

## Article

# Comparative analysis of maternal and neonatal outcomes between elective and emergency cesarean section at a single tertiary hospit

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**Abstract.** The aim of this study was to determine the most common maternal and neonatal complications related to cesarean section at Sultan Qaboos University Hospital (SQUH) and to compare the outcomes between emergency and elective cesarean sections. A retrospective cohort study was conducted in the department of Obstetrics and Gynecology at SQUH from 1st January 2016 to 31st December 2016. This comparative study involved 300 women who underwent cesarean section, 150 in elective cesarean section group and 150 in emergency cesarean section group. Data was collected from the delivery ward maternity registry and Electronic Patient Records. SPSS software version 23 was used to analyze the data. The mean maternal age was 29.66 ( $\pm$  4.96) and 33.22 ( $\pm$  4.63) years in the elective and emergency cesarean section groups respectively ( $p=0.001$ ). The main risk factor for both the groups was maternal diabetes and the most common indication for both was previous cesarean section. Hypotension related anesthetic complication was noted more in elective cesarean section (15.3%) than in emergency cesarean section group (4.0%) with  $p$  value=0.002. The most common major intraoperative complication in both groups was postpartum hemorrhage, 66.9% women in emergency group and 63.0% women in elective group. Post-partum fever was seen in 12.0% of women in emergency group as compared to 4% in elective group ( $p=0.019$ ). Anemia was observed in 79.2% and 65.3% in emergency and elective groups respectively ( $p=0.011$ ). Respiratory distress syndrome and transient tachypnea of the newborn were the main neonatal complications in both groups. There was no significant difference between emergency and elective cesarean section related maternal and neonatal complications except for transient intraoperative hypotension, maternal postoperative febrile morbidity and anemia. Future prospective studies including larger sample size and multiple centers is recommended.

**Keywords:** cesarean section; risk factors; pregnancy complications; pregnancy outcome

## 1. Introduction

### 1.1. Background:

Cesarean section is a common procedure performed to terminate the pregnancy<sup>1</sup>. It became a common practice in obstetrics in the late 19th century and now accounts for more than a quarter of births in the UK and 50% in China due to various factors including advanced maternal age, multiple gestation and medico-legal concerns.<sup>2</sup> World Health Organization recommends that the cesarean section rate should not be more than 15%.<sup>3</sup> Among Arab countries, the rate of cesarean section is below 5% in Yemen, Mauritania, Sudan, and Algeria. While UAE, Egypt, Jordan, Kuwait, Palestine, Oman, Morocco, Libya, Tunisia and Saudi Arabia have cesarean rates between 5-15%. Only Lebanon, Qatar and Bahrain have a cesarean rate above 15%.<sup>4</sup> Analysis of cesarean section rate done in a single tertiary hospital in Oman for 6 months in 2009 showed that 20% of pregnant women were delivered by cesarean section.<sup>5</sup> The obstetrics and gynecology department's annual report

at SQUH reported a cesarean section rate of 16.4% in 2016. The Study conducted in Nigerian university hospital showed that the rate of elective cesarean section significantly increased from 1.2% to 6.2% whereas the rate of emergency cesarean section increased from 11.3% to 20.9% between 1990-2005.<sup>6</sup>

### *1.2. Indications and risk factors for cesarean section*

Cesarean section is performed to preserve the life of the fetus and mother; however repeated cesarean sections carry various risks.<sup>7</sup> There are various indications to perform a cesarean with the two most common maternal indications being previous history of cesarean section and dystocia or cephalo-pelvic disproportion.<sup>8</sup> Other maternal indications include lesions in the lower genital tract for example vaginal septa, large vulvovaginal condyloma, malignancies and leiomyomas of the lower uterine segment which interfere with engagement of the fetal head.<sup>9</sup>

Fetal indications include fetal distress, malpresentation (i.e. breech or transverse lie), presence of congenital defects such as neural tube defects, skeletal dysplasias such as type III osteogenesis imperfecta and hydrocephalus with an enlarged biparietal diameter.<sup>9</sup> Different risk factors may contribute to increase complications of cesarean section. Those include: pre-eclampsia, eclampsia, sickle cell disease, antepartum hemorrhage and diabetes.<sup>10</sup>

