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EFFECTIVENESS OF ROBSON'S CLASSIFICATION IN REDUCING UNNECESSARY CESAREAN SECTIONS: A MULTI-CENTER STUDY

Obstetrics & Gynaecology

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ABSTRACT

Background And Aims: Cesarean section (CS) is a life-saving obstetric procedure; however, its rising rates have raised concerns about unnecessary surgical interventions. The Robson Classification System (RCS) is a globally recognized tool for standardizing CS audits and identifying trends across obstetric populations. This study aimed to evaluate the effectiveness of RCS in reducing unnecessary CS and analyzing its influence on clinical decision-making across multiple tertiary care centers. **Methods:** A multi-center retrospective case-control study was conducted using medical records from tertiary care hospitals. Ethical approval was obtained, and data from 300 pregnant women (150 CS and 150 vaginal deliveries) were classified using RCS. Maternal demographics, obstetric history, and CS indications were recorded. Statistical analysis included Chi-square tests, logistic regression, and odds ratios to assess factors influencing CS rates. A p-value <0.05 was considered statistically significant. **Results:** The highest CS contribution was from Robson Group 5 (21.0%), followed by Group 2 (16.3%) and Group 4 (7.3%). Advanced maternal age (>35 years), obesity (BMI >30 kg/m²), and higher education (Bachelor's degree or above) were significantly associated with increased CS rates ($p<0.05$). Private obstetrician-led deliveries were also strongly linked to CS preference. **Conclusion:** We concluded that repeat CS (R5) and pre-labor CS (R2, R4) significantly contributed to overall CS rates, highlighting the need for better labor management strategies and VBAC promotion. Implementing RCS consistently can help reduce unnecessary CS while improving maternal and neonatal outcomes.

KEYWORDS

Cesarean Section, Robson Classification, Trial of Labor After Cesarean, Maternal Health, Obstetric Outcomes

INTRODUCTION

Cesarean section (CS) is a crucial obstetric procedure performed when vaginal delivery poses risks to the mother or fetus [1,2]. It involves surgically delivering the fetus via an incision in the abdomen and uterus after the age of viability [3]. Despite being lifesaving, the global rise in CS rates has raised concerns regarding its overuse. A survey of 150 countries reported an average global CS rate of 18.6%, with rates varying from 6% in the least developed countries to 27.2% in the most developed ones [4]. Africa records the lowest CS rate (7.3%), whereas Latin America and the Caribbean report the highest (40.5%) [4]. Variability in CS rates is also evident within countries, depending on the healthcare facility [5].

The rising CS trend is more pronounced in middle- and high-income countries, though low-income nations are not exempt [4,6]. Several factors contribute to this increase, including fear of litigation, changing maternal demographics, advancements in electronic fetal monitoring, and evolving medical practices [3,4,7]. Additionally, sociocultural and economic influences drive non-medically indicated CSs [4,8]. Private healthcare facilities report higher CS rates than public hospitals, largely due to economic incentives and maternal preferences [9]. Furthermore, CSs in private facilities are more than twice as likely to be performed for undefined reasons compared to public institutions [10].

According to the World Health Organization (WHO), CS rates above 10% at the population level do not improve maternal or neonatal outcomes [11,12]. However, many hospitals report rates surpassing this threshold, with an increasing trend observed over recent decades [3,5]. As of 2024, the most recent data from NFHS-5 (2019-21) reports India's CS rate at 21.5%, with 14.3% in public and 47.4% in private hospitals. State-wise, Telangana (60.7%) has the highest and Nagaland (5.2%) the lowest CS rate [13]. Although CS is safe when conducted by trained professionals, it carries risks, including postpartum hemorrhage, infections, stillbirths, placenta previa, morbidly adherent placenta, and uterine rupture, potentially necessitating hysterectomy and compromising future fertility [1,14]. Additionally, CS increases healthcare costs compared to vaginal delivery [4,14].

