Original Article

DOI: 10.7860/JCDR/2026/87254.24510

Determinants and Outcomes of Primary Caesarean Section: A Retrospective Observational Study

Obstetrics and Gynaecology Section

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ABSTRACT

Introduction: A Primary Caesarean Section (PCS) is defined as the first caesarean delivery in a woman with no previous uterine scar. PCS rates are rising globally, necessitating an understanding of associated factors to improve maternal and foetal outcomes.

Aim: To determine the prevalence of PCS, examine its indications, and analyse sociodemographic and obstetric factors associated with PCS, with particular emphasis on parity.

Materials and Methods: The present retrospective observational study was carried out between March 2024 and December 2024 in the Department of Obstetrics and Gynaecology at Sri Devaraj Urs Medical College, Kolar, Karnataka, India. A total of 620 women undergoing PCS with a gestational age of >28 weeks were enrolled. Data on maternal age, Body Mass Index (BMI), parity, gestational age, antenatal co-morbidities, and indications for caesarean section were collected from medical records. Chi-square and binary logistic regression analyses identified significant associations and independent predictors of PCS.

Results: Out of 2710 deliveries, 872 were PCS (32% overall rate). Among 620 included participants, 330 were predominantly under 25 years (53.2%), 394 were from lower socioeconomic status (63.5%), and 450 were primigravida (72.6%). The leading indication was foetal distress among 220 participants, accounting for 35.5% of cases, followed by cephalopelvic disproportion in 98 participants (15.8%). Fifty PCS were due to maternal request and accounted for 8.1%. Factors significantly associated with higher odds of PCS included maternal age ≥36 years (Adjusted Odds Ratio (AOR) 5.16; 95% Confidence Interval (CI): 2.39-11.26), although the wide confidence interval suggests limited precision due to the smaller number of women in this age category. PCS was also associated with increased maternal morbidity (AOR 4.19) and neonatal intensive care unit admission (AOR 2.20). Notably, all neonatal deaths occurred among multigravid mothers.

Conclusion: PCS remains a major contributor to rising caesarean rates. Factors such as advanced maternal age, high BMI, diabetes mellitus, and induction of labour significantly increase the likelihood of PCS. Targeted strategies, including adherence to evidence-based guidelines, judicious labour management, and regular audits, are essential to reduce unnecessary PCSs while ensuring maternal and neonatal safety.

Keywords: Elective, Indication, Multigravida, Primigravida

INTRODUCTION

The Caesarean section (CS) is a critical life-saving intervention that plays a significant role in reducing maternal and neonatal morbidity and mortality. It is the most frequently performed surgical procedure worldwide. The World Health Organisation (WHO) recommends an optimal caesarean section rate of 15%; however, this threshold has been surpassed in India, where the rate has reached 21.5%, as reported in the 2019-2021 National Family Health Survey-5 [1]. In the private sector, these numbers stand at 43.1% (2016) and 49.7% (2021) [1]. The sharp rise in caesarean birth rates, without a corresponding reduction in maternal or neonatal morbidity and mortality, raises concerns regarding the appropriateness and justification of the indications for these procedures [2]. This issue is further highlighted by the WHO's 2015 statement, which stresses that the focus should be on ensuring access to caesarean sections for women who genuinely require them, rather than aiming to meet a predetermined rate [3].

A PCS is defined as the first caesarean delivery in a woman with no previous uterine scar [4]. The most common indications for primary caesarean delivery are foetal distress, failure to progress, foetal malpresentation and cephalopelvic disproportion [5,6]. Non-medical indications (e.g., maternal request) constitute one-third of the total 18.5 million caesarean sections performed annually [7]. Multiple factors contribute to the rise in primary caesarean rates like increased use of electronic foetal monitoring, medico-legal concerns, maternal requests, rising maternal age, increased prevalence of assisted reproductive technologies, and higher rates of labour inductions [8].

Achieving a safe reduction in the caesarean section rate necessitates a comprehensive evaluation of the indications currently recommended and implemented in clinical practice. Accordingly, the present study aimed to determine the prevalence of PCS, examine their indications, and analyse the associated sociodemographic and obstetric factors influencing PCS, with particular emphasis on parity, in a tertiary care centre in Southern India.

MATERIALS AND METHODS

The present Retrospective observational study was conducted at a tertiary care hospital affiliated with Sri Devaraj Urs Academy of Higher Education and Research (SDUAHER) from March 2024 to December 2024 in the Department of Obstetrics and Gynaecology. Ethical clearance for the study was obtained from the Institutional Ethics Committee of SDUAHER (Approval No: SDUAHER/KLR/R&D/CEC/F/NF/2024-25/43).

Inclusion and Exclusion criteria: The study population comprised all pregnant women who underwent PCS during the study period, had a confirmed gestational age of 28 weeks or more and provided informed consent to participate. Exclusion criteria included patients with a history of previous uterine surgery, those with incomplete medical records, deliveries that occurred outside the study facility, and individuals who declined to provide informed consent. A total of 620 women who met the inclusion criteria were enrolled consecutively during the study period.

