GENERAL ANESTHESIA IN CESAREAN SECTIONS: A PROSPECTIVE REVIEW OF 465 CESAREAN SECTIONS PERFORMED UNDER GENERAL ANESTHESIA

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Abstract

Background: In many countries, neuraxial blocks comprise the majority of anesthetics given for cesarean section. In Iran, however general anesthesia for cesarean section is prevalent. In our institution, the rate of general anesthesia for cesarean section is 39%, providing an opportunity to collect data regarding airway management in the parturients. We report on the outcomes of a series of patients who received general anesthesia for cesarean section.

Methods: A prospective observational study was conducted in two university hospitals, with approximately 5,500 deliveries annually. Demographics and airway characteristics were recorded. Eight potential risk factors for difficult intubation (short neck, obesity, facial edema, swollen tongue, receding mandible, and single, missing or protruding maxillary incisors) were analyzed. Then, laryngoscopic view, difficulty at intubation, and major complications were recorded.

Results: Data were obtained from 465 patients. There was a significant correlation between higher Mallampati score and both higher laryngoscopic view graded on the Cormack-Lehane system ($P < 0.001$) and difficulty at intubation (P-Value=0.05). Emergency cesarean section was not associated with difficult intubation (P=0.67). Multivariate analysis showed that receding mandible was the only potential risk factor for difficult tracheal intubation ($P < 0.001$) and removed short neck or protruding maxillary incisor which initially was powered as a risk factor by univariate analysis. A grade 3 laryngoscopic view was obtained in 15 cases (3.2%). There was no case of grade 4 view. There was only one failed intubation (0.2%), and 9 cases of very difficult intubation (1.9%).

Conclusion: General anesthesia for cesarean section is safe with minimal risk.

Keywords: obstetric anesthesia; difficult intubation; failed intubation; risk factor.

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Introduction

In Western Europe and North America, elective cesarean section is most frequently performed using regional anesthesia[1-3]. Most of the statistics we have about the difficulty or failed (0.4%) tracheal intubation apply primarily to trainees in anesthesia, rather than fully qualified practitioners[4,5]. We do not know the incidence of failed or difficult intubation when anesthesia is performed by experienced individuals. General anesthesia in obstetrics is usually given in emergency situations such as hemorrhage or nonreassuring fetal heart rate.

Iranian women frequently express a preference for general anesthesia over regional anesthesia for cesarean section. Common reasons cited by patients for this preference include fear of pain during the regional anesthetic procedure, pain during the cesarean section, awareness of voices and operating room sounds, and cultural preferences for not being awake during surgery. Therefore, our practice mandates a high percentage of patients requiring airway management at term pregnancy, allowing us to determine the incidence of problems during airway management in this patient population over a relatively short period. The aim of the current study is to assess the incidence of difficult intubation as well as identifying the risk factors associated with difficult intubation in a group of Iranian women undergoing cesarean sections.

Methods

The study was conducted over a 31-month period from February 18, 2007 to September 9, 2009. Research ethics board waived the need for written consent. There was no conflict of interest in the study. Patients who were emergent, NPO for at least 8 hours, or declined neuraxial block were included in the general anesthesia group.

Preoperative patient data, airway assessment, history of previous intubation, and potential risk factors for difficult intubation were recorded prospectively on a group of patients presenting for cesarean section under general anesthesia at Shabih-Khani and Beheshti Hospitals, the teaching hospitals of Kashan University of Medical Sciences, Kashan, Iran, with approximately 5,500 deliveries annually and 45% cesarean section rate.

All but four cases were intubated by the same anesthesiologist. All patients were intubated with a size 7 cuffed SUPA (SUPA C E, Tehran, Iran), PVC tracheal tubes, without an intubating stylet. Prior to anesthesia an assessment was made of the oropharyngeal structures using the test first described by Mallampati[6] and subsequently modified by Samsoon and Young[7]. The classification was as follows: class I = soft palate, fauces, uvula, and tonsillar pillars visible; class II = soft palate and fauces seen, tip of uvula obscured; class III = soft palate and only base of uvula seen; and class IV = soft palate not visible. Patients were asked not to phonate during the test since the classification may be affected by this maneuver[8].

