Original Article
Received on 11.11.2016, **Accepted on** 15.11.2016

Indian Journal of Anaesthesia and Analgesia
Volume 3 Number 3, September - December 2016
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.3316.8

Airway Changes in Pregnant Women and Non Pregnant Women: A Comparative Study

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Abstract

*Introduction:*Two possible respiratory muscle strategies can be considered during pregnancy. 1) Higher inspiratory intercostal and accessory muscle recruitment, since the increased thoracic volume displacement and pleural pressure swings could also be a consequence of their enhanced action. 2) Similar relative contribution between the diaphragm and the inspiratory intercostal muscles, since the slope of the P_{ga} *versus* P_{oes} curve remains constant .

Methodology: Study was conducted in 60 female patients .These patients were divided into two groups Group I consisted of 30 pregnant women posted for cesarean section under general anaesthesia. Group II consisted of 30 non pregnant women posted for General Surgeries under General anaesthesia.

Results: the distribution of Wilson Risk-Sum-Values in both the groups. In groupI, 21 out of the 30 patients belonged to Wilson score 0 (70%) compared to 23 out of the 30 patients in group II (76.7%). In group I, 6 out of 30 patients belonged to Wilsons score 2 (10%) compared to 2 out of the 30 patients in group II (6.7%). Using chi-square test it was found that there was no statistically changes in Wilsons risk-sum-values between two groups (P>0.05).

Conclusion: The prediction of difficult airway in an obstetric patient is best done using Modified Mallampatti classification in the preoperative period

Keywords: Pregnancy; Airway Changes; Wilsons Risk-S um-Values.

Introduction

With pregnancy progression, the resting position of the diaphragm moves 5 cm upward with the increasing uterus size, as shown by chest radiograph measurement [1-3]. This causes the following changes to the diaphragm: its capability to generate tension increases secondary to muscle fibre lengthening; its area of apposition to the lower ribcage increases; and its radius of curvature increases, due to the progressive enlargement of the lower ribcage to give space to the lungs. In addition, the upward movement of the diaphragm causes FRC decrease.

The inspiratory movements of the diaphragm are similar or become even broader than postpartum [1,3], and trans-diaphragmatic pressure swings during tidal breathing do not change [2]. The diaphragmatic work may increase as a consequence to contract against higher load represented by higher end-expiratory P_{ga} and enlarged gravid uterus. This hypothesis is supported by the tension time index of the diaphragm, which falls after delivery [2].

During pregnancy, chest wall expansion is shifted toward the ribcage because of an enhanced coupling between abdominal pressure and the lower ribcage [3,4]. Thanks to the increased area of apposition, in fact, the abdominal pressure generated by the contraction of the diaphragm acts mainly on the lower ribs, thereby elevating and expanding the ribcage where the diaphragm is apposed.

Two possible respiratory muscle strategies can be considered during pregnancy. 1) Higher inspiratory intercostal and accessory muscle recruitment, since the increased thoracic volume displacement and pleural pressure swings could also be a consequence of their enhanced action [2,4]. 2) Similar relative contribution between the diaphragm and the inspiratory intercostal muscles, since the slope of the P_{ga} *versus* P_{oes} curve remains

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constant [2,4].

The progressive increment of the anterior abdominal dimension leads to morphological adaptation of the abdominal muscles by lengthening their fibres up to 115%, changing their line of action, altering their angle of insertion and reducing their thickness. The consequences are compromised functional ability, poor torque production and reduced ability to stabilise the pelvis against resistance. The latter may be implicated in back pain during pregnancy [5,6].

Methodology

Source of Data

Study was conducted in 60 female patients.These patients were divided into two groups Group I consisted of 30 pregnant women posted for cesarean section under general anaesthesia. Group II consisted of 30 non pregnant women posted for General Surgeries under General anaesthesia.

Inclusion Criteria

Group – I: Female patients aged 18-39 years of ASA grade I and II, pregnant at term, posted for LSCS with no obvious airway problem.

Group – II: Female patients aged 18-39 years of ASA grade I and II without any obvious airway problem requiring general anaesthesia.

Exclusion Criteria

- Patients of ASA Grade III and IV
- Patients with jaw tumours
- Patients with obvious difficult airway

Preoperative Period

All the patients were visited and evaluated thoroughly on the day of the surgery or previous day of surgery as regard to history and general physical examination.

The airway of the patients was then assessed pre-operatively using,

a. Modified mallampati's classification.

b. Wilson's-Risk-sum values.

Modified mallampati's classification was assessed by asking each patient to sit upright and to open her mouth widely the head in neutral position. The patient was then asked to protrude her tongue maximally. The observer was seated opposite the patient at eye level and an assessment was made of the oropharyngeal structures visualized. The view was then graded as follows.

Class I: Soft palate, fauces, uvula and tonsillar pillars visible.

