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# A 10 Year Clinical Auditing of Cesaren Section Performance in El-Minia Maternity University Hospital

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**ABSTRACT**

The caesarean section rate has increased all over the world for the past 3 decades. This has now become an issue of intemational public health concern. Obstetric intervention would have the risks to both the mother and baby.There is no clinical evidence justified caesarean section lead to better outcomes. The main objective of this clinical audit was to test if maternal and neonatal outcomes improved with increase in caesarean section rate. An observational retrospective study was carried out in our university hospital from January 2004 till January 2014.Data were collected from registered files at the department of gynecology and obstetrics in El-Minia University Hospital from January 2004 to January 2014. Data included personal history (age, residence), medical history, obstetric history (antenatal care, number of pregnancies, number of labor) operative details and suspected cause of death. In situations where these data were deficient, verbal autopsy was done through interview with patient relatives or phoning them. There was a significant increase in caesarean section rate from 18.4% in 2004 to 23.6% in 2014. Failure of progress and fetal distress were the primary indications for emergency caesarean section, while previous caesarean birth, maipresentation and maternal request were common reasons for elective caesarean section. Both maternal request and repeat caesarean section were significantly increased across 10- year study period. Advanced maternal age was indicated as a contributing factor for caesarean section.Maternal blood loss was significantly higher in women with caesarean section than normal vaginal delivery and assisted delivery. More obstetric perineal trauma was found in women with normal vaginal births.Subgroups of gestational age less than 33 weeks and birth weight 1 toI .5kg had the highest caesarean section rate. Newborns delivered by caesarean section had lower Apgar score i minute after birth than those by normal vaginal delivery. Higher rate of admission to neonatal intensive care unit was found in newborns delivered by caesarean section. More serious birth trauma occurred in newborns by instrumental delivery.caesarean section rate is significantly increased in those with previous history of caesarean section (11.16%).The main indications were done in primiparas and fetal distress. A 4.02% decrease was found in sections done for fetal distress.



## Introduction

Clinical audit is defined as a systematic and critical review of activity of all aspects of clinical care of patients by medical and paramedical staff in order to improve effectiveness and efficiency of health care [1].Martin and Schofield point out an audit can facilitate development of professional education and self- regulation, needs assessment, improvement of motivation and teamwork [2].

The incidence of cesarean delivery has risen significantly in Egypt. It is estimated that one of every sex deliveries today in Egypt is being carried out by a caesarean section [1]. This figure is almost three times higher than the early 1990s [2]. This dramatic increase raises several concerns of medical, ethical an economic importance. Further, the public health significance of this increase is strongly debated.

Some advance the argument that caesarean delivery is an indicator for availability of and accessibility to maternal health care services. The premise is that surgical interventions such as caesarean delivery are keys to avoid maternal mortality and morbidity due to pregnancy complications [3]. Caesarean section is a life saving procedure in cases of obstructed labor, eclampsia and intractable hemorrhage [4, 5]. Therefore, the proportion of deliveries with caesarean section was suggested to serve as a proxy for the extent to which health care facilities provide this essential element of obstetric care [3]. Further, the increase in caesarean section delivery could be explained by either the availability of modern medical emergencies or the increasing in the demand for hospital deliveries.

Contrarily, others have voiced several concerns about the rising trend of caesarean section deliveries. First, though caesarean section is a fairly safe surgical procedure, several studies have reported a statistically significant increase in the risk of acute and chronic complications [6 – 14] when compared with attended vaginal delivery.

Exposing women unnecessarily to an increased risk of these complications is medically and ethically unacceptable. Second, it is not uncommon that caesarean delivery is overused or used for inappropriate indications, i.e. for reasons not related to preserving the life and health of mother or infant. The procedure can be convenient and lucrative for physicians but carries risks for the woman, particularly when conducted in less than optimal conditions [3].

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Third, unnecessary caesarean deliveries impose unjustified costs on the part of the patient and waste the medical and economic resources on the part of the health system [15-19]. Fourth, it is not known whether the trends are universal in all regions of Egypt. It is said that the increase in caesarean delivered has occurred in the rich urban centers.

The proportion of caesarean deliveries in the poor and rural areas is not known. These are the areas where maternal deaths are higher and the need for emergency obstetric care is greater.

The aìm was to study the trend of caesarean section rate, to audit the indications for operative deliveries, and to compare the maternal and newborn outcomes between caesarean sections and other mode of deliveries.

**Materials and methods**

Institutional ethical approval was obtained to audit the medical records of our weekly mid-yearly, annual maternity meetings. This was a prospective clinical audit conducted in el-minia maternity univeristy hospital in Egypt which provides service to the population in El Minia governorate, more than 5000 births delìvered each year. The audit period was Jan to Jan from 2004 to 2014 in order to study the secular trend in caesarean section rate.

In order to make sure all the cases within the study period included, the number of cases was checked by the total of live births on birth registry records in labor ward. Any missing or unclear data was valìdated by birth registry records.

**Collected data were as follow**

1-Mode of delivery: normal vaginal delivery. Vacuum extractìon, forceps assisted delivery, elective or emergency caesarean section.

2- Personal characteristics of mother: age, parity and previous caesarean

3- Clinical characteristics of pregnancy: gestation, Onset of labor, use of oxytocin for augmentation, liquor, epìdural anesthesia, singleton or multiple pregnancy.

