ADDIS ABABA UNIVERSITY

COLLEGE OF MEDICAL & HEALTH SCIENCES

SCHOOL OF MEDICINE DEPARTMENT OF ANESTHESIA

MAGNITUDE & ASSOCIATED FACTORS OF DIFFICULT AIRWAY IN PREGNANT MOTHERS WHO UNDERWENT CAESAREAN SECTION UNDER GENERAL ANESTHESIA IN ALL GOVERNMENTAL HOSPITALS OF ADDIS ABABA.

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THESIS SUBMITTED TO THE SCHOOL OF ANESTHESIA, COLLEGE OF MEDICINE AND HEALHT SCIENCES, ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTERS DEGREE IN ANESTHESIA

May, 2016

ADDIS ABABA

Abstract

Background: Difficult airway contributes to higher number of maternal morbidity and mortality attributed to anesthesia. Especially in developing countries like Ethiopia in which economical problems impart wide varieties of infrastructural challenges such as lack of appropriate facilities, equipments, highly trained anesthetists, antenatal care of pregnant women and continues and up to date trainings for the professionals who are part of the clients care.

Objectives: To assess the magnitude and risk factor of difficult airway among pregnant mothers who underwent general anesthesia for caesarean section in all governmental hospitals of Addis Ababa from February 1- April 30 2016.

Methods: Institutional based cross sectional study was conducted from February 1- April 30, 2016 in eight governmental hospitals of Addis Ababa city that provide General Anesthesia for Caesarean section. A total of 302 participants were included in the study period. Patient demographics, airway management, difficult intubation, failed intubation were studied among participants in which general anesthesia was given.

Result: The study found that the magnitude of difficulty intubation was 5.6%. The result of multivariate analysis showed that age group 25-29, 30-34, mandibular protrusion and history of exposure to anesthesia were strongly associated with difficulty intubation at p-value less than 0.05. The odd of developing difficulty intubation was five times less in mallampati class I than the odd of developing difficulty intubation in mallampati class II (AOR, 5.436, 95%C.I;.627-47.089)

Conclusion: General anesthesia is most commonly used in cases where emergent delivery was needed. The magnitude of difficult intubation and failed intubation is higher in this study than studies conducted in other parts of the world.

Keyword: difficult airway, difficult intubation, caesarean section, failed intubation

ACKNOWLEDGMENT

I am very thankful to my advisor Mrs. Meron Abrar (MSC in anesthesia) who helped me in every step of the way for the success of the project by providing ideas and comments from the beginning to the end. I would like to provide my heartfelt gratitude to all the data collectors & the supervisors who worked tirelessly despite of all the challenges in each hospital. I am very grateful to all anesthetists & OR staffs of each hospitals who helped me relentlessly throughout the data collection process. Last but not least am forever indebted for my family to their sacrifices and prayers that made me who I am today.

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List of Acronyms

AOR: Adjusted odd ratio

ASA: American Society of Anesthesiologists physical status

BMI: Body Mass Index

CS: Caesarean Section

CC: Closing Capacity

C.I: Confidence Interval

COR: Crudes Odds Ratio

DAS: Difficult Airway Society

DL: Direct Laryngoscopy

FRC: Functional Residual Capacity

GA: General Anesthesia

ILMA: Intubating Laryngeal Mask Airway

LMA: Laryngeal Mask Airway

SGA: Supraglottic Airway

TMJ: Tempromandibular Joint

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CHAPTER ONE

INTRODUCTION

1.1.Background

The airway is the main gateway to life giving gas, oxygen, into the body. Securing a patent airway is the primary step in providing care for the patient especially for pregnant mothers because caring a mother is also care for the fetus.[1]

The use of general anesthesia has declined in obstetrics in recent times due to familiarity and advanced techniques in regional anesthesia, different countries inclined to use regional anesthesia for caesarean section than general anesthesia. [2, 3,4]

Different literatures define difficult airway in different ways, a standard definition of the difficult airway cannot be identified in the available literature. The ASA practice guideline for difficult airway define difficult airway as the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with facemask ventilation of the upper airway, difficulty with tracheal intubation, or both. The concept may extend to include failed intubation and failed mask ventilation.[2,3]

Some literatures involve difficulty in placing supraglottic airway devices among definitions of difficult airway. The proper insertion of endotracheal tube requires more than 3 attempts or more than 10 minutes by a trained anesthesiologist that include an assistant with optimal positioning of the patient and optimal external laryngeal manipulation. Difficult laryngoscopy is when it is not possible to visualize any portion of the vocal cords.[2,4]

Difficult mask ventilation can be defined as “not possible for the unassisted anesthesiologist to maintain oxygen saturation more than 90% using 100% oxygen and positive pressure mask ventilation in a patient whose oxygen saturation was more than 90% before anesthetic intervention, and/or it is not possible for the unassisted anesthesiologist to prevent or reverse signs of inadequate ventilation during positive pressure mask ventilation[3]. The first non invasive access to the airway to relieve airway obstruction was in 1880 by Scotsman Sir McEwen passing an oral tube into the trachea using blind digital intubation first on cadaver latter used it clinically. The first laryngoscopy was done for the first time by Manuel Garcia in 1855 demonstrating autolaryngoscopy on him since he lacks gag reflex[1].

Airway management lay in the center of anesthetic management of surgical, critically ill and emergency patients requiring airway intervention. Managing the airway helps in providing: patent airway, delivering vital gases, inhaled anesthetic agents, protecting the airway from aspiration of gastric contents and blood and other secretions. Expert skills are required to manage the patient’s airway which is the gateway to everything. In some situations failing to do so may lead the patient to disastrous complications that even end up with death[3].

Difficult airway, which is difficulties in performing airway management skills are inevitable part of anesthesia practice. But the situation will be grave if it involves two lives at stake, a mother and a child, which require great attention and meticulous preparation due to vulnerable physiological state of a mother and fetus. Anatomical and physiological changes put the pregnant mother to greater risk for difficult airway than her non pregnant counterpart[4, 5].

Difficult airway contributes to higher number of maternal morbidity and mortality attributed to anesthesia[2]. Especially in developing countries like ours in which economical problems impart wide varieties of infrastructural challenges such as lack of appropriate facilities, equipments, highly trained anesthetists, antenatal care of pregnant women and continues and up to date trainings for the professionals who are part of the clients care[4].

