

Difficult and Failed Tracheal Intubation in Obstetrics: A Seven-year Review in a Saudi Maternity Hospital

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ABSTRACT

Background: Airway difficulty is a major contributor to mortality and morbidity during caesarean section (CS) under general anaesthesia. Though general anaesthesia is safe, the changes associated with pregnancy make securing airway more difficult. The purpose of this study was to investigate the pattern and factors associated with airway difficulty in the parturient in the region.

Methods: This was a retrospective, descriptive study of parturients who suffered airway difficulty during caesarean section under general anaesthesia over seven-year period. Their medical records were reviewed and data collected included total CS done under general anaesthesia, age, weight, nature of airway difficulty, coexisting diseases, and timing of surgery, outcomes and Apgar scores. Data was analysed using SPSS version 23 for Windows®.

Results: General anaesthesia was used in 51.3% of 10,275 CS with 42 documented as “difficult airway” giving 0.8% incidence and incidence ratio of 1:125. Failed intubation was recorded in 58% while difficult intubation was 42% of those with difficult airway. Among these, the CS was in 55% of cases “emergent”. The mean age was 33.32±5.96 years. The weight ranged from 60 to 163kg. Over 58% weighed more than 90kg. In 50% of cases, the airway was rescued with LMA and in 50%, reintubation succeeded. Outcome was good for mother and fetus in all cases.

Conclusion: Obstetric airway difficulty remains a valid concern. Effort should be made to use regional anaesthesia to reduce the risk. High awareness and preparation during obstetric general anaesthesia are recommended.

Keywords

Difficult airway, Failed intubation, Obstetric anaesthesia, Caesarean section, Maternity.

Key Message

Airway difficulty remains a valid concern for caesarean section under general anaesthesia. Obstetricians and anaesthesiologists should work together to encourage the use of regional anaesthesia. Whenever general anaesthesia is the option of anaesthesia, a high degree of expectation of airway difficulty and preparation should be implemented to reduce the risk.

Introduction

Airway difficulty is a leading cause of mortality and morbidity associated with Caesarean delivery under general anaesthesia [1]. As a consequence of this and other advantages, [2] spinal anaesthesia has become the anaesthetic technique of choice for Caesarean delivery globally [3]. However, due to some reasons that may contraindicate the use of spinal anaesthesia, general anaesthesia is still used for Caesarean section in some cases.

General anaesthesia is a safe technique of anaesthesia. However, in the parturient, the gravid uterus and other changes associated with pregnancy can make securing the airway a challenge. The

pregnant uterus is a classic example of a “full stomach” with the present risk of aspiration that can result in Mendelson’s syndrome (aspiration pneumonitis) [4]. The changes that occur in the airway lead to capillary engorgement, mucosal edema and increased tissue friability [5]. This results in narrowed airway and increased risk of airway bleeding during airway manipulation. The weight gain associated with pregnancy, if coupled with a pre-existing obesity, a short stature and enlarged breasts can contribute to real difficulty in securing the airway. A difficult airway may result in the ‘can’t intubate, can’t ventilate’ (CICV) situation which is life threatening.

According to the American Society of Anesthesiologists’ (ASA) Taskforce guidelines on difficult airway, the airway is said to be ‘difficult’ whenever a conventionally trained anaesthesiologist experiences difficulty in instituting a facemask ventilation of the upper airway, intubating the trachea or both [6]. For the purpose of aggregate analysis and cross-study comparison, the updated guidelines by ASA recommend that difficult airway be categorised and as much as possible be assigned a numerical value.

The objective of this study was to assess the pattern and evaluate the factors associated with airway difficulty in parturient presenting for Caesarean delivery under general anaesthesia.

Materials and Methods

Setting

The study was based in the Anaesthesia department of the Maternity and Children’s Hospital, Al Jouf, Kingdom of Saudi Arabia. This facility is a 150-bedded hospital solely dedicated for the obstetric, gynaecological and paediatric health needs of the people living in Al Jouf, North-western region of the Kingdom of Saudi Arabia. Located in the town of Sakaka, the capital of the Al Jouf Region with a population of 508,500 as at 2017, the hospital was established in 2001 [7].

Design

This was a retrospective descriptive study of parturients who had Caesarean section under general anaesthesia who presented with difficulty in endotracheal intubation or mask ventilation or both. The study covered a seven-year period from January 2012 until December 2018. The total number of Caesarean sections performed during the period was retrieved from the operating room (OR) records. The number done under general anaesthesia was deduced wherefrom. All parturients reported to have had difficulty with the airway during general anaesthesia were identified and included in the study. Those who had general anaesthesia but with no airway difficulty, and those who received regional anaesthesia successfully were excluded. The personal files of these patients were retrieved from the Medical Records department after an approval from the Hospital’s Administration. Data collected from the records were the following: Age, weight, parity, gestational age, past medical history, ASA class, indication for surgery, nature of operation based on time, primary or previous CS, indication for general anaesthesia, estimated blood loss (EBL), transfusion,

fetal outcome, Apgar score, anaesthetic complication, nature of difficulty, any cause of the difficulty, anaesthesia induction agent used, relaxant agent used, laryngoscopy used, category of practitioner involved, outcome of the airway, how difficulty was overcome, extubation problems, how resolved, post-operative complications and how managed, airway trolley use, if any.

