%) require supplemental oxygen while the rest 14 (28.6%) did not.

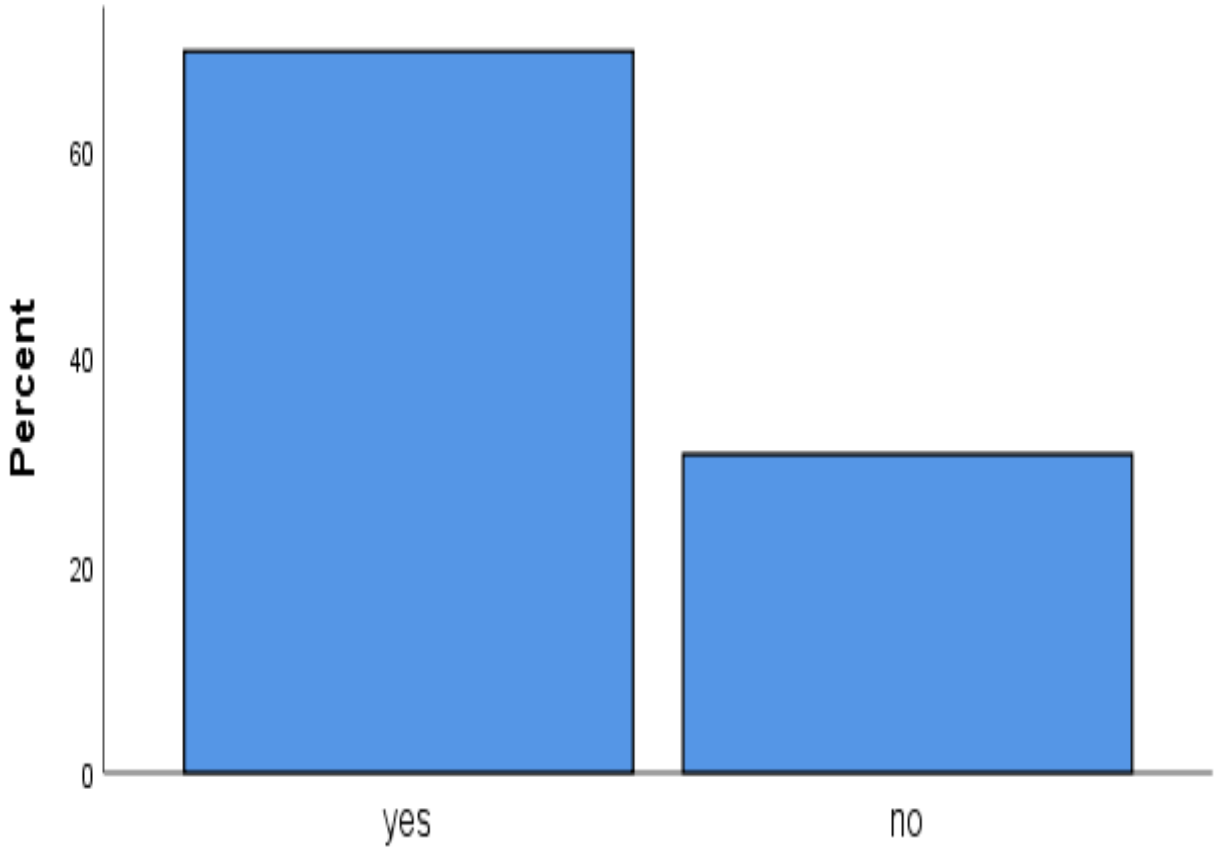

FIGURE 5.2: SHOWS PATIENTS THAT REQUIRE O2 PRE PROCEDURALLY IN PERCENT

Most of the procedures 32(65.2%) were done at night time while 17(34.8%) were done at daytime. 22(44.9%) of procedure were done by Anesthesiology residents and Pediatric surgeon, 17(34.7%) were by consultant Anesthesiologist and Pediatric Surgeon while 10(20.4%) were done by MSC or BSC anesthetist and Pediatric surgeon.