### *1.3. Complications of cesarean section*

Although cesarean section is relatively safe in the present century, serious complications can occur in some patients. According to a study conducted in Peshawar hospital in Pakistan, anesthesia related complications in emergency cesarean section including regurgitation of stomach content, delayed recovery and difficult intubation was significantly higher. However, none of the cases of elective cesarean section had anesthesia related complications. In addition, wound infection, damage to surrounding viscera and bladder injury were found to be higher in emergency cesarean section while there were no such complications observed in elective cesarean section. Anemia developed in 35 patients after emergency cesarean section group whereas 20 patients had it in elective cesarean section group. Hemorrhage, fever, and upper respiratory tract infection were other complications associated with cesarean section (Mehnaz Raees , Sumaira Yasmeen et al. 2013).<sup>11</sup>

A longitudinal descriptive study done in a teaching hospital in Kerala found that 40.4% of babies delivered by emergency cesarean section developed neonatal complications versus 9.2% of babies delivered by elective cesarean section. These complications included perinatal asphyxia, transient tachypnea of the newborn, sepsis, respiratory distress syndrome and still birth. The odds ratio was found to be 0.15%, which indicated less risk of neonatal complications among women who delivered by elective cesarean section compared with those delivered by emergency cesarean section.<sup>12</sup> Cross-sectional prospective study at Souissi maternity hospital of Rabat in Morocco found that perinatal mortality was 10.2 per 1000 births and was only recorded for emergency cesarean section.<sup>13</sup> Meta-analysis study showed the neonatal mortality rate in emergency cesarean section (9.8%) was much higher than in elective cesarean section (1.7%).<sup>1</sup>

There are various complications associated with cesarean section and the maternal and neonatal outcomes differ depending upon whether the procedure is done electively or as an emergency. The study aimed to determine the most important complications related to cesarean section at Sultan Qaboos University Hospital (SQUH) and to compare the outcomes between emergency and elective cesarean sections. It is important to conduct such a study and identify the various complications in order to establish the best management approach and reduce the rates of those complications for better short and long term outcomes.

## **2. Materials and methods**

### *2.1. Study design and data collection*

A retrospective cohort study was conducted in the Department of Obstetrics and Gynecology at Sultan Qaboos university hospital (SQUH). Data was collected from maternity and neonatal registries and Electronic Patient Records on all women who underwent cesarean section at SQUH between 1<sup>st</sup> of January 2016 to 31<sup>st</sup> of December 2016. Total sample size was 300 cases, 150 in elective cesarean section group and 150 in emergency cesarean section group. Sample size was estimated based on a study done by Yang<sup>1</sup> which showed a difference of 8% in fetal mortality rate between study groups with alpha error of 0.05. The program that was used to calculate the sample size is Master 2.0. Sample Size Software. Total of 205 patients were required to detect such difference with 80% power. To prevent missing information, we included 300 cases. Exclusion criteria included preterm cesarean sections before 37 weeks of gestation and cesarean section for multiple pregnancy. Ethical approval was obtained from Medical Research Ethics Committee, College of Medicine and Health Sciences, MREC#1952.

Demographic data including maternal age, gravidity, parity, BMI, presence of maternal risk factors, history of previous cesarean section, and indication for cesarean section in current pregnancy were collected. All details related to maternal morbidity were studied with the emphasis on the need for blood transfusion, anemia (postoperative hemoglobin level < 11 g/dl), uterine scar rupture, respiratory complication, fever, abdominal distension, wound infection, thrombophlebitis, thromboembolic complications, retained placenta, urinary tract infection and postpartum hemorrhage (estimated blood loss > 500 ml).

Neonatal data, birth weight and APGAR scores were collected. Neonatal outcomes were also recorded which included transient tachypnea of the new born, respiratory distress syndrome, sepsis, perinatal asphyxia and still birth.

