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**Original Research Article**

# Analysis of caesarean deliveries using modified Robson classification, a retrospective observational study in a tertiary care teaching hospital in southern India

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## Abstract

**Background:** The number of caesarean section deliveries is progressively increasing all around world including India and is a cause of concern. It is important to identify and categorise the women into different groupings as per Robson ten group classification system and the CS rate among them to try to decrease the C-section rate.

**Aim**: To estimate the frequency and indications for CS in our hospital and to analyse them according to Modified Robson ten group classification.

**Materials and Methods**: This retrospective observational study was done in a tertiary care teaching hospital in Mangalore, Karnataka. Data was collected of women who delivered by C-section from January, 2023 to June, 2023 and fractions in various groups according to Modified Robson ten group classification system was calculated.

**Results**: A total of 522 deliveries were conducted in the study duration, of which 297 (56.896%) were by CS. Maximum women belonged to Group 1 which constituted 25.67% of the study population. The CS rates differed from 100% among women with breech presentation, abnormal lie and multiple pregnancies (Group 6, 7, 8 and 9) to 11.86% in Group 3. Group 5 contributed maximum to the total number of CS (41.076%).

**Conclusion**: In this study, women with breech presentation, abnormal lie and multiple pregnancies delivered by C-section and repeat caesarean was the most significant factor overall. TOLAC should be offered routinely to reduce CS rates. Similarly, appropriate choice of women for induction with IOL protocols will help minimise primary C-section.

**Keywords:** Caesarean section, Robson classification, Previous caesarean section.

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## 1. Introduction

The commonest surgery in obstetrics is the lower segment caesarean section.[1] From the time caesarean section has come to the forefront in obstetrical practice, it has revolutionised the modern obstetrics. But just like any intervention, it has its own merits and demerits.[3,4] The rough rate of caesareans performed is an important indicator for assessing access to obstetric services.[2,8]

Rising caesarean section rates is a global concern.[5] The rate of the c-section have risen consistently during the past three decades worldwide, especially in high-income countries.[8] Most countries have exceeded the limit of 10-15% set by the World Health Organisation in 1985.[5] Caesareans are comparatively high in women who are educated with atleast secondary level education, belong to urban areas of dwelling or those with rich socioeconomic status.[6] The unjustified, excess use of interventions can cause an ever-increasing cascade of avoidable interventions and become life-threatening in the present or future pregnancies for the women and the baby.[9]

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The upsurge in caesarean section rate has become a budding public health concern and a reason for debate due to possible maternal and perinatal risks, cost issues, and disproportionate access to healthcare resources.[9] Some of the most common complications associated with CS are increased chances of maternal morbidity and mortality, increased requirements of blood transfusion, prolonged hospital stays, postpartum infections, etc. This goes to show that if not chosen rightly, women may have needless exposure to these complications.[6]

Achieving reductions in maternal and infant morbidity and mortality rates are, among others, the objectives promoted by the World Health Organisation for 2030. Of the many suggested ways to meet this goal, one consists of avoiding clinically unnecessary C-sections. However, the challenge is to keep caesarean rate at minimum while making sure safe outcomes for mothers and infants.[9] Clinical audit is a significant way to mend and optimise patient care by means of critical analysis and review of the data available. Hence comes the need, for an internationally accepted universal classification system of caesareans that allows for meaningful and also pertinent comparison of caesarean section rates.[3]

One of the main referred hitches was the lack thereof of a sorting tool that would be feasible to be used globally.[9] In 2001, Dr. Michael Robson introduced a grouping, also called the ten-group classification system to classify CS into one of the ten groups on the basis of five parameters: obstetric history (parity and previous caesareans), onset of labour, foetal presentation or lie, number of foetuses and gestational age. A 2011 systematic review by Torloni and colleagues of 27 caesarean section classification systems found that the ten-group classification system was the most appropriate to compare surgery rates.[8]

The World Health Organisation proposes the utilisation of Robson ten-group classification system as the universal standard as it allows for the analysis of differing trends over time and makes it viable to compare the distinctions between various centres and gives information on the ways how changes in the clinical practices can optimise CS rates, thus making sure excellence in maternal and perinatal care.[9]

This study aims to find the frequency and indications for caesarean sections at the Dept. of Obstetrics and Gynaecology at a teaching hospital in Southern India and to analyse them according to Modified Robson ten group classification.