In 34(69.4%) of the cases, breathing was controlled but in the rest 15(30.6%) of the cases breathings were assisted with some conversion to controlled due to some adverse events.

The median DOP was 40 minutes with ranges from 15-120 minutes while the median DOA was 60minutes ranging from 30-180 min. Duration of procedure in 26(56.6%) was > 60min while the remaining 23(43.3%) were ≤ 60 min.

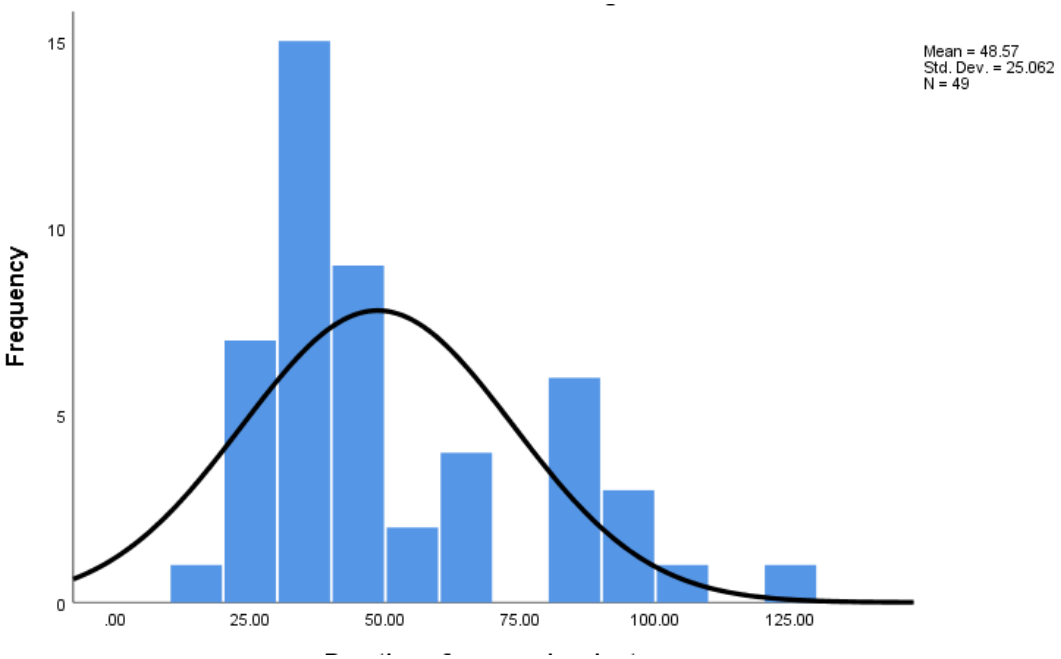

FIGURE 5.3: HISTOGRAM SHOWING THE DURATION OF PROCEDURES IN MINUTES

The incidence of adverse events during the procedure were desaturation 26(53.1%), persistent hypoxia 22(44.8%), bradycardia 8(16.3%), aspiration 5(10.2) laryngospasm 3(6.1%), laryngeal edema 3(6.1%) and 1(2%) death.

FBA were found in 47(95.9%) with 27(57.5%) of aspirated FB being organic and 20(42.5%) inorganic.

In 20(40.8%) cases FB was found in larynx and trachea. Equally 20(40.8%) were found in the right bronchus, 6(12.2%) were in the left bronchus and in 1(2.2%) case, organic foreign body was found on bilateral bronchus.