Efforts to reduce unnecessary CS should not compromise access to medically indicated procedures, as ensuring appropriate CS use is vital for maternal and perinatal health [14]. Understanding the characteristics of women undergoing CS and assessing whether procedures are justified is critical [15]. Moreover, analyzing CS trends across various healthcare settings can help identify drivers of overuse [16].

To standardize CS audits and enable meaningful comparisons, an internationally accepted classification system is essential [15,17]. The Ten-Group Robson Classification System, recommended by WHO and FIGO, is a globally recognized tool for monitoring and analyzing CS rates across different settings [12,18]. It categorizes women based on parity, gestational age, previous CS, labor onset, fetal presentation, and plurality [19]. Evidence suggests that adopting the Robson system in healthcare facilities can help reduce unnecessary CS [11].

This multi-center study aims to evaluate the effectiveness of Robson's classification in reducing unnecessary cesarean sections. By identifying high-risk groups and analyzing CS trends, this research will contribute to refining clinical strategies, ensuring optimal maternal and neonatal outcomes while preventing unnecessary surgical interventions.

MATERIAL AND METHODS

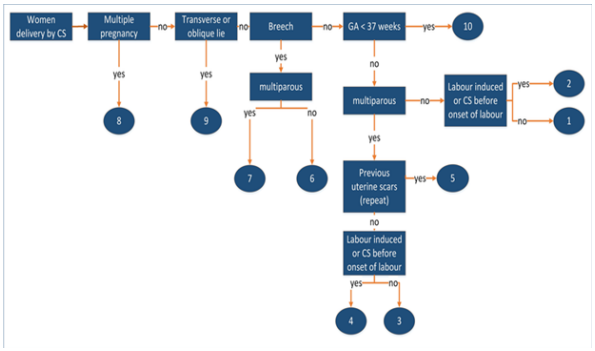
Study Design And Setting: This study was a multi-center retrospective case-control study conducted to evaluate the effectiveness of Robson's classification in reducing unnecessary cesarean sections. Medical records of pregnant women who delivered in the obstetric units of selected tertiary care hospitals were analyzed according to the Robson Classification System (RCS) for the most recent fiscal year.

Study Population And Selection Criteria: The study population included all women who had delivered in the labor rooms of the participating hospitals during the study period. The inclusion criteria required that the pregnant women had a living fetus at the time of delivery. Cases were excluded if they involved "born before arrival" (BBA) or had incomplete labor records, ensuring that only well-documented cases were considered for analysis.

Data Collection And Variables: A structured electronic data collection form was developed and used to record the relevant data. It consisted of three sections. The first section captured maternal demographic information, including age, body weight, height (used for BMI calculation), educational level, and the type of maternity care (public or private). The second section focused on obstetric variables classified according to the Robson Classification System, which included parity, previous cesarean section history, onset of labor (spontaneous, induced, or pre-labor CS), number of fetuses (singleton or multiple gestation), gestational age at delivery (preterm, term, or post-term), and fetal presentation (cephalic, breech, or transverse lie). These variables were encoded and categorized into the ten Robson groups using statistical software. The third section documented the mode of delivery (vaginal or cesarean section) and neonatal outcomes,

including gestational age at birth, birth weight, APGAR scores, NICU admissions, and perinatal morbidity and mortality.

Robson Classification According To Who



The validity of the data collection tool was reviewed and approved by three senior obstetric experts before its implementation. Additionally, ethical approval was obtained from the Institutional Review Board (IRB) of the participating hospitals, ensuring compliance with ethical research protocols.

Statistical Analysis: The collected data were analyzed using statistical software to determine trends in cesarean section rates across different Robson groups. Descriptive statistics, including percentages, means, and standard deviations, were used to summarize demographic and clinical characteristics. The CS rate was calculated as a percentage relative to the total obstetric population, while the absolute contribution represented the proportion of CS in relation to total deliveries in the hospital. The relative CS rate was determined as the proportion of CS within each Robson group concerning the total number of CS cases.