## 2. Materials and Methods

This study was a retrospective observational study done in A.J. Institute of Medical Sciences, a teaching hospital – tertiary care centre in Mangalore, Karnataka. Institutional Ethics Committee issued ethical clearance for the study.

### *2.1. Study sample*

1. Universal sampling technique was adopted.
2. All women who delivered within a period of six months starting from January, 2023 to June, 2023 were included in the study.

### *2.2. Inclusion criteria*

1. Women who gave birth during the period of six months starting from January, 2023 to June 2023.

### *2.3. Exclusion criteria*

1. All women with period of gestation that was less than 20 weeks and who gave birth to foetuses less than 500 grams.
2. Women with incomplete records or with inadequate data.
3. All clinically diagnosed abdominal pregnancy proved on laparotomy
4. All clinically diagnosed ruptured uterus proved on laparotomy

Relevant information was collected from institutional labour room register. Patient details such as patient demography, period of gestation, parity, number of foetuses, presentation and lie of foetus were noted. Details of onset of labour, i.e., if the patient arrived with spontaneous labour or was induced was collected.

The study population was then sorted as per Modified Robson Classification as follows:

1. Group 1: Nullipara, singleton pregnancy in cephalic presentation, >/= 37 weeks, with spontaneous labour
2. Group 2: Nullipara, singleton pregnancy in cephalic presentation, >/= 37 weeks, was induced or caesarean section performed before labour
3. Group 3: Multipara, singleton pregnancy in cephalic presentation, >/= 37 weeks, with spontaneous labour
4. Group 4: Multipara, singleton pregnancy in cephalic presentation, >/= 37 weeks, was induced or caesarean section performed before labour
5. Group 5: All previous caesarean section, singleton pregnancy in cephalic presentation, >/= 37 weeks
6. Group 6: All nulliparous women with breech presentation
7. Group 7: All multiparous women with breech presentation (includes previous caesarean section)
8. Group 8: All multiple pregnancies (includes previous caesarean section)
9. Group 9: All abnormal lie (includes previous caesarean section but excludes breech presentation)
10. Group 10: All singleton pregnancy in cephalic presentation, </= 36 weeks (includes previous caesarean section)

Groups 5-10 were additionally subdivided into women with spontaneous onset of labour, labour induced with inducing agents/ methods or C-section prior to labour.

Definitions used for the core variables were as follows:

1. Nullipara: Woman who has not delivered at >/= 28 weeks of gestational age or a baby weighing >/= 1 kg, alive or dead by any route.
2. Multipara: Woman who has delivered at least once at >/= 28 weeks of gestational age or a baby weighing >/= 1 kg, alive or dead by any route.
3. Spontaneous Labour: Woman who was in labour without the use of pharmacologic and/or mechanical interventions to initiate labour prior to delivery.
4. Induced labour: Woman who was not in labour on admission to the hospital but then was induced by the use of pharmacologic and/or mechanical methods.
5. Caesarean section before labour: Woman for whom a decision to deliver by CS was taken before she was in labour.
6. Term pregnancy: Period of gestation >/= 37 weeks
7. Pre-term pregnancy: Period of gestation < 37 weeks

### *2.4. Statistical analysis*

All the demographic information and the obstetric data with the pregnancy result were organised using MS Excel software according to Modified Robson criteria[12] and analysed. Percentages were calculated after the descriptive statistical analysis. As per Robson's ten group classification system, proportions in various groups were calculated.