No foreign body was found in 2(4%) cases

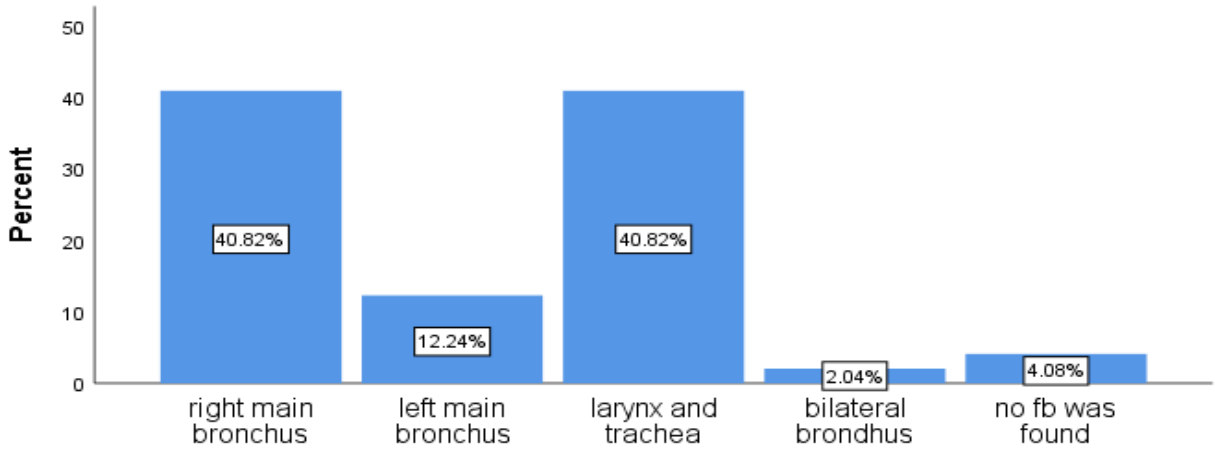

FIGURE 5.4: SITE FROM WHERE THE FOREIGN BODIES WERE EXTRACTED

After the procedure most of the patients 35(71.4%) were in a relatively stable condition and transferred to the PACU. The remaining 13(26.5%) had severe adverse events and were transferred to PICU, 6 (12.5%) of which being intubated.

TABLE. 6.1: SHOWS WHERE PATIENTS TRANSFERRED TO, AT THE END OF PROCEDURE

		Frequency	Percent
	ICU	13	26.5
	Ward	35	71.4
	Total	48	98.0
Missing	System	1	2.0
Total		49	100.0

One patient died on the OR table from persistent hypoxia from prolonged procedure.

48(98%) patients discharged from hospital with improvement, the maximum day of stay in the hospital being 16 days.

6. Discussion

The study demonstrated that most of the FBA cases were seen in children aged < 60 months of age, who were predominantly boys. As consistent with other literatures, the incidence of FBA was higher in boys compared to girls in our study result.

This result suggested that the median age is 48 months which is higher contrary to the hypothesized association of lower age (< 36 months of age) and to a mean age of 29.6±31.2 months from a study finding done in Turkey in 2019 [1,4]

Among 49 case, FB were successfully extracted in 46(93.9%) and the remaining 2(4.08%) had no FB which is in line with one study finding done in Turkey where foreign bodies were successfully extracted in 71 (87.7%) cases and no FBs were found in the remaining 10 (12.3%) cases.([1,7])

This study demonstrated that most 27(57.4%) of the FB were organic and 20(42.6%) were inorganic, which showed lager number of organic FBA. This result supported the finding from Turkey which showed (66.7%) of the foreign body were organic (44%).[4]

This study showed foreign bodies were located in right bronchus 20(40.8%) and equally in larynx and trachea 20 (40.8%), in left bronchus 6(12.8%) and in both bronchus 1(2.2%) which challenges the existing theory that right bronchus is the commonest site and inconsistent with Pakistan's results which showed that right bronchial tree 35 (43.3%) left bronchial tree fb 16(19.7%), laryngeotracheal tract 20 (23.3%) and no FB 10 (12.3%) cases.([1]) The ASA score was I in all patients, in contrast to the study done in Pakistan with ASA I 18(22.2%), ASA II 62(76.5%) and ASA III 1 (1.2%) in our case lower ASA classification ([1]). Our patients were less risk patients. ([15])

The median DOP and DOA were 40 minutes with ranges of 15-120 minutes and 60 minutes ranging from 30-180 min respectively, which is longer compared to study of Pakistan (DOS 27.35 ± 14.20, DOA 44.30 ± 14.72) or to a study done in SA.([1,4])

The DOP had statistically significant association with persistent hypoxia with a p-value <0.01) which is consistent with a study done in China in 2009 and Switzerland in 2016 ([15, 16]).