Difficult airway if left unmanaged can leads to different range of complications among these are the risk of hypoxic cardio pulmonary arrest, hypoxic brain insult, aspiration, postoperative upper airway and pulmonary complications and death are few of them[3].

1.2. Statement of the problem

During general anesthesia the airway must always be managed, and airway management is more difficult in the obstetric patient. Anesthesia related complications are the sixth leading cause of pregnancy related maternal complications in the United States[3, 6].Airway problems were by far the most common cause of anesthesia related deaths [2,7], Even though the use of general anesthesia for caesarean section has been declined in recent times general anesthesia for caesarean section appears to be associated with higher rates of serious and life-threatening complications than regional anesthesia. Most of maternal mortalities in anesthesia are related to airway management during general anesthesia[2,6].

Anatomic and physiologic changes accompanying pregnancy are the main reason for occurrence of difficult airway management in pregnant mothers compared to the non pregnant ones. These factors include increased weight gain, particularly enlargement of the breast, edema of the airway, decreased functional residual capacity and increased oxygen consumption due to increased maternal metabolic state.[2,6]

Maternal mortality is about 830 women per day which is 239 per 100,000; of these 99% of the deaths occur in developing countries. The sub-Saharan Africa contribute to 75% of these number as a part developing countries. The main reason for this is lack of medical facilities to give birth but this problem is being solved due to the government's effort to establish health centers in proximity to the areas in which people resides these can be shown by the fact that mortality rate halved since 2000 G.C and the decline rate is 5.5%[4]. The number is not matched with the quality service being given to pregnant mothers due to lack of experienced anesthetist, standardized facilities, appropriate equipments specially for managing difficult airway and drugs, failure to adhere with the ASA difficult airway algorithm in managing difficult airways in developing countries[4]. On top of these constraints, to my knowledge there is no information available on the magnitude of difficult airway under anesthesia even for the professional practitioner in Ethiopia. This probably indicates the less attention given for the possibility of difficult airway under general anesthesia in our country.

Proper management of difficult airway will the save the mother and the child from catastrophic complications and the anesthetist from legal litigations. This study may also use as a base line

data to conduct further multicenter studies in Ethiopia on the same area of interest. Last but not least it contributes to the efforts made to decrease maternal and fetal morbidity and mortality in Ethiopia.

1.3. Significance of the study

Although the number of General anesthesia administered to caesarean section has been declined, its being done in patients who have indication for general anesthesia, times when difficult regional anesthesia and when rapid delivery of the baby is needed. The magnitude of difficult airway: difficult mask ventilation, difficult tracheal intubation, failed intubation and difficult Laryngeal Mask airway (LMA) placement, is very high in obstetric patient.

The magnitude of difficult airway in caesarean section under anesthesia may vary between countries depending on the presence of skilled and experienced anesthetist, well functional and equipped facilities, and culture of using systematic and well organized approach towards managing difficult airway like using ASA or DAS guidelines of difficult airway in case of difficulties. Lack of evidence based information on the number and severity of the problem in Ethiopia also contribute to the little attention given to the problem that would save plenty of maternal and fetal life by creating awareness to the professional practitioner, concerned governmental and non-governmental organizations.

The main concerns of this study is to fill the information gap of anesthetists and other concerned health professionals on the prevalence and associated risk factors of difficult airway in caesarean section under general anesthesia which will contributes in the improvement of difficult airway management, anesthesia related complications, maternal and fetal condition and postoperative patient satisfaction. The result will help anesthetists to better consider the problem now more than any other time before to improve techniques, consider patients with risk factors, assess their patients preoperatively for any possible difficult airway, prepare equipments and adhere to systematic algorithms in cases of difficulty, thereby decreasing maternal and fetal morbidity and mortality which is the main national concern at this time.

This study will provide evidence based information to anesthetists and other concerned bodies on the magnitude (magnitude) and associated risk factors of difficult airway in pregnant mothers presenting for caesarean section under general anesthesia. It provides ways in managing the airway and current guidelines and recommendations in managing airway especially in time the need arise for difficult airway and ways to decrease the risk of airway intervention by creating

awareness about the gravity of the problem in the study area that will be reference for other areas too.

The study can point out areas of improvement regarding perioperative management of pregnant mothers for resource allocators and health managers. This study may also initiate researchers to conduct multicenter studies at a national level that will improve the anesthetic practice in our country.

CHAPTER TWO

LITERATURE REVIEW

Different literatures define difficult intubation differently. Difficult airway involves difficulty in mask ventilation, laryngoscopy, and difficult intubation or both. The ASA guideline for difficult airway management define it as a clinical situation in which conventionally trained anesthesiologist experiences difficulty with face mask ventilation of the upper airway, difficulty with tracheal intubation or both[5].

Difficult face mask or supraglottic airway (SGA) ventilation (e.g LMA, ILMA, laryngeal tube) is defined if It is not possible for the anesthesiologist to provide adequate ventilation because of one or more of the following problems: (1) inadequate mask or SGA seal. (2) Excessive gas leak, or (3) excessive resistance to the ingress or egress of gas or difficult mask ventilation can be defined as "not possible for the unassisted anesthesiologist to maintain oxygen saturation more than 90% using 100% oxygen and positive pressure mask ventilation in a patient whose oxygen saturation was more than 90% before anesthetic intervention, and/or it is not possible for the unassisted anesthesiologist to prevent or reverse signs of inadequate ventilation during positive pressure mask ventilation[2].

Difficult laryngoscopy is when it is not possible to visualize any portion of the vocal cords after multiple attempts at conventional laryngoscopy. Difficult tracheal intubation is when intubation requires multiple attempts (greater than two times) or more than 10 minutes in the presence or absence of tracheal pathology by a conventionally trained anesthesiologist. Failed intubation in the other way is when placement of the endotracheal tube fails after multiple attempts and other technique is used to intubate[2,5, 6].

Failed intubation occurs approximately 0.13% to 0.35% or 1: 750 to 1: 280 of obstetric patients. The magnitude of failed intubation in pregnant mothers has been estimated to be 1.3 to 3 per thousand and difficult endotracheal intubation of 64 per thousand[2].

Even though mask ventilation is not routinely used or relatively contraindicated during caesarean section under general anesthesia because of its emergency procedure, situation may necessitate the use of mask ventilation when other means of maintaining airway proved difficult. Routine preoperative assessment focuses most of the time on predicting difficult endotracheal intubation.