For the purposes of this study "true" high BMI is defined. True high BMI is considered where a very high proportion of total body fat is distributed in head, neck, and upper chest, which interferes with intubation. Following assessment of oropharyngeal structures, patients were examined for the following eight potential risk factors: short neck; true obesity; missing maxillary incisors; protruding maxillary teeth; single maxillary tooth; receding mandible; facial edema; and swollen tongue. Short neck, true obesity, facial edema, and swollen tongue were subjectively assessed as either present or absent by the anesthesiologist. Receding mandible was assessed by placing three fingers under the mandible between the thyroid cartilage and the mentum. If the thyromental distance was less than the breadth of the three fingers, the patient was assessed as having a receding mandible. Protruding maxillary incisors were assessed as present or absent in a patient with no receding mandible viewed from the lateral position with the head in the neutral position and the teeth clenched. Single maxillary incisor and missing upper incisors are self-explanatory.

Patients were transferred to the operating room in the left lateral position. After 3 min of preoxygenation, anesthesia was induced with thiopental (5mg/kg) followed by succinylcholine (1.5mg/kg), then after 60 seconds the trachea was intubated. We did not use nerve stimulators as they were not available in our obstetric centers. Cricoid pressure was applied by nurse anesthetist upon loss of consciousness and maintained

until the trachea was intubated, the cuff inflated, and correct tube location verified. Mcintosh laryngoscope blades were used for all intubations.

During the rapid-sequence induction, an assessment was made of the view at laryngoscopy as described by Cormack and Lehane[9]. The classification is as follows: grade A = most of the glottis visible; grade B = only the posterior extremity of the glottis visible; grade C = no part of the glottis visible, only the epiglottis visible; grade D = the epiglottis not visible.

After laryngoscopy, the trachea was intubated, and an assessment of the ease or difficulty of intubation was made according to the following scale: grade 1 = easy intubation at the first attempt, no difficulty; grade 2 = some difficulty, insertion of tracheal tube not achieved on the first attempt but successful after adjustment of laryngoscope blade and/ or adjustment of head position but not requiring additional equipment, removal, and reinsertion of the laryngoscope; grade 3 = very difficult, requiring removal of the laryngoscope, further oxygenation by mask ventilation and subsequent intubation with or without the use of an introducing stylet, an alternative laryngoscope blade; and grade 4 = failed intubation, failure to pass tracheal tube after several attempts, or unrecognized esophageal intubation[10].

For each patient the following data were recorded: age, weight, height, indication for cesarean section, including emergency versus elective nature.

Statistical analysis

Statistical analysis was performed using SPSS version 16 (SPSS inc., Chicago, IL). Descriptive statistics were used for demographic data. Preoperative oropharyngeal classification (Mallampati), grade of view at laryngoscopy (Cormack), and ease or difficulty at intubation were presented as descriptive data. Preoperative oropharyngeal classification and each of the specific potential risk factors were compared for association with difficulty at intubation using univariate analysis (Chi square test). Grade 1 and 2 were combined into one group and compared against combined grade 3 (very difficult) and 4 (failed) using binomial logistic regression. Factors that have a significant association with difficult intubation on univariate analysis were then subjected to a stepwise elimination procedure. A *P* Value of less than 0.05 was considered statistically significant.

Results

A total of 465 cases were entered into the study of which 461 were intubated by the same anesthesiologist. The patient's demographics are presented in Table 1. Emergency cesarean section was not associated with increase in laryngoscopic grade (Table 2) or difficulty of intubation (Table 3).

Table 1

Demographic charchteristics

	Mean ± SD	Range
Age (yr)	27.6 ± 5	(16-43)
Weight (kg)	78.7± 13.1	(39-127)
Height (cm)	158.9 ± 6.5	(140-180)

Table 2

Laryngeal view (Cormack) during direct laryngoscopy in patients subjected to elective or emergency cesarean section

Laryngoscopic view/	Elective	Emergency	Total
A	163 (72.4%)	165 (68.8%)	328 (70.5%)
B	56 (24.9%)	66 (27.5%)	122 (26.2%)
C	6 (2.7%)	9 (3.8%)	15 (3.2%)
D	0	0	0
Total	225 (100%)	240 (100%)	465 (100%)

Table 3

Ease of intubation in elective and emergency cesarean section

	Elective	Emergency	Total
Grade 1 (Easy intubation)	207 (92.0%)	215 (89.6%)	422 (90.8%)
Grade 2 (Some difficulty)	14 (6.2%)	19 (7.9%)	33 (7.1%)
Grade 3 (Very difficult)	4 (1.8%)	5 (2.1%)	9 (1.9%)
Grade 4 (Failed intubation)	0	1 (0.4%)	1 (0.2%)
Total	225 (100%)	240 (100%)	465 (100%)