This study also provides a new insight into the relationship between prolonged DOA and a significant association with hypoxia with a p-value of (0.02) which may be explained by prolonged surgical time requiring prolonged time for recovery from anesthesia too. The duration of anesthesia had no clinically significant association with intraoperative

complications in a study done in China.([15]). This may be explained by the fact that they used sevoflorane and dexemetodomidine during the procedure ([16,26]).

The magnitude of procedural adverse events were hypoxia 24(49%), bradycardia 8(16.3%), aspiration 5(10.2%), laryngospasm 3(6.1%) and mortality 1(2%) which were larger compared to the study done in Pakistan in 2019 with results of desaturation 16(19.7%), air way edema 11(13.6%), laryngospasm 11(16.3%) ([1,2,9]).

This study showed mortality is 1(2%) which is higher than other studies.Most reports indicate a low morbidity (0.42%), however it ranges from 3.1% from TASH report review some report to as high as mortality (11%) of children aspirating a FB [4]

This result built on existing evidence that most patients 35 (71.4%) post procedurally were in a relatively smooth condition and transferred to ward, the remaining 13(26.5%) were transferred to PICU which was in line with Pakistan's study of the 81 patients, 63 (77.8%) of them were transferred to the ward and the remaining 18(22.2%) transferred to PICU ([1]). However, the higher ASA class in these patients in the Pakistan's study should be taken in to account. .

Persistent hypoxia (0.02), presence of post procedure complications ($p<0.01$) and prolonged DOP in minutes (0.02) had significant association with PICU admissions, which had difference with the study done in Pakistan 2019 which showed the incidence of laryngeal edema, laryngospasm and desaturation were significantly higher in the patients transferred to the ICU postoperatively ($p<0.05$).([1])

7. Limitations of the study

Small sample size due to missed and incompleteness of data.

The methodological choice was constrained by the rareness of FBA cases

Single center study

The type of anesthesia used during bronchoscopy procedure was beyond the scope of this study.

8. Strength of the study

There was no research done on this topic in JU (also in Ethiopia) that makes this study a stepping stone to various small and large scale studies in this area.

We had many statistically significant association with complications and outcome of disposition even with small sample size.

We are able to identify risks for adverse events and outcome of patients like referral delay that can be solved by simple communication.

9. Conclusion

The magnitude of adverse events were higher than any other researches. The incidence of mortality 1(2%) was also higher than other results and even large scale studies and reviews showed <0.42%.

Our patients ASA classification were much less risk patients than others but we encountered more complications.

Even though further studies are needed to clarify more and identify the factors affecting for PICU admission, the incidence of PICU transfer were 12(16%) with low ASA class patients and higher incidence of mortality 1(2.2%).

10. Recommendation

For researchers, do research on this area in the larger scale country wide to get more inclusive findings.

For JUMC, communicate with referring hospitals and institutions to facilitate early referral that can decrease delay which is one of the risk factor for adverse outcome.

For ACCPM department, Work closely with pediatrics surgery department to decrease DOP, to improve outcome of patients and to develop guideline on FBA removal procedure and also training of caregivers (parents, educators), “Heimlich maneuver,” and disengagement of the upper airways.

For FMOH and Regional health bureaus, parents of children should be educated about FBA prevention methods, its risks and the specific period in which their child is most susceptible for aspiration of FB.

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Annexes 1: Information Sheet & Consent Form

Introduction: Hello, I am _____from JUMC and working with investigator Wondwossen Admasu (MD) who is doing his thesis for partial fulfillment of the requirement for a specialty certificate in anesthesiology.

Purpose: The study will be helpful to assess pattern of adverse events and outcomes of foreign body aspiration removal among pediatrics patients undergoing emergency surgery at Jimma University Medical Center, Jimma, Ethiopia. The study period is from December 1, 2019 to December 30, 2022 at JUMC. The Information collected during this study could be used by the MOH, JUMC, organizations supporting the services and researchers. Furthermore, the main aim of this study is to write a thesis as a partial requirement for the fulfillment of specialty certificate in anesthesiology.