2.2. Data analysis

Data was collected and analyzed using Statistical Package for Social Sciences (SPSS) software (version 23). Chi-square test and students' t-test were used to obtain the significance of association. A *p*-value < 0.05 was considered significant. Results were depicted as tables.

3. Results

3.1. Demographic data

A total of 300 pregnant women were included out of which 150 had emergency cesarean section and 150 had elective cesarean section. The maternal age was significantly different between the two groups. In emergency cesarean section group, the mean age was 29.66 ± 4.96 years while in elective cesarean section group it was 33.22 ± 4.63 years (*p*=0.001). In emergency section group, mean gravidity and parity were found to be 2.93 ± 4.96 and 1.60 ± 1.73 respectively while in elective section group it was 4.16 ± 2.17 and 2.46 ± 1.65 respectively which was statistically significant (*p*=0.001). Most women were obese with a BMI of 32.45 ± 6.12 kg/m<sup>2</sup> and 32.23 ± 6.92 kg/m<sup>2</sup> in emergency and elective groups respectively (*p*=0.779). The mean duration of emergency cesarean section was longer 57.13 ± 21.69 minutes as compared to elective cesarean section 61.35 ± 18.35 minutes which did not reach statistical significance (*p*=0.085). The mean neonatal birth weight was 3.14 ± 0.49 kg in the emergency group while in elective group it was 3.06 ± 0.39 kg with no significant difference between the two groups (*p*=0.141) (Table 1). APGAR score at five minutes for neonates born by both elective and emergency cesarean section was 8-10 in 148/150 (98.7%). (*p*=1.000) (Table 2).

Table 1. Maternal and Neonatal Demographic data.

		Emergency cesarean section (N=150)	Elective cesarean section (N=150)	<i>p</i> -value
		Mean (Range) ± SD*	Mean (Range) ± SD*	
Maternal	Maternal age (years)	29.66 (20-43) ± 4.96	33.22 (21-44) ± 4.63	0.001
	Gravidity	2.93 (1-15) ± 2.12	4.16 (1-12) ± 2.17	0.001

	Parity	1.60 (0-8) $\pm$ 1.73	2.46 (0-9) $\pm$ 1.65	0.001
	Body mass index (kg/m <sup>2</sup> )	32.45 (19.47-55.52) $\pm$ 6.12	32.23 (19.78-50.44) $\pm$ 6.92	0.779
	Duration of surgery (minutes)	57.13 (7-175) $\pm$ 21.69	61.35 (6-117) $\pm$ 18.35	0.085
Neonatal	Neonatal weight (kg)	3.14 (1.72-4.28) $\pm$ 0.49	3.06 (2.11-4.27) $\pm$ 0.39	0.141

\*SD: Standard deviation.

**Table 2.** APGAR\* score of neonates at 5 minutes.

	Emergency CS** (%) (N=150)	Elective CS (%) (N=150)
APGAR score 1-3	0 (0%)	0 (0%)
APGAR score 4-7	2 (1.3%)	2 (1.3%)
APGAR score 8-10	148 (98.7%)	148 (98.7%)

*p*-value: 1.000.; \*APGAR: Appearance, Pulse, Grimace, Activity, and Respiration, \*\*CS: Cesarean section.

### 3.2. Risk factors and indications for cesarean section

Table 3 shows that the main risk factor associated with cesarean section was diabetes and gestational diabetes mellitus which was noted in 45 (30.0%) women in emergency cesarean section group, and 43 (28.7%) women in elective cesarean section group (*p*=0.899). Hypertension was the second risk factor and was found in 9 (6.0%) and 11 (7.3%) women in emergency and elective groups respectively. (*p*=0.817). None of the other risk factors showed a significant difference between the 2 groups except for previous surgery other than cesarean section which was significantly higher (4.7%) in the elective group and none had it in emergency group (*p*=0.022).