4- Indications for caesarean section stated on operation record were collected. The indìcations for elective and emergency caesarean sectìon were examined separately.

5- Maternal outcomes: total blood loss, obstetric perineal injuries and maternal death. Obstetric injuries including perineal tear, vaginal tear, cervical tear and haematoma.

6- Newborn outcomes: birth weight, Apgar score at1 min and 5 min after birth, birth traurna, admission to neonatal intensive care unit, perinatal death. Birth trauma included cephalobaematotna, intracranial hemorrhage, fractures, skin laceration and cut wound.

**Statistical Analysis**

Statistical analysis was performed by using the Statistical Package for the Social Sciences (Windows version 20.0; SPSS Inc. Chicago US).The number of live births by different modes of delivery were calculated and expressed in percentage.

The trend of caesarean section rate was analyzed by Chi-squared test.The indications for elective and emergency caesarean sections and the trend across the 10- year study period were tested by Chi- squared analysìs. Maternal and newborn outcomes in caesarean section were compared with normal vaginal delivery and assìsted delivery.

One- way analysis of variance methods (ANOVA) were used to compare continuous variables, including, maternal blood loss, gestations birth weight, Apgar score at 1 and 5 minutes among three different groups of delivery.

**Results**

**Mode of delivery**

Total 50990 live births delivered in study period from 2004 to 14. Overall 35890(70.4%) women had normal vaginal delìvery. 4170 (8.2%) women had instrumental delivery. 10770 (21.1%) women delivered by caesarean section. Only 160 (0.3%) had vaginal breech delivery. Overall cesarean section rate increased from 18.4% in 2004, to 23.6% in 2014.

**Personal charcteristjcs of mother**

In women with caesarean births, mean age was 31.7 ± 5.1; ranged from 17.4 to 46. 1 year-old. By comparing the mean age in Women with normal vaginal delivery (mean=29.5 ± 5.1) and with assisted delivery (29.9 ± 5.0), caesarean section group was signìficantly older than the other 2 groups (F 75.8, p< 0.0001). In Post Hoc test, mean difference of' caesarean section group and normal delivery group was 2. 18 (p< 0.0001), mean difference of caesarean section group and assisted delivery was 1.75 (p< 0.0001).

Totally 62 10 women delivered by caesarean section ìn first pregnancy counting for 22.9%. In women with prior deliveries, higher caesarean section rate of 71.5% in women with previous caesarean section compared with only 9% in women with previous vaginal births. Almost half 1850/3880 (47.7%) of the women with previous caesarean bìrth, declined for trial oflabor and decided for elective caesarean seclion. Among the group for Irial of labor, overall success rate was 28.4%; 950 women bad normal vaginal delìvery while 150 women assisted by instrumental delivery. Remaining 950 women were delivered by emergency caesarean section either for failed trial of 1abor or early labor before the scheduled date for elective operation.

**Clinical characteristics of pregnancy**

The mean gestational age in caesarean births was 38.9 ± 2.0 weeks, ranged from 28 to 44 weeks. When compared with vaginal delivery (mean 39.5 ± 1.5 weeks) and assisted delivery (mean 39.6 ± 1.9 weeks), caesarean births showed sìgnìflcantly smaller in gestational age (F 58.94, p< 0.0001). In Post Hoc test, mean difference between caesarean births and normal delivery was 0.59 (p< O.00O1) while 0.71 between caesarean births and assisted delìvery (p< 0.0001). In subgroup analysis, p rematurity with gestational age less than 33 weeks had the highest caesarean section rate 50%.

**Table 1. Caesarean section rate in different subgroups of gestational age**

| Gestational age | frequency | Cesarean section rate | P-value |
|---|---|---|---|
| < 33 weeks | 190/380 | 50.0 | 0.0001 |
| 33 to 36 weeks | 680/1740 | 39.1 | |
| 37 to 42 weeks | 9850/48640 | 20.3 | |
| >42weeks | 50/230 | 21.7 | |

Overall rate of induction of labor was I 6.3%. Caesarean section rate in women with ìnduction of labor in first pregnancy was 3 1 .4%. Caesarean section rate in multiparous women with ìriduced labor was 12.6%.

Oxytocin iniìision was u.sed to augment the labor progress. In ow study, 35.9% (1832/ 5099) women were given oxytocin for augmentation.

Incidence rate of multiple pregnancies in our study group was 11.7/1000 pregnancy (total: 590 pairs of twin). 10 cases of friplet, counted for 2/10000 pregnancy. Half of the multiple pregnancy was delivered by caesarean section.

**Indications for caesarean sections**

Failure of progress and fetal distress were the commonest primaiy indications for emergency caesarean section. Previous

uterine scar, breech presentation and maternal request were the three main indications for elective caesarean section.Indications for both elective and emergency caesarean sections were listed in Table 2.