Table 4
Association Between Oropharyngeal Structures (Mallampati Classification) and view at laryngoscopy (Cormack Grade)

Mallampati Classification / Cormack Grade	1	2	3	4	Total
A	99 (21.4%)	176 (38%)	51 (11%)	0	326 (70.4%)
B	17 (3.7%)	73 (15.8%)	32 (6.8%)	0	122 (26.3%)
C	0	7 (1.5%)	8 (1.8%)	0	15 (3.3%)
D	0	0	0	0	0
Total	116 (25.1%)	256 (55.3%)	91 (19.6%)	0	463 (100%)

The classifications of the patients according to their Mallampati classification and their Cormack grade as well as their easy/difficulty to tracheal intubation are presented in Table 4 and Table 5.

There was a significant association between Mallampati class and view at laryngoscopy ($P < 0.001$) as well as difficulty at intubation (P=0.05). None of the parturients was a Mallampati class 4. Only 8.8% and 4% of class 3 airway cases were associated with grade C laryngoscopic view and very difficult intubation respectively. None of the class 3 airway cases were associated with a failed intubation. There were nine cases of difficult intubation (1.9%) and only one case of failed intubation, giving an overall incidence of 1 in 465 (0.2%) of cases.

The overall frequency of obesity (BMI >30 kg/m^2) was 284 (61.2%), including 84 (18.2%) whose BMI was >35 kg/m^2, and 13 (3%) with BMI >40 kg/m^2. There was neither an association between obesity and laryngoscopic view (P = 0.71) nor difficulty at tracheal intubation (P= 0.6).

In order of frequency of occurrence, 53 (11.3%) were truely obese; 18 (3.8%) had facial edema, 8 (1.72%) had protruding maxillary teeth, 5 (1%) patients were assessed as having a short neck, 4 (0.86%) had a receding mandible, and 3 (0.64%) had a swollen tongue. The association between individual risk factor (univariate analysis) laryngoscopic view and difficulty at intubation are shown in table 6.

Multivariate analysis recognized receding mandible as the only risk factor for difficult intubation

Table 5
Correlation between Oropharyngeal Structures (Mallampati) and Subsequent Difficulty of Tracheal Intubation

Mallampati Classification / Tracheal Intubation	**1**	**2**	**3**	**4**	**Total**
Grade 1 (Easy intubation)	111 95.7%	234 91.4%	75 82.4%	0	420 90.7%
Grade 2 (Some difficulty)	4 3.4%	17 6.6%	12 13.2	0	33 7.1%
Grade 3 (Very difficult)	1 0.9%	4 1.6%	4 4.4%	0	9 1.9%
Grade 4 (Failed)	0	1 0.4%	0	0	1 0.2
Total	116 100%	256 100%	91 100%		463 100%

Table 6
Univariate Analysis of Individual Risk Factors and Their Association with Class C & D Laryngoscopic View and or with Difficulty at Tracheal Intubation

RISK FACTOR	Chi Square (*P-value*) Laryngoscopic View	Chi Square (*P-value*) Tracheal Intubation Difficulty
Protruding Maxillary		
Incisor (n=8)	10.856 (0.004)	18.710 (0.000)
Short Neck (n=5)	11.39 (0.003)	14.41(0.001)
Obesity (n=53)	4.134 (0.127)	2.118(0.347)
Facial Edema (n=18)	0.97 (0.616)	0.397(0.820)
Swollen Tongue (n=3)	0.184 (0.912)	0.182(0.913)
Receding Mandible (n=4)	16.06 (0.000)	41.97(0.000)

Table 7
Probability of experiencing difficult intubation. (Combined grade 3 and 4)

Combination of risk factors	***Probability (%) of difficult intubation***
1-class 1	0.85
2- class 2	1.50
3- class 1 + RM	16.15
4- class 1 + PI	0
5- class 1 + SN	2.037
6- class 2 + RM	25.50
7- class 2 + PI	0
8- class 2 + SN	3.56
9- class 1 + RM + PI	0
10- class 1 + RM + SN	31.82
11- class 1 + PI + SN	0
12- class 2 + RM + PI	0
13- class 2 + RM + SN	45.33
14- class 2 + PI + SN	0
15- class 1 + RM + PI + SN	0
16- class 2 + RM + PI + SN	0

RM = Receding Mandible
PI = Protruding Maxillary Incisor
SN = Short Neck

in cesareans. Twenty five percent of patients with receding mandible ended up being difficult to intubate. Only one patient had restricted neck extension.