Comparisons of CS rates among Robson groups were performed using the Chi-square test. The 95% confidence intervals (CIs) were calculated using Cochran's and Mantel-Haenszel statistics to determine the common odds ratio for CS occurrence. Additionally, binary logistic regression analysis was conducted to assess the adjusted odds ratios for different predictors of cesarean delivery, adjusting for maternal and obstetric characteristics. A P-value <0.05 was considered statistically significant.

RESULTS

The majority of the participants were in the 20-34 years age group (72.3%), with 20.7% above 35 years and 7.0% below 20 years. The distribution of BMI showed that 41.7% of participants had BMI between 25.0-29.9 kg/m², while 29.4% had BMI >30 kg/m², which was significantly associated with CS rates (p<0.001). A higher proportion of participants with a Bachelor's or Master's degree underwent CS compared to those with lower education levels (p<0.001). Additionally, deliveries managed by private obstetricians had a significantly higher CS rate compared to those handled by nonspecific obstetricians (p<0.001), as shown in Table 1.

Table 1. Demographic Data

Demographic Data	N (%)	CS	ND	P-value
Age (years)				
< 20	21	11	10	<0.001***
20-34	217	109	108	<0.001***
> 35	62	30	32	<0.001***
Height (cm)				
< 145 cm	2	1	1	0.527
> 145 cm	298	149	149	0.527
BMI (kg/m²)				
< 18.5	2	1	1	<0.001***
18.5-24.9	85	43	42	<0.001***
25.0-29.9	127	63	64	<0.001***
> 30	86	43	43	<0.001***
Education Level				
Below Primary School	4	2	2	<0.001***
Primary School	37	18	19	<0.001***
High School	152	75	77	<0.001***
Diploma	33	16	17	<0.001***
Bachelor's degree	111	55	56	<0.001***
Master's degree	16	8	8	<0.001***
Primary Doctor				
Private Obstetrician	93	47	46	<0.001***
Nonspecific Obstetrician	207	103	104	<0.001***

The distribution of deliveries across Robson Classification (RC) groups is summarized in Table 2. Group 5 (previous CS, single cephalic, term pregnancy) contributed the highest CS rate (21.0%), followed by Group 2 (16.3%) and Group 4 (7.3%). The CS rates in Group 2b, Group 4b, and Group 5 were 100%, indicating that pre-labor CS was a significant contributor to overall CS rates. Group 10 (preterm, single cephalic) accounted for 9.7% of total deliveries, with a CS rate of 55.2%, as shown in Table 2.

Table 2. All Delivered Women According to Robson Classification

Group	N (%)	CS (%)	CS rate	Absolute Contribution
R1	49 (16.3%)	11 (7.3%)	22.4%	3.7%
R2	49 (16.3%)	41 (27.3%)	83.7%	13.7%
R2a	13 (4.3%)	5 (3.3%)	38.5%	1.7%
R2b	35 (11.7%)	35 (23.3%)	100.0%	11.7%
R3	68 (22.7%)	4 (2.7%)	5.9%	1.3%
R4	22 (7.3%)	11 (7.3%)	50.0%	3.7%
R4a	13 (4.3%)	2 (1.3%)	15.4%	0.7%
R4b	9 (3.0%)	9 (6.0%)	100.0%	3.0%
R5	63 (21.0%)	63 (42.0%)	100.0%	21.0%
R6	6 (2.0%)	6 (4.0%)	100.0%	2.0%
R7	5 (1.7%)	5 (3.3%)	100.0%	1.7%
R8	4 (1.3%)	4 (2.7%)	100.0%	1.3%
R9	3 (1.0%)	3 (2.0%)	100.0%	1.0%
R10	29 (9.7%)	16 (10.7%)	55.2%	5.3%
Total	300 (100.0%)	150 (100.0%)	50.0%	100.0%

The factors associated with CS in spontaneous labor (R1, R3) are detailed in Table 3. Obesity (BMI >30 kg/m²), higher education (Bachelor's degree), and private obstetrician-led care were significantly associated with increased CS rates (p<0.001). Maternal age and height were not significantly linked to CS risk in these groups, as shown in Table 3.