**Table 2. Indications for elective and emergency caesarean sections**

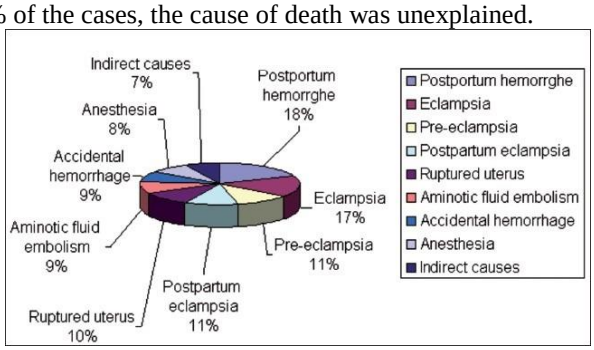
| Indications | Elective cs | Emergency cs | P value |
|---|---|---|---|
| Failure of progress | 0 | 3100 | |
| Fea1 distress/ J1JGR | 60(3.2) | 1840(96.8) | 0.0001 |
| Previous uterinescar | 1850(69.0) | 830(31) | 0.0001 |
| Maternal request | 1460(75.6 | 47(24.4) | 0.0001 |
| Breech presentation | 1080(56.4) | 840(43.6) | 0.0001 |
| Medical disease | 390(38.4) | 610(61.6) | 0.731 |
| Multiple pregnancy | 24040) | 36(60) | 0.998 |
| Antepartum haemorrhage | 390(49.3) | 380(50.7) | 0.091 |
| Unfavorable cervix, pelvis | 240(77.4) | 70(22.6) | 0.0001 |
| Cord prolapse | 10 | 60 | |
| Other | 10 | 20 | |
| Total | 5730 | 8590 | |

Note: Some cases with more than one indications, total = 14320. For breech presentation, 88.8 % (1920/ 2160) was delivered by caesarean section 3.7% (80/2160) was by normal vaginal delivery after sucessful external cephalic Version. 49.5% (1070/2160) were delivered by elective caesarean section.

**Maternal outcomes**

The maternal blood loss among three different modes of delivery were tested by ANOVA. Higher blood loss was found in women with caesarean births (mean = 462.7 ± 232 ml), compared with assisted delivery and normal vaginal delivery at F =358.6 (ID< 0.0001), In Post Hoc test, mean difference between caesarean section and normal delivery was 133.6 m1 (p< 0.0001), mean difference between caesarean section and assisted delivery was 80.9 nil (p< 0.0001). The mean blood loss in emergency caesarean section (mean = 465.4 ± 250 ml) did not show any significant difference when cornpaied with elective caesarean section (mean = 4563 ± 194ml).

Women with normal vaginal delivery were found to suffer from more obstetric injuries (perineal, vaginal, cervical tear and haematoma) than women with assisted delivery (55.4, p< 0.0001). From January 2004 till January 2014, a total of 187 maternal deaths were recorded during the 5-year study period, out of 50990 cases admitted at the Department of Obstetrics at our university hospital, giving a maternal mortality ratio (MMR) of 953/100,000 deliveries. The yearly MMR was 950/100,000 in 2004, 925/100,000 in 2005, 947/100,000 in 2006, 953/100,000 in 2007 and 677/100,000 in 2008, 745/100,000 in 2009, 654/100,000 in2010, 576/100,000 in 2011, 435/100,000 in 2012, 402/100,000 in 2013, 365/100,000 in 2014. Exactly 133 cases were multiparous (71%) while 54 cases were primigravida (29%)(*P*=0.0005).Concerning antenatal care, majority of the cases received no antenatal care (65%); only 10 cases had regular antenatal care (5.3%). Rest of the cases experienced irregular antenatal care (29.7%). Exactly 120 cases in this study delivered by cesarean sections (64.2%) and only 35 cases have had vaginal delivery (18. 7%) (*P*=0.00002). Eighty-eight cases in this study died after delivery, representing 47% of total cases; 67 cases (36%) died during labor and only 17% died before labor .Maternal mortality rate recorded in this study (953 per 100,000) is higher than the mortality rate in Egypt (84 per 100,000). This may be explained based on the factthat El-Minia university hospital is a tertiary care unit and complicated cases from peripheral areas are referred to the hospital.The first leading cause of obstetric death was postpartum hemorrhage (18.2%) followed by eclampsia (17.1%), pre-eclampsia (11.2%) and postpartum eclampsia (10.7%). Ruptured uterus led to death in 10.2% of the cases and accidental hemorrhage in 8.6% of cases. Amniotic fluid embolism was suggested as a cause of death in 9.1% of the cases and anesthesia in 8% of the cases. In 6.9% of the cases, the cause of death was unexplained.




**Neonatal outcomes**

**Table 3. ANOVA for neonatal outcomes**

| | MEAN | F | P |
|---|---|---|---|
| Birth weight (gram) | | | |
| Normal delivery | 3218±432 | 7.92 | 0.0001 |
| Assisted delivery | 3230±498 | | |
| Caesarean section | 3154±622 | | |
| Apgarscore(1 mm) | | | |
| Normal delìvery | 7.98±0.39 | 30.06 | 0.0001 |
| Assisted delivery | 7.79±0.88 | | |
| Caesarean section | 7.85±1.0 | | |
| Apgar score (5 min) | | | |
| Normal delìvery | 9.02±0.26 | 4.92 | 0.05 |
| Assisted delivery | 8.99±0.67 | | |
| Caesarean section | 9.06±0.78 | | |

The mean bìrth weight in newborns delivered by caesarean section was 3 1 543 ± 622 gram, in newborns by vaginal delivery was 3218.8 ± 432 gm and 3230 ± 498 gin by assisted delivery. The study showed significant lower in birth weight in groups of caesareaii section (F= 7.92, p< 0.0001), as shown in Table 3. In Post Hoc test, mean difference between caesarean section and normal delivery was -64.5 gm (p< 0.0001) while -75.6 gm (p< 0.05) between caesarean section and assisted delivery. The caesarean section rates in different subgroups of birth weight were listed in Table 4.