**Table 3.** Risk factors for cesarean section (CS).

	Emergency CS (%) (N=150)	Elective CS (%) (N=150)	<i>p</i> -value
hypertension / pregnancy induce hypertension	9 (6.0)	11 (7.3)	0.817
Diabetes mellitus / gestational diabetes mellitus	45 (30.0)	43 (28.7)	0.899
Anemia	2 (1.3)	6 (4.0)	0.282
Sickle cell disease	1 (0.7)	2 (1.3)	1.000
Premature rupture of membranes	3 (2.0)	0 (0.0)	0.246
Polyhydramnios	5 (3.3)	1 (0.7)	0.216
Intrauterine growth restriction	1 (0.7)	0 (0.0)	1.000
Previous surgery other than cesarean section	0 (0.0)	7 (4.7)	0.022
Hypothyroidism	3 (2.0)	3 (2.0)	1.000
Antepartum hemorrhage	4 (2.7)	4 (2.7)	1.000

Previous cesarean section was the major indication for emergency and elective cesarean section, 52 (34.7%) women were found in emergency group, and 79 (52.7%) women in elective group (*p*=0.002). The second most major indication in emergency group was non reassuring fetal heart tracing on cardiotocography (CTG) which was found in 38 (25.3%) women which was statically difference from elective cesarean section group in which there was only 16 (10.7%) women (*p*=0.002). Furthermore, non-progress of labor was seen more in emergency group than in elective group, 28 (18.7%) women versus 12 (8.0%) women respectively and that showed significant difference (*p*=0.002). However, the second most major indication in elective group was malpresentation including breach and transverse lie, which was recorded in 23 (15.3%) women (Table 4).

**Table 4.** Indications for cesarean section (CS).

	Emergency CS (%) (N=150)	Elective CS (%) (N=150)	<i>p</i> -value
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Previous cesarean section	52 (34.7)	79 (52.7)	0.002
Malpresentation	20 (13.3)	23 (15.3)	0.742
Patient request	12 (8.0)	12 (8.0)	1.000
Non reassuring CTG	38 (25.3)	16 (10.7)	0.002
Non progress of labor	28 (18.7)	12 (8.0)	0.011
Previous Myomectomy	3 (2.0)	4 (2.7)	1.000
Eclampsia	3 (2.0)	0 (0.0)	0.246
Cord prolapse	2 (1.3)	2 (1.3)	1.000

\*CTG: Cardiotocography .

### 3.3. Maternal complications

General anesthesia was used more in emergency cesarean group 86 (57.3%) women while in elective cases only 47 (31.3%) women had this type of anesthesia. More women in elective cesarean section had spinal anesthesia 102 (68.0%) as compared to emergency group 59 (39.3%). Only 4 (2.7%) women in emergency group had epidural anesthesia while none in the elective group.

The maternal anesthetic complication in the form of difficult intubation was found in 19 (12.7%) women of the emergency cesarean section group versus 9 (6.0%) women in elective cesarean section group ( $p=0.074$ ). In emergency group, there were 5 (3.3%) women who required ventilatory support while only 1 (0.7%) woman required it in the elective group ( $p=0.216$ ). Hypotension was recorded in 6 (4.0%) and 23 (15.3%) women in the emergency cesarean section and elective cesarean section groups respectively ( $p=0.002$ ) (Table 5).

**Table 5.** Maternal anesthetic complications.

	Emergency CS* (%) (N=150)	Elective CS (%) (N=150)	<i>p</i> -value
Difficult intubation	19 (12.7)	9 (6.0)	0.074
Ventilator required	5 (3.3)	1 (0.7)	0.216
Hypotension	6 (4.0)	23 (15.3)	0.002

\*CS: cesarean section.

Regarding the intraoperative complications, in the emergency cesarean section group, postpartum hemorrhage occurred in 99 (66.9%) women while in elective group it occurred in 94 (63.0%) women ( $p=0.625$ ). In cases of emergency cesarean section, extension of the uterine incision was found in 2 (1.3%) women and organ damage was noted in 1 (0.7%) woman only. While in the elective cesarean section group there were no women with such complications but this was not statistically significant ( $p=0.478$  & 1.000) (Table 6).

