Original Article

DOI: 10.7860/JCDR/2021/46668.14676

Analysis of Caesarean Section Rates Using the Robson Ten-group Classification at a Tertiary Care Teaching Hospital in Eastern India: A Cross-sectional Study

Obstetrics and Gynaecology Section

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ABSTRACT

Introduction: The Robson ten-group classification identifies the women's groups that make the greatest contribution to the overall rate of Caesarean Section (CS), and thereby helps to optimise CS rates. It also helps to ensure optimum maternal and perinatal outcomes.

Aim: To examine the rates of CS using the Robson ten-group classification, and also to identify the women's groups that contribute most to CS rates in a tertiary care teaching and referral hospital in Kolkata, India.

Materials and Methods: This cross-sectional observational study was conducted over a period of one year from May 2012 to April 2013. All pregnant women admitted under the supervision of a particular unit of the Department of Obstetrics and Gynaecology and delivered in that hospital during the study period were included. Necessary data collection was done on the following parameters, i.e., previous obstetric history, category of pregnancy, course of labour and delivery, and gestational age. The women were categorised into the ten Robson groups. For each group, the CS rate, relative size of the group, and the percentage contribution made by the group to the overall CS rate were calculated and expressed in percentages. Chi-square test, Z-test and the trial version of Statistical Package for Social Sciences (SPSS) version 20.0 were used to analyse the data.

Results: The CS rate in the present study was 43.13% (735 out of 1704 deliveries). Not only the largest group in terms of relative size 649 (38.08%), the Robson group 1 had a CS rate of 41.75% (271/649), as well as the largest absolute number of caesarean deliveries. The group 1 made the largest contribution (271) to the overall CS rate (15.9%). The group 5 was the second largest contributing group 155 (9.09%), followed by group 3 96 (5.63%) and group 2 69 (4.04%). In the present study group 5 showed the CS rate of 95.67%, group 3 with CS rate of 24.48% and group 2 with CS rate of 60.52%.

Conclusion: The Robson groups 1, 2, 3 and 5 were found to be the major contributors to the overall CS rate. These groups may be targeted for effective interventions to reduce the CS rate. Active management of labour in a primigravida with spontaneous onset, reduction of primary caesarean delivery, promoting vaginal birth after CS, and careful assessment of cases before induction of labour in nulliparous women, are likely to be few effective strategies.

Keywords: Caesarean section rate, India, Robson classification women's groups

INTRODUCTION

The Caesarean Section (CS) rates continue to rise steadily worldwide over the past few decades in both developed and developing countries. The major driving forces of this trend are still unclear and quite controversial [1]. The consequences are also not clearly understood. Increasing caesarean birth rates are associated with high maternal and neonatal complications and consequent increased health care costs. It is an issue of growing public health concern worldwide [2].

The World Health Organisation (WHO) in 1985 suggested that the CS rates should not exceed 15% in any region [3]. However, the CS rates increased from 6.7% in 1990 to 19.1% in 2014 worldwide (increase by 12.4 percent with an Average Annual Rate of Increase (AARI) of 4.4 percent) [2]. Moreover, the CS rates vary worldwide. Latest estimates show highest rate in Latin America and the Caribbean (42.2%), followed by Oceania (32.6%), Northern America (32.3%), Europe (25.0%), Asia (19.5%) and Africa (7.4%) [2]. In the United States, the CS rate in 2016 was 31.9% [4]. According to the National Family Health Survey (NFHS) data, the CS rate in India has increased from 2.9 percent of the childbirth in 1992-93 (NFHS 1) to 17.2 percent in 2015-16 (NFHS 4) with an AARI of 8 percent. The CS rate is 23.8 percent in the state of West Bengal in Eastern India [5].

"The WHO proposes the use of Robson ten-group classification system as the global standard for assessing, monitoring and comparing CS rates within healthcare facilities over time and between facilities" [6]. Robson proposed this classification in 2001 to examine CS within mutually exclusive groups of women with particular obstetric characteristics (rather than the indication for CS).