But the most catastrophic situation is the case in which intubation failed and mask ventilation becomes difficult. Therefore prediction of difficult mask ventilation takes equally important place as prediction of difficult intubation.

Different studies provides different magnitude rates for difficult mask ventilation and it's expected to occur from 0.07% - 1.4%[8].The magnitude of difficult intubation increases in patients with difficult mask ventilation with the magnitude of 15% - 30% compared to 8% without difficult mask ventilation[9].

The magnitude of difficult airway, difficult intubation, difficult laryngoscopy, difficult mask ventilation, difficult, are very high in obstetric patients compared to non pregnant patient populations. This is due to anatomic and physiologic changes accompanying pregnancy[1, 3.]

2.1 Anatomical changes

Anatomical changes place pregnant mother at increased risk of airway management complications and difficult intubation. These includes pregnancy related weight gain particularly enlargement of breast size and increased risk of pulmonary aspiration. In supine position the enlarged breast tend to fall in to the neck, which interfere with the insertion of the laryngoscope blade which necessitate the use of short handle and placing the mother in sniffing position of extending the neck. Other abnormalities that happen in pregnant mothers but not in non pregnant population ones include full dentition, small mandible, protruding incisors, limited mouth opening or neck extension, short neck, large breasts[1, 2]. Increased mechanical pressure from the gravid uterus displace the abdominal contents and produce alignment of the upper airway structures, finally a badly placed hip wedge causing a thoracic lift effect, as well as misapplied cricoid, inadequate anesthesia plus muscle relaxation because of propensity to minimize doses and anxiety on the part of the inexperienced anesthesia provider during induction of anesthesia may also complicate airway management in the obstetric population. Many of these changes can be overcome with preparation and attention to details such as positioning[1].

2.2 Physiologic changes

The physiologic changed on top of the anatomical pregnancy related alterations make the situation severe for the mothers. Pregnant mothers have 20% to 30% higher oxygen consumption

due to fetal metabolic needs[1]. There is generalized weight gain in obstetrics patients up to 20 Kg or more associated with this there is enlargement of breast size which tend to fall into the neck when patients lay in supine position which make difficulty in inserting the handle of the laryngoscope. Increased in BMI will increase the risk of anesthetic complications [2, 10, 11.]

Due to the enlarging uterus the inferior vena cava and abdominal aorta will be compressed when the pregnant mother lie supine that occurs in 12 to 15 % of patients at term that decrease venous return and cardiac output, blood pressure and uterine blood flow[1, 5]

In the respiratory system decreased FRC and vital capacity as well as increased consumption can increase the development of material hypoxia this can be associated with increased weight gain and uterine enlargement that accelerates the onset of hypoxia at times of hypoxia and hypoventilation.[2, 5] . Total lung compliance is diminished due to the upward shift made by the enlarging uterus on the abdominal contents. The closing capacity (CC) is unchanged, the resultant decrease in the ratio FRC: CC produce rapid airway closure when lung volume reduced predisposing parturient at higher risk of hypoxia than non pregnant ones[1, 13]. Progesterone induced increase in total body water lead to generalized body edema. The edema is not clinically significant but vascular engorgement of the respiratory tract during pregnancy leads to edema of the nasopharynx, oropharynx and trachea.[1, 2, 14, 15, 16].There is also associated enlargement of the tongue secondary to the airway edema.

Pregnant patients have an elevated gastric acid contents (decreased PH) and progesterone and mechanical induced decrease in the tone of the gastro-esophageal sphincter and gastric emptying[1].consequently all laboring mothers should have to be considered as full stomach patients that are at increased risk of regurgitation of gastric contents in the pharynx, even they are considered full stomach beyond 20 weeks of pregnancy. Pregnant women are more prone to aspiration of the gastric contents after induction of general anesthesia than non pregnant patients[2].

The anatomic and physiologic changes need understanding of the problem and their implication in management of anesthesia that require detailed preparation and meticulous attention to the changes that accompany administration of anesthesia which prevent catastrophe to the mother and the fetus[2]. In the following paragraph I would like to mention some points that help in

considering the anatomic and physiologic changes that leads to adverse outcomes if not dealt appropriately.

The increased weight gain tends to make the body to be edematous which also produce enlargement of the breast. The edema also makes engorgement of the respiratory tract vessels. Small size endotracheal tube, use of vasoconstrictor during the instrumentation of the nasal and oral mucosa will help in confronting the challenges of airway edema The falling back of the enlarged breast to the neck tend to produce difficulty of manipulating the handle therefore use of short handled laryngoscope are advised[2]. Placing the patient in left lateral position will avoid hypotension secondary to aorto-caval compression[2,3,5]. Preoxygenation (denitrogenation) for 5 minute will avoid the desaturation associated with apneic periods for example intubation due to decreased FRC in pregnant patients[3]. Enlargement of the tongue may obstruct airway visualization during laryngoscopy may predispose to difficult airway. Aspiration prevention should be given greater attention in both pharmacological and mechanical terms. These may include administration of non particulate antacids, Histamine (H2) receptor blocker, and metoclopramide as gastrokinetic agents pharmacologically. Use of nasogastric tube to decompress the gastric volume should be considered. Finally application of cricoid pressure during rapid sequence induction is mandatory[2,5].

2.3 Airway Management

Management of failed obstetric airway is often problematic with the two lives at stake. The physiologic and anatomic changes add pressure on the anesthetist to intubate the trachea more quickly and to give up rapidly resulting in failed intubation before desaturation or aspiration occurs. Failure to intubate should lead to the initiation of ‘failed intubation drill’ to find alternative method to ventilate and oxygenate the patient[15]. Around 50% of difficulties in obstetric occur unexpectedly therefore preparation is required to solve these challenges and management guidelines have to be available easily. Anesthetists and anesthesiologists should perform preoperative evaluation of patients and predictive tests for possible airway difficulties. Other possible cause for to increased occurrence of difficult airway in obstetrics as by many authors is increased use of GA for caesarean section in particular and obstetric anesthesia in

general consequently and diminished exposure to airway management of in these group of patients by trainee anesthetists.[17,5,18]

Failed intubation is found to be 1 in 224 or approximately 0.13% to 0.35% or 1:750 to 1:280 of obstetric patients [1, 11, 17]. Magnitude of difficult endotracheal intubation is 64 per thousand[1]. To avoid such challenges or to solve them appropriately it is indispensible to perform airway assessment that is predictive of difficult airway. There are numerous methods for assessing the airway, which may help in predicting a difficult airway. However, a simple three step method of airway evaluation may be performed that includes a assessment of (1) the mouth opening and the visibility of the posterior pharyngeal structures (supine versus sitting),(2) the mandibular length, and (3) the neck mobility[5].