Caesarean section rate was evaluated by dividing the total no. of caesarean deliveries by total number of births and was expressed as percentage of 100. The relative size of individual group was determined by means of division of total no. of women in each and every group by the whole sum of study population and was expressed in percentages. CS rate in each set was determined by dividing the total no. of CS in individual group by the total no. of women in each group. Absolute contribution of CS in each and every group to the whole delivery rate was estimated by dividing total no. of women who underwent C-section in each and every group by total no. of deliveries and was expressed as percentage. Relative contribution of each group to the cumulative C-section rate in percentage was determined via division of total number of C-section in individual group by the total amount of CS performed in the study population.

## 3. Results

In the period of study of 6 months extending from the month of January 2023 to June 2023, a whole sum of 522 antenatal women delivered in our institution, out of which 297 women underwent a lower segment caesarean section. The general caesarean section rate in our hospital was 56.896%.

The age of the study populace extended from 18 years of age to 44 years with the mean age of 28.96 +/- 4.86 years. The period of gestation of the patients varied from 27 weeks+2 days to 40 weeks + 6 days with the average period of gestation of 37 weeks + 4 days +/- 2 weeks + 2 days.

The relative size of each group is described in **Figure 1**. Group 1 formed the largest group with approximately constituting 26% of the study population followed by Group 5 with 24% of the population. The most obstetric population was by women with no prior issues with term gestation in cephalic presentation, i.e., Groups 1 and 2 making it 35% of the study population. Women who had children prior with singleton pregnancies in cephalic presentation who had not gone through a previous caesarean section delivery (Group 3 and 4) formed about 27% of the total sample. Group 7, 8 and 9 had 1% of the population each making them the least among the distribution.

**Table 1** presents the sorting of the study population in the Modified Robson ten-group classification and their relative, and absolute contribution to the caesarean section rate and deliveries respectively. Group 5, i.e., singleton term pregnancies in cephalic presentation with previous caesarean section or a scar on the uterus had the maximum contribution to CS rate with 99.18% of the group population undergoing caesarean section and with absolute contribution being 23.371% and relative contribution to the overall CS rate being 41.077%. Group 8 constituting of all population with multiple gestation including previous C-section, and Group 9 with all abnormal lie population excluding breech, but including prior c-section had the least contribution to the caesarean rates. Group 4 made of multipara, singleton pregnancy in cephalic presentation, >/= 37 weeks, was induced or c-section performed before labour had the second least contribution for caesarean rate with absolute contribution to delivery being 0.95% and relative contribution to the whole caesarean rate of 1.68%.