Confidentiality: In this study, data will be collected from the operation theatre log books and medical records retrospectively. Information regarding any specific personal identifiers like

the name of the clients will not be collected and information generated will be disclosed in totality. In addition, confidentiality of any personal information will be maintained throughout the study process and no unauthorized access to the information is allowed. If you have any questions or need further information regarding the planned study, you are free to get clarification from the principal investigator. Email. Address, wend.admasu@gmail.com

Would you be willing to participate in the study?

1. Agree_____

2. Disagree _____

Signature of the data collector: _____ Code: _____

<u>የመጠይቅ ፈቃድ</u>

ጂማ ዩኒቨርሲቲ ጤና ሳይንስ ኮሌጅ ፣ህክምና ትምህርት ቤት፣የአንስቴዥዮሎጂ ትምህርት ክፍል

የመጠይቅ ፈቃደኛነት ቅጽ

ስሜ_____ይባላል፡፡ እኔ በጂማዩኒቨርሲቲ በአንስቴዥዮሎጂ ትምህርት ክፍል የምርምር ቡድን ዉስጥ አንድ አባል ነኝ፡፡ የዚህ መጠይቅ አላማ.

ከቀዶ ጥገና በኋላ የሚመጣ ተያያዥ ነገሮችን ለማዎቅ የሚደረግ ምርምር/ጥናት /መረጃ መስብሰብ ነው፡፡

እርስዎ አንድ የጥናቱ ክፍል አድርጌ ስመርጥ አስፈላጊ የሆኑ መረጃዎችን እንደሚሰጡኝ በማሰብ ነው፡፡ በጥናቱ ለመሳተፍ ፈቃደኛ ከሆኑ ከእርስዎ የሚገኘው ማንኛውም መረጃ በሚስጥር ይጠበቃል፡፡ ለዚህም ሲባል የእርስዎ ሥም እና አድራሻ አይገለጽም፡፡

የቃል ሥምምነት

የዚህ ጥናት ዓላማው ገብቶኝ በጥናቱ ለመሣተፍ

ሀ. ፈቃደኛ ሆኛለሁ ለ. ፈቃደኛ አይደሆሁም

በጥናቱ ለመሳተፍ ፈቃደኛ ከሆኑ ቃለመጠይቁን መቀጠል ይቻላል፡፡

ፈቃደኛ ከሆኑ የመጠይቁ መለያ ቁጥር _____ መጠይቁ የተካሄደበት ቀን _____

የጠያቂው ስምና ፊርማ _____

የሱፐርቫይዘር ስምና ፊርማ _____ ጥናቱን በተመለከተ ማንኛዉም አይነት ጥያቄ ካላችሁ የሚከተለዉን አድራሻ ተጠቀሙ

Informed consent form Afaan Oromo version

Walii galtee Qorannoo dhukkubbii yaalii baqaqsanii yaaluu boodaa fi wantoota sanaan wal qabatan.

Ani Obboo/addee/Dr _____ , miseensa garee qorannoo irra.

Qorannoon kun kan inni irratti xiyyeefate, waa'ee yaalamtota kutaa da'umsaati irratti. Kanaafuu qorannoo kana irratti wanta isin irraa eegamu akka nuuf gootan kabajaan isin gaafanna. Kunis ammoo fayyaa yaalamtota kutaa da'umsaa irratti fayidaa fi jijjiirama guddaa ni fida.

Waliigaltee fi eeyyama kessaniin malee iccitii keessan nama biraaf yookin ammoo waajjira tokkoofuu akka dabarsinee hin kenninee waadaa isiniif galla.

Yoo qorannoo kana irratti hirmachuu kessan waliigallee, gaaffii waliigalaa irraa isiniif jalqabna. Deebii keessan kan dhugaa irratti hundahee yoo kennitan, faayidaa jijjiirama fayyaatiif nu gargaara.

Qorannoon kun karaa univarsiitii Jimma irraa fudhatama argatee jira. Kanafuu qorannoo kanarratti hirmaachuuf fedhii qabduu?