Table 6 shows that the major maternal postoperative complications which were of significance between the groups were postpartum fever and anemia. Postpartum fever was recorded in 18 (12.0%) women in the emergency group, while in elective group, it was recorded in 6 (4.0%) women ( $p=0.019$ ). Most patients with anemia were found in emergency cesarean section group 118 (79.2%) as compared to the elective cesarean group 98 (65.3%) ( $p=0.011$ ). In emergency cesarean section group, abdominal distention was noted in 35 (23.3%) women, while in elective cesarean group it was noted in 24 (16.0%) women ( $p=0.146$ ). Respiratory complications were found in 12 (8.0%) women in emergency cesarean section, while in elective cesarean section were found in 10 (6.7%) women ( $p=0.825$ ). Blood transfusion was required for 7 (4.7%) women in emergency cesarean section group, while in elective group it was needed for 10 (6.7%) women ( $p=0.617$ ).

**Table 6.** Maternal intraoperative and postoperative complication.

	Emergency CS (%) (N=150)	Elective CS (%) (N=150)	<i>p</i> -value
Postpartum hemorrhage	99 (66.9)	94 (63.0)	0.625



Uterine incision extension	2 (1.3)	0 (0.0)	0.478
Organ damage	1 (0.7)	0 (0.0)	1.000
Abdominal distension	35 (23.3)	24 (16.0)	0.146
Wound infection	5 (3.3)	3 (2.0)	0.720
Urinary tract infection	1 (0.7)	1 (0.7)	1.000
Respiratory complications	12 (8.0)	10 (6.7)	0.825
Blood transfusion	7 (4.7)	10 (6.7)	0.617
Headache	9 (6.0)	7 (4.7)	0.797
Endometritis	7 (4.7)	5 (3.3)	0.768
Sepsis	1 (0.7)	1 (0.7)	1.000
Anemia	118 (79.2)	98 (65.3)	0.011

\*CS: Cesarean section.

### 3.4. Neonatal complications

The neonatal complication rate in the emergency group was 27.3% (41/150) as compared to elective group 22.0% (33/150). However, none of the neonatal complications showed any significant differences. Respiratory distress syndrome was noted in 10% (15/150) of neonates in the emergency cesarean group, whereas in elective cesarean group it was 10.7% (16/150) ( $p=1.000$ ). It was found that 13 (8.7%) neonates had transient tachypnea of newborn in emergency group, while 11 (7.3%) neonates had it in the elective group ( $p=0.831$ ). The incidence of sepsis in neonates in emergency cesarean group was 2.7% (4/150), while in elective cesarean group, it was 0.7% (1/150) ( $p=0.367$ ). Other neonatal complications are shown in Table 7.

**Table 7.** Neonatal outcomes.

	Emergency CS (%) (N=150)	Elective CS (%) (N=150)	<i>p</i> -value
Respiratory distress syndrome	15 (10.0)	16 (10.7)	1.000
Transient tachypnea of the newborn (TTN)	13 (8.7)	11 (7.3)	0.831
Apnea/Secondary apnea	8 (5.3)	4 (2.7)	0.377
Perinatal depression	1 (0.7)	1 (0.7)	1.000
Sepsis	4 (2.7)	1 (0.7)	0.367

\*CS: Cesarean section.

## 4. Discussion

The study looked at the complications related to cesarean section and compared these complications between emergency and elective cesarean section groups at SQUH. The mean maternal age, gravidity and parity were higher in elective cesarean section group than in emergency section group as the most common indication in that group was previous multiple cesarean sections. A longitudinal descriptive study conducted in a Teaching Hospital in Kerala found that the mean maternal age and gravidity were higher in elective group and they found that the major indication was previous multiple caesarean section.<sup>14</sup> The major antenatal risk factor in both study groups was either overt diabetes mellitus or gestational diabetes mellitus. Data on 165 women also found that gestational diabetes mellitus was one of the most common antenatal complication in both study groups.<sup>14</sup>