**Table 4. Caesarean section rate in different subgroups of birth weight**

| Birth weight | Frequency | Cesarean section rate | P-value |
|---|---|---|---|
| < 1000 gm | 10/60 | 16.7 | 0.0001 |
| 1000-1499gm | 220/280 | 78.6 | |
| 1500-2499gm | 1130/2800 | 40.4 | |
| 2500-4000gn | 8680/45830 | 18.9 | |
| >4000gm | 730/2020 | 36.1 | |

The mean apgar score at I minute afler birth ìn group of caesarean section was 7.83 ± LO, while 7.98 ± 0.4 in group of vaginal delivery and 7.79 ± 0.9 in assisted delivery. The Apgar score was sìgnificantly lower in caesarean section group (F = 30.1, p< 0.0001), as showi in Table 6. In Post Hoc test., the significant mean difference of 10.13 was found between caesarean section and normal delivery (p< 0.0001), but no significant difference with assiste delivery.

The mean Apgar score at 5 mInute after bIrth in group of caesarean section was 9.06 ± 0.78, while 9.02 ± 0.26 in group of vaginal delivery and 8.99 ± 0.67 in assisted delivery. The Apgar

score was significantly higher in caesarean section group (F = 4.92, p< 0.007), as shown in Table 6. Hi Post Hoc test, the mean difference between caesarean section and normal delivery was 0.04 (j< 0.05) while 0.07 between caesarean section and assisted delivery (p< 0.05).

Two third of serious complications including cephalohaeatoma ìntracranial hemorrhage, skull fracture and clavicle fracture occurred in newborns by instrumental delivery (100/150). The study showed significant higher birth trauma in group ofassisted delivery (= 36.1, p < 0.0001).

Newborns delivered by emergency caesarean section had a significant hìgher admission rate to neonatal intensive care unit (65.8%) compared with groups of assisted delivery (11.4%) and normal vaginal births (22.8%); (p< 0.0001).

Totally there were 6 cases of neonatal death, survival time from i to 22 days. 5 were delivered by emergency caesarean section and i by assisted breech delivery (p< 0.000 1).

**Predictors for caesarean section**

Possible independent variables for caesarean section were tested by logistic regression. Both adjusted and crude odds ratio for each potential variable were calculated for comparison. Tested predictors for caesarean section were listed in Table 8.

**Table 5. Predictors for caesarean section**

| Predictors | Adjusted odds ratio (95% Confidence Interval | Crude odds ratio (95% Confidence Interval) |
|---|---|---|
| Maternal age: p value for linear trend = 0.0001 | | |
| <24.99 | 1.00 | 1.00 |
| 25-29.99 | 1.64* (1.27-2.12) | 1.59* (1.25-2.02) |
| 30-3499 | 2.52* (1.95-3.26) | 2.32* (1.84-2.92) |
| 35-39.99 | 4.03* (3.00-5.40) | 3.22* (2.50-4.14) |
| >40 | 7.68* (4.69-12.6) | 5.02* (3.36-7.48) |
| Parity: p value for linear trend = 0.0001 | | |
| parity=0 | 1.00 | 1.00 |
| pañty = 1 | 0.24* (0.19-0.29) | 0.83* (0.72-0.96) |
| parity=>2 | 0.15' (0.10 | 0.21) 0.69* (0.53 |
| Liquor: p value for linear trend 0.000 1 | | |
| normal | 1.00 | 1.00 |
| thin meconiumstained | 1.44*(1.07- L95) | 0.99 (0.76 - 1.30) |
| moderate meconium | 1.74* (1.27 -2.39) | 1.23 (0.93 - 1.62) |
| Thick meconìum stained | 232* (1.36-3.96) | 1.89* (1.20-2.99) |
| Labor augmeutaton: | | |
| No | 1.00 | 1.00 |
| Yes | 0.33* (0.27 - 0.39) | 0.32* (0.27 - 0.38) |
| Previous caesarean section: | | |
| No | 1.00 | 1.00 |
| Yes | 27.8* (20.9-37.2) | 12.4* (9.80-156) |
| Multiple pregnancy: | | |
| No | 1.00 | 1.00 |
| Yes | 6.60* (3.42- 12.7) | 8.66* (479 15.7) |
| Birth weight: p value for linear trend 0.61 | | |
| <1 kg | 1.40 (0.04-53.8) | 086 (0.10-7.34) |
| 1-1.499kg | 12.9* (3.09-54.6) | 15.7* (6.34-38.8) |
| 1.5-2.499kg | 2.19* (1.58-3.03) | 2.90* (2.26-3.72) |
| 2.5-4kg | 1.00 | 1.00 |
| >4kg | 2.85* (2.02-4.03) | 2.42* (1.80-3.26) |
| Gestational age: p value for linear trend 0.70 | | |
| < 28 weeks | 0.44 (0.03 - 6.45) | 0.79 (0.17 - 3.60) |
| 28-32weeks | 1.52 (0.39-5.91) | 744* (3.31-16.7) |
| 33-36weeks | 1.23 (0.80-1.89) | 2.53* (1.853.45) |
| 37-42weeks | 1.00 | 1.00 |
| >42weeks | 1.38 (0.45-4.20) | 1.09 (0.41-2.95) |

Our study showed maternal age had a significant linear relationshìp with caesarean section rate. The odds ratio for caesarean section increased as women's age. Maternal age more than 40 was the most significant factor for caesarean section, with odds ratio of7.68(95% CI: 4.69 - 12.6, p< 0.0001).Multi-parìty was found to be a significant protective factor for caesarean section.For women with one previous pregnancy, odds ratio of caesarean section was 0.24 (95% CI: 0.19 - 0.29 p< 0.0001) when compared women with no history of birth. The protection was increased if women had 2 previous bìrths, odds ratiowas 0.15 (95%C1: 0.10-O.21,p<O.0001). Our study indicated high risk for caesarean section in future pregnancy if women with previous caesarean births; the odds ratio for repeated caesarean section was 27.8 (95% CI: 20.9 - 37.2, p< 0.0001).