Study Procedure

Data were collected from hospital records, operation theatre registers, and patient case sheets using a predesigned data collection proforma. The parameters collected included demographic details (age, parity), antenatal complications (e.g., Gestational Diabetes Mellitus (GDM), Pregnancy Induced Hypertension (PIH), anaemia), mode of labour onset (spontaneous/induced), type of caesarean (elective/emergency), indication for caesarean section, intraoperative findings and complications, maternal outcomes (e.g. post-partum haemorrhage) and neonatal outcomes (e.g., birth weight, APGAR (Appearance, Pulse, Grimace, Activity, and Respiration) scoring, Neonatal Intensive Care Unit (NICU) admission). Socioeconomic status was categorised using the Modified Kuppuswamy Scale [9]. For analysis, the original five categories of the Modified Kuppuswamy Scale were grouped into 'high/medium' (combining upper, upper-middle, and lower-middle classes) and 'lower' (combining upper-lower and lower classes).

Elective caesarean sections were classified as procedures scheduled in advance and conducted prior to the onset of labour, while emergency caesarean sections were those undertaken in response to acute maternal or foetal complications [10].

STATISTICAL ANALYSIS

Statistical analysis was conducted using SPSS version 26. Sociodemographic variables were summarised as frequencies and percentages. Qualitative data were presented as frequencies and percentages and analysed using the chi-square test. Variables showing significant associations were subsequently subjected to binary logistic regression to identify independent predictors of PCS, with results expressed as adjusted odds ratios and corresponding 95% CI. A p-value of <0.05 was considered statistically significant.

RESULTS

In this study, out of 2710 deliveries, 872 were PCSs, resulting in an overall PCS rate of 32%. After excluding cases that did not meet the inclusion criteria, 620 participants were included. Most participants were under 25 years (53.2%), from lower socioeconomic status (63.5%), and primigravida (72.6%) [Table/Fig-1].

Parameters	Category	n (%)
Age (years)	≤25	330 (53.2)
	26-35	260 (41.9)
	≥36	30 (4.8)
Socioeconomic status	High/medium	226 (36.5)
	Lower	394 (63.5)
BMI (kg/m^2)	<18.5	0
	18.5-24.9	76 (12.3)
	25.0-29.9	460 (74.2)
	30.0-35	52 (8.4)
	>35	32 (5.2)
Parity	Primigravida	450 (72.6)
	Multigravida	170 (27.4)
Gestational age (weeks)	<37	82 (13.2)
	37-40	382 (61.6)
	>40	156 (25.2)
Twin/singleton	Twin	8 (1.3)
	Singleton	612 (98.7)
Antenatal comorbidity	Nil	320 (51.6)
	Hypertension	126 (20.3)
	Diabetes mellitus	48 (7.7)
	Anaemia	70 (11.3)
	Others	56 (9.0)
History of prior abortion	No	554 (89.4)
	Yes	66 (10.6)
History of foetal loss	No	600 (96.8)
	Yes	20 (3.2)
Induction of labour performed	No	458 (73.9)
	Yes	162 (26.1)
Caesarean section indication	Foetal distress	220 (35.5)
	Failed induction	30 (4.8)
	Failure to progress	52 (8.4)
	Malpresentation	60 (9.7)
	Caesarean delivery at maternal request	50 (8.1)
	Cephalopelvic disproportion	98 (15.8)
	Placenta previa	10 (1.6)
	Multiple pregnancy	4 (0.6)
	Medical disorders	16 (2.6)
	Intrauterine growth retardation	20 (3.2)
	Oligohydramnios	24 (3.9)
	Bad obstetric history	10 (1.6)
	Obstructed labour	26 (4.2)
Type of caesarean section	Elective	24 (3.9)
	Emergency	596 (96.1)
Blood transfusion for postpartum haemorrhage	No	592 (95.5)
	Yes	28 (4.5)
Maternal morbidity	No	600 (96.8)
	Yes	20 (3.2)
Baby weight (Kg)	<1.5	22 (3.5)
	1.5-2.5	148 (23.9)
	2.5-3.5	398 (64.2)
	>3.5	52 (8.4)
Need of admission at NICU	No	560 (90.3)
	Yes	60 (9.7)
Neonatal death	No	616 (99.4)
	Yes	4 (0.6)

[Table/Fig-1]: Sociodemographic parameters N=620.

Among the multigravida mothers who underwent PCS, the association between parity and age, BMI, gestational age, singleton/twin status, antenatal comorbidity, indication for caesarean section, and type of CS was statistically significant [Table/Fig-2].