The main indication for the cesarean section in the emergency group was previous cesarean section followed by non-reassuring CTG. While in elective cesarean group the main indication was previous multiple cesarean sections followed by malpresentation. An Indian study found that the major indication for emergency section group was previous cesarean section followed by cephalopelvic disproportion whereas it was reverse in elective cesarean group in which cephalopelvic disproportion ranked first followed by previous cesarean section.<sup>10</sup>

Data related to maternal anesthetic complications revealed that difficult intubation and ventilator requirements were not significantly different between emergency and

elective cesarean section. A similar study conducted in Peshawar Hospital, Pakistan showed the same finding in which there was no significant difference in anesthetic complications between the emergency and elective groups and the explanation for that could be due to the type of anesthesia used.<sup>11</sup> Whilst a prospective study at 12 centers in 9 countries found that the anesthetic complications were significantly higher in emergency section group than in elective group.<sup>15</sup> Our study showed that the hypotensive anesthetic complication was higher in elective cesarean group which was not mentioned in previous studies. The possible explanation for this finding is that most of the mothers who underwent elective cesarean section had spinal anesthesia and one of the most common complication of spinal anesthesia is hypotension.

Our results showed that there was no significant difference between emergency and elective cesarean section in the following intraoperative complications: postpartum hemorrhage and organ damage which is in contrast with other studies which had shown significant difference between study groups.<sup>11</sup> One possibility is that both our groups were high risk groups with similar comorbidities and similar BMI. The other reason could be the availability of senior obstetricians for supervision at all time during the emergency surgeries. Bergholt et al reported more incidence of cervical and vaginal laceration in the emergency cesarean group, which our subjects did not suffer from. The rest of the complications did not show any significant difference between the study groups.<sup>16</sup>

Our study did not show a statistical difference for most postoperative complications in both groups. Soren et al study found that postoperative fever, blood transfusion and respiratory complications were significantly different between study groups and were higher in emergency group.<sup>10</sup> However, this is in conflict with our study, which showed significant difference only in postoperative fever. A meta-analysis of 9 studies showed that all the following complications were significantly different between emergency and elective group which were urinary tract infection, infections in general and postoperative complications except headache. Only postoperative fever is in agreement with our findings.<sup>1</sup>

An observational study conducted in a tertiary care teaching hospital for one-year duration showed that headache, respiratory infection and wound infection did not show any significant difference between the emergency and elective cesarean section which is in agreement with our study. However, urinary tract infection was significantly more in emergency group which was not seen in our study.<sup>14</sup>

Chongsuvivatwong et al found no significant difference between study groups in endometritis as a postoperative complication which is similar to our finding, but they found other postpartum complications significantly different between study groups including: peritonitis, hemorrhage, wound infection and urinary infection.<sup>15</sup> Postoperative anemia was significantly seen more in the emergency cesarean group. A possible explanation could be that most of the patients who had emergency surgeries were un-booked patients and not seen in our hospital with pre-existing anemia which makes them more prone for postoperative anemia after an emergency cesarean section.

In addition, neonatal complications did not show any significant differences between the study groups. Soren et al study also found that there was no significant difference for the following complications: transient tachypnea of the newborn, respiratory distress syndrome and sepsis.<sup>10</sup> A study done by Daniel et al interestingly showed that neonatal complications were significantly higher in emergency group.<sup>12</sup> Also Yang and his group showed significant difference in neonatal complications in emergency group.<sup>1</sup> The explanation for this finding is that most of the high risk mothers had a planned elective delivery with availability of senior neonatologists to improve the immediate care for the newborn.

#### 4.1. Limitations

The study has some limitations as it is a retrospective study; with missing some information. Other limitations is the small sample size and that it is a single center experience.

## 5. Conclusion

There was no significant difference between emergency and elective cesarean section related maternal and neonatal complications except for transient intraoperative hypotension, maternal postoperative febrile morbidity and anemia.

The results of our study can be used as a basis to conduct future studies in Oman. It is recommended to conduct a prospective study with a larger sample size including various centers in Oman. Further work is required looking into risk factors, indications and its relationship with cesarean section complications.

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