Most importantly, this classification identifies groups that make the greatest contribution to the overall rate of CS, and thereby helps to create and implement effective strategies specifically targeted to optimise CS rates. It also helps to ensure optimum maternal and perinatal outcomes [7].

With the above background, the present study was undertaken with the following objectives:

1. To examine the rates of CS using the Robson ten-group classification system at a tertiary care teaching and referral hospital in kolkata, India.
2. To identify the groups within the obstetric population that contribute most to CS rates and thus to examine the applicability of the Robson classification system in a setting which caters a good fraction of referral cases.

MATERIALS AND METHODS

A Hospital-based cross-sectional descriptive study was carried out in the Department of Obstetrics and Gynaecology, Calcutta National Medical College and Hospital, a tertiary care teaching and referral hospital in Kolkata, West Bengal, India from May 2012 to April 2013.

Ethical clearance for doing this study was obtained from the Institutional Ethics Committee (No. CNMC/ETHI/46, dated 03.01.2012). Informed consent to participate in the study was obtained from all the eligible women. Overall, 1704 women were included in the study.

Inclusion criteria: All pregnant women admitted under the supervision of the Unit-2 of the Department of Obstetrics and Gynaecology and delivered in the above-mentioned hospital. The obstetric characteristics as described in the Robson classification [8] were considered, i.e., parity, onset of labour, gestational age, foetal presentation and number of fetuses.

Exclusion criteria: Women with incomplete/missing information on the above selected characteristics.

The following study tools were used: (1) A pre-designed and pre-tested schedule; (2) Previous obstetric records; (3) All antenatal records regarding present pregnancy; (4) Hospital records including labour ward register; (5) Ultrasonography (USG) reports.

All the relevant information were obtained under four obstetric concepts on which the Robson classification [Table/Fig-1] [8] is based, namely previous obstetric history (nulliparous; multiparous without previous CS; multiparous with previous CS), category of pregnancy (single-cephalic, breech, transverse or oblique; multiple), course of labour and delivery (spontaneous; induced; CS before labour-elective or emergency) and gestational age (in completed weeks at time of delivery). Then the women were categorised into ten groups on the basis of certain obstetric characteristics, i.e., parity, previous CS, plurality, foetal presentation, onset of labour, gestational age.

Group	Classification
1	Nulliparous, single cephalic, ≥37 weeks, in spontaneous labour
2	Nulliparous, single cephalic, ≥37 weeks induced (including prelabour CS)
3	Multiparous (excluding previous CS), single cephalic, ≥37 weeks, in spontaneous labour
4	Multiparous (excluding previous CS), single cephalic, ≥37 weeks, induced (including prelabour CS)
5	Previous CS, single cephalic, ≥37 weeks
6	All nulliparous breeches
7	All multiparous breeches (including previous CS)
8	All multiple pregnancies (including previous CS)
9	All transverse/oblique lies (including previous CS)
10	All preterm single cephalic, <37 weeks, including previous CS

[Table/Fig-1]: Robson ten-group Classification [8].
CS: Caesarean section

All relevant data were collected within a day after delivery and entered in the schedule.

STATISTICAL ANALYSIS

Data were analysed using the Robson ten-group classification system. For each group, the CS rate was calculated by dividing the number of CS by the total number of deliveries in each group and expressed it in percentage. The relative size of each group was calculated by dividing the number of deliveries in each group by the total number of deliveries in the obstetric population and expressed it in percentage. The percentage contribution made by each group to the overall CS rate was calculated by dividing the number of CS in each group by the total number of deliveries in the obstetric population. Chi-square test for linear trend and Z-test for proportions were performed as and when necessary. The trial version of SPSS, version 20.0 (IBM Corp., Armonk, New York, United States) was used for statistical analysis.

RESULTS

This study was conducted on 1704 pregnant women. Out of 1704 women, 969 (56.87%) had a vaginal delivery and 735 (43.13%) had a CS.