Oxytocin infusion was used if the labor progress was slow. Our study showed these cases would have lower chance for caesarean section; the odds ratio was 0.33 (95% CI: 0.27. - 0.39, p< 0.0001).

Meconium stained lìquor (MSL) may signify fetal compromise. The odds ratios for caesarean section were increased when compared with cases having normal liquor. There was dose- response gradient for caesarean section as the meconium changed from thin to thìck (p< 0.0001). Thick meconìum stained liquor was found to be the highest factor for caesarean section, odds ratio of 2.32 (95% CI: i .36 - 3.96, p< 0.005).

Women with multiple pregnancy were classified as high rìsk group. The odds ratio of 6.60 (95% CI: 3.42 - 12.7 p< 0.001) indIcated multiple pregnancy increasing the chance for caesarean section.

Birth weight of 1 - 1.5kg was showed to be the most significant factor for Caesarean section; odds ratio of 12.9 (95% CI: 3.09 - 54.6, p< 0.0001). Other subgroups ofbirth weight of 1.5 -2.5 kg and more than4 kg also were indicated as factors for caesarean section.

In running logistic regression anaIysis gestational age was not ìndicated as a significant factor for caesarean section,

**Predictors for postpartum hemorrhage**

Primary postpartum hemorrhage ìs defined as blood loss more than 500ml.Clinically related variables for maternal primary postpartum hemorrhage were tested by logistic regression.

Both assisted delivery and caesarean section contributed prìmary postpartum hemorrhage of blood loss more than 500 ml. Caesarean section had the highest odds ratio of6.l1 (95% CI: 4.48 - 8.33, p<O.000l). Induction oflabor, previous caesarean section and labor augmentation were not found to be important factors for heavy blood loss. Birth weight of more than 4 kg was significantly contributed for primary postpartum hemorrhage.

From January 2004 till January 2014, a total of 187 maternal deaths were recorded during the 5-year study period, out of 50990 cases admitted at the Department of Obstetrics at our university hospital, giving a maternal mortality ratio (MMR) of 953/100,000 deliveries. The yearly MMR was 950/100,000 in 2004, 925/100,000 in 2005, 947/100,000 in 2006, 953/100,000 in 2007 and 677/100,000 in 2008, 745/100,000 in 2009, 654/100,000 in2010, 576/100,000 in 2011, 435/100,000 in 2012, 402/100,000 in 2013, 365/100,000 in 2014. Exactly 133 cases were multiparous (71%) while 54 cases were primigravida (29%)(*P*=0.0005).Concerning antenatal care, majority of the cases received no antenatal care (65%); only 10 cases had regular antenatal care (5.3%). Rest of the cases experienced irregular antenatal care (29.7%). Exactly 120 cases in this study

delivered by cesarean sections (64.2%) and only 35 cases have had vaginal delivery (18. 7%) (*P*=0.00002). Eighty-eight cases in this study died after delivery, representing 47% of total cases; 67 cases (36%) died during labor and only 17% died before labor .Maternal mortality rate recorded in this study (953 per 100,000) is higher than the mortality rate in Egypt (84 per 100,000). This may be explained based on the factthat El-Miniauniversity hospital is a tertiary care unit and complicated cases from peripheral areas are referred to the hospital.The first leading cause of obstetric death was postpartum hemorrhage (18.2%) followed by eclampsia (17.1%), pre-eclampsia (11.2%) and postpartum eclampsia (10.7%). Ruptured uterus led to death in 10.2% of the cases and accidental hemorrhage in 8.6% of cases. Amniotic fluid embolism was suggested as a cause of death in 9.1% of the cases and anesthesia in 8% of the cases. In 6.9% of the cases, the cause of death was unexplained Making efforts to decrease maternal mortality rate is a moral, economic and human rights related issue. This issue could not be handled without investigation of maternal mortality related factors.

**Predictors for low Apgar score at 1 minute after birth**

The median ofapgar score at I inmute among total 5099 cases was S , which was then used to define as low and high apgar score. Predicators for low Apgar score was analyzed by logistic regression.

Newborns by assisted delivery were found to have low apgar score at 1 minute after birth. odds ratio of 4.27 (95% CI: 3.22 - 5.66, $p < 0.0001$). Both elective and emergency caesarean sections were not found to be a factor for low apgai score at I minute. Meconium stained lìquor were the significant factors for low Apgar score. General anesthesia contributed low score at birth. Prematurity and low birth weights were indicated as factois for low Apgar score at i minute after birth.

**Predictors for low Apgar score at S minute after birth**

The median of Apgar score at 5 minute among total 5099 cases was 9, which was then used to define as low and high Apgar score. Predicators for low Apgar score was analyzed by logistic regression.