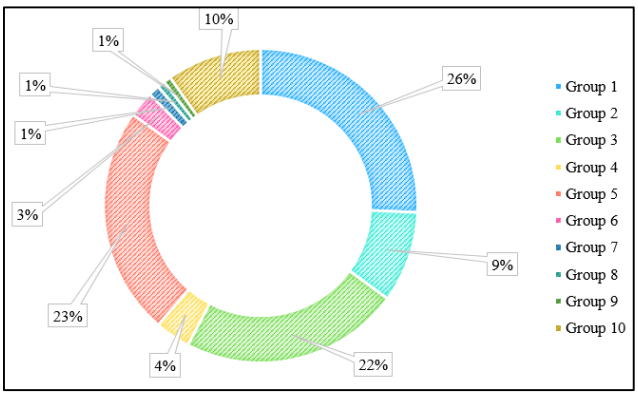


**Figure 1:** Relative size of each group in percentage

**Table 1:** Classification of women according to Modified Robson Ten Group Classification

| Modified Robson's ten group classification | Number of women in the group (N) | Number of women delivered by VD | Number of women delivered by CS | Relative size of each group (%) | CS rate in each group (%) | Absolute group C-section rates contribution in relation to total deliveries (%) | Relative group contribution to total CS rate (%) |
|---|---|---|---|---|---|---|---|
| Group 1 | 134 | 70 | 64 | 25.67 | 47.76 | 12.26 | 21.548 |
| Group 2 | 49 | 18 | 31 | 9.386 | 63.265 | 5.938 | 10.437 |
| Group 3 | 118 | 104 | 14 | 22.605 | 11.86 | 2.681 | 4.713 |
| Group 4 | 19 | 14 | 5 | 3.639 | 26.31 | 0.957 | 1.683 |
| Group 5 | 123 | 1 | 122 | 23.563 | 99.186 | 23.371 | 41.077 |
| Group 6 | 14 | 0 | 14 | 2.681 | 100 | 2.681 | 4.713 |
| Group 7 | 6 | 0 | 6 | 1.149 | 100 | 1.149 | 2.020 |
| Group 8 | 4 | 0 | 4 | 0.766 | 100 | 0.766 | 1.346 |
| Group 9 | 4 | 0 | 4 | 0.766 | 100 | 0.766 | 1.346 |
| Group 10 | 51 | 18 | 33 | 9.77 | 64.70 | 6.321 | 11.111 |
| Total | **522** | **225** | **297** | 100 | | **56.896** | 100 |

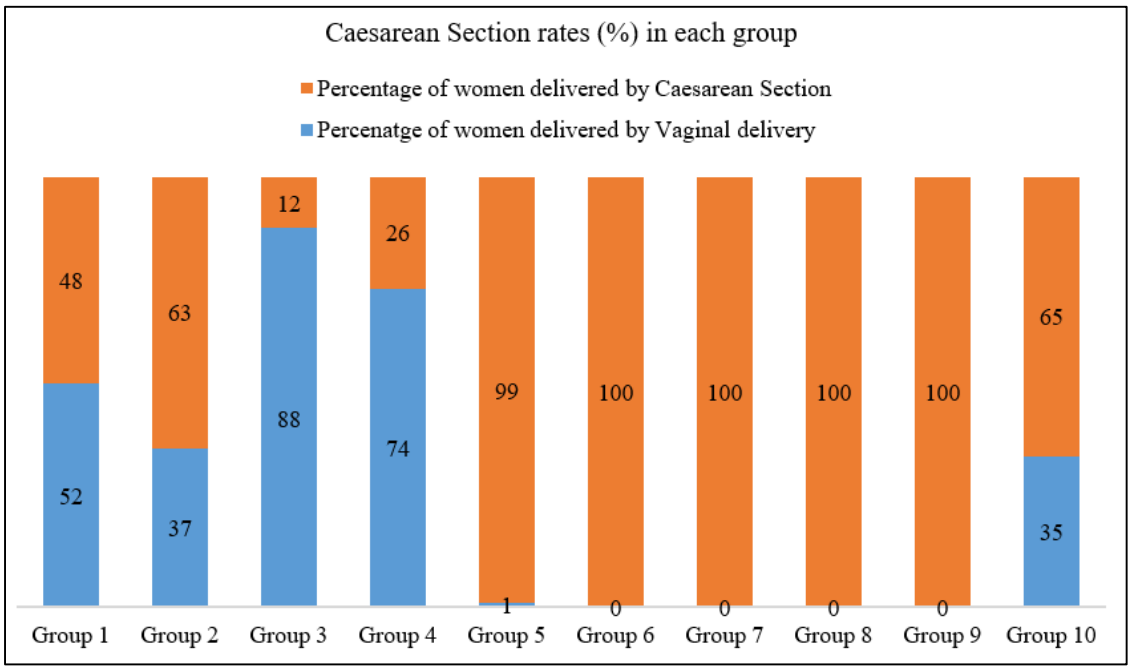


**Figure 2:** Caesarean section rate in percentage in each group

**Figure 2** shows the caesarean section rates in each group as compared to vaginal delivery. There was 100% caesarean section rate seen in groups 6 (nulliparous women with breech presentation), 7 (multiparous women with breech presentation, includes previous C-Section), 8 (multiple gestation, includes previous C-Section) and 9 (abnormal lies including previous CS). The second highest caesarean section rate was seen in Group 5 (singleton term pregnancy with previous CS) at 99.18%. Group 3 (multiparous women with singleton, term pregnancy who went into labour spontaneously) had the least caesarean rate of 12%.