All of the above data are from outside of Ethiopia and Africa. I tried to search on Pubmed and other anesthesia journals, but it is not possible to find any data in Ethiopia even in Africa. In this study, it was tried to assess the magnitude and possible risk factors of difficult intubation in pregnant mothers who undergo caesarean section under general anesthesia.

CHAPTER THREE

OBJECTIVES

3.1. General Objective

- To assess the magnitude and risk factor of difficult airway in pregnant mothers who underwent general anesthesia for caesarean in all governmental hospitals of Addis Ababa from February 1- April 30 2016.

3.2. Specific Objective

1. To assess the magnitude of difficult airway in pregnant mothers who underwent general anesthesia for caesarean section.
2. To determine risk factors of difficult airway in pregnant mothers who underwent general anesthesia for caesarean section.

CHAPTER FOUR

METHODOLOGY AND MATERIALS

4.1. Study area and period

The study was conducted in all governmental hospitals of Addis Ababa city; out of the thirteen governmental hospitals in Addis Ababa eight of them provide delivery service by caesarean section were included in the study. The hospitals are Black Lion specialized Hospital, Zewditu Hospital, Ghandi memorial Hospital, Yekatit 12 Hospital, ALERT Center, St. Paul Millennium College Hospital, St. Peter Hospital & Tirunesh-Bejing Hospital. The study was conducted from February 1 to April 30, 2016 G.C.

4.2. Study Design

A facility based cross-sectional study was conducted in all governmental hospitals in Addis Ababa in the specified study period.

4.3. Population

4.3.1. Source Population

The source population was all obstetric clients who underwent caesarean section under general anesthesia.

4.3.2. Study population

The study population was all selected obstetric clients who received general anesthesia for caesarean section in the study period.

4.3.3. Study unit

The study units were each patient who underwent caesarean section under General anesthesia.

4.4. Eligibility Criteria

4.4.1. Inclusion criteria

Clients who underwent caesarean section under general anesthesia were included.

4.4.2. Exclusion criteria

Clients who were under 18 years of age and who refused to participate in the study

4.5. Sampling technique and sample size determination

4.5.1. Sample population

All patients who fulfill the inclusion criteria in the specified time period were the sample population

4.5.2. Sampling technique

All patients in the study period were included**.** A consecutive sampling technique was employed in the predetermined study period.

4.6. Variables

4.6.1. Dependent variable

Difficult airway

4.6.2. Independent variable

- Age
- Obesity
- Receding mandible
- Short neck
- Large breast
- Reduced mouth opening
- Poor cervical spine movement
- Obstructive sleep apnea
- History of snoring
- Protruding tooth
- Anterior tooth gap

Anesthesia related variables:

- Inexperienced anesthetist
- Absence of appropriate equipment
- Rapid sequence induction

Procedure related variables:

- Caesarean section
- Previous airway surgery
- Emergency surgery

4.7. Data collection technique

Difficult airway checklist or questionnaire was prepared in English and then translated to Amharic and was used as data collection instrument. During data collection eight BSc holders were used as a data collector in each of the hospital and one Msc holder was involved as a supervisor for the data collection process. Training was given to data collectors. After informed consent was taken from the patients verbally, data was collected from participants after receiving the clients into preoperative waiting area; they were assessed by the data collectors on the socio-demographic characteristics, history and preoperative airway assessment. Once the participants entered into the operation theatre the data collectors observed and filled the difficult airway checklists as the induction of anesthesia and airway management was performed.

4.8. Data processing and analysis

The data was entered into Epi info version 7 and was exported to SPSS version 20 computer program for analysis. Descriptive statistics was used to summarize data, tables and figures for display results. Bivariate and multivariate analysis was used to see the effect of independent variable over difficult airway. The variables which were significant on bivariate analysis at p-value less than 0.2 were taken to multivariate analysis. In multivariate analysis P- value of less than 0.05 was used as a cut of point for presence of association. Strength of association was measured by 95% confidence interval and Odd ratio**.**

4.9. Data quality control and assurance

Data collectors was trained on each items included in the questionnaires. Then the prepared field work manual was given to each data collectors. The developed questionnaires were translated to Amharic then back to English to see consistency of questionnaire. The Supervisor cross checked for completeness and accuracy of data on daily basis.

4.10. Dissemination plan

This study upon completion could serve as a reference material to researchers, experts and policy makers for intervention. To reach these bodies the completed paper will be submitted to College of Health Sciences, Department of anesthesia. In addition, a copy of this material will be given to Tikur Anbessa specialized hospital, ALERT center, Zewditu Hospital, Ghandi Memorial Hospital, Yekatit 12 Hospital, St. Paul Millennium College Hospital, St. peter Hospital, Tirunesh-Bejing Hospital, Ethiopian Association of Anesthetists and Ethiopian ministry of health. The result will also be disseminated through publication in peer reviewed journals and through presentation in related workshops and seminars.

4.11. Operational definition

1. **Difficult airway** : is defined as the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with facemask ventilation of the upper airway, difficulty with tracheal intubation, or both
2. **General anesthesia**: medically induced loss of consciousness, loss of protective reflexes resulting from administration of one more general anesthetic agents
3. **Difficult facemask or supraglottic airway (SGA) ventilation** (*e.g.*, laryngeal mask airway [LMA], intubating LMA [ILMA], and laryngeal tube): It is not possible for the anesthesiologist to provide adequate ventilation because of one or more of the following problems: inadequate mask or SGA seal, excessive gas leak, or excessive resistance to the ingress or egress of gas.
4. **Difficult laryngoscopy**: It is not possible to visualize any portion of the vocal cords after multiple attempts at conventional laryngoscopy.