Mode of delivery was found to be factors for admìssion to neonatal intensive care unit (NICU). Newborns delivered by emergency caesarean section had the highest chance for admissionwith odds ratio of5.23 (95% CI: 2.37 - 11.6, $p< 0.0001$). Moderate and thick ineconìum stained liquor were significant contributors for admission to NICIJ. Premature newborns ofless than 36 weeks had a higher chance to be admitted to NICU. The result showed a dose response relationship as the younger the maturity, the hìgher odds ratìo for admission. Birth weight less than 2.5kg was a factor for admission. The lower the birth weight, the higher the odds ratio for admission to NICU.

**Discussion**

This audit showed a significant increase in caesarean section rate from 18.4% in between 2004 to 23 .6% in 2014, comparable to western developed countries (OECD health report 2002), The overall caesarean section rate in our study was 21.1%, similar finding as in UK national caesarean section audit in 2000 (21 .5%). Our result was lower than that 27. 1% in territory- wide audit in which high caesarean section rate in private hospitals was included (Leung et al., 2001).

The finding was much hìgher than that suggested by WHO of 15% caesarean section rate. This implied clinical monitoring on caesarean section rate is needed.

The rate of instrumental delìveries was also decreasing. In forceps assisted delivery, it dropped from 2.3% in 2004 to 0.2% in 2014. Similar findings with vacuum extraction, it decreased from 9.4% in 2004 to 6.3% in 2014. It may reflect the situatìon of transforming instrumental delivery to caesarean section.

For caesarean section in first pregnancy, our study (22.9%) showed similar findings as UK national audit report (24.2%). Previous uterine scar is one of the main indications for caesarean section. This group ofwomen will have a higher chance to repeat caesarean births in future pregnancy as 71.5% women would have repeated caesarean section in our study. Number of previous caesarean section was significantly increased across 10- year study period (2 g 6, $p < 0.05$). Trial of scar is being promoted as one strategy to reduce caesarean section. Auditable standard in UK national audit: a trial of labor should be considered in women who have had a previous caesarean section. The overall rate of vaginal birth after a previous caesareans section was 28.4% in our study lower than 33% in UK audìt. Option for trial oflabor should ht gìven to women with previous uterine scar, as one way to reduce caesarean section rate.

Failure to progress is one of the primary indications for emergency caesareansection. Auditable standard in UK national audit: oxytocin should be used in the management ofprimigravicla with suspected failure to progress in labor prior to caesarean section. J.n our study, only 43.5% prìmìgravida women requiring emergency caesarean section for no progress were given oxytocin for augmentation, much lower than 8 1 % in UK audit. Uterine rupture ìs serious complication in using oxytocin inui.ision. It is relatively safe in first pregnancy; special precaution is needed in women with previous uterine scar. More use of labor augmentation can be consìdered in order to reduce caesarean section for failure of progress.

Caesarean section for breech presentation has been identified as one of the major reasons for caesarean section. In UK national audit report the overall incidence of breech was 3 % at term, higher incidence in early gestation. Our study showed similar result: 333% before 28 weeks 8% from 28 to 36 weeks arid 3.8% at term. 92.4% of breech was delivered by caesarean section in our study, compared with 88% in UK report. It hasbeen widely recognized there is high perinatal mortality and morbìdity in breeh presentation, clue to prematurity, congenital anomalies, birth asphyxìa and trauma. Caesarean section has become the normal mode of delivery in centers in Europe and North America, as one way of redueìng the associated fetal problems (Cheng and Hannah, 1993). The rate of vaginal breech delivery in our study was low, only counting for 0.2 - 0.5% ofall lives births during the study period. Most of the women delivered by caesarean section, only 8 cases had successful external cephalic version. Clinical guidelines on the management of breecb presentatior in 2001, by Royal College of Obstetricians and Gynecologìsts (RCOG). Suggested all women with ari uncomplicated breech pregnancy at term should be offered external cephalic version. The commìttee reviewed six randomized controlled trials and found there was significant reduction in the risk of caesarean section in women where there was an intention to undertake external cephalic version without any increased risk to the baby. The committee also issued another recommendation oftbe best method ofdelivering a term frank or complete breech singleton by planned caesarean section. It was based on an international mutlicentre randomized controlled trial of planned vaginal breech delivery versus planned elective caesarean section for the uncomplicated term breech, by Canadian term breech trial collaborative group. Elective caesarean section for breech presentation is now highly recommended. Therefore, this does not only contribute to an increase in caesarean section in current practice, but also

contribute a marked rise of repeated caesarean section in future pregnancy.

Another debatable factor for caesarean section is maternal request. Maternal request has been reported as a significant factor in the rise in caesarean section rate (Jackson and Irvine, i 998). In our study, more women requested for elective caesarean section if having previous caesarean births or breech presentation. Number of caesarean section for niatemal request was significantly increased across 4- year study period (x 2 26.14, p< 0.0001).

Our study showed significantly higher blood loss was found in women with caesarean section (mean blood loss for caesarean section 462.7m1 for assisted delivery = 381.8 ml, and for normal delivery 329.1 ml). This result was expected as higher blood loss during operation. Antepartum hemorrhage including placental abruption and placenta praevia are one of the indications for caesarean Section. This group of women actually is high risk for heavy blood loss and hemorrhage. In our study, 53 .3% of caesarean section for antepartum hemorrhage had bloodloss over 500ml. 9/ 75 cases (12%) hadprofuse bleeding from 1100 to 4200ml. This ìs more related to the nature of placental problem, rather than the procedure of caesarean section. The number of caesarean section for this high risk group with antepartum hemonhage was very small 72 I 1432, accounting for 5%. However, for women with some other reasons for elective caesarean section, the risk and possible complications related to caesarean section should be clearly explained to the patients before deciding their mode of delivery.