Parameters	Category	Parity		Chi-square (p-value, df)
		Primigravida n (%)	Multigravida n (%)	
Age (years)	≤ 25	256 (77.6%)	74 (22.4%)	χ^2=21.009 (p-value <0.001 df=2)
	26-35	182 (70.0%)	78 (30.0%)	
	≥ 36	12 (40.0%)	18 (60.0%)	
Socioeconomic status	High/medium	164 (72.6%)	62 (27.4%)	χ^2=0.00 (p-value=0.99, df=1)
	Lower	286 (72.6%)	108 (27.4%)	
BMI (kg/m^2)	<18.5	0	0	χ^2=20.44 (p-value <0.001, df=3)
	18.5-24.9	64 (84.2%)	12 (15.8%)	
	25.0-29.9	330 (71.7%)	130 (28.3%)	
	30.0-35.0	42 (80.8%)	10 (19.2%)	
	> 35	14 (43.8%)	18 (56.3%)	
Gestational age (weeks)	< 37 (pre-term)	42 (51.2%)	40 (48.8%)	χ^2=35.87 (p-value <0.001, df=2)
	37-40 (term)	272 (71.2%)	110 (28.8%)	
	>40 (post-term)	136 (87.2%)	20 (12.8%)	
Twin/singleton	Twin	0	8 (100.0%)	χ^2= 22.12 (p-value <0.001, df=1)
	Singleton	450 (73.5%)	162 (26.5%)	

Antenatal comorbidity	Nil	244 (76.2%)	76 (23.8%)	χ2= 23.113 (p-value =0.0001, df=4)
	Hypertension	98 (77.8%)	28 (22.2%)	
	Diabetes mellitus	22 (45.8%)	26 (54.2%)	
	Anaemia	50 (71.4%)	20 (28.6%)	
	Others	36 (64.3%)	20 (35.7%)	
History of prior foetal loss	No	450 (75.0%)	150 (25.0%)	χ2=54.70 (p-value <0.001, df=1)
	Yes	0 (0.0%)	20 (3.2%)	
Induction of labour performed	No	362 (79.0%)	96 (21.0%)	χ2=36.74 (p-value <0.001, df=1)
	Yes	88 (54.3%)	74 (45.7%)	
Caesarean section indication	Foetal distress	168 (76.4%)	52 (23.6%)	χ2=78.76 (p-value <0.001, df=12)
	Failed induction	26 (86.7%)	4 (13.3%)	
	Failure to progress	34 (65.4%)	18 (34.6%)	
	Malpresentation	36 (60.0%)	24 (40.0%)	
	Caesarean delivery at maternal request	42 (84.0%)	8 (16.0%)	
	Cephalopelvic disproportion	80 (81.6%)	18 (18.4%)	
	Placenta previa	0 (0.0%)	10 (100.0%)	
	Multiple pregnancy	0 (0.0%)	4 (100.0%)	
	Medical disorders	12 (75.0%)	4 (25.0%)	
	Intra uterine growth retardation	12 (60.0%)	8 (40.0%)	
	Oligohydramnios	18 (75.0%)	6 (25.0%)	
	Bad obstetrics history	0	10 (100.0%)	
	Obstructed labour	22 (84.6%)	4 (15.4%)	
Type of caesarean section	Elective	12 (50.0%)	12 (50.0%)	χ2=6.39 (p-value =0.011, df=1)
	Emergency	438 (73.5%)	158 (26.5%)	

[Table/Fig-2]: Association between parity and various parameters among mothers undergoing Primary Caesarean Section (PCS) N=620.

A statistically significant association ($p < 0.05$) was observed between parity and maternal morbidity, birth weight, NICU admission, and neonatal mortality [Table/Fig-3].

Parameters	Category	Parity		Chi-square (p-value, df)
		Primigravida n (%)	Multigravida n (%)	
Required blood transfusion postoperatively	No	434 (73.3%)	158 (26.7%)	χ^2=3.51 (p-value 0.06, df=1)
	Yes	16 (57.1%)	12 (42.9%)	
Maternal morbidity	No	442 (73.6%)	158 (26.4%)	χ^2=11.02 (p-value 0.001, df=1)
	Yes	8 (40.0%)	12 (60.0%)	
Birth weight (kgs)	<1.5	8 (36.4%)	14 (63.6%)	χ^2=21.20 (p-value <0.001, df=3)
	1.5-2.5	100 (67.6%)	48 (32.4%)	
	2.5-3.5	298 (74.9%)	100 (25.1%)	
	>3.5	44 (84.6%)	8 (15.4%)	
Required neonatal intensive care unit admission	No	416 (74.3%)	144 (25.7%)	χ^2=8.45 (p-value 0.04, df=1)
	Yes	34 (56.7%)	26 (43.3%)	
Neonatal death	No	450 (73.0%)	166 (27.0%)	χ^2=10.65 (p-value 0.001, df=1)
	Yes	0	4 (100.0%)	

[Table/Fig-3]: Association between parity and outcomes in Primary Caesarean Sections (PCS) N=620.

Maternal age ≥36 years had markedly higher odds of PCS (adjusted odds ratio (AOR)=5.16), compared to the age groups 26-35 years, and ≤25 years, and this association was statistically significant. The presence of diabetes mellitus (AOR=3.79), and women who required induction of labour (AOR=3.17) exhibited higher odds of PCS with a statistically significant association [Table/Fig-4].

Parameters	Binary logistic regression				