5. **Difficult tracheal intubation**: Tracheal intubation requires multiple attempts, in the presence or absence of tracheal pathology.
6. **Failed intubation**: Placement of the endotracheal tube fails after multiple attempts.
7 **American Society of Anesthesiologists (ASA) physical status**: is a method of categorizing patients' physical state developed by the ASA taskforce which classify patients according to their physical status (systemic wellbeing). It is classified into six classes.

   ASA class I: normal healthy patient except the surgical compliant he had

   ASA class II: a patient with a mild systemic disease without functional limitation

   ASA class III: a patient with severe systemic disease with functional limitation

   ASA class IV: a patient with severe systemic disease that is a constant threat to life

   ASA class V: moribund patient who is not expected to survive without the operation

   ASA class VI: a declared brain-dead patient whose organs are being removed for donor purpose.
8 **Rapid sequence induction:** is simultaneous administration of sedative drugs and rapid acting muscle relaxant to render the patient rapidly unconscious to facilitate tracheal intubation by applying cricoid pressure to reduce aspiration of gastric contents into their lungs for patients who are at risk of aspiration.
9 **Severe hypoxemia**: was defined as a pulse oximetery recording of less than 85% at any time.
10 **Aspiration:** inhalation of the gastric content in to the broncho-pulmonary tree typical signs and symptoms, with or without bronchoscopic or x-ray findings and with the exclusion of alternative diagnoses.

4.12. Ethical consideration

After approval of proposal, a letter of support and permission was obtained from Research ethical review committee of Anaesthesia department, Addis Ababa University. Permission to conduct was obtained from the hospitals. The advantage and purpose of the study was explained to the participants. The information obtained was kept confidential.

CHAPTER FIVE

RESULTS

5.1. Personal socio-demographic characteristics

The study was conducted on 302 pregnant mothers who underwent caesarean section at governmental hospitals in Addis Ababa. The highest number of cases 37.1% (n=112) were belonged to the age group of 25 – 29 year followed by age group between 30-34 30.1%, (n=91).The mean age is 28.76 $\pm$ 4.713 (minimum 18 and maximum 38). All of them are from urban areas. Majority of them were multigravida and primigravida. From all the participants of the study 162 of all cases were overweight. Intubation was classified difficult in 24 of 302 which is 1 in 13 patients. Failed intubation occurred in four patients (1 in 75). (See table 1).

Table1 Personal and socio-demographic characteristics of pregnant mothers who gave birth by caesarean section at governmental hospitals in Addis Ababa from February 1-April 30 2016.

Variable	Category	Frequency	Percentage
Age	20-24	58	19.2
	25-29	112	37.1
	30-34	91	30.1
	35-39	41	13.6
	Total	302	100
Gravida	Primigravida (1)	142	47
	Multigravida (2-4)	136	45
	Grand multigravida (>5)	24	8
	Total	302	100
BMI	Normal	140	46.4
	Overweight	162	53.6
	Total	302	100

Of all pregnant mothers who gave births by caesarian section at hospitals in Addis Ababa, majority of the cases had no difficulty intubation. Most of the cases are laryngoscopy grade 1 (n=162). Higher proportion of difficulty was seen in higher level of laryngoscopy grading, mouth opening < 4 cm and absence of external laryngeal manipulation. (See table 2)

Table 2 The relationship between airway management and difficulty intubation among pregnant mothers who gave birth by caesarean section at governmental hospitals in Addis Ababa from February 1- April 30 2016.

Variable	Category	Difficulty intubation		Total
		Yes	No	
Laryngoscopy grading	4	4	77	83
	1	6	156	162
	2	5	23	28
	3	3	26	29
	Total	18	284	302
Stylet Used	yes	3	130	144
	no	14	155	158
	Total	17	285	302
Mouth opening	>4	10	79	89
	≤4	6	207	213
	total	16	286	302
External laryngeal manipulation	yes	3	19	22
	no	15	261	276
	Total	18	280	298

About 78% of all pregnant mothers who gave birth at governmental hospitals in Addis Ababa were ASA class II and followed by ASA class III 15%, while there was only 5% and 2.3% of them had ASA class I and ASA class IV respectively. But, none of the patients were grouped under ASA class V. (see figure 1)

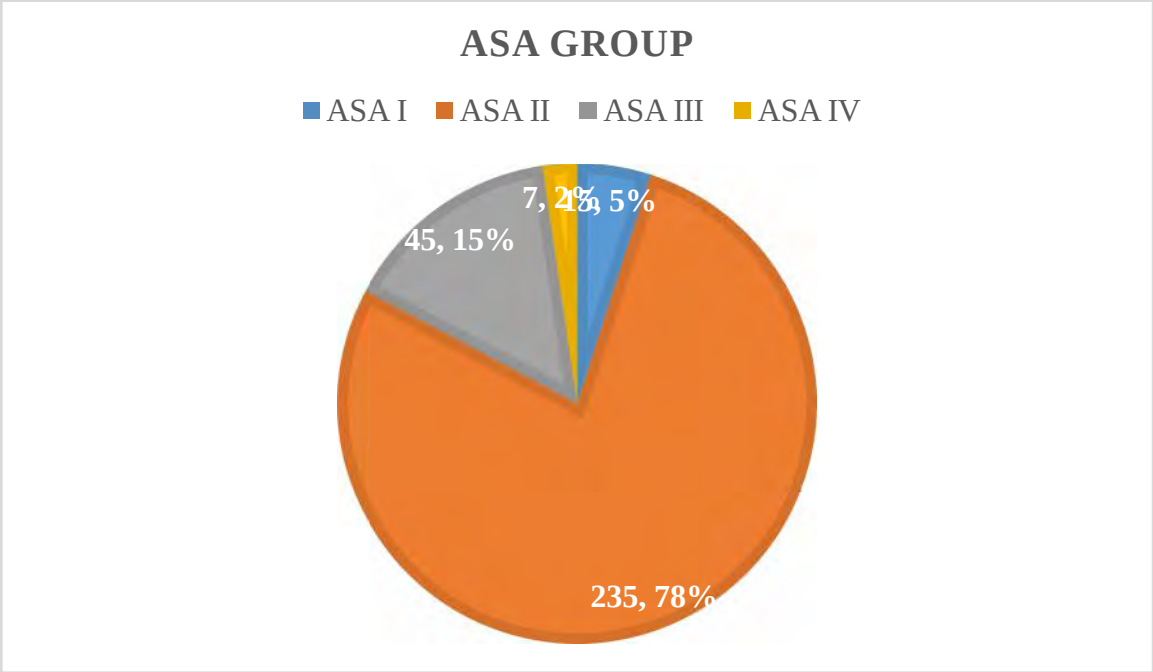


Figure 1. ASA group of pregnant mothers who gave birth by caesarean section at governmental hospitals in Addis Ababa from February 1- April 30 2016.