Analysis of the hospital records revealed that, the overall CS rate in this hospital increased from 33.29% to 40.4%, an increase of 7% over a period of 4 years including the period of present study (2012-2013) and its preceding three years (2009-2010, 2010-2011, and 2011-2012). At the same time, the rate of vaginal delivery decreased from 66.71% to 59.6%. This trend was found to be statistically significant (χ^2 for linear trend=82.46, p-value ≤0.001) [Table/Fig-2].

Year	Vaginal delivery (%)	Caesarean delivery (%)
May 2009-April 2010	5753 (66.71)	2871 (33.29)
May 2010-April 2011	6355 (63.21)	3699 (36.79)
May 2011-April 2012	7176 (64.34)	3977 (35.66)
May 2012-April 2013	6278 (59.6)	4251 (40.4)

[Table/Fig-2]: Rate of vaginal and caesarean deliveries over the period of four years (May 2009-April 2013).
χ^2 for linear trend=82.46, p-value ≤0.001

Among 1704 women included in the study, number of booked cases in this hospital was 839 (49.24%), number of cases never booked in any hospital (unbooked) was 93 (5.46%), and number of booked and referred cases from other hospitals (referred) was 772 (45.31%). This table also shows that the rate of caesarean delivery was significantly higher among booked cases in this hospital was 362 (21.24%) than among unbooked cases i.e. 27 (1.58%) (Z=2.51, p<0.05). Similarly, the referred cases had significantly higher CS rate was 346 (20.31%) than the unbooked cases 27 (1.58%) (Z=2.80, p<0.05). However, the difference in CS rates among booked cases in this hospital and referred cases was not significant (Z=0.64, p>0.05) [Table/Fig-3].

Type of delivery	Booking status		
	Booked case[a] (%)	Unbooked case[b] (%)	Referred case[c] (%)
Vaginal delivery	477 (28)	66 (3.87)	426 (25)
Caesarean delivery	362 (21.24)	27 (1.58)	346 (20.31)
Total	839 (49.24)	93 (5.46)	772 (45.31)

[Table/Fig-3]: Distribution of the study population according to type of delivery and booking status in the hospital (n=1704).
$Z^{[a \text{ and } b]}$=2.51, p<0.05. $Z^{[b \text{ and } c]}$=2.80, p<0.05. $Z^{[a \text{ and } c]}$=0.64, p>0.05

[Table/Fig-4] shows the number of vaginal and caesarean deliveries in each group. Group 1 was the largest contributor to both caesarean 271 (15.9%) and vaginal 378 (22.2%) deliveries. In the group 5, vaginal delivery 7 (0.41%) was negligible compared to caesarean delivery 155 (9.09%). All the women were delivered by CS in the group 9.

[Table/Fig-5] depicts the CS rate in each group (column C), relative size of each group (column D) and contribution of each group to overall CS rate (column E). The number of deliveries and the number of CS in each group are listed in columns B and A, respectively. The contribution made by each group to the overall CS rate is not only dependent on the rate within the group, but also on the size of the obstetrical population in that group. The five largest groups in the total obstetrical population were group 1 (38.08%), group 3 (23%), group 10 (14.02%), group 5 (9.5%) and group 2 (6.69%). Not only the largest group in terms of relative size; group 1 was the largest contributor to the overall rate of CS also (15.9%). This group had a CS rate of 41.75%, as well as the largest absolute number of caesarean deliveries.

Robson group 5 made the second largest contribution to the overall CS rate 155 (9.09%). This group accounted for 9.5% of the total obstetric population (fourth largest group), with CS rate of 95.67%. It had the second largest absolute number of caesarean deliveries.

Robson group 3 made the third largest contribution to the overall rate of CS 96 (5.63%). This group accounted for around one-fourth (23%) of the total obstetric population, with CS rate of 24.48%. It had the second largest absolute number of deliveries after group 1.

