

# Gastric pH and volume change in emergency and elective cesarean section: A randomized trial

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## Abstract

**Context:** Pregnancy is a condition when a woman suffers numerous changes in the body. These changes can be physical and physiological. There are numerous factors which affect the volume and gastric pH of a pregnant lady. A lady has to bear a number of changes during pregnancy, mainly in her first trimester and after pregnancy. Vomiting is a normal symptom of pregnancy which effects a lady in her first trimester. This badly affects the gastric content and increase in pH as well as volume. In cesarian cases also the digestion is badly affected and anesthesia also plays a major role in distortion of proper gastric functions.

**Aim:** To compare the gastric pH of the fluid in elective cesarean v/s emergency sections.

**Setting and Design:** This study is a cross-sectional survey performed in Lahore from September 2009 to June 2010.

**Material and Methods:** A total number of 150(n= 150) patients were studied and divided into two groups. These patient were with elevated caesarian section and emergency caesarian section. Statical analysis: The results were statistically significant. (p-value < 0.05).

**Result:** Patients in emergency cesarean section group had a lower value of gastric pH ranging from (2.16 + 0.64) and higher value of, the volume of gastric acidic (26.33 + 10.59) as compared to that in elective cesarean section group (4.56 + 1.28 and 11.65 + 4.37 respectively).

**Conclusion:** The study concluded that in emergency and elective caesarian section the level of gastric volume was significantly high whereas the level of gastric pH was low.

**Keywords:** Gastric pH, Emergency cesareans section gastric fluid volume, Elective cesarean section.

**Key message:** Pregnancy is a state of several physical and physiological adaptations. Caesarian is also a condition which produces numerous physical changes. These changes create an impact on gastric pH in elective and emergency caesarian sections. A considerable difference was seen in the gastric volume and pH in both types to sections.

## Introduction

Pregnancy is a state of numerous physiological adaptations. Major adaptations need to be done after baby birth and few considerable changes are seen in the first trimester of the pregnancy. Pregnancy affects nearly all the systems of the mother, maximum effect is seen on the digestive system. During the cesarean decreased pH and gastric emptying was seen, whereas the volume of gastric fluid was elevated.<sup>1,2</sup> It represents gastroesophageal reflux disease (GERD) for maximum time.<sup>3</sup> Labor pain, opioids, and anxiety leads the exacerbation of these functions.<sup>4,6</sup> The gastroduodenal injury may cause due to the release of more acid. Less acid secretion results due to absorption of calcium, iron, vitamin B12 and other drugs, which can predispose the enteric function of the patients. In pregnancy central control of food intake is modulated by many factors, the effect of these factors needs to be studied thoroughly.<sup>7</sup>

Due to the unidirectional flow of gastric juice in the lower respiratory tract and larynx, there is a high risk of pneumonitis in pregnant women. The most prominent cause of pneumonia includes Mendelson's syndrome or aspiration pneumonitis. This is considered as chemical pneumonitis caused due to aspiration of the gastric content, the infection is caused due to infection of oropharyngeal secretions by pathogenic bacteria. While there is some overlap between these two syndromes, they are distinct clinical entities. So, these conditions can lead due to increased gastric volume,

decreased gastric pH or disrupted defense mechanism.<sup>8</sup> Delivery through the abdominal and uterine incision is known as caesarian. The anesthesia used to perform caesarian effect the physiology of the gastrointestinal tract. It enhances gastroesophageal reflux and effect emptying of the stomach or can be said that it effects or slow down the digestion.<sup>9</sup> Anesthesia also causes pneumonitis, the severity of pneumonitis depends on the volume and pH of the gastric juice.<sup>10</sup> In parturient risk of aspiration, pneumonitis is increased when the gastric volume is 25 ml or more and the pH of the gastric fluid is 2.5 or less.<sup>11</sup> Therefore, in all the parturients especially in emergency section prophylaxis is recommended over pulmonary aspiration and regurgitation. Any earlier studies reporting the comparison of gastric pH and volume during pregnancy and elevated caesarian level are not published earlier. Therefore we performed a comparative study of gastric volume and pH during elective and emergency cesarean sections.