Combination of risk factors increases the probability of difficult intubation. Presence of receding mandible increases the chance of difficult intubation. Probability of difficult intubation in presence of receding mandible and other risk factors are even more when receding mandible is the only risk factor for difficult intubation. Relationship between the presence of one or more risk factors and the percentage for the presence of difficult intubation are shown in Table 7.

Discussion

A recent decrease in the number of general anesthetics for cesarean section has caused inadequate exposure of residents to the techniques of airway management in parturients, and as a result mothers may be endangered when general anesthesia is necessary[2,3-11]. Furthermore, the average age and weight of women giving birth is rising and the medical complexity of cases is increasing[2].

The incidence of failed intubation in this study which was 1 in 465 or 0.2% is less than that the reported studies from Australia[2], UK[5,12], and from USA[13] which was about 1 in 250 or 0.4%. One explanation may be that in this study all but four of the patients were

intubated by a consultant anesthetist, while in the studies referenced above the patients were intubated by trainees. General anesthesia given for obstetrics is safer in experienced hands compared to trainees, and the likelihood of encountering difficult intubation is predicted by the experience of the anesthetist[2].

The incidence of difficult intubation in this study was 1 in 51 (1.9%) and consistent with Rocke *et als*[10], finding but lower than some previous studies in obstetric patients[2,12-13]. Although having grade C laryngoscopic view increases the probability of difficult intubation, 4 of our 9 cases of difficult intubation had grade B laryngoscopic view.

In this study, there was only one case of failed intubation without any obvious risk factor, indicating that difficult or failed intubation can occur unexpectedly[16]. Attempting to predict difficult intubation is therefore unlikely to be useful[15]. Adequate preparation with experienced personnel and appropriate equipment when general anesthesia is performed in the obstetric population.

The main risk factors for predicting difficult intubation (short neck, protruding maxillary incisor, and receding mandible) are structural and not necessarily related to pregnancy. A good airway examination is crucial and it has been shown that the predictive value of incremental risk factors for difficult intubation is greater than one isolated risk factor[16].

Urgency of the operation does not worsen the laryngoscopic view nor increase the chance of difficult or failed intubation, which is in agreement with McDonnel et al[2] findings.

The distribution of body fat and high BMI, as shown in this study, are not necessarily equivalent. Distribution of body fat (true obesity) was assessed subjectively by considering the accumulation of fat in the face, neck or upper chest might interfere with intubation. Many of the patients with BMI>30 kg/m^2 had accumulation of fat in their buttocks, groins or abdomen with thin neck and faces. Rocke *et al*.[10] also recommended to exclude weight as a risk factor because in a large proportion of their patients, weight was distributed around the patient's thighs and buttocks. True obesity is defined as the appearance of accumulation of upper body fat deemed significant by the evaluating anesthesiologist. Neither subjectively (truely) obese patients nor patients with high BMI showed intubation difficulty. Our experience in obese non obstetric patients also indicates that true (subjective) obesity is not accompanied with difficult intubation. However, there were a few obese patients and difficult intubations in the current study; so it may not be acceptable to generalize the results of this work to the general obstetric population. Finding from the current study is comparable to what Bamgbde *et al*.[17] found in their observational study. The incidence of obesity of pregnancy in this study was the same as their population. Also McDonnell et al.[2] reported that a weight of 100 kg or more is not an independent predictor of a difficult intubation and the obesity does not necessarily make intubation difficult. In contrast, Hood and Dewan[20] have shown that there is a significant correlation between obesity and difficult tracheal intubation when compared with the control group. D'Angelo and Dewan reported an incidence of 33% difficult intubation in morbid obese parturients[19]. We not only had a low number of morbid obese patients (n=12) but also their BMI (40-47) was obviously less than the patients in these studies. This may be a possible explanation for this difference. In addition Shiga et al.[16] in a meta-analysis confirmed that obese nonpregnant patients have a greater incidence of difficult intubation due to an increase in oral soft tissue, but because of the small number of studies, data in obstetric population is inconclusive. A feature of this study demographics is homogenicity of the population unlike many western countries where the population is heterogenous and this factor may play a dominant role in determining intubation success rate.

In conclusion, although neuraxial anesthesia has become the preferred method of anesthesia for cesarean sections, general anesthesia can be given safely when necessitated by the condition of the parturients or fetus, and experienced physician and necessary equipments are available.

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