Robson classification groups	Number (%) of vaginal deliveries	Number (%) of caesarean deliveries	Total number (%)
1. Nulliparous, singleton, cephalic, ≥37 weeks, spontaneous labour	378 (22.2)	271 (15.9)	649 (38.08)
2. Nulliparous, singleton, cephalic, ≥37 weeks, induced labour or CS before labour	45 (2.64)	69 (4.04)	114 (6.69)
3. Multiparous women, singleton, cephalic, ≥37 weeks, without a previous CS, spontaneous labour	296 (17.37)	96 (5.63)	392 (23)
4. Multiparous, singleton, cephalic, ≥37 weeks, without a previous uterine scar, induced labour or by CS before labour	37 (2.17)	19 (1.11)	56 (3.28)
5. Multiparous, singleton, cephalic, ≥37 weeks, with a previous CS	7 (0.41)	155 (9.09)	162 (9.5)
6. Nulliparous, singleton, breech	11 (0.64)	21 (1.23)	32 (1.87)
7. Multiparous, singleton, breech	10 (0.59)	13 (0.8)	23 (1.34)
8. Multiple pregnancy (twins or higher-order multiples)	12 (0.7)	18 (1.05)	30 (1.76)
9. Singleton, transverse or oblique lie	-	7 (0.41)	7 (0.41)
10. Singleton, cephalic, <37 weeks	173 (10.15)	66 (3.87)	239 (14.02)
Total obstetrical population	969 (56.87)	735 (43.13)	1704 (100)

[Table/Fig-4]: Vaginal and caesarean deliveries by Robson classification groups (n=1704).
Figures in the parentheses indicate percentages. CS: Caesarean section

	A	B	C	D	E
Robson classification groups	Caesarean sections (No.)	Total deliveries (No.)	Rate of CS in each group (A/B) x 100 (%)	Relative size in each group (B/Total obstetrical population) x 100 (%)	Contribution of each group to overall CS rate (A/Total obstetrical population) x 100 (%)
1. Nulliparous, singleton, cephalic, ≥37 weeks, spontaneous labour	271	649	41.75	38.08	15.9
2. Nulliparous, singleton, cephalic, ≥37 weeks, induced labour or CS before labour	69	114	60.52	6.69	4.04
3. Multiparous women, singleton, cephalic, ≥37 weeks, without a previous CS, spontaneous labour	96	392	24.48	23	5.63
4. Multiparous, singleton, cephalic, ≥37 weeks, without a previous uterine scar, induced labour or by CS before labour	19	56	33.92	3.28	1.11
5. Multiparous, singleton, cephalic, ≥37 weeks, with a previous CS	155	162	95.67	9.5	9.09
6. Nulliparous, singleton, breech	21	32	65.62	1.87	1.23
7. Multiparous, singleton, breech	13	23	56.52	1.34	0.8
8. Multiple pregnancy (twins or higher-order multiples)	18	30	60	1.76	1.05
9. Singleton, transverse or oblique lie	7	7	100	0.41	0.41
10. Singleton, cephalic, <37 weeks	66	239	27.61	14.02	3.87

[Table/Fig-5]: Rates of Caesarean Section (CS) by Robson classification groups (n=1704).
CS: Caesarean section

Robson group 9 had 100% CS rate. Robson group 6 also had quite high CS rate (65.62%) (third among all groups after group 9 and group 5). However, both the group 6 and group 9 made a relatively little contribution to the overall CS rate (1.23% and 0.41%, respectively) and the relative sizes of these groups were also very small (1.87% and 0.41%, respectively). Robson group 2 had the fourth highest CS rate (60.52%). This group accounted for 6.69% of the total obstetric population and contributed 4.04% to the overall CS rate (fourth contributor). Robson group 10 was the third largest group in terms of relative size (14.02%). It had CS rate of 27.61%, and made 3.87% contribution to the overall CS rate. Relative sizes of the group 4 (3.28%), group 7 (1.34%) and group 8 (1.76%) were relatively small and their contributions to the overall CS rate were also less (1.11%, 0.8% and 1.05%, respectively). Though their CS rates were quite high (33.92%, 56.52% and 60%, respectively).

DISCUSSION

This study was an attempt to identify the particular Robson groups which contribute most to overall CS rate, and thus to examine the applicability of the Robson classification system in a setting which caters a good fraction of referral cases.