“Scoline apnoea” was defined as failure to recover from the muscle paralysis following the use of suxamethonium for intubation after reversal at end of surgery. Due to limited reporting, difficult airway was taken as such following a list of such patients kept in the department alert notice board [8]. From the list, the file numbers of the patients were traced manually in the medical record. The details above were retrieved. The information about airway difficulty was retrieved from the anaesthetic charts of the patients while the information about the mother’s pre-partum health and baby outcome were retrieved from the other sections of the record.

Data Analysis

Data collected were entered into a spreadsheet and analysed using the SPSS statistical package version 23 for Windows® (SPSS Inc., Chicago, IL, USA). Descriptive data were presented as mean \pm SD, mode, median and percentages. Student’s t-test was used to analyse nominal data with p-value of <0.05 accepted as significant. Results were presented as mean, mode, percentages, tables, charts and graphs.

Results

A total of 10,275 Caesarean sections were done during the period. General anaesthesia was used in 5276 cases giving a rate of 51.3%. Total number of difficult airway recorded was 42. The percentage of difficult airway was 0.8% giving an incidence ratio of 1:125.

Of the 42 recorded, seven case files were not found in the medical record department. Two cases were for non-obstetric purposes while four did not have any documentation of the type or nature of airway difficulty in their records. Therefore, 31 parturients had their records intact and were included in the study. One parturient was referred to higher centre for her airway management. Of these 31 parturients, 26 (86.7%) had airway challenges: 11(42.3%) had difficulty in ETT intubation giving an incidence rate of 0.2%; 15 (57.7%) had failed intubation, an incidence rate of 0.3%. Four (13.3%) had ‘scoline apnea’.

The youngest parturient was 23 and the oldest was 44 with a mean of 33.32 ± 5.96 years. The weight ranged from 60 to 163kg. Heights were not recorded and so BMI could not be calculated. However, 23 (74.2%) weighed over 80kg while 15 (48.4%) were over 90kg and 3 (9.7%) were over 130kg. See table 1.

Twenty-two parturients (71%) had past medical conditions. The commonest indication for surgery was previous Caesarean section. See table 2. The ASA classification status was not recorded in 3 patients. Of the 28 recorded, 11(39.3%) were ASA I, 16(57.1%) were ASA II and 1(3.6%) was ASA III.

Table 1: Showing the age, weight and parity distributions of the parturient.

Parameter	N	Percentage
Age (years)		
≤20	0	0
21-25	3	9.7
26-30	9	29
31-35	8	25.8
36-40	5	16.1
>40	6	19.4
Total	31	100
Weight (Kg)		
60-69	3	9.7
70-79	5	16.1
80-89	8	25.8
90-99	5	16.1
100-109	7	22.6
110-119	0	0
120-129	0	0
>130	3	9.7
Total	31	100
Parity		
0	9	29
1-3	11	35.5
4-6	7	22.6
≥7	4	12.9
Total	31	100

Table 2: Showing the past medical history and indication for Caesarean section.

Parameter	Number	Percentage
Past Medical History		
Thyroid diseases	6	27.3
Diabetes mellitus	5	22.7
Hypertension	4	18.2
Gall bladder diseases	3	13.6
Hernias	2	9.1
Others	2	9.1
	22 (71%)	100
None	9 (29%)	
Total	31	
Indication for Caesarean Section		
Previous Caesarean section	10	32.2
Abnormal CTGs/Fetal Distress	5	16.1
Hypertensive disorders	3	9.7
Abnormal lie	3	9.7
Macrosomia	3	9.7
Others	7	22.6
Total	31	100

On urgency, 14 (45.2%) were elective cases while 17 (54.8%) were emergencies. Sixteen (53.3%) had primary sections while 14 (46.7%) were repeat sections. The Lucas classification of urgency of Caesarean section was not used.

One parturient was referred to a higher centre due to two consecutive failed intubations in previous Caesarean sections. There was no report of ‘Can’t intubate, can’t ventilate’ (CICV) situation. The

classical Mackintosh laryngoscopy was the intubation method used in all. No video or fibre optic laryngoscopy was used. Suxamethonium was used for muscle relaxation in all cases. In 15(50%), the airway was rescued using LMA and intubation succeeded after re-attempts in 15 (50%) of cases. The number of attempts was not recorded. No case was postponed. No record of the use of gum elastic bougie. In 29 (93.5%), the Anaesthetist involved was a Specialist, 1 (3.2%) Consultant and 1 (3.2%) was a Resident. The commonest post extubation complication was laryngospasm. Commonest treatment administered was hydrocortisone, dexamethasone and oxygen. One patient was re-intubated and mechanically ventilated in PACU. No airway trolley was available for use in all cases. Outcome was good both for mother and for new-borns in all cases.