## Materials and Methods

The study was performed in the duration of six months between September 2009 to June 2010 in Operation theater of Hameed Latif Hospital, Lahore. Before starting the study ethical clearance was taken by the administration of Hameed Latif Hospital, Lahore. The total number of patients selected were 150(n=150). They were further divided into two groups. Out of the 75 were elective and 75

were emergency, with 95% confidence level, 80% power of the study, taking magnitude (mean+SD) of pH.i.e.4.9+ 1.1 in emergency cesarean sections and 3.11+1.17 in elective cesarean section. Gastric pH and volume were studied in both groups. The study was a cross-sectional study. The inclusion criteria were patients between the age group 20 to 40 years. All patients with ASA II, having a normal gestation period, all caesarian were performed under general anesthesia, the surgery lasts for 30 to 90 minutes and during the surgery the patients were maintained in supine position. The exclusion criteria of the present study were patients with diaphragmatic hernia, peptic ulcer, morbid obesity, gastroesophageal reflux, achalasia of esophagus and Zollinger- Ellison syndrome.

Minimum mandatory monitoring was done using non-invasive blood pressure, pulse oximetry, ECG and capnography. After pre-oxygenation, general anesthesia was given through rapid induction sequences with thiopentone sodium 5 mg/Kg along with succinylcholine sodium 1.5 mg/Kg. After the wear off the effect of short-acting in case of no history of G/A, long-acting relaxant was given. Three minutes after giving muscle relaxant, gastric aspirate was taken with orogastric tube no. 16. Analgesia was provided through Tramadol 2 mg/kg and was maintained through 100 % O<sub>2</sub> in the inhalation agent. The data analysis was done by SPSS. The t-test was used to compare the pH value between the two groups. Descriptive statistics including a mean and standard variable for age and pH were calculated along with frequency and percentage.

**Results**

The results were obtained via thorough analysis of both the groups. Distributions of patients were done on the basis of age, pH value, the gastric volume of aspirates and weight. From table 1 the mean age of the patients undergone

emergency cesarean were from 20 to 40 years and average age obtained was 28.17+4.21 years. Among them, 28 % patients were between age group 20-25 years, and 50.7 % patients were between the age group 26-30 years, 46% patients relies in 31-35 years, where as 6% patients ranged from 36- 40 years. While the mean age of patients with elective cesarean was 27.88 years and ranged from 20-40 years. Where 38 % of patients were aged from 20-25 years, 36 % of patients were from 26-30 years, 18 5% patients ranged 31 to 35 years and only 6.7 % ranged from 36 to 40 years.

From table 2 where the weight of the included patients was studied in elevated and emergency caesarian section, the mean weight of the patients with emergency cesarean was 83.5+5.99 kg. Where 6.7 % of patients were of range 65-75kg, 52% of the patients ranged between 76- 85 kg, 45 % exceed from 85 kg and 1% of them were obese above 95kg. The mean age for elevated cesarean were 81%, maximum weight range found was 86 to 95 kg and no patients were found obese who exceeded 95kg of body weight.

The results obtained from table 3 defines that the patients were also compared for the value of gastric volume and pH. In emergency cesarean section the mean value of pH analyzed was 2.16+0.64, whereas in elevated cesarean section the mean value was 4.56+1.28 When the two groups were compared with each other, the results were significant (p-value < 0.05). The patients were also compared on the basis of gastric volume. The mean of gastric acid volume aspirated in the emergency cesarean section was 26.33+10.59 ml and in the elective cesarean section was 27.82+4.48 ml. Both groups were also compared with each other. The results were statistically significant (p-value < 0.05).

**Table 1:** Distribution of patients according to age (n=150)

Age in years	Elective		Emergence	
	No of patients	Percentage	No. of patients	Percentage
20-25	29	38.6	21	28
26-30	27	36	38	50.7
31-35	14	18.7	11	14.6
36-40	5	6.7	5	6.7
Mean + SD	27.82 + 4.48		28.17+ 4.21	
Range	20-40		21-38	

Showing number of patients and distribution according to the age group, their mean and ranges.

**Table 2:** Distribution of patients by weight (n=150)

Weight in Kg	Elective		Emergence	
	No of patients	Percentage	No of patients	Percentage
60-75	8	10.7	5	6.7
76-85	46	61.3	29	52
86-95	21	28	30	40
>95	0	0	1	1.3
Mean + SD	81.9 + 5.49		83.5 + 5.99	
Range	65-90		65-98	

Table 2 showing distribution of patients according to weight, percentage in emergency and elevated caesarian, their mean and their range.