1. nanqaba ……. Deebiin nanqaba yoo jette gaafii itti anutti fufi.
2. Hinqabu …… deebiin hinqabu yoo jette , galatomaa jedhiiti gaafii addaan kuti.

Fedhii qorannoo adeemsisuuf yaada namarraa kan fuudhu.

Maqaa_____

guyyaa gaaffii itti gaafatame ……/…../..... mallattoo…….

Hordofaa isaatiin mirkanaa'uu kan muli'isu

Maqaa……guyyaa……../……./……mallattoo…….

Annex 2: Questionnaires

Questionnaire no. _____

Socio-demographic factors

1. Age (in month)_____

2. Weight _____

3. Sex A. male B. Female

Patients related factors

4. Preoperative coexisting medical diseases such as cardiovascular, respiratory, hepatic, renal, neurologic and endocrinology (circle above if any) A. yes B. no (please specify) _____

5. Was the patient on O2 prior to the procedure A. yes B. no

6. Was the patient presented with respiratory distress A. yes B. no

7. Was there any pulmonary infection before the procedure? A. yes B. no (If yes, please specify) _____

8. Any preoperative FBA complications seen before the procedure. A. yes B. no (If yes, Please specify) _____

Surgical factors

10. The number of bronchoscopy procedure done at different time A. 1st B. 2nd C. More than two

11. Duration of surgery in minutes _____

Anesthesia related factors

12. ASA score A. I B. II C. III D. IV

13. Mode of ventilation A. Spontaneous B. Controlled C. Assisted

Associated complications and intervention

14. Any intra operative complications A. Yes B. No . If yes to Q no.14 what was the intra operative complications (more than 1 option can be selected)

15 Bradycardia A. Present B. Absent

16. Bronchospasm A. Present B. Absent

17. Laryngospasm A. Present B. Absent

18. Aspiration A. Present B. Absent

19. Hypoxemia (saturation <92% for >2 min) A. Present B. absent

20. Cardiac arrest (absent of pulse in carotid artery for > or = to 10 sec) A. present B. absent

21. Mortality (death occurring in association with anesthesia or surgery during the procedure or within 7 days of procedure) A. present B. absent

22. Other complications, please specify_____

23. How long the hypoxia lasts A. < 1min B. 1-5 min C. 6-10 min D. >10 min _____

24. Procedure done to improve hypoxia A. Two lung ventilation B. Increase depth of anesthesia

C. Muscle relaxation D. Bronchodilators (inhalational) E. Other please specify _____

25. Duration of anesthesia in minutes _____

Other factors

26. Duration of aspiration before arriving to FBAR A. < 24 hrs. B. > 24 hrs.

27. Reason for delay A. Referral from another hospital B. The family did not think FBA

C. The patient had no symptoms D. Did not delay E. other specify _____

28. Site of foreign body found (more than 1 option can be selected)

A. FB in right bronchial tree B. FB in left bronchial tree C. FB in larynx and trachea

D. Specific location not identified E. No FB F. Other please specify _____

28. Aspirated things A. Organic materials (pleases specify) _____ B. Inorganic material (please specify) _____ C. No foreign body found _____

29. How was the procedure done? A. urgent and emergent procedures done at night B. urgent and emergent procedures done at daytime C. all the vital sign were stable and done at night D. stable performed on the next available daytime operating list rather than doing it late at night

30. Procedure done by A. Anesthesiologist and Pediatric surgeon B. Anesthesiology resident and Pediatric surgeon C. Anesthesiologist and Pediatric surgery resident D. Anesthesiology resident and Pediatric surgery resident E. MSC or anesthetist

31. Patients transferred to A. Intubated to the ICU B. Extubated to the ICU

C. PACU and then to the ward D. PACU and then to EOPD

32. Is there any post procedural complications A. Yes B. No

33. What was the complication? A. Hypoxia B. Laryngeal edema C. Laryngospasm D. Pulmonary infections E. Other (please specify) _____

34. The patients discharge on A. Less than 24 hrs. B. 2 to 3 days C. More than 3 days

Thank You!