Majority {20 (64.5%)} of the babies were female while 9 (29%) were male. Sex of the babies was not indicated in 2 (6.4%) of the cases. The Apgar scores of the babies at one and five minutes and their weights are shown in figure1 below.

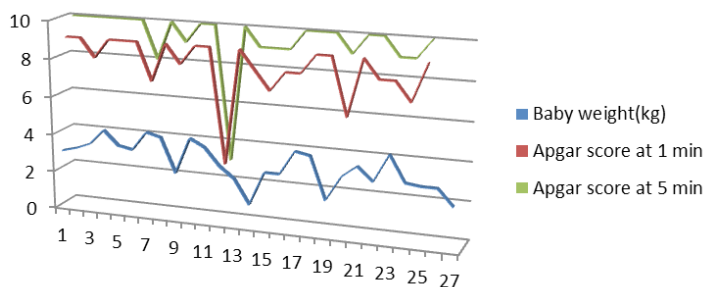


Figure 1: Line chart showing the weights of babies, Apgar scores at one and five minutes.

Discussion

As the use of general anaesthesia for Caesarean delivery continues to decline so also is the likelihood of difficult airway in obstetric anaesthesia. The picture may however be different where more general anaesthesia is used than regional in Caesarean delivery. More general anaesthesia provides more opportunities to intubate and more occasions for possible difficult airway. In our study, the incidence of difficult airway of 0.8% compares well with many other researchers’ findings [8,9]. The incidence rate of 1: 125 indicates that the problem of airway management in the obstetric patient deserves attention. This is because of the contribution of airway difficulty to the overall maternal morbidity and mortality. In an analysis of anaesthesia related maternal deaths in the United States during 1991 through 2002, Hawkins et al [10] found that overall, the leading causes of anaesthesia-related maternal deaths were induction problems or intubation failure, respiratory failure, and high spinal or epidural block. In our study, the rate of use of general anaesthesia for caesarean delivery (51.3%) was high. While this may have provided opportunity for the practitioners to gain hands-on experience in intubation, the large number could as well have contributed to the rate of airway difficulty. Many authors opine that the receding numbers of cases done under general anaesthesia globally is responsible for obstetric endotracheal intubation becoming “a vanishing art” [11].

This study reveals that the documentation of airway challenges were not in accordance with the ASA guidelines. While the guidelines provide for five types of specification of airway difficulty (see table 3 below), the records in this study branded all affected parturient as ‘difficult intubation’. It was the analysis of the anaesthetic charts that enable us to know the ones that were ‘failed intubations’ and ‘difficult intubations’. Where we saw the patient airway was managed with a supraglottic airway device e.g. LMA after induction and muscle relaxation, we counted that as failed intubation and where there was a successful intubation after initial failed attempts, we recorded as difficult intubation. This approach complies with the criteria of the ASA Taskforce, which recommends some ways to determine airway difficulty in its report, which is reproduced in table 4 below. While some studies have shown that anaesthetists tend not to record every event during incidents of difficulty during anaesthesia [12], we conclude that in this instance it was more due to paucity of awareness of the ASA guidelines by the practitioners. Labelling airway challenges as ‘difficult intubation’ precludes those who might have had difficult laryngoscopy, difficult mask ventilation or others.

Table 3: ASA recommended description of difficult airway#.

Number	Name	Description
1	Difficult facemask or supraglottic airway (SGA*) ventilation	Impossible to provide adequate ventilation because of inadequate mask or SGA seal, excessive gas leak, or excessive resistance to ingress or egress of gas.
2	Difficult SGA placement	SGA placement requires multiple attempts, in the presence or absence of tracheal pathology.
3	Difficult laryngoscopy	Impossible to visualize any portion of the vocal cords after multiple attempts at conventional laryngoscopy.
4	Difficult tracheal intubation	Tracheal intubation requires multiple attempts, in the presence or absence of tracheal pathology.
5	Failed intubation	Placement of the endotracheal tube fails after multiple attempts.

*SGA = supraglottic airway e.g. LMA (laryngeal mask airway).

#Modified from American Society of Anaesthesiologists Task Force on Management of Difficult Airway.

Table 4: Criteria recommended for assessment and labelling of difficult intubation based on anaesthetic record review[§].