**Table 3:** Distribution of patients by pH value and gastric volume aspirated

	Emergency cesarean section	Elective cesarean section	p-value	Significance
Mean of pH value	2.16 + 0.64	4.56 + 1.28	0.000 (< 0.05)	Significant
Mean of gastric volume	26.33 + 10.59	11.65 + 4.37	0.000 (< 0.05)	Significant

Table 3 showing distribution of patients on the basis of their changed gastric pH and volume during emergency and elective cesarean.

**Discussion**

There are many studies performed earlier to evaluate the gastric pH and its management. So far, this is one of the few rather first studies conducted, which compares the gastric pH within the elective and emergency cesarean section. Best up to our knowledge and believe this was the first ever study conducted in this aspect. However, before that Ngwingtin L, et al., 1987 studied on 97 patients to evaluate the changes in gastric volume and pH during the labor pain and pregnancy. They studied the changes in gastric volume and pH after providing anesthesia. In their study, the patients were divided into three groups. 39 patients in group I received treatments with elective cesarean section, 44 patients in group II had some elective gynecological surgery and 14 patients in group III had an emergency cesarean section. The objective of this study was to evaluate the modifications in gastric pH and volume during pregnancy and labor. Mean pH of gastric contents in the 3 groups were respectively 2.57+0.23; 3.21+0.29; and 2.77+0.42 and no significant changes were analyzed among the groups. They concluded that pregnancy and labor do not influence gastric pH, but gastric volume. This study was one of the similar study in one context that, their method and study parameters were almost similar. In this study, gastric pH noted was 2.16+0.64 in emergency cesarean section while in their study, gastric pH was nearly similar to our study, whereas in elevated cesarean the value of gastric pH was significantly low as compared to our study. In our study, the gastric pH in the cesarean section was comparatively higher in an emergency cesarean, while for elective cesarean both the studies showed similarly high pH values. However, the results in their study were not clinically significant, while in our study, the results were significant.

In a clinical trial by Hong JY et al., 2003, they studied the gastric pH and volume in both pregnant and normal women, they observed increased gastric volume and lower gastric pH in pregnant women as compared to normal. No significant difference was found in the level of serum gastrin. In another study by Naoguchi J et al., 1989 they studied the effect of anesthesia on gastric volume and pH through halothane anesthesia. They divided their study into three groups the enflurane anesthesia, halothane for thoracic epidural block and implementation of halothane for premedication without atropine. In the group receiving halothane anesthesia gastric pH was increased, the more considerable increment was found in older people. In the

rest two groups also increment in gastric pH were noticed. But in the group receiving halothane without premedication of atropine, no significant increment of gastric pH and decrement in the volume of gastric juice was seen. They concluded that due to parasympathetic nerve block gastric pH was increased. While in our study we found variation in gastric pH as well as in volume of the gastric juice. These parameters have been broadly used in different clinical trials. Stuart JC et al., 1996 compared the different prophylactic drugs to find their effectiveness in gastric pH. They included 384 patients requiring emergency Caesarean section undergone random general anesthesia where one out of six received the aspiration prophylaxis when the surgery was planned. The studied gastric pH as the main parameter and concluded gastric pH to be a universal parameter for GI tract in obstetric patients.

It has been suggested from a long time, that gastric volume and pH are studied for measuring the aspiration during caesarian. Though earlier studies volume of gastric fluid must be more than 0.4 ml/kg and gastric pH must be less than 2.5 have been a risk factor for the aspiration. These markers have been widely accepted by different clinical studies. Achievement of these parameters is an ideal condition for the risk of aspiration to be prevented (Negalhaut JJ., 2003). However, there is need of time to develop policies in our setups to reach these optimal parameters. These may include adding few antacids and H2 receptor blockers, antacids were used for neutralizing gastric pH before that, especially before emergency cesarean section. The most prominent limitation of this study was not being a double-blind study. One of the limitations of this study was that it was not a double-blinded study.

**Conclusion**

The gastric pH and gastric volume were lower in patients receiving emergency caesarian section as compared to that in patients with the elective caesarian section. This difference is statically significant. However, large multicentre clinical trials with a larger population are still required in support of these results.

**Conflict of Interest:** None.

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