Among all pregnant mothers, majority of them were intubated within one attempt of intubation (n=188) and only one participant was intubated after five attempts.| (see figure 2).

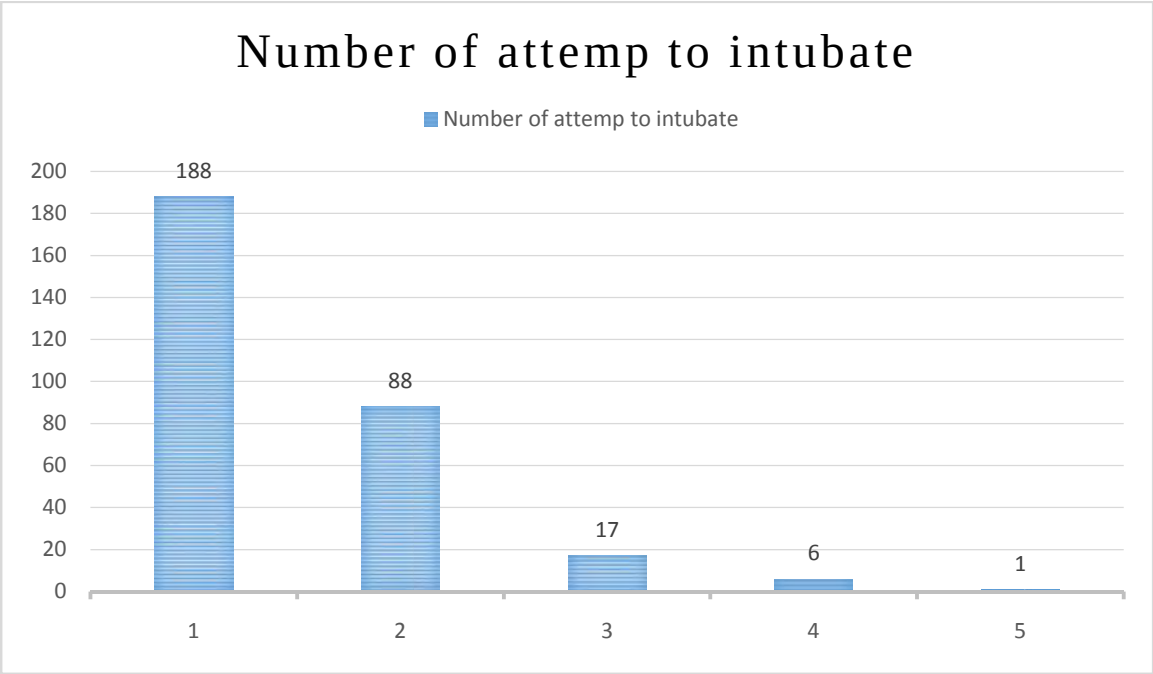
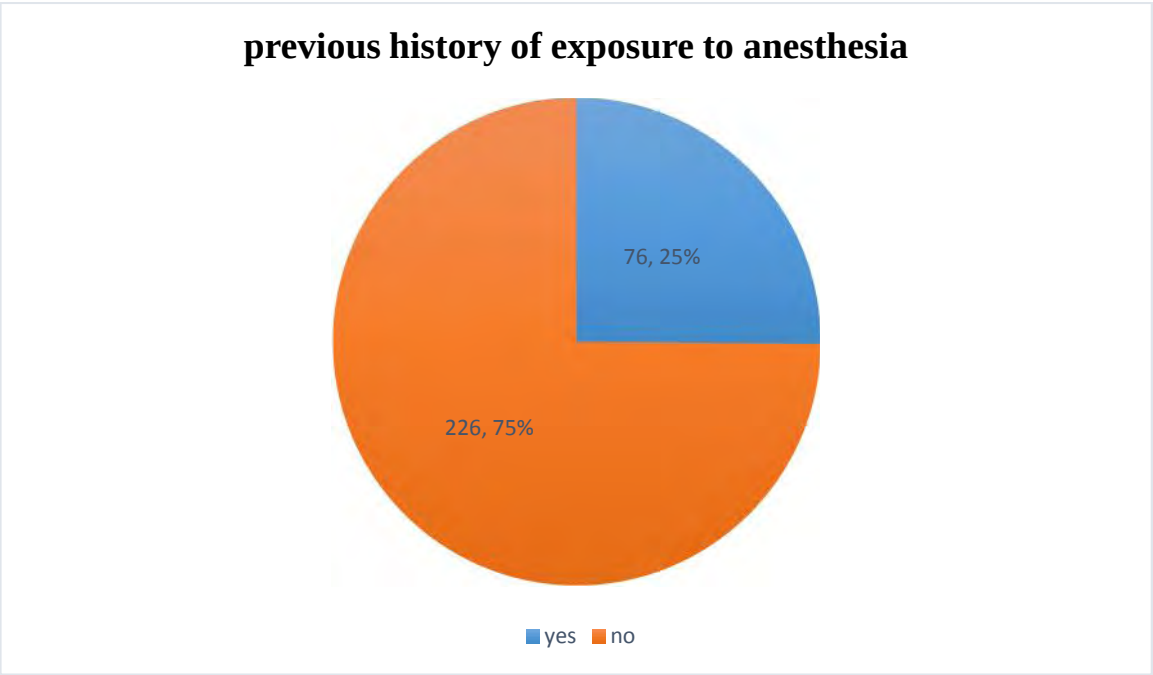


Figure 2. Number of attempt to intubated pregnant mothers who gave birth by caesarean section at governmental hospitals in Addis Ababa from February 1- April 30 2016.


previous history of exposure to anesthesia
76, 25%
226, 75%
yes
no

5.2. Association between factors affecting difficult airway and intubation

The result of multivariate analysis showed that age group between, 25-29, 30-34, mandibular protrusion and history of exposure to anesthesia were strongly associated with difficulty intubation at p-value less than 0.05 were as, history of diabetes; ASA group, History of Snoring, Atlanto occipital joint mobility and mallampati were not associated to difficulty intubation at the same value. The odd of developing difficulty intubation was five times in mallampati class II than the odd of developing difficulty intubation in mallampati class I (AOR, 5.436, 95%C.I; .627-47.089). Those pregnant mothers who have mandibular protrusion class C has eight times more likely to develop difficulty intubation than class A and class B. ((AOR, 8.216, 95%C.I; 1.796-37.584).