Table 3. Factors Associated with CS in Pregnant Women with Spontaneous Labor (R1, R3)

Demographic Data	N	CS (%)	OR (95% CI)	P-value	Adjusted OR (95% CI)	Adjusted P-value
Age (> 35)	40	5	1.00 (0.70-1.44)	0.994	0.994	-
Age (< 35)	259	36	1	-	-	-
Height (< 145 cm)	298	256	0.61 (0.08-4.80)	0.640	0.640	-
Height (> 145 cm)	1	1	1	-	-	-
BMI (> 30)	78	63	1.56 (1.20-2.04)	0.001**	1.74 (1.33-2.28)	<0.001***
BMI (< 30)	222	187	1	-	-	-
Education (Bachelor's degree)	72	58	1.78 (1.37-2.32)	<0.001***	1.45 (1.08-1.95)	0.013**
Education (Under Bachelor's degree)	228	192	1	-	-	-
Primary Doctor (Private obstetrician)	32	22	3.07 (2.16-4.37)	<0.001***	2.74 (1.86-4.03)	<0.001***
Primary Doctor (Nonspecific obstetrician)	268	128	1	-	-	-

The analysis of CS before labor compared to labor induction (R2, R4) is presented in Table 4. Advanced maternal age (>35 years) and higher education levels were significantly associated with CS in pre-labor

cases (p=0.003, p<0.001, respectively). Women managed by private obstetricians had significantly higher odds of undergoing CS (OR: 8.39, p<0.001), as shown in Table 4.

Table 4. Factors Associated with CS Before Labor Compared with Labor Induced (R2, R4)

Demographic Data	N	R2b+ R4b (%)	OR (95% CI)	P-value	Adjusted OR (95% CI)	Adjusted P-value
Age (> 35)	58	41	1.57 (1.17-2.12)	0.003*	1.13 (0.08-1.58)	0.496
Age (< 35)	241	145	1	-	-	-
Height (< 145 cm)	3	2	0.77 (0.29-2.68)	0.608	0.608	-
Height (> 145 cm)	296	185	1	-	-	-
BMI (> 30)	96	56	0.78 (0.61-0.99)	0.042*	1.04 (0.80-1.36)	0.773
BMI (< 30)	204	126	1	-	-	-
Education (Bachelor's degree)	132	104	3.76 (2.93-4.82)	<0.001***	1.61 (1.20-2.17)	0.002**
Education (Under Bachelor's degree)	168	84	1	-	-	-
Primary Doctor (Private obstetrician)	134	115	8.39 (6.34-11.11)	<0.001***	6.65 (4.86-9.08)	<0.001***
Primary Doctor (Nonspecific obstetrician)	166	71	1	-	-	-

DISCUSSION

The Robson Classification (RC) system was applied to evaluate CS trends in the present study. The analysis was divided into two primary aspects: the type of population and the CS rate.

In the present study, most pregnant women who delivered were single cephalic term pregnancies, with 16.3% being nulliparous (R1) and 22.7% being multiparous (R3). The R1/R2 ratio was 0.98, lower than the expected 3.3 WHO-MCS benchmark [20], indicating a higher prevalence of high-risk primigravida requiring CS, contributing to an increased CS rate. The R3/R4 ratio was 3.0, aligning with the expected more than 2.0 threshold [20].

The multiparous women with a previous CS (R5) made up 21.0% of the study population, exceeding the WHO recommendation of 15% [21]. This was 1.5 times higher than Anekpornwattana S et al. and nearly double Khornwong S et al. [22,23], indicating a higher repeat CS rate.

The combined prevalence of breech presentations (R6, R7) was 3.7%, aligning with the expected 3-4% range [20]. The multiple gestation group (R8) comprised 1.3%, slightly lower than the expected 1.5% [20-23]. The transverse and oblique lie category (R9) made up 1.0%, slightly exceeding the expected <1.0% [20-23]. The single cephalic preterm pregnancy group (R10) was 9.7%, considerably higher than the expected 2.0%, but similar to Anekpornwattana S et al. (10.4%) and Khornwong et al. (12.7%) [22,23], reflecting the referral pattern in tertiary care centers.