**Figure 3** depicts the indications of caesarean section. A previous caesarean surgery was the greatest reason for a repeat caesarean. We further classified it based on the number of CS and if the patient was in labour or not. Previous one caesarean not in labour contributed maximum to the indication (n=79) followed by previous two caesareans (n=30), previous one CS in labour (n=22) and lastly previous two LSCS in labour (n=5) respectively in a descending order. A request from the patient was the second commonest indication for a caesarean section delivery. Short stature, oblique lie and cord presentation were the least common cause of LSCS (n=1).

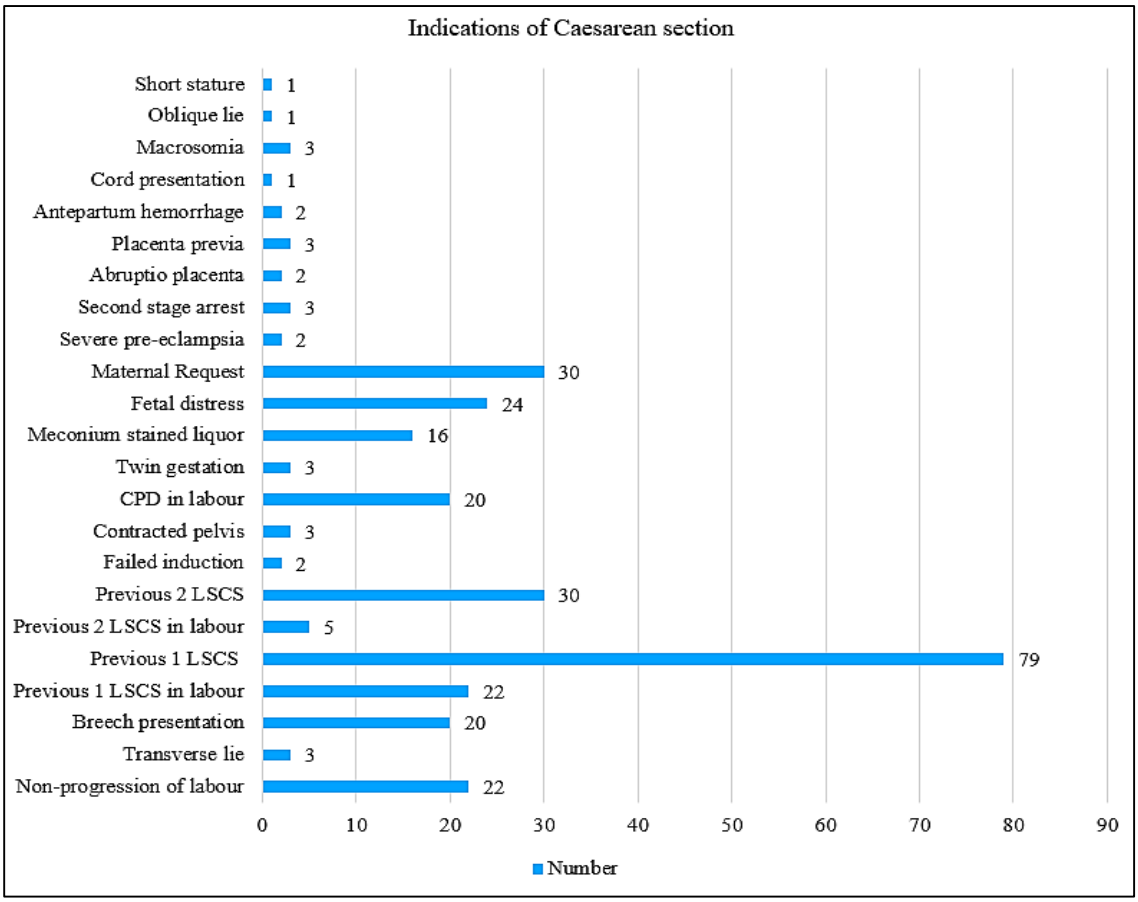


**Figure 3:** Indications of caesarean section

## 4. Discussion

A caesarean surgery can successfully fend off maternal and perinatal morbidity and mortality when there is a medically justified reason. It is the advised method to deliver in abnormal lies or nulliparous breech presentation and is vindicated in these categories of women. Another arguable category of women for caesarean sections are the ones with a scarred uterus. Since, all categories contribute for the total C-section rates in an institution, the rate of caesarean sections should no longer be considered as too high or too low, but should be seen if they are appropriate or not.[3]