Table 3 Factors associated with difficulty airway intubation among pregnant mothers who gave births by caesarean section at governmental hospitals in Addis Ababa from February 1- April 30 2016.

Variable		Sig.	AOR	95% C.I. for EXP(B)	
				Lower	Upper
Age	20-24				
	25-29	.016	.116	*	*
	30-34	.04	6.414	.682	60.282
	35-39	.033	6.697	1.164	38.534
	20-24	.370	1.827	.489	6.817
Diabetic	Yes	.082	.091	.006	1.360
	No		*	*	*
ASA group	ASA II	3	.953		
	ASA II	1	1.000	4.590	.000
	ASA III	1	1.000	.000	.000
	ASA IV	1	1.000	.000	.000
Mandibular	Group A	.025			
	Group B	.068	5.422	.882	33.348

	Group C	.007	8.216	1.796	37.584
History of Snoring	Yes	.513	.559	.098	3.196
	No		*	*	*
History of exposure to anesthesia	Yes	.014	.202	.056	.726
	No		*	*	*
Mallampati	Class I	.219			
	Class II	.124	5.436	.627	47.089
	Class III	.966	1.040	.167	6.470
Atlanto occipital joint mobility	Yes	.143	10.750	.447	258.573
	No				
BMI	Normal				
	Overweight	.23	3.45	3.64	12.34

CHAPTER SIX

DISCUSSION

This study tried to assess the magnitude and associated risk factor of difficult airway in pregnant mothers who underwent general anesthesia for caesarean section. The highest number of cases 37.1% %(n=112) were belonged to the age group of 25 – 29 year followed by age group between 30-3430.1%, (n=91).The mean average is 28.76 ± 4.713 (minimum 18 and maximum 38).The study found that the magnitude of difficulty intubation was 5.6%.In contrast, another study showed that failed intubation occurs approximately 0.13% to 0.35% or 1: 750 to 1: 280 of obstetric patients. The magnitude of failed intubation in pregnant mothers has been estimated to be 1.3 to 3 per thousand and difficult endotracheal intubation of 64 per thousand.[1, 2] this showed that in present study, magnitude of failed intubation was high. This may be likely due to inadequate preoperative assessments, lack of well-equipped health facilities and inadequate preparation of anaesthetist working in the current study area.

In this study, it was found that most of the airway assessment of pregnant mother was normal. One of the abnormalities noted were restricted neck movement and history of snoring which is consistent with other similar study [3]. Another study conducted on magnitude and predictors of difficulty intubation showed that Atlanto-occipital joint mobility and mallampati were not associated to difficulty intubation, but they were positive predictors of difficulty intubation. [4, 5]

In this review, it was also found that as body mass index increases, the likely hood of difficulty intubation increases. Another similar study revealed that increases in body mass index, limited or severely limited mandibular protrusion, thick/obese neck anatomy, a history of sleep apnea and a history of snoring were identified as independent predictors for difficulty intubation.[6]

In the present study, it was found that pregnant mothers who have mandibular protrusion class C have eight times more likely to develop difficulty intubation than class A and class B. In another study, conducted on predictors of difficulty intubation, as the grade of mandibular protrusion increases, the likelihood of difficulty intubation will also increases.[7]

The finding of the current study showed that higher proportion of difficulty was seen in higher level of laryngoscopy grading, mouth opening < 4 cmand absence of external laryngeal manipulation. Similar result was reported by different literatures that restricted mouth opening and higher value of Cormack and Lehans classification was strongly associated with difficulty intubation. The literature also suggest that there has been wide variation between studies and individual anesthetists in the reporting of the view at laryngoscopy due to differences in mitigating factors (e.g., cricoid pressure, head position, degree of muscle relaxation and type or size of laryngoscope blade).[8.9]

In line with the present study increase in age, the increase body mass index, and Mallampati class were found to be risk factors of failed tracheal intubation. The significance of older age in the index cases is unclear. It can be speculated that older age at pregnancy is associated with more co-morbidity including obesity and pregnancy complications. Increasing UK obesity rates have been repeatedly reported in the literature, particularly in the obstetric and the finding of their result showed that nearly one in every 1000 women giving birth in the UK was shown to be extremely obese (BMI 50 or higher). [10, 11] However, obese and extremely obese pregnant mothers were not found in the present study.

CHAPTER SEVEN

STRENGTH AND LIMITATION OF THE STUDY

7.1. Strength

The strength of the research is, as to my knowledge there was no research done on the magnitude/incidence of difficult airway in pregnant mothers undergoing caesarean section under general anesthesia and it is also a multi center study. Therefore it can help as a baseline data for researchers and stake holders of maternal care.

7.2 Limitation

A multicenter comparative study between pregnant and non pregnant mothers on the incidence of difficult airway was not conducted due to time and financial constraints that would provide better results with ideal study design.

CHAPTER EIGHT

CONCLUSION AND RECOMMENDATION

8.1. Conclusion

The magnitude of difficult intubation was considerably high with 5.6 % and that of failed intubation is 1 in 75, 1.32% predominantly in the age group 25-29. Majority of difficulty was seen in higher level of laryngoscopy grading, mouth opening < 4 cm and absence of external laryngeal manipulation. Of all determinants of difficulty intubation, age group, 25-29, 30-34, mandibular protrusion and history of exposure to anesthesia were strongly associated.

8.2. Recommendation

Preoperative assessment of pregnant mothers for prediction of difficult intubation is very important to have meticulous preparation that will help in challenging difficulties when they arise. Increased adherence to regional anesthesia techniques whenever indicated by analyzing the risk benefit ratio based on case to case situation is important way to minimize facing the challenge of difficult intubation. Looking for patients with expected difficulty have a scientific plan/ back up plan is very important when dealing with difficult airway.