Vaginal births do cause obstethc trauma to the women. Episiotomy is the commoest procedure during labor, wtiìch in fact is a form of second degree perineal laceration by excluding episìotomy, women with vaginal births still showed a higher rate ofperineal injuries (cervical tear, third degree tear, vaginal tear and haematoma) compared with assisted delivery. Perineal injuries can cause edema, pain at coitus, urinary retention, infection, long- term urinary and faecal incontinence (Whitfield, 1995). More women now worry about these complications after vaginal births, and so some prefer caesarean births. From January 2004 till January 2014, a total of 187 maternal deaths were recorded during the 5-year study period, out of 50990 cases admitted at the Department of Obstetrics at our university hospital, giving a maternal mortality ratio (MMR) of 953/100,000 deliveries. The yearly MMR was 950/100,000 in 2004, 925/100,000 in 2005, 947/100,000 in 2006, 953/100,000 in 2007 and 677/100,000 in 2008, 745/100,000 in 2009, 654/100,000 in2010, 576/100,000 in 2011, 435/100,000 in 2012, 402/100,000 in 2013, 365/100,000 in 2014. Exactly 133 cases were multiparous (71%) while 54 cases were primigravida (29%)(*P*=0.0005).Concerning antenatal care, majority of the cases received no antenatal care (65%); only 10 cases had regular antenatal care (5.3%). Rest of the cases experienced irregular antenatal care (29.7%). Exactly 120 cases in this study delivered by cesarean sections (64.2%) and only 35 cases have had vaginal delivery (18. 7%) (*P*=0.00002). Eighty-eight cases in this study died after delivery, representing 47% of total cases; 67 cases (36%) died during labor and only 17% died before labor .Maternal mortality rate recorded in this study (953 per 100,000) is higher than the mortality rate in Egypt (84 per 100,000). This may be explained based on the factthat El-Miniauniversity hospital is a tertiary care unit and complicated cases from peripheral areas are referred to the hospital.The first leading cause of obstetric death was postpartum hemorrhage (18.2%) followed by eclampsia (17.1%), pre-eclampsia (11.2%) and postpartum eclampsia (10.7%). Ruptured uterus led to death in 10.2% of the cases and accidental hemorrhage in 8.6% of cases. Amniotic fluid embolism was suggested as a cause of death in 9.1% of the cases and anesthesia in 8% of the cases. In 6.9% of the cases, the cause of death was unexplained Apgar score at i minute after birth in newborns delivered by caesarean section was found to be significantly low when compared wìth normal births. The case samples in caesarean group were actually more compromised, leading to emergency caesarean section. Some babies had the problems of prematurity, low birth weight, intrauterine growth retardation. multiple pregnancy, meconium stained liquor, together with maternal niedìcal diseases. All these conditions could lead to fetal distress, requiring emergency interventions. Then at 5 mìnute after birth the mean apgar store of 9M6 in caesarean section group was siìnìlar to 9.02 in normal vaginal births. This can be explained by the effects of general anesthesia in which the anesthetic drugs could cross the placenta and sedate the baby before bìrth so relatively low apgar score at I minute. Resuscitation and reversal drugs would then be given, making apgar score sinilar to group ofnormal vaginal delivery at 5 minutes after birth. More newborns admitted to neonatal intensive care unit if delivered by caesarean section. This result was more related to the compromised case samples, rather than the procedure of caesarean section. Early delivery is needed if any fetal distress suspected, eìther by caesarean section or instrumental delivery. The success of modem neonatal intensive care unit does save the lives of newborns, especially the premature and low birth weight babies.

There were only 60 cases of neonatal death during the study period. This low neonatal mortality could not be concluded as due to caesarean section. Unless our locality showed a marked increase in caesarean section rate, with correspondingly low neonatal mortality rate, then it might indicate caesarean sections saved the lives of the babies.

This audit did not show any better outcome in caesarean section group than normal delivery. The lower Apgar score may be related to the fetal wellbeing, birth weight and gestation, not necessarily direct to the caesarean section. Once our study did not confirm higher caesarean section rate would bring better neonatal outcomes.

The reasons for the rising caesarean section rate actually are very complex. Advanced maternal age is a contributing factor to high caesarean section rate. Our study showed more risks for caesarean section as women increased of age. Women above age of 3 5 were found to have 300% more chance for caesarean section as compared with women below age of25. In UK national audit report, the caesarean sectionrate was highest in women aged 40 - 50 (33.4%) followed with group aged 35 - 39 (28%).

Multiparity was confirmed to be a protective factor for caesarean section. Theodds ratio for caesarean section decreased as parity increased. Only if the women having prior caesarean birth, then the chances of repeat caesarean section would be increased.

Oxytocin infusion is considered for augmentation if labor progress is slow. Failure of progress was the clinical outcome due to uterine dysfunction, cephalopelvic disproportìon, failed induction or persistent occipitoposterior position. Oxytocin inñision is now widely used as one way to reduce caesarean section rate for failed progress. This might decrease the overall odds ratio for caesarean sectionto 0.33 (95% CI: 0.27 - 0.39, p < O.00Ol).