Class II: Soft palate, fauces seen, tip of uvula obscured.

Class II: Soft palate and base of uvula seen.

Class IV: Soft palate not visible only hard palate seen.

Wilson-risk-sum values was then assessed. This scores five factors-weight, head and neck movement, jaw movement, receding mandible and buck teeth from 0 to 2 giving a total, ranging from 0 to 10.

Wilsons Risk-Sum Values

Risk Factors	Level
Weight	<90kg 90-110kg > 110kg
Head and neck movement	Above 90 degrees About 90 degrees (i.e,) ± 10 Deg. Below 90 degrees
Jaw movement subluxation > 0	Inter incisor Gap ≥5CM or Inter incisor Gap <5CM and subluxatin = 0 Inter incisor Gap <5CM and subluxation < 0
Receding mandible	Normal Moderate Severe
Buck teeth	Normal Moderate Severe

Head and neck movement was measured by asking the patient to extend fully the head and neck, while a pencil was placed to stand vertically on the forehead. The orientation of the pencil was adjusted so that it was parallel to a distant window frame.

Then, while the pencil was held firmly in position, the head and neck were fully flexed and pencil was sighted against the horizontal of the window frame to judge if it has moved through 90^0.

In jaw movement inter incisor gap and subluxation was assessed.

Inter-incisor gap was measured with the mouth fully open.

Subluxation was assessed as maximal forward protrusion of the lower incisors beyond the upper incisors.

The severity of receding mandible or long upper incisors (buck teeth) was estimated on a subjective scale.

Following preoperative assessment of the airway the anesthetic procedure to be undertaken (i.e.,) application of cricothyroid pressure-the sellick smanoeuvre was explained to the patients.

All the patients received injection Glycopyrolate 4µg/kg intramuscuarly along with injection Ranitidine 50mg intravenously and injection Ondansetron 4mg intravenously as premedication, half an hour shifting the patient to the operating room.

Intra-Operatively

Once the patient was shifted to operating room the patient was connected to the routine monitors which included ECG, Non-invasive blood pressure and pulse oximetry.

All resuscitation equipments like the intubation trolly with the airway, laryngoscopes, endotracheal tubes along with drugs necessary were kept ready. The anaesthesia machine was also checked along with the oxygen deliver system.

Baseline pulse rate, blood pressure were noted.

A standard induction and intubation protocol was listed for all patients. A rapid sequence induction and intubation was carried out in all patients.

After preoxygenation for 3 minutes with 100 percent oxygen, anaesthesia was induced with injection Thiopental 5mg/kg. I.V. followed by injection Succinylcholine 2mg/kg. I.V., cricoids pressure was applied by an assistant upon loss of consciousness and maintained until the trachea was intubated, the cuff inflated and correct tube location verified.

Larynogoscopy was performed after the disappearance of fasciculations in the face and neck muscles, using a#3 Macintosh blade.

During the rapid-sequence induction and intubation an assessment was made of the view at laryngoscopy as described by Cormack and Lehane.

The extent of exposure of the glottis was expressed on a scale of A to D as follows.

Grade A: Most of the glottis visible.

Grade B: Only posterior extremity of glottis visible.

Grade C: No part of glottis visible only the epiglottis is visible.

Grade D: Not even the epiglottis is visible.

After laryngoscopy, the trachea was intubated and subjective assessment of the ease or difficulty of intubation was made according to the following scale.

Grade 1: Easy intubation at first attempt, no difficulty.

Grade 2: Some difficulty, insertion of gracheal tube not achieved at first attempt but successful after adjustment of laryngoscope blade and / or adjustment of head position but not requiring additional equipmet, removal and reinsertion of laryngoscope or senior assistance.

Grade 3: Very difficult, requiring removal of laryngoscope, further oxygen by mask ventilation and subsequent intubation with or without the use of an introduction stylet, an alternative laryngoscope blade or intubation by senior colleague.

Grade 4: Failed intubation, including failure to pass the tracheal tube after several attempts or unrecognized oesophageal intubation with subsequent tube placement by a senior anaesthesiologist.

Results

Table 1: Shows the ASA grading for the each group in Group I, 23 out of the 30 patients belonged to ASA-I, an incidence of 76.7 percent and 7 patients belonged to ASA-II an incidence of 23.3 percent, in Group II, 24 out of the 30 patients belonged to ASA I giving an incidence of 80 percent and 6 patients belonged to ASA-II an incidence of 20 percent. Distribution of ASA

grading was not statistically significant between the groups using chi-square test (P>0.05).

Table 2 shows the distribution of modified mallampati's classification in both the groups. In group I, 9 patients out of the 30 belonged to mallampati classification grade I (30%). In group II, 21 out of the 30 patients belonged to mallampati grade I (70%). In group I, 12 out of the 30 patients belonged to mallampati grade II (40%). In group II, 6 out of the 30 patients belonged to mallampati grade II (20%). In group I, 9 out of the 30 patients belonged to mallampati grade III (30%) and 3 out of the 30 patients belonged to mallampatis grade III (10%).