Analysis of the hospital records revealed that there was a statistically significant increasing trend (an increase of 7%) of the overall CS rate in this hospital over a period of 4 years (2009-2013) (p=0.001).

This study showed that the rate of caesarean delivery was significantly higher among booked cases in this hospital than among unbooked cases (p<0.05). Similarly, the referred cases had significantly higher CS rate than the unbooked cases (p<0.05). However, the difference in CS rates among booked cases in this hospital and referred cases was not significant (p>0.05). This might be due to the fact that majority of the booked cases in this hospital was in high risk group requiring CS. Similarly, majority of the referred cases admitted through the emergency obstetric unit also required immediate caesarean delivery. This shows that antenatal clinic may not be the absolute pregnancy care center unless emergency obstetric care is available in a health facility.

The CS rate in the present study was found to be 43.13%. This rate is quite comparable to other studies done in different parts of the world [7,9-11]. In India, the CS rates vary across different institutions as reported by other studies. However, some previously reported rates are lower than the present study [12,13]. A study done across 30 teaching hospitals in India reported the overall rate of CS as 28.1% (range 11.6-58.7%) [14]. It can be expected that caesarean delivery rates will vary across hospitals based on patients' clinical conditions and choices, hospital capacity, and degree of obstetric and neonatal care specialisation, among other factors [15].

The high CS rate in a tertiary referral center in India may be attributed to the higher number of complicated, unbooked and neglected

pregnancies, most of which are referral cases. Additionally, pertaining to the large influx of referral cases at any part of duty hours, CS are often performed at a lower threshold of abnormality to manage the labour ward space and also to avoid constant patient care load.

Different multicenter studies [7,8] done across different countries suggested Robson classification system as a robust and useful tool for ongoing surveillance. Our finding that group 1 makes the largest contribution to the overall CS rate is consistent with the results found by earlier study [12] from India. However, this group ranked either second or third in the studies done in other parts of the world [7,9,16,17].

In the group 1, majority of the CS are performed due to labour complications such as foetal distress and dystocia, or on maternal request. Subsequently, it becomes a key indicator of the CS in the same women in future pregnancies. Therefore, this group should be given more attention during intrapartum period in an attempt to reduce the CS rate. It is considered that the active management of labour in a primigravida with spontaneous labour onset can be an effective protocol for the promotion of vaginal delivery.

Group 5 made the second largest contribution to the overall CS rate. This finding is consistent with that found by earlier study [12] from India. However, studies done in different parts of the world found this group as the largest contributor to the overall CS rate [7,9,16,17]. A CS rate of 95.67% in the group 5 reveals negligible Vaginal Birth After Caesarean (VBAC). A significant reduction in the rate of CS can be achieved by reducing the primary caesarean delivery and promoting or increasing access to VBAC. It appears that a well-defined protocol recommending a trial of labour after CS can be as safe as a planned CS for the mother and infant both. Not only that, as larger groups 1, 2 and 3 are likely to result in a larger group 5 in the future, unnecessary CS in the groups 1, 2 and 3 should be prevented. Probably the last one is the best way to reduce the overall rate of CS in the group 5, as having a previous delivery by CS always increases the likelihood of CS in the subsequent pregnancy.

Third largest contributor to the overall CS rate is group 3, while its place is fourth in another study done in India [12]. This group ranked second and fourth in the studies done in Brazil and Latin America respectively [7,9]. Compared to other groups, these women are less likely to have obstetric indications for CS since they present very low risk in general. Therefore, the CS rate in this group is expected to be low. However, a rise in CS rate in this group could indicate the underlying causes as non-medical or mis-classification with regard to their history of previous CS. So, this group also needs attention in intrapartum period in an attempt to reduce CS rate.

Fourth largest contributor to the overall CS rate is group 2. In other studies, this group is second largest [17], third largest [7,12,16] or fifth largest [9]. The CS rate in this group (60.52%) is also quite high. The high CS rate in this group might be due to the presence of certain medical conditions (e.g., pre-eclampsia at term) that required induction of labour, or these women had elective labour induction and pre-labour CS only for the sake of convenience or other non-medical reasons (e.g., maternal request). The reasons behind this high rate of CS in the group 2 should be investigated in detail and proper actions need to be taken. In this regard, obtaining a second opinion may be made mandatory to reduce CS rates, which will in turn improve maternal and perinatal outcome.