The highest contribution to CS in the present study was from R5 (21.0%), similar to findings in previous studies [22,23]. A 100% CS rate in this group follows existing clinical practice guidelines. However, Trial of Labor After Cesarean (TOLAC) implementation could reduce repeat CS rates [24-26], though it is not currently practiced at the study site. Lowering primary CS rates could significantly reduce R5 cases in the future.

The absolute contribution of R1-R5 was 80.0%, exceeding the WHO's 66% benchmark [20]. CS rates in R1 (22.4%) and R3 (5.9%) were higher than WHO recommendations [20], raising concerns about CS indications and variability in obstetricians' decision-making. Factors like clinical judgment, legal concerns, and hospital protocols contribute to this variation. The CS rates in Anekpornwattana S et al. (37.1% in R1, 9.4% in R3) and Khornwong S et al. (18.9% in R1, 6.2% in R3) [22,23] provide a useful comparison.

The present study identified demographic and clinical factors associated with CS. Advanced maternal age (>35 years) was observed in 62 women, with 30 undergoing CS, but this association was not statistically significant (p=0.994). Maternal height <145 cm did not significantly predict CS (p=0.640). However, obesity (BMI >30 kg/m²) showed a strong correlation with CS (p<0.001), with an adjusted OR of 1.74 (1.33-2.28).

Higher educational attainment (Bachelor's degree) was significantly linked to CS (p=0.013) –[34]. Additionally, private obstetrician-led deliveries were associated with higher CS rates (p<0.001), reflecting a preference for elective CS.

The CS rate was 83.7% in R2 and 50.0% in R4, similar to Anekpornwattana S et al. (84.0% in R2, 58.3% in R4) and Khornwong S et al. (90.2% in R2, 73.0% in R4) [22,23] but contrary to WHO recommendations [20].

Subgroup analysis revealed that pre-labor CS (R2b/R2a) and labor induction CS (R4b/R4a) rates were high, elevating the total CS rate. The CS rates for induced labor were 38.5% (R2a) and 15.4% (R4a), exceeding Anekpornwattana S et al. 's 49.4% in R2a and 7.4% in R4a [22], suggesting that failed labor induction contributed to higher CS rates.

Among factors associated with CS in R2 and R4 groups, advanced maternal age (>35 years) was significant (p=0.003), but lost significance after adjustment (p=0.496). Obesity (BMI >30 kg/m²) did not significantly correlate with CS in these groups (p=0.773). Higher education (Bachelor's degree) and private obstetrician-led care remained significantly associated with CS (p<0.05), suggesting a trend toward Cesarean Section on Maternal Request (CSMR) [27-30].

To address high CS rates, strategies such as enhancing patient education, promoting normal delivery benefits, and improving labor induction protocols should be prioritized. Raising awareness about CS risks, including infection, postpartum hemorrhage, thromboembolism, and anesthesia complications [31-33] is crucial.

Encouraging Vaginal Birth After Cesarean (VBAC) in appropriate cases, alongside improving labor management protocols, can reduce unnecessary CS. Additionally, maternal request CS should be regulated to align with evidence-based guidelines.

CONCLUSION

We concluded that repeat cesarean sections (R5) and pre-labor CS (R2, R4) were major contributors to the overall CS rate, emphasizing the need for better labor management strategies to reduce unnecessary interventions. Factors such as maternal obesity, higher education, and private obstetrician-led deliveries were significantly associated with higher CS rates, suggesting that non-medical influences play a role in delivery choices. While ensuring access to medically necessary CS, efforts should focus on optimizing labor induction, encouraging VBAC where feasible, and improving patient counseling. Consistent use of Robson's classification across healthcare facilities can help in standardizing CS audits, refining clinical practices, and ultimately improving maternal and neonatal outcomes.

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