<ol style="list-style-type: none"> 1. Use of an awake technique to intubate the trachea; or 2. Explicit description of the laryngoscopy and/or intubation as “difficult”, irrespective of the technique; or 3. Cormack-Lehane Grade 3 or 4 on direct laryngoscopy; or 4. One or more surrogate markers of difficult intubation including: <ol style="list-style-type: none"> a. need for three attempts at direct laryngoscopy by an experienced laryngoscopist; b. conversion to an alternative intubating device different from the primary intubating equipment; c. repeat dose of succinylcholine within the first five minutes after induction; d. release of cricoid pressure noted prior to intubation of the trachea to facilitate intubation; e. oxygen saturation <85% lasting >five minutes at induction.
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[§]Modified from: Practice guidelines for management of the difficult airway. A report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. *Anesthesiology* 1993; 78: 597-602.

Age and weight

Over 60% of the reported difficulty in this study occurred in those above 30 years old. Age has been associated with difficult intubation in other studies. Mackeen *et al* [9] observed in their study that maternal age greater than 35 years was associated with difficult intubation even though age was not retained as a significant factor.

About 75% of the airway difficulty in our study occurred in parturient weighing 80kg and above while about half of the cases occurred in those 90kg and above. This agrees with the finding of Mackeen *et al* [9] who identified weight of 90 to 99kg as risk factor for difficult or failed intubation. The non-documentation of height prevented us from calculating the body mass index. Obesity is known to have deleterious effects on a wide range of obstetric parameters [13]. In the airway, obesity increases the soft tissue around the head and neck region, resulting in short neck and poor neck extension. The Patel (thyromental distance) and Savva (stern omental distance) tests could predict difficulty in these patients pre-operatively [14,15]. But in our study, there was no documentation of these examinations in any of the parturient. The associated large breasts in the obese also contribute to difficult intubation as they prevent the insertion of the classical Mackintosh laryngoscope [16]. This challenge can be mitigated by the use of the short-blade laryngoscope or the fibre-optic laryngoscope [17]. In this study, only the classical laryngoscopy was the method of intubation attempted.

Obesity causes a reduction in functional residual capacity (FRC), atelectasis and shunting in dependent lungs [18]. Due to increased tissue mass on the thorax, the work of breathing and oxygen demand are increased leading to early desaturation during intubation. The increased tissue mass in the airway results in the narrowing of the airway, easy bruising and poor neck flexion/extension. These effects coupled with the changes induced by pregnancy tend to make tracheal intubation in the obese parturient difficult.

Obesity is known to be associated with other diseases. Hypertension and diabetes are known to be commonly associated with obesity [18]. Our study agrees with these findings. Among our study population, 23% had diabetes mellitus, 18% were hypertensive and 27% had thyroid diseases. Diabetes mellitus is known to be associated with arthritis, which may affect the flexibility of the neck and contribute to difficulty in intubation. Palmer’s or prayer sign is a clinical method of assessing the possibility of arthritic deformity affecting airway management. In our study, we did not notice any assessment or use of the prayer sign in the pre-operative assessment. Perhaps this was due to the majority of the cases being emergencies.

The emergent nature of most of the cases studied made pre-operative assessment for possible difficulty during tracheal intubation inadequate. Apart from the emergency nature influencing the choice of anaesthesia, often in favour of general anaesthesia, it also means there is often not enough time to prepare the patient as would be the case in elective procedures. The finding

of airway difficulty therefore in these parturient is in agreement with practical reality.

We observe in our study that the urgency of the cases followed the traditional practice of classification of cases as 'elective' and 'emergency'. This traditional classification is of limited value in assessing the effect of urgency on the parturient and the fetus and makes auditing difficult [19]. The Royal College of Obstetricians and Gynaecologists (RCOG) currently recommends the use of the classification put forward by Lucas et al [20] in 2000 which classifies urgency of Caesarean section into four categories. In category (1), there is immediate threat to life of parturient or fetus; (2) maternal or fetal compromise not immediately life threatening; (3) needs early delivery but no maternal or fetal compromise and (4) for delivery at convenience of mother and obstetric team. With the adoption of this universally, anaesthetists can provide regional anaesthesia for category 2-4 parturient and even some in category 1 without unduly prolonging the decision to delivery interval (DDI). The provision of regional anaesthesia would prevent the risks associated with general anaesthesia including the difficult or failed tracheal intubation.

Conclusion

The finding in this study emphasises that airway difficulty in obstetric anaesthesia practice presents a valid challenge. Obesity remains a leading associated cause of difficult airway along with diabetes and advanced age. The non-use of the Lucas' classification of obstetric emergencies prevented the use of regional anaesthesia in some cases which would have prevented the exposure of some of the parturient to the risk of difficult airway. Practitioners should prepare adequately for management of airway difficulty when giving general anaesthesia to the parturient.

Limitation

It is not all possible cases of airway difficulty that were traced during the period as only the ones so labelled by the record could be tracked.

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