Worldwide, there has been an increase in the caesarean section rates, albeit, with wide variation from one institution to another. The rate of CS influences the operational capacity of a medical unit and the resources it requires. A globally recognised, easy classification system helps the healthcare providers, administrators and health policy creators to gather, assimilate and analyse the trends in specific categories to further the optimisation of resource allocation, determine quality improvement opportunities and areas of prospective research.[12] The WHO proposed that the Robson classification system be used as the global standard and issued an implementation manual to clarify definitions.[17] The Canadian modification of the original classification as suggested by SOGC committee (Society of Obstetricians and Gynecologist of Canada) added subgroups to describe if the labour occurred spontaneously or was induced, or whether caesarean section was performed before the onset of labour.[12]

This study set out to audit caesarean sections in our institution using Modified Robson classification and to recognise the various reasons pertaining the CS rates for different groups in our institution.

The overall caesarean rate in our institution over the study period of six months was 56.896%. This is almost double of the rate reported by a similar study in a teaching hospital in South India by RC Prameela et al which was 29.33%.[10] Two similar studies conducted in Western India by Patel MK et al, and Jogia A et al, reported rates of 29.78% and 41.02% of caesarean rates respectively.[1,3] A study by Jain R et al, in Madhya Pradesh showed CS rate of 42.39%.[2] A trend prediction study for caesarean deliveries done in North India showed an overall rate of about 25% with an increase of about 1% each year in the CS rates.[5] As our institution is a tertiary teaching hospital, number of referrals of complicated antenatal cases is raised explaining the high CS rate. The CS rate, hence, generally ranges from 30-50% which is well above the denominator set by the WHO and the trend of increased CS rate echoes with the findings of other studies worldwide.[8,9]

Group 9 made up 0.766% of the total population which is less than 1% as expected by WHO in a study with good

quality of data collection and had a CS rate of 100%. The total size of population formed by nulliparous, singleton, term pregnancies in cephalic presentation in our study was 35.056% which falls in the range of 35-42% that is expected. Groups 3 and 4 combined represented 26.244% of the study sample as opposed to 30% expected, mostly due to larger size of Group 5 and a higher overall CS rate. The size of Group 5 was 23.563% which was about half of the overall caesarean section rate in our hospital of 56.896%. The total size of pregnancies with breech presentation was 3.83% and was within the 3-4% expected. Group 8 made up 0.766% of the total sample, lower than expected. The size of Group 10 was 9.77% which was quite high compared to the standard of less than 5% due to the institution being a tertiary care centre with referrals of high-risk pregnancies. The ratio of Group 1 to Group 2 was 2.7:1 as expected while the ratio of Group 3 to Group 4 was 6.2:1. Meanwhile, the ratio of Group 6: Group 7 was 2.3:1. [17]

The findings of our study noted that Group 5 contributed the maximum to the total number of caesareans at 41.077%. Groups 1 and 2 combined contributed 31.97% to the total caesarean rate, with group 1 making 2/3rd of the contribution. Other group that made significant contribution was Group 10 at 11.11%. Previous CS was the major cause of a repeat caesarean, possibly due to the fear of complications of TOLAC (trial of labour after caesarean) such as uterine rupture, perinatal mortality, etc., which are life threatening. High caesarean rate in Group 5 was also seen in other similar studies by Jogia A et al, Patel MK et al, Jain R et al, Dogra K et al, Prameela RC et al, Hassan L et al, Savchenko J et al, Crosby DA et al and Rajput H et al.[1-4,10,14-16,19] Hence, reducing primary CS and good labour protocols for a successful VBAC are the ways forward to reduce the caesarean rates. Appropriate case selection for TOLAC with continuous monitoring both the mother and foetus are necessary to ensure successful VBAC.[19]