Presence of meconium ìn amniotic fluid signified compromised fetal wellbeing, so requirìng intensive fetal

monitoring. Our study confirmed meconium stained. Liquor was a significant indicator for caesarean section with a dose response gradient. Thick meconiuni stained liquor was the most worrying. These groups would have higher chance for caesarean section, odd ratio of 2.32 (95% Cl: 1.36 - 3.96).

Advance assisted reproductive technology makes an important contribution to multiple pregnancy. In our study group, the incidence of multiple pregnancy was 117/ 10000 pregnancy, higher than 9 % as reported in wide audit in 1999. Babies of either too small or too big in terms of birth weight were found to be factors for caesarean section, Low birth weight of I .5 - 2.5 kg showed odds ratio of2.19 (95% CI: 1.58 - 3.03, p < 0.0001) whìle very low birth weight of 1 - 1.5 kg showed odds ratio of 12.9 (95% CI: 3.09 - 54.6, p < 0.0001).

Subgroup of very very low birth weight of less than i kg did not shown to a significant factor for caesarean section; this may be due to small sample size 6 cases out of 5099 total live births. Macrosomia ofbirth weìght more than 4 kg was a contributing factor for caesarean section, odds ratio was 2.85 (95% CI:Il 2.02 - 4.03, p < 0.0001). Clinically macrosomia has the problem of cephalopelvic disproportion and failure of progress, resulting in caesarea section. Gestational age was not shown to be a contrìbuting factor for caesarean section.95.4% were delivered at term between 37 to 42 weeks gestation. Only 212/ 5099 (4.2%) cases were premature less than 37 weeks, and 23/ 5099 (0.4%) cases were post-term beyond 42 weeks. Small sample size might not show any significant result.

The subgroups of gestation between 28 to 36 weeks were found to be a factor for caesarean section oaly in crude odds ratio.

Our study showed both assisted delivery and caesarean section beìng the significant factor for heavy blood loss. Caesarean section was the most significant contributing factor with odds ratio of 6.1 (95% CI: 4.47 - 8.32, p < 0.0001). Induction of labor was indicated as a factor for postpartum hemorrhage. Big baby with birth weight more than 4 kg was also fourd to be a factor for heavy maternal blood loss, odds ratio of2.42 (95% CI: 1.61 - 3.64, p < OE0001).

The mean of Apgar score at I minute among total 5099 cases was 7.93, the Median was 8. There were only 11 cases with apgar score of3 orless at i mìnute.This study used 8 as a cut- off point for high and low apgar score at i minuteafter birth. Only assisted delivery was a significant factor for low Apgar score.

The mean of Apgar score at 5 minute among total 5099 cases was 9.03, themedian was 9. There were 6 cases with Apgar score of3 or less at S minutes after birth. This study used 9 as a cut- off pomi for high and low Apgar score at 5 minute after birth. Similar contributing factors as for low Apgar score at 1 minute.

Assisted delivery was again a factor for low Apgar score at 5 minutes. Only the crude odds ratio indicated caesarean section as a factor for low Apgar score at 5 minutes. Both prematurity and postmaturity were indicators for low score, similar findings as at imiriute after birth. This part of result dìd not prove the cause andthe effect. Premature newborns do have risk ofrespiratory distress syndrome while post- term babies have risk of meconium aspiration pneumonia, all these may coniribute lower Apgar score after birth.

Obstetric interventions were found to contribute high risk for admissìon to neonatal intensive care unit (NICU). Emergency caesarean section had the highest odds ratio of 5.23 (95% CI: 2.37 - 11.6) among dierent modes of delivery. Meconium stained liquor may signify fetal compromise, so leading to higher ehance for admission. Prematurity of less than 36 weeks and low birth weight less than 2.5 kg had more problems of lung prematurity which requiring resuscitation and intensive supportive care, so significantly leading to hIgh risk of admission to neonatal intensive care unit. Hìgh admission rate in groups of caesarean section is not directly related to the procedure, it may be the result of high risk pregnancy. This result reflects the need for neonatal ìntensíve care unit in tertiary obstetric centers provìding care to high risk pregnancy.

**Limitations of tbe study**

Only one investigator did this whole clinical audit. Usually, a team of auditing staff is required in order to complete the whole process. As most ofthe data were retrieved from medical records and hospital database, the reliability and validity of data cottid then be challenged. This is the main drawback ofthis study. There was no definite process for data va1idation which is particularly important in an audit. As this audit cycle has not yet completed, more staff and effort should be involved in future parts.

Obstetricians should abide by ethics in clinical practice and carefully evaluate the indication in every CS and take an unbiased decision before performing CS on demand/request. Although the debate will continue regarding the appropriateness of CS on demand, any discussion of risks and benefits must include the potential for long term risks of repeated CS, including hysterectomy and maternal and fetal death.

It is expected that obstetricians should always provide prompt, competent, skilled, and evidence based services to women. Carefully supervised vaginal delivery after CS needs to be enthusiastically encouraged by promoting trial of scar or trial of labor. Routine practice of external cephalic version is recommended during antenatal period in selected cases of breech presentation. The question of seeking a second opinion from a senior and experienced obstetrician before performing a CS for a controversial indication, is ticklish, but may be seriously considered or debated in the best interest of the profession and of the women as well. It is possible to maintain CS rate close to 10-15% and still have very low maternal and perinatal mortality.

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