- Anesthetist is recommended to do preoperative assessment and to identify risk factors of difficulty.
- Researcher are recommended to do further researches in a large scale so that it can represent magnitude of difficulty airway.
- Health facilities were recommended to make sure that the presence fully equipped facilities manage to the airway when difficulties arise.

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ANNEX

Annex I: የፍቃደኝነት መቀበያ ቅፅ

አዲስ አበባ ዩኒቨርሲቲህክምናና ጤና ሳይንስ

የአንስቴዥያ ትምህርት ክፍል

ይህ ቅፅ የፍቃደኝነት መቀበያ ቅፅ ሲሆን በአንስቴዥያ ባለሞያዎች በጊዚያዊ የመተንፈሻ አካላት እርዳታ ወቅት የሚሞላቅፅነው።

እኔ ብሩክ ተስፋዬ በአዲስ አበባ ዩኒቨርሲቲ ህክምናና ጤናሳይንስ የአንስቴዥያትምህርት ክፍል የድህረ ምረቃ ሁለተኛ ዓመት ተማሪ ነኝ።

ይህ ቅፅ የተዘጋጀው ሰውሰራሽ የመተንፈሻ መርጃመሳሪያዎችን በኦፕራሲዮን ጊዜለሚዎልዱ እናቶች የማስገባት ችግርምን ያህል እንደሆነ ለማጥናት የተዘጋጀ ነው።ጥናቱም የወሊድ ኦፕራሲዎን አገልግሎት በሚሰጡ በሁሉም የመንግስት ሆስፒታሎች ይሆናል።ይህ ጥናት ሰው ሰራሽ የመተንፈሻ መርጃ መሳሪያወችን በወሊድ ኦፕራሲዎን ጊዜ ለሚዎልዱ እናቶች የማስገባት ችግር እና ተያያዥ ችግሮች ስፋትና ጥልቀት በመረጃ በተደገፈ መልኩ ያጠናል።ትክክለኛ የሰው ሰራሽ የመተንፈሻ መርጃ መሳሪያዎች አጠቃቀም እናትን ሆነ የሚወለደውን ልጅ ህይወትን ሊነጥቁ ከሚችሉ ችግረች ይጠብቃል።

ተሳታፊዎች በጥናቱ ላይ ለመሳተፍ አይገደዱም።የተሳትፎ ሁኔታ በፍቃደኝነት የተመሰለተ ነው።የመረጃው ምሚስጥራዊነትና የተሳታፊዎች ማንነት በከፍተኛ ሁኔታ የተጠበቀነው።በጥናቱ ላይ መሳተፍም ሆነ አለመሳተፍ የሚያመጣው ጉዳትም ሆነ ችግር የለም።ቅፁን ለመሙላት የሚዎስደውጊዜ 15 ደቂቃ ነው።ስለዚህ በጥናቱ ላይ በፍቃዶ እንዲሳተፉ በአክብሮት እጠይቃለሁ።ስለ ትብብሮትም አመሰግናለሁ።

Annex I: Consent form

I am BirukTesfaye I study in AAU, CMHS, School of Anesthesia

This form is to assess the incidence of difficult airway under general anesthesia on patients presenting for caesarean section, in all governmental hospitals Addis Ababa. This study will provide evidence based information to anesthetists and other concerned bodies on the incidence (magnitude) and associated risk factors of difficult airway in pregnant mothers presenting for caesarean section under general anesthesia. Proper management of difficult airway will the save the mother and the child from catastrophic complications. So you are kindly requested to participate on this study and provide appropriate response to questions. Your participation is voluntary. Only anonymous data will be analyzed and we strictly keep confidentiality of participants. Participating or not participating on this study will not bring any harm on you. This form will take a maximum of 15 minutes to be filled. Therefore I kindly request you to fill all the form based on your willingness. Thank you for your participation.

Annex II: Difficult Airway form

ADDIS ABABA UNIVERSITY

COLLEGE OF MEDICAL AND HEALTH SCIENC

SCHOOL OF ANESTHESIA

Part One: Socio Demographic Characteristics		
1.	Age	
2.	Weight (Kg)	
Part Two: Assessment Of Difficult Airway		
3.	Indication for C/S	
4.	ASA status	I ☐ II ☐ III ☐ IV ☐ V ☐ VI ☐
5.	Indication for GA	
6.	Mallampati class	I ☐ II ☐ III ☐ IV ☐
7.	Thyromental Distance(cm)	
8.	Neck (atlanto-ocipial joint) mobility	
9.	Mouth opening(cm)(no. of finger)	
10.	Large breast	Yes ☐ No ☐
11.	Dentition	Lost ☐ Loo ☐ Prut. ☐ oth ☐
12.	Short neck	
13.	Micrognathia, receding chin	Yes ☐ No ☐
14.	Mandibular protrusion test	GA ☐ GB ☐ GC ☐

	Part Three: Patient Characteristics	
17.	History Previous anesthesia	Yes ☐ No ☐
18.	History of snoring during sleep	Yes ☐ No ☐
19.	Obvious Trauma	Yes ☐ No ☐
20.	Diabetic	Yes ☐ No ☐
21.	Neuromuscular disease	Yes ☐ No ☐
22.	Rheumatoid arthritis	Yes ☐ No ☐
23.	Kyphoscoliosis	Yes ☐ No ☐
24.	Congenital abnormalities	Yes ☐ No ☐
	Part Four : Airway Management	
25.	DL blade type & No.	MAC. # _____ MILL. # _____
26.	DL view grade (Cormack & Lehane laryngoscopy grading)	G1 ☐ G2 ☐ G3 ☐ G4 ☐
27.	Stylet used	Yes ☐ No ☐
28.	No. of attempts	
29.	Alternative approach to intubate?	
30.	Blood Pressure(mmHg)	

31.	Heart Rate(beates per minute)	
32.	Dental damage	Yes ☐ No ☐
33.	Esopageal intubation	Yes ☐ No ☐
34.	Time taken to intubate	
35.	External laryngeal pressure	
36.	No. DL attempts	

Annex III:

ASSURANCE OF PRINCIPAL INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific ethical and technical Conduct of the research project and for provision of required progress reports as Per terms and conditions of the Research Publications Office in effect at the time of Grant is forwarded as the result of this application.

Name of the student: _____

Date._____ Signature _____

Approval of the primary Advisor

Name of the primary advisor:_____

Date._____ Signature _____