The study by Parveen R et al showed that Group 10 was the largest contributor to the overall caesarean rate with groups 5 and 1 in second and third position respectively. However, they too noted that a previous CS was the most common indication for a repeat CS at 20.4%.[6] In a study by Tura AK et al done in Ethiopia, they found that Group 3 formed the most significant group that contributed to the overall CS at 21.4% with groups 5 and 1 following closely behind at 21.1% and 19.3% respectively.[7] A study done in Spain by Vila-Candel R et al noted Group 2 to be the largest contributor for CS (29.4%).[9] A higher number of CS rate in induced population warrants strict induction protocols after appropriate patient selection. Unnecessary induction of labour should be avoided. This helps to reduce primary CS.

Groups 1 and 2 contributed about 1/3rd to the total caesarean deliveries in the present study. This shows the increasing incidence of CS in primgravidae and the necessity in reducing reducing them. The major indication for a primary CS in our study was maternal request. The study population consisted of largely of women belonging to a higher socio-economic status which could be an explanation for the same. This sheds light on the other plausible reasons for a pre-labour caesarean in low-risk pregnancies such as labour anxiety in women, either regarding the pain or the necessary perineal surgical intervention during labour, post-delivery pain management and recovery, and longterm complications. Hence, adequate in-depth counselling regarding pregnancy, labour and postnatal recovery during antenatal period, along with good rapport with the treating obstetrician plays a major role. Women should be informed about labour analgesia and PCEA (patient controlled epidural analgesia) should be offered whenever possible. Respectful maternity care is a must with quality moral support and a good birthing companion.[6-8]

Another significant cause for a primary caesarean section in our study was fetal distress which was comparable to studies by Parveen R et al and Tura AK et al.[6,7] It has been observed that there is an increasing number of unnecessary CS on the basis of abnormalities in CTG (cardiotocograph) detected on continuous FHR (fetal heart rate) monitoring. Prediction of fetal hypoxia or acidosis based on continuous CTG is often erroneous as it has been shown is many studies that the perinatal outcome of the foetus is generally good in caesareans taken up with non-reassuring CTG being an indication.[15] Therefore, intermittent auscultation with electronic fetal doppler maybe advisable in low-risk pregnancies.[19] Utmost care must be taken to correctly recognise the cases of foetal distress where prompt delivery is of highest importance. Other indications that made notable contribution in our study included meconium stained liquor, non-progression of labour and abnormal presentations.

The need to analyse the reasons for the increasing growth of CS is imminent. Though this study is in accordance with the large number of other Indian studies that state Group 5 as the largest contributor to the overall CS rate, global data suggests other groups can make a significant contribution for the high CS rate, especially Groups 1 and 2. Hence, Robson classification can be a standard tool for international comparisons. It also helps to recognise, analyse and interpret how interventions employed in each specific, relevant groups at a given institution can be optimised.

The strength of the study is that the results obtained confirm a good quality of data collected under the guidelines of WHO.[17] The limitations of the study include the possible existence of recording errors in medical records, is not a nation-wide study including all types of institutes, and the study was conducted in a single tertiary care centre with HDU facility which deals with a higher CS rate as compared to other levels of health institutes.

## 5. Conclusion

In our study, the main contributor to the overall caesarean section rate was Group 5 with previous LSCS being the most common indication. Groups 1 and 2 made significant contribution too. Modified Robson classification is easy to implement and can be utilised effectively to analyse the mode of delivery and the contributors to the caesarean rate. Hence, it can be used for internal audits of caesarean section and also global comparison. As women with a previous LSCS are the maximum contributors to the overall CS rate, evidence-based labour management protocols and induction protocols must be followed by institutes to optimise caesarean section rates.

## 6. Author Contribution

Authors have contributed to the methodology, data collection, data analysis, writing and proof-reading of the manuscript.

## 7. Source of Funding

None.

## 8. Conflict of Interest

None.

## 9. Ethical Approval

Ethical No.: AJEC/REV/221/2023.

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