Among induced labour groups, though group 2 (nulliparous women) is of concern because of the high rate of CS in this group, the other group, i.e., group 4 (multiparous women) also had a considerably high CS rate (33.92%). The same reasons, as described for the high rate of CS in the group 2, can be applicable for the group 4 also.

Group 10 constituted the fifth largest group in terms of contribution to the overall CS rate. This finding is consistent with the other studies [7,12,17], while this group ranked fourth in some other studies [9,16]. These women mainly present with preterm premature rupture of membrane, antepartum haemorrage, loss of foetal movement, etc. This group should be carefully studied. Tertiary referral centers are expected to manage high-risk pregnancies and therefore, have elevated rates of preterm deliveries.

Women in the groups 6-9 due to their obstetric factors like breech presentation, multiple pregnancy, transverse or oblique lie, can be expected to have higher rates of CS in each group. Though the contributions of these groups to the overall CS rate are low considering the size of the population in these groups. Furthermore, group 9 should always have a CS rate of 100% by definition, as it represents transverse or oblique lie where CS is necessary. This is the group, which can be used to assess the quality of data collection. In the present study, most patients in the group 9 were referred cases.

In this study, groups 1, 2 and 3 together made the largest contribution to the overall CS rate. This finding corroborates to another study done in India [12], whereas group 5 was the largest contributor alone as reported in other studies [9,16,17]. It can be emphasised further that the larger contributing groups 1, 2 and 3 are likely to result in a larger group 5 in future.

This study provides a valuable addition to the existing body of evidence, as it shows the successful application of the Robson classification system to analyse the CS rate in a tertiary care setting in India, and the results can be compared with other hospitals. Although, very few studies in India have analysed the CS rate in a single healthcare facility. However, the use of the Robson classification system which was applied in this study would help to bring awareness and improve the quality of care by applying this system in a single healthcare facility, and deliver the services according to the specific needs of that facility. Regular audits and feedback using the Robson classification system should be implemented in the hospitals in order to identify issues with existing practice to improve the quality of care. The study has identified the major contributing groups to increased CS rate. The outcome following implementation of identified strategies to those particular groups is expected to come out in a prospective study which is under way in the same institute.

Limitation(s)

Firstly, the possibility of existence of wrongly recorded data in medical records can not be ruled out. Secondly, this study was designed to examine the applicability of the Robson classification system in a setting which caters a good fraction of referral cases. Risk assessment of these cases as mostly admitted in labour, was not possible in majority.

CONCLUSION(S)

The Robson classification identified the main groups of women, i.e., groups 1 (nulliparous, singleton, cephalic, term, spontaneous labour), 2 (nulliparous, singleton, cephalic, term, induced labour or CS before labour), 3 (multiparous, singleton, cephalic, term, without a previous CS, spontaneous labour) and 5 (multiparous, singleton, cephalic, term, with a previous CS), who contributed most to the overall CS rate in a tertiary referral center in India. These groups may be targeted for effective interventions to reduce CS rate in this hospital. Active management of labour in a primigravida with spontaneous onset, reduction of primary caesarean delivery, promoting vaginal birth after CS, and careful assessment of cases before induction of labour in nulliparous women, are likely to be few effective strategies. The study findings should motivate the hospital authority as well as the local health authority to take up effective strategies to reduce CS rates when appropriate.

Acknowledgement

The authors are grateful to all the residents, faculty and staff members in the Department of Obstetrics and Gynaecology of

Calcutta National Medical College and Hospital for their help, support and assistance.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Sep 10, 2020
- Manual Googling: Nov 10, 2020
- iThenticate Software: Feb 03, 2021 (23%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Sep 08, 2020**
Date of Peer Review: **Nov 20, 2020**
Date of Acceptance: **Jan 16, 2021**
Date of Publishing: **Mar 01, 2021**