Introduction

Cesarean section (CS) is delivery of one or more fetuses by incision in the abdominal and uterine wall. The increasing frequency of CS has raised the concerns, particularly when performed in the absence of clear-cut medical indications. Many countries have CS rates higher than 19%. CS rates vary considerably across regions and hospitals within countries, and a closer look at this variation may help to identify factors that contribute to higher than necessary rates ***(Hoxha et al., 2017).***

The indications for CS can therefore be divided into absolute e.g. (absolute disproportion, chorioamnionitis, maternal pelvic deformity, eclampsia and HELLP syndrome….etc) and relative indications e.g. (pathological cardiotocography, failure to progress in labor, previous CS….etc). Elective CS, performed solely at the wish of the mother, without any medical indication, is considered a separate indication ***(Mylonas and Friese 2015).***

Approximately 2-fold increase in maternal mortality and morbidity with cesarean delivery relative to a vaginal delivery: Partly related to the procedure itself, and partly related to the conditions that may have led to needing to perform a cesarean delivery (Infection, thromboembolic disease, anesthetic

complications, surgical injury, uterine atony and delayed return of bowel function) ***(Landon, 2008)***.

CS rates in Egypt have steadily increased, reaching 52% of all deliveries according to the most recent 2014 Egypt Demographic and Health Survey (EDHS) and representing more than a 100% increase in the CS rate since 2005 (***Ministry of Health, 2015).***

Worries about such increases have led the World Health Organization (WHO) to advise that CS rates should not be more than 15%, with some evidence that CS rates above 15% are not associated with additional reduction in maternal and neonatal mortality and morbidity ***(Kazmi et al., 2012)***.

The WHO adopted the Robson classification system as a global standard for assessing, monitoring and comparing CS rates. Robson's system classifies women into 10 groups based on five obstetric characteristics that are routinely documented: parity (nulliparous, multiparous with and without previous CS), onset of labor (spontaneous, induced or prelabor CS), gestational age (preterm or term), fetal presentation (cephalic, breech or transverse), and number of fetuses (single or multiple) ***(Nakamura-Pereira et al., 2016).***

The proposal and implementation of measures to reduce cesarean rates present large challenges and require critical study to identify the highest-risk mothers. In 2001, Robson proposed a simple, clinically relevant, reproducible and reliable classification system for cesareans. This classification system is the monitoring and audit tool that best meets local and international needs by including data commonly recorded at institutions providing different levels of care ***(Betra´n et al., 2014).***

The WHO, in its statement of April 10, 2015, proposed that the Robson classification of CS should be used as a global standard to compare cesarean rates over time at the same hospital or among different hospitals in the same region or country ***(Bolognani et al., 2018).***

Aim of the Work

Is to assess the indications of CS in Ain Shams University Maternity Hospital (ASUMH) according to Robson criteria and its relation to maternal & neonatal outcomes.

Cesarean Section

Nowadays, cesarean delivery has become one of the most common surgical intervention worldwide ***(Charoenboon et al., 2013).*** It is a life-saving intervention for both the mother and her child when vaginal delivery is not possible, contraindicated or carries maternal and fetal complications. In such cases, delay of cesarean section (CS) endangers the life of the mother and the fetus ***(Patel and Nag, 2018).***

The main advantage of CS is prevention of the complications associated with vaginal delivery especially in complicated cases and life-threatening deliveries ***(Inyang-Otu 2014).*** However, CS has its own maternal and fetal complications which risk the current and subsequent pregnancies as well ***(Robson et al., 2015)***.

In recent times, the rate of performing CS is escalating without a clear evidence of the indications and consequences, particularly in middle- and high-income countries, which made it a major controversial public health concern ***(Betrán et al., 2016).*** Therefore, the World Health Organization (WHO) stated: ‘‘There is no justification for any region to have a cesarean section (CS) rate higher than 10–15%” ***(Vindevoghel et al., 2014).***

This declaration augments the fact that there is no scientific evidence indicating any radical maternal and prenatal benefits from this increasing rates. Furthermore, some studies proved that higher rates could be associated with negative outcomes for both the mother and the fetus ***(Keag et al., 2018).***

Prevalence of Cesarean Section

According to the worldwide estimates, 18.6% of all deliveries are through CS, ranging from 6% to 27.2% in the least and most developed regions, respectively. Latin America and the Caribbean region has the highest CS rates (40.5%), followed by Northern America (32.3%), Oceania (31.1%), Europe (25%), Asia (19.2%) and Africa (7.3%) ***(Betrán et al., 2016).***

Based on data from 169 countries, trend analysis showed that during 2015, the global average CS rate was 29.7 million. The largest absolute increases occurred in Latin America and the Caribbean (44.3%), followed by Northen America (32%), Middle East and North Africa (29.6%), East Asia and Pacific (28.8%), Eastern Europe and Central Asia (27.3%), Western Europe (26.9%). The least contribution was from West and Central Africa (4.1%) ***(Boerma et al., 2018).***

Asia had the highest average annual rate of increase (6.4%), in contrast to Northern America where the lowest rate was reported (1.6%) ***(Betrán et al., 2016).***

Countries with the highest CS rates in each region are Brazil (55.6%) and Dominican Republic (56.4%) in Latin America and the Caribbean, Egypt (51.8%) in Africa, Iran

and Turkey in Asia (47.9% and 47.5%, respectively), Italy (38.1%) in Europe, United States (32.8%) in Northern America, and New Zealand (33.4%) in Oceania. **Figure (1)** shows country variation of CS rates according to latest nationally-representative reported data ***(Betrán et al., 2016).***

High Rates of Cesarean Section

Recently, the rate of cesarean section has nearly doubled in two decades and reached "epidemic" proportions in some countries. In 2015, 29.7 million C- sections were performed worldwide representing 21 % of all births. While it was only 16 million in 2000, representing 12 % of all births ***(Boerma et al., 2018).***

That increase in CS rates in the past few decades involved both developed and developing countries. Surprisingly, this high rate is not only associated with high risk groups, but also expanded to increase among low risk groups as well ***(Reddy et al., 2018).***

At least 35% of all CS currently performed is unnecessary ***(Farghali et al., 2014).*** In 2008, there were only 6.2 million unnecessary cesarean sections performed worldwide. China and Brazil represent approximately 50% of all cesarean sections without medical indication ***(Kcm et al., 2017).***

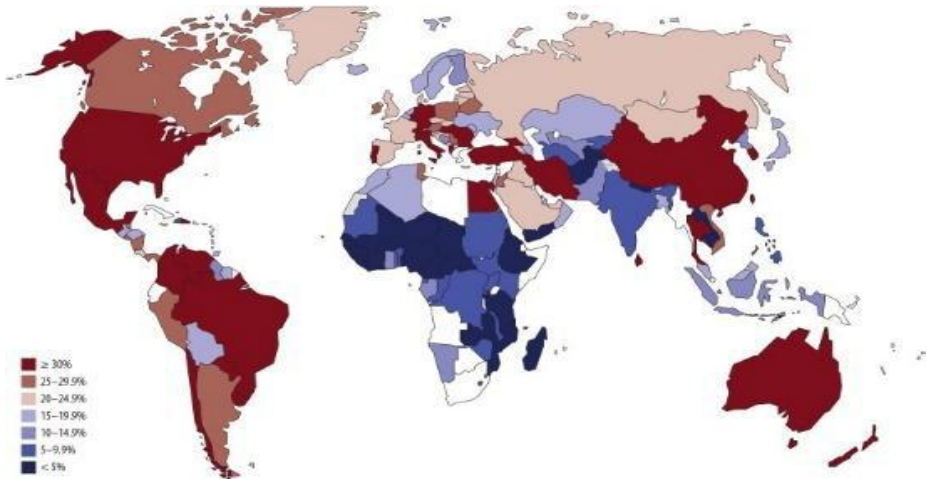


Figure (1): latest available data on cesarean section rates by country ***(Betrán et al., 2016).***

Factors associated with high rates of cesarean section

1. Common causes

There are many factors contributing to the escalating rate of CS. The most common factors include: rise in number of women with previous CS, women who refuse Vaginal Birth After Cesarean delivery (VBAC), increased use of electronic fetal monitoring which in turn identifies more cases as fetal distress, increased incidence of elderly primigravida, increased CS on maternal request and increased number of pregnancies following infertility treatment including multiple pregnancies ***(Abdel- aleem et al., 2013; Reddy et al., 2018).***

2. Professional reasons

Some physicians favors CS over vaginal delivery due to changes in obstetric training regarding the use of instruments, medico-legal concerns, a decline in competence in vaginal breech delivery and fear of malpractice suits and litigation, in addition to the undeniable financial incentives ***(Inyang-Otu. 2014).***

3. Maternal risk profile Changes

Other important factors that play a role in this steady rise in cesarean delivery and encourage maternal request include

changing characteristics of women such as increasing maternal body mass index, delayed childbearing, sedentary lifestyle, high income level and poor tolerance to pain (***Zhao et al., 2016; Kant and Mendiratta, 2018).*** The risk profile of mothers and fetuses has been cited in recent years as important factors contributing to the rise in cesarean rates including ***(Hallgrimsdottir 2017).***

3.1. Increased maternal age:

The increase in mean maternal age appears to have an important role in cesarean rates. For some years now, pregnancy in a woman aged over 35 years has been considered a high-risk pregnancy ***(Mylonas and Friese, 2015).***

3.2. Obesity and diabetes mellitus:

Some pre-existing diseases in the mother increase the probability of risk factors requiring a cesarean section. The first of these is diabetes mellitus or gestational diabetes, which if untreated can result in the birth of children with a birth weight over 4000g ***(Vagel et al., 2017).***

Since the prevalence of obesity is continually rising, the logical result is the probability of increasing the women with diabetes who will become pregnant , or developing gestational

diabetes. In addition, overweight and obesity are associated with other risks such as hypertension. Fetal macrosomia is regarded as a relative indication for CS ***(Mylonas and Friese, 2015).***

3.3. Fertility treatment:

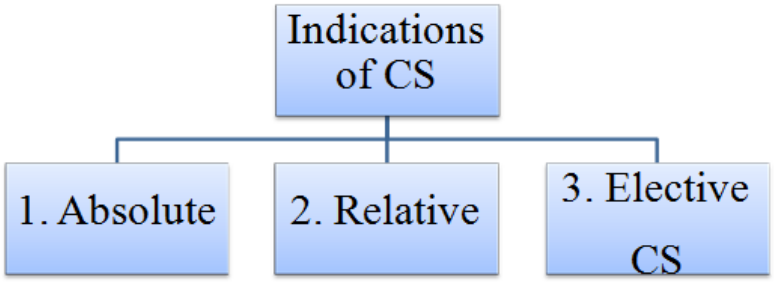
Another reason for the observed increase in cesarean sections is the rise in assisted reproductive interventions, which in turn are leading to multifetal pregnancies. Reproductive interventions themselves lead to an increased cesarean rate , but maternal anxiety about a healthy outcome for her child may also play an important part ***(Gillet et al., 2011).***

All these factors when taken together with the public perception that a cesarean delivery is now an almost risk-free procedure cause that enormous rise in the number of performed cesarean sections ***(Mylonas and Friese, 2015).***

Indications of Cesarean Section

The decision to perform a cesarean section depends on what is best to save the lifes of the mother and the child. Such decision is often made based on risk assessment, after extensive discussion with physicians, the pregnant mother and her family. There are multiple ways to classify the indications of CS; absolute and relative indications, maternal and fetal and according to the International Statistical Classification of Diseases and Related Health Problems-10 (ICD-10) categories. ***(Jenabi E et al., 2019).***

The ICD-10 categories comprise: previous CS, fetal distress, disorders of amniotic fluid, postdated pregnancy, prolonged and obstructed labor, hypertensive disorder, malpresentation, other indications. Elective cesarean section which is performed upon request of the mother, without any medical indication, is considered a distinct indication ***(Jenabi E et al., 2019).***



1. Absolute indications

According to Association of Scientific Medical Societies in Germany[AWMF] ***(Mylonas and Friese, 2015)***:

1.1. Absolute disproportion

Cephalopelvic Disproportion (CPD) occurs in a pregnancy where there is mismatch in size between the fetal head and the maternal pelvis, resulting in failure of the fetus to pass safely through the birth canal for mechanical reasons. This may be caused by the fetal head outgrowing the capacity of the maternal birth canal, or by presentation in a position or attitude that will not allow descent through the pelvis. Untreated, the consequence is obstructed labor, which endangers the lives of both mother and fetus. CPD leads to failure of adequate progression of labor with imminent fetal asphyxia is the most common reason to perform emergent cesarean section ***(Hacker et al., 2015).***

1.2. Chorioamnionitis

It is also known as amniotic infection syndrome. It is an infection of the placenta and could expand to include the fetus. Chorioamnionitis is associated with multiple maternal and fetal complications which mostly necessitates CS delivery including

fetal sepsis, postpartum hemorrhage, placental abruption and dysfunctional labor ***(Casanova R 2018).***

1.3. Eclampsia and HELLP syndrome

They are life-threatening complications of pregnancy, usually necessitate cesarean delivery. Eclampsia attributes in approximately 50,000 deaths per year all over the world ***(Lam M and Dierking E. 2017).***

Moreover, Hemolysis, Elevated Liver Enzyme Levels and Low Platelets (HELLP) syndrome has 3.5-24.2% of maternal mortality rate as a result of coagulation disorders, brain edema, hypovolemic shock, abruption placenta and renal failure. The definite management of both eclampsia and HELLP syndrome is delivery. CS is considered in patients with both conditions especially before 32-34 weeks of gestation life-saving surgery ***(Lam M and Dierking E.2017).***

1.4. Fetal asphyxia or fetal acidosis

Both are life-threatening fetal conditions that necessitate immediate delivery. Hypoxia can lead to brain damage or death. Additionally, fetal acidosis as well can cause circulatory failure and as a result heart and brain damage ***(Sandstorm A. et al., 2017).***