A statistically highly significant changes was seen in mallampati grading between group I and group II using the chi-square test (P<0.01).

Table 1: ASA-physical status distribution

ASA-grade		Group I	Group II	P	Remark
ASA I	No. of patients	23	24	>0.05	NS
	% within group	76.7	80.0		
ASA II	No. of patients	7	6	>0.05	NS
	% within group	23.3	20.0		
Total	No. of Patients	30	30		

NS - Non-significant

Table 2: Modified mallampatis classification

		Group I	Group II	P	Remark
Mallampati I	No. of patients	9	21	P<0.01	HS
	% within group	30.0	70.0		
Mallampati II	No. of patients	12	6	P<0.01	HS
	% within group	40.0	20.0		
Mallampati III	No. of patients	9	3	P<0.01	HS
	% within group	30.0	100.0		
Total	No. of Patients	30	30		

HS – Highly significant

Table 3: Wilson risk-sum-values

		Group I	Group II	P	Remark
Wilson score 0	No. of patients	21	23	P<0.05	HS
	% within group	70.0	76.7		
Wilson score 1	No. of patients	6	5	P<0.05	HS
	% within group	20.0	16.7		
Wilson score 2	No. of patients	3	2	P<0.05	HS
	% within group	10.0	6.7		
Total	No. of Patients	30	30		

NS - Non-significant

Table 3 shows the distribution of Wilson Risk-Sum-Values in both the groups. In groupI, 21 out of the 30 patients belonged to Wilson score 0 (70%) compared to 23 out of the 30 patients in group II (76.7%).

In group I, 6 out of 30 patients belonged to Wilsons score 2 (10%) compared to 2 out of the 30 patients in group II (6.7%). Using chi-square test it was found that there was no statistically changes in Wilsons risk-sum-values between two groups (P>0.05).

Discussion

In this study was compared the airway changes in pregnant women coming for ceasarean section with non-pregnant women coming for general surgeries during general anaesthesia.

This prospective study was conducted in Sixty female patients between the age group of 18 to 39 years of ASA Grade I and II, were selected and divided into two groups of 30 each.

Group I consisted of 30 pregnant women who underwent cesarean section under general anaesthesia.

Group II consisted of 30 non-pregnant female patient who underwent general surgeries under general anaestheia.

Pre-operative assessment of the airway was carried out in both the groups using.

1. Modified mallampatis classification.
2. Wilsons Risk-sum values.

A standard induction and intubation protocol was used for all the patients (i.e.,) Rapid sequence induction and intubation.sss.

During Rapid-Sequence induction and intubation an assessment was made of the view at laryngoscopy as described by Cormack and Lehane.

After laryngoscopy the trachea was intubated and a subjective assessment of the ease or difficulty of intubation was made.

In our study it was noted that there was a general increase in the modified mallapatisocre in pregnant women compared to non-pregnant women. As depicted in Table 4, using the modified mallampati test as modified by Samsoon and Young 70 percent of the non-pregnant patients were described as Class I, compared to 30 percent in pregnant patients. 20 percent of the non-pregnant patients were described as Class II compared to 40 percent in pregnant patients. 10 percent of the non-pregnant patients were described as Class III, compared to 30 percent in pregnant patients.

This is similar to the result obtained by S. Pilkington et al. (1995) [7] who concluded that there was an increase in Mallampati score during pregnancy.

In our study there was no significant difference in the Wilsons Risk-sum values between both groups.

Cormack and Lehane (1984) [8] have noted that difficult laryngscopy in pregnant women was fairly rare which correlates well without study as in our study there was no significant variation in the Cormack and Lehaneslaryngoscopic grading in both the groups.

In our study it was observed that there was a general increase in the degree of difficulty in visualizing the larynx as assessed by Cormack and Lehanes grading with the increase in modified mallampati score. D.A. Rockeet at. (1992) [9], Oates et al. (1991) [10] and C.M. Frerk (1991) [11] noticed a general increase in degree of difficulty in visualizing the larynx with increase in modified mallampatis score which co-related well with our study.

Oates et al. (1991) [10] and Wilson et al. (1988) [12] noticed an increase in degree of difficulty during intubation in pregnant women compared to non-pregnant women which is similar to the conclusion of King TA et al. (1990) [13], Samsoon and Young (1997) [14] who concluded that there was an increase in the incidence of difficult intubation in pregnant women compared to non-pregnant women.

Conclusion

The prediction of difficult airway in an obstetric patient is best done using Modified Mallampatti classification in the preoperative period. Wilsons score does not help us much in predicting the difficulty to intubate in an obstetric patient.

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