



Rising Cesarean Rates: Are Primary Sections Overused?

Kalpana Mahadik¹ 

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Abstract

Doubling of C-section rates from year 2000 to 2015 globally was declared an eye-opener on October 13, 2018, in FIGO World Congress. Rapid increase in rates without clear evidence of concomitant decrease in maternal or neonatal morbidity or mortality raises significant concern that cesarean delivery is overused. This review addresses issues related to exponentially rising rates, reasons for it, and strategies to reduce. Previous cesarean delivery has main contribution to rising rates as per evidence from the literature search in last 5 years. Focus on optimizing indications of primary C-section resulted in making us rethink modifiable indications like labor dystocia, indeterminate fetal heart rate tracing, suspected fetal macrosomia, malposition, risk-adapted obstetrics, litigation fears, on demand cesarean in literate women and overuse of labor induction. Use of uniform classification system (Robson/WHO classification) with recommendations of WHO, FIGO and annual audits with cloud-based anonymous registry will streamline decisions for cesarean in nullipara and help to control the situation.

Keywords Rising cesarean rates · Robson classification · Modifiable indications of cesarean · Primary cesarean · Labor dystocia

Background

Doubling of C-section (CS) rates from year 2000 to 2015 globally is a serious fact and declared an eye-opener on October 13, 2018, at Brazil in FIGO World Congress [1]. FIGO position paper addresses issues related to rising rates and strategies to improve. Rapid increase in CS rates without clear evidence of concomitant decrease in maternal or neonatal morbidity or mortality raises significant concern that cesarean delivery is overused [2]. WHO advocates that every effort should be made to provide CSs to women in need rather than achieving specific goal [3]. CS is an absolute indication for contracted pelvis, placenta previa, malpresentations like transverse lie, brow and uterine rupture. However, for low-risk conditions, CS delivery appears to pose more risk than vaginal delivery [4]. Forgetting art and expertise of vaginal delivery is a serious challenge to nature and training of future obstetricians. It is concluded

that medical personnel alone cannot reverse this. Healthcare insurance industry, governmental bodies and more specifically women's social organizations need to start a movement against this concept. In an overview, journey of delivery care starting from twenty-first century ends in rising rates of C-section worldwide. The figures are worse for affluent and economically sound countries. This review addresses issues related to exponentially rising rates, reasons for it and strategies to reduce it. We mainly focus on optimizing indications of primary C-section. Labor dystocia, abnormal or non-reassuring fetal heart rate, malpresentations and positions, suspected fetal macrosomia and failed induction of labor are commonest modifiable indications. Cost of decision of C-section for not a very justified indication is paid by mother in the form of morbidity, society in the form of absence of a woman from carrying out her family duties specially toward other offspring and nation in the form of economical and manpower burden.

Kalpana Mahadik, Professor, Department of Obstetrics and Gynaecology, at R. D. Gardi Medical College, Ujjain, India.

✉ Kalpana Mahadik
kalpanavmahadik@hotmail.com

¹ Department of Obstetrics and Gynaecology, R. D. Gardi Medical College, Ujjain 456006, India

Global Scenario and Indian Context

Lancet series in October 2018 declared statistics that 29.7 million births (21.1%) occurred by C-section in 2015 as compared to 16.0 million (12.1%) in year 2000. North America, Western Europe and Latin America show rising rates from 24.3 to 32, 19.6 to 26.9 and from 32.3 to 44.3%, respectively. South Asia has fastest rise from 7.2 to 18.1% per year. This applies to India also. Lowest increasing rates are seen in sub-Saharan Africa which is only from 3 to 4.1% in 10 years [5]. The main reason is non-accessibility to delivery care and poor transport system.

With the support of World Bank, Government of India started Janani Suraksha Yojana (a cash incentive scheme) in 2005 by establishing National Rural Health Mission (NRHM). Implementation of it resulted in appreciably higher rates of institutional births which went up from 26.2 to 80.8% from 2005 to 2016 [6]. Cesarean rates also increased proportionately as health delivery system improved. CS rate was 24% in primigravida, while it was 15.6% in second to third gravida. It was also seen that literacy is proportional to higher rates as illiterate women show rate of 6.0% only, while it is 33.6% in women who have completed high school education. Wealth index is showing proportionate rise in CS rates as it is 4.4% in labor class and highest 35.9% in rich class women. In India, it is documented that public sector health facility has an optimum rate of 11.9%, while private sector facility shows rate of 41.0% [6]. The mentality of profit-making, increasing literacy and on demand CS are the reasons behind this highest rate. Indian figures from two following studies definitely concentrate on modifiable situations. In a recent report from a district-level household survey carried out in 19 states of India, higher odds of CS births were observed for private health facility, urban residence and primigravida. Surprisingly, antenatal visits more than 4 and ultrasound examination of antenatal woman are two factors associated with higher CS rates in a statistical analysis by DLHS-4. This is contradictory; more awareness resulted in more number of CS [7]. A study in Gujarat published in 2017 comparing rates in tribal and non-tribal population with equal exposure to community facility concluded that latter community shows more rates of CS. There was 60% difference in the CS rates between tribal and non-tribal women, while previous CS contributed 96% of it. Previous CS, advanced maternal age, higher maternal education and number of ANC visits are important determinants of CS rates. Previous CS in non-tribal women was commonest indication [8]. These Indian data clearly show that increasing number is contributed by primigravida who is left to have a repeat CS in hands of risk-adapted obstetric practice.

Standardizing Analysis of Cesarean Rates

A serious effort is required to criticize or accept the changing scenario. To understand rising rates, we draw our attention to analyze indications of CS. Over the world in different socioeconomic and health delivery systems, we cannot apply a single criterion for analysis. Learning from what has happened and why it happened in background of local situations is rewarding. After all a critic attitude will make us understand a justifiable indication of CS. Kinetics of labor changes every minute, and one cannot question why and how. As labor progresses, behavior of uterine action and progress of denominator mostly which is occiput are beyond our control and they do not follow any human made rules. Broadly, we should focus on a uniform system appropriately suggested by Robson.

Robson's Ten Group Classification System (TGCS)

We focus on a uniform system of classification. Robson first introduced this system in the year 2001. The obstetric status of a woman in labor is considered. All women undergoing CS will fall in one of these groups. This was specially implied for comparing number of women undergoing CS in each group. It offers a uniform system to understand what is going wrong and where as far as rising rates of CS are concerned. Validity and usefulness of TGCS are supported by many authors [9, 10]. Uniformity in classification system helps developing registry for data on CS rates and particularly for Indian setting. A step further, analysis, audits and remedies at Central Ministry for Health and Family Welfare in India are most welcome to allay rising rates.

Mainly based on five parameters: obstetric history (parity and previous cesarean section), onset of labor (spontaneous, induced or cesarean section before onset of labor), fetal presentation or lie (cephalic, breech or transverse), number of fetuses, and gestational age (preterm or term), following groups are formed.

1. Nullipara, singleton pregnancy, cephalic presentation, gestational period 37 weeks or more and spontaneous labor.
2. Nullipara, singleton pregnancy, cephalic presentation, gestational period 37 weeks or more and induced labor or CS before labor.
3. Multiparous, without previous CS, single, cephalic, gestational period 37 weeks or more and spontaneous labor.

4. Multiparous, without previous CS, single, cephalic, gestational period 37 weeks or more and induced labor or pre-labor C-section
5. Multiparous with prior CS, single, cephalic and gestational period 37 weeks or more.
6. All nulliparous breech.
7. All multiparous breech, including previous CS.
8. All multiple pregnancies including previous CS.
9. All pregnancies with transverse lie or oblique including previous CS.
10. Single, cephalic, less than 36 weeks including previous CS.

Lot of work has been done to standardize the situation by validating indications for CS. Like TGCS group 1 and 2 differ only by the presence of induction of labor or no induction. As induction is something done purposefully, concerns are if it was justifiable or not. It may or may not be but mostly it is relative and modifiable. Or is it subjective? This question arises as some authors reported rising numbers in groups 5, 8 and 10. A large group is group 5, meaning multipara with prior CS in whom rest of factors (cephalic presentation and gestational period 37 weeks or more) are common and natural. This group consists of women with previous CS whose indication in present pregnancy may not be very justifiable and be questionable. When all other factors are normal in them, vaginal birth after cesarean (VBAC) needs justice in hands of a good obstetrician. In all multiple pregnancies, indication for CS is not there by default. In twins, prematurity is common, so the small baby weight is most justifiable for vaginal delivery if fetal presentations are favorable, both cephalic or first cephalic and second breech. In TGCS group 10 single, cephalic, with gestational period less than 36 weeks, most justifiable indication would be a medical disorder threatening life of mother and fetus where only for urgency CS is done. This rising rate in groups 5, 8 and 10 is reported in a Palestinian report in 2018 [11].

In another report, overall CS rate in Brazil was 51.9% (42.9% in the public and 87.9% in the private health sector). The Robson groups with the highest impact on Brazil's CS rate in both public and private sectors were group 2 (nulliparous, term, cephalic with induced or cesarean delivery before labor), group 5 (multiparous, term, cephalic presentation and previous cesarean section) and group 10 (cephalic preterm pregnancies), which accounted for more than 70% of CS carried out in the country. Larger size of group 2 will ultimately result in enhancing group 5 in same women. That is how a cycle will continue. High-risk women had significantly greater CS rates compared with low-risk women in almost all Robson groups in the public sector only [12]. The authors recommend public policies should be directed at reducing CS in nulliparous women, particularly by reducing the number of elective CS in these women, and encouraging

VBAC to reduce repeat CS in multiparous women. Robson groups are self-explanatory, and it demarcates significantly between absolute and relative indications where driving force is obstetric knowledge of decision maker. The TGCS can be used to audit induction of labor, taking into account epidemiological variables. Over the world with different philosophies and management care, TGCS is best implied for standardization over the time comparisons. For implementation in low- and middle-income countries, training of medical staff for appropriate data collection is required. Major contribution of group 5 very well suggests that more CSs are done in primigravidas, and how to avoid this is discussed in text which is following. Some authors suggested modifications of TGCS.

Are Modifications of Robson TGCS Practical?

Investigators in Canada in 2012 tried to modify TGC. They focused on decision for CS depending on if it was induced labor or elective section. Ultimate conclusion was that this classification does not consider whether CS was by demand or as a result of obstetric indication. It also does not consider medical and surgical condition, as well need for repeat section by choice or by failure of VBAC [13]. In a review supported by WHO in the year 2014, authors strongly recommend the use of Robson classification as it is easy to implement and interpret. They also feel that some modifications could be useful only in some facilities and countries with local factors [14]. Some Indian authors suggested their own modifications for Robson criteria. They sub-classified each TGC group for spontaneous labor, induced labor and CS done before labor. Contribution made by previous CS was 61.5%. Ninety-one percent women with previous section resulted in CS. The authors recommend their modifications by name of TMC (Thrissur Medical College) modified Robson classification. But this appears complicated and does not serve purpose [15]. As our focus is on primary CS, the details will create a confusion in minds of data collecting personnel. We personally feel that original TGC is optimum for all geographical locations and socioeconomic situations.

Why to Target Primary C-Section?

In a report in 2015 by a panel of authors, the findings on CS rates are controversial in middle- and low-income countries. They compared two studies of WHO survey in 2004–2008 and 2010–2011. Use of Robson criteria allows comparison of data across countries and timepoints. It also identifies sub-populations driving changes in CS rates. A distinctive finding of this survey is that women having previous CS are increasingly important determinant of overall CS rates

in countries with a moderate or low HDI. The ten Robson categories are mutually exclusive, totally inclusive and can be applied prospectively, since each woman admitted for delivery can be classified immediately on the basis of a few variables that are generally routinely recorded. This system helps institution-specific monitoring and auditing and offers a standardized comparison method between institutions, countries and timepoints. Quantifying increasing rates of CS in all Robson classification groups, major contributors for rising rates are use of induction of labor, pre-labor cesarean section, CS in multipara with induction and its rise in all Human Development Index (HDI) groups [16].

US CS rate increased from 20.7 to 32% from 1996 to 2015. Primary C-sections were major contributors. The rate was same for many years before 1996 due to more practice of VBAC [17]. Primary C-section is a obstetric stigma in most societies in India and other low-income countries. From technical point of view in one way, it is true. The middle-class family who spends good amount of money on childbirth permanently falls victim to aura that the woman in family will always have a difficult labor. These issues are not considered seriously at the time of primary C-section. Threshold of patience of obstetric team gives way in a primigravida who is in agony of labor pains, with rising mental pressure on family members and obstetrician. Because a young primigravida cannot tolerate labor pain, and because a young obstetrician wants to get rid of the situation as early as possible; are we justified in carrying out a quick delivery by C-section? There are many modifiable indications which need serious attention.

Sequele and Risk of Repeat C-Section

The increase in CS rate has been associated with the increase in maternal mortality [18]. Anesthesia risk in a laboring obstetric woman deserves attention. PPH, urological complications, infections and pulmonary embolism are major immediate complications. Severe maternal morbidities like hemorrhage, uterine rupture, anesthetic complications, shock, cardiac arrest, acute renal failure, assisted ventilation, venous thromboembolism, major infection, or in-hospital wound disruption or hematoma were increased threefold for cesarean delivery as compared with vaginal delivery: 2.7% and 0.9%, respectively [19–21]. Serious consequences in subsequent pregnancies include spontaneous preterm birth, uterine rupture, placenta previa and accreta and occasionally obstetric hysterectomy. Although initial cesarean is associated with increase in mortality and morbidity repeat CS has still higher risk. Fetal complications are iatrogenic prematurity, respiratory distress syndrome, obesity-related problems in neonate in future and cross-infections in NICU.

Modifiable Indications

Labor Dystocia

In 2014, American College of Obstetrics and Gynecology and Society for Maternal–Fetal Medicine jointly published document revising definitions of clinical latent phase and active phase [22]. Appropriateness of decision for CS in a primigravida for a relative indication is questionable. Failed induction and arrest of labor need a concrete definition for streamlining perception of this clinical phenomenon. Definitions of failed induction and arrest of labor were reviewed. Consideration for new definitions of active phase of labor and arrest is suggested. A liberal approach in decision making may be detrimental. Induction of labor should only be used for maternal or fetal justifiable indications and not for elective fanciful desires of affluent society.

It is critical to allow adequate time for normal latent and active phases of the first and second stages of labor, unless urgent delivery is indicated. The rate of dilatation at admission to delivery affected the pattern of labor progression. In a study on 60 thousand labors with singleton pregnancies at term, with spontaneous onset, delivering vaginally and normal neonatal outcome, dilatation of six centimeters was observed to be demarcating point for onset of active labor [23]. The standard teaching of 4 centimeters may confuse us for defining and acting actively for taking decisions for CS. First- and second-stage arrest was also redefined to allow longer time, and these were confirmed by the recent Obstetric Care Consensus Document [22, 23]. Criteria set for defining first-stage arrest was 6-cm dilatation, ruptured membrane, 4 or more hours of adequate contractions or 6 or more hours of inadequate contractions with no change in cervical dilatation. Failed induction should be diagnosed only after an adequate attempt which is defined as at least 24 h of oxytocin with artificial membrane rupture (if feasible) with the failure to generate regular contractions and cervical change. Limiting use of induction of labor, like to avoid elective inductions, recognizing the association of cesarean with cervical status and the importance of allowing the induction sufficient time to progress may result in lower cesarean rates [24].

Malpositions

Commonest malposition is occipito-posterior position which is commonly seen for first time in a primigravida. The diagnosis is tricky because of prolonged latent phase, hypotonic uterine inertia and prolonged first stage of labor. This is seen

in android pelvis, and diagnosis is only after a fair trial. All posterior positions do not end in CS as the likely outcomes are anterior rotation or direct posterior rotation. But the borderline obstetric outlet at level of ischial spine may result in deep transverse arrest. This is the genuine indication. Those fetal diameters which can negotiate the ischial spine will require some vaginal manipulations like manual rotation of fetal occiput. Intrapartum ultrasonography has been used to increase the accurate diagnosis of fetal position for planning further progress. Ventouse application in an expert hand is a much rewarding intervention to prevent primary CS.

Non-Reassuring Fetal Heart Rate

Introduction of non-stress test (NST) in obstetrics has done more harm than benefits. Some RCTs established that it has false positive value of 99.8% and is associated with higher rates of CS [25]. It does not predict cerebral palsy. Category-I NST is moderate variability and presence of accelerations and is a fairly reliable indicator of normal neonatal arterial pH. Category-II is a non-reactive fetus to the external stimulus which may or may not be associated with fetal jeopardy. It is questionable to take decision of CS in such situations where amnioinfusion, maternal repositioning and hydration can help alleviate fetal acidemia if the patient is in advanced stage of labor. In teaching hospitals creating panic for this modifiable situation is not advised. Many a times in second stage of labor, the sustained uterine contractions may show this type of picture and operative vaginal delivery by forceps or ventouse is advocated rather than rushing for CS. In such situation, a skilled obstetrician can do miracles. Of course Category-III tracings of recurrent late decelerations, recurrent variable deceleration, bradycardia and sinusoidal rhythm are most justified indications for CS [26].

Suspected Fetal Macrosomia

ACOG defines fetal macrosomia to estimated fetal weight of at least 5 kg. But in middle-income and low-income countries, this does not hold good. Ultrasonographic fetal weight estimations are imprecise in the late third trimester. This indication may hold good as a secondary indication in elderly primigravidas with or without obesity. Macrosomia per se is not an indication, while individualization of patients is advised.

Other Modifiable Situations

Concept of risk-adapted obstetrics is an established concept in the beginning of twenty-first century. While considering the prolonged latent phase and active phase arrest, there is always a risk of neonatal asphyxia and maternal side of it in the form of atonic PPH and sepsis. In a literate society,

we cannot keep the patient in dark and hence we always explain this to her. In the era of concept of small family size, patients also request for a quick and safe delivery by CS. But a skilled and experienced obstetrician can always resolve such issues by his counseling ability and a good reputation earned by him in society. How far and how much to fall prey to such situations indicates the standard of care offered to laboring women. By keeping goals in the form of time will give a fair chance to uterine action and honor the kinetics of labor. Unknown factors operational in vaginal delivery like length of first stage of labor, endurance capacity of a primigravida, the psyche of accepting vaginal delivery as a natural event, moral support given by the obstetric team and reassurance by chief obstetrician are valuable and changeable factors. Situations are different in different laboring primigravida. In rich and highly literate countries including India, a fashion of easy money by media people is upcoming. Balance between obstetrician's conscience and chaos around has to be maintained. Fear of litigation is one of the major reasons for CS to avoid any future imaginary complication.

Recommendations to Reduce Primary CS

Midwife-led care helps allay women of fear of labor pains. This important issue is addressed by Ingela Wiklund from Karolinska Institute, Stockholm, Sweden [27].

- Prevention of the first cesarean is a major drive to reducing overall cesarean rates.
- There are numerous obstetric, fetal and maternal factors that are modifiable and impact cesarean delivery rates.
- Patience is necessary to allow normal labor; recent data demonstrate that the labor course is longer than previously taught.
- Second opinion for decision of CS specially in a low-risk primigravida is required.

Federation of Obstetric and Gynecological Societies of India (FOGSI) 2018 version

FOGSI recommends the setting up of a cloud-based registry linked to its website which will collect anonymous data at hospital level using the WHO recommended Robson's ten group classification system as the first step in determining the range of cesarean rates.

"We would like to emphasise that the hallmark of labor management in the 21st century should be individualized care for the laboring woman with the expectation of a successful and safe vaginal delivery, together with the ability to intervene with a cesarean delivery, if needed, to prevent morbidity and mortality". (*Adapted from Caughey A B BIRTH 41:3 September 2014*) [28].

WHO Recommendations to Reduce Unnecessary C-Sections

WHO draws attention to financial implications involved in operative delivery which is costly and can pull resources away from other essential health services.

These are non-clinical interventions and have a high national value.

- Alteration in reimbursement model for doctors and hospitals which favor vaginal delivery.
- Equal amount to be paid for C-section and vaginal delivery in cash incentive schemes like Janani Suraksha Yojana in India.
- Educational interventions for women and families creating a meaningful dialogue between providers and patients.
- Decision making on mode of delivery be pre-informed to family members.
- Use of clinical guidelines.
- Audits of CS.
- Timely feedback to health professionals about CS practices by health authorities.
- As the problem is complex, answers are also multifaceted. Interventions with multiple components are more successful and therefore desirable. Midwife-oriented care is advisable.
- Mandatory second opinion for decision.
- Advocacy on collaborative midwifery-obstetrician model.

FIGO Recommendations [29]

1. Fees for CS and vaginal delivery should be same including in private sector.
2. Hospitals should be obliged to publish annual CS rates.
3. Hospitals should use uniform classification system for CSs (Robson/WHO classification).
4. Women should be properly counseled for risks and benefits of CS delivery.
5. Money which will be saved from lowering CS rates be invested in resources for better preparation for labor delivery care, adequate pain relief, practical skills, training for doctors and midwives and need for vaginal instrumental deliveries.
6. In rural areas, access to CS, fetal surveillance and assisted or operative vaginal delivery be made available.

In a recent publication of March 2019, a large-scale quality improvement program in California, it was concluded that in efforts to reduce primary CS, there was no effect on maternal and neonatal outcomes. In this

California Maternal Quality Care Collaborative (CMQCC), nulliparous, term, singleton, vertex cesarean delivery rate fell from 29.3 in 2015 to 25.0 in 2017. This study supports safety of efforts to reduce primary CS using American College of Obstetricians and Gynecologists and Society for Maternal–Fetal Medicine guidelines for vaginal birth [30].

Conclusion

Cesarean rates doubled from year 2000 to 2015 over the world. As CS in nullipara is major contributor for CS in subsequent pregnancy, a fair consideration and justice is required while taking a decision. Attention to modifiable indications for primary CS, honoring a second opinion needs serious attention. As per guidelines of WHO, FIGO and FOGSI, an anonymous CS registry is advised for auditing and efforts to improve. Robson TGCS is widely accepted for streamlining the indications.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Boema T, Ronsmans C, Melesse DY, et al. Global epidemiology of use of and disparities in caesarean sections. *Lancet*. 2018;392(10155):1341.
2. Gregory KD, Jackson S, Korst L, et al. Caesarean versus vaginal delivery: whose risks? Whose benefits? *Am J Perinatol*. 2012;29:7–18.
3. WHO statement on caesarean section rates. Geneva: World Health Organisation. 2015.
4. Clark SL, Belfort MA, Dildy GA, et al. Maternal death in the 21st century: causes, prevention, and relationship to caesarean delivery. *Am J Obstet Gynecol*. 2008;199:36e1–5.
5. Editorial. Stemming the global caesarean section epidemic. *The Lancet*. 2018;392(10155): 1279.
6. National Family Health Survey (NFHS-4) 2015–16. International Institute for Population Sciences, Mumbai, India.
7. Singh P, Hashmi G, Swain PK. High prevalence of cesarean section births in private sector health facilities- analysis of district level household survey-4 (DLHS-4) of India. *BMC Public Health*. 2018;18:613.
8. Desai G, Anand A, Modi D, et al. Rates, indications, and outcomes of caesarean section deliveries: A comparison of tribal and non-tribal women in Gujarat, India. *PLoS ONE*. 2017;12(12):e0189260. <https://doi.org/10.1371/journal.pone.0189260>.
9. Tanaka K, Mahomed K. The ten-group Robson classification: a single centre approach identifying strategies to optimise caesarean section rates. *Obst Gynecol Int* 2017, 5648938, 5 p. <https://doi.org/10.1155/2017/5648938>.
10. Torloni MR, Betran AP, Souza JP, et al. Classifications for Cesarean section: a systematic review. *PLoS ONE*. 2011;6(1):14566. <https://doi.org/10.1371/journal.pone.0014566>.

11. Zimmo MW, Laaine K, Hassan S, et al. Cesarean section in Palestine using the Robson Ten Group Classification System: a population-based birth cohort study. *BMJ Open*. 2018;1:2. <https://doi.org/10.1136/bmjopen-2018-022875>.
12. Nakamura-Pereira M, do Carmo Leal M, Esteves-Pereira AP, et al. Use of Robson classification to assess cesarean section rate in Brazil: the role of source of payment for childbirth. *Reprod Health*. 2016;13(3):128. <https://doi.org/10.1186/s12978-016-0228-7>.
13. Farine D, Shepherd D. Classification of Caesarean Sections in Canada: the modified Robson Criteria. *A Comm Opin Obstet Gynaecol Can*. 2012;34(10):976–9.
14. Betran AP, Vindevoghel N, Souza JP, et al. A systematic review of the Robson classification for Caesarean section: what works, doesn't work and how to improve it. *PLoS ONE*. 2014;9(6):e97769. <https://doi.org/10.1371/journal.pone.0097769>.
15. Jacob KJ, Jayaprakash M, Hibina KP. TMC (Thrissur Medical College) modified Robson criteria for caesarean sections. *Int J Reprod Contracept Obstet Gynecol*. 2017;6:5038–43.
16. Voge JP, Betrán AP, Vindevoghel N, et al. Use of the Robson classification to assess caesarean section trends in 21 countries: a secondary analysis on behalf of the WHO Multi-Country Survey on Maternal and Newborn Health Research Network. *Lancet*. 2015;3(5):e260–70.
17. Catherine Y, Sponge MD. Prevention of the first cesarean delivery. *Obstet Gynecol Clin North Am*. 2015;42(2):377–80. <https://doi.org/10.1016/j.ogc.2015.01.010>.
18. Souza JP, Betran AP, Dumont A, et al. A global reference for caesarean section rates (:c-model) a multicountry cross-sectional study. *BJOG*. 2016;123:427–36.
19. Liu S, Liston RM, Joseph KS, et al. Maternal mortality and severe morbidity associated with low-risk planned caesarean delivery versus planned vaginal delivery at term. *Maternal Health Study Group of the Canadian Perinatal Surveillance System*. *CMAJ*. 2007;176:455–60.
20. Rajbhandary S, Shrivastava VR. Study of Indications and post-operative complications of primary caesarean section in tertiary care hospital in Nepal. *Int J Reprod Contracept Obstet Gynecol*. 2018;7(3):835–40.
21. Bhowmik J, Kyal A, Das I, et al. Pregnancy with previous caesarean section: an overview of adverse of fetomaternal sequelae. *Int J Reprod Contracept Obstet Gynecol*. 2018;7(5):1817–21.
22. Caughey AB, Cahill AG, Guise J-M, et al. Safe prevention of the primary caesarean delivery. *Am J Obstet Gynecol*. 2014;201(3):179–93.
23. Zhang J, Landy H, Branch W, et al. Contemporary patterns of spontaneous labor with normal neonatal outcomes. *Obstet Gynecol*. 2010;116:1281–7.
24. Spong CY, Berghella V, Wenstrom K, et al. Preventing the first Cesarean delivery; summary of a Joint Eunice Kennedy Shriver National Institute Of Child Health And Human Development, Society For Maternal- Fetal Medicine, and American College Of Obstetrician And Gynecologists Workshop. *Obstet Gynecol*. 2012;120:1181–93.
25. Nelson K, Sartwelle T, Rouse D. Electronic fetal monitoring, cerebral palsy, and caesareans: assumptions versus evidence. *BMJ*. 2016;355:16405.
26. *Obstetric Care Consensus ACOG number 1, March 2014*.
27. Wiklund I, Malata M, Cheung NF, Cadee F. Appropriate use of caesarean section globally requires a different approach. *Lancet*. 2018;392:1288–9.
28. <http://www.fogsi.org>.
29. Visser GHA, Ayres-de-Campos D, Barnea ER, et al. FIGO position paper: how to stop the caesarean section epidemic. *Lancet*. 2015;392(10155):1286–7. [https://doi.org/10.1016/S0140-6736\(18\)32113-5](https://doi.org/10.1016/S0140-6736(18)32113-5).
30. Main EK, Chang S-C, et al. Safety assessment of a large-scale improvement collaborative to reduce nulliparous Cesarean delivery rates. *Obstet Gynecol*. 2019. <https://doi.org/10.1097/AOG.0000000000003109>.

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About the Reviewer



Kalpana Mahadik is a graduate and postgraduate from GMC, Nagpur. She has teaching experience of 18 years. She has presented many research papers in National and International conferences. She has 16 publications in International and 4 in National Journals. She is postgraduate examiner to many universities. Her paper on microalbuminuria as screening for pre-eclampsia was very much appreciated in 66th JSOG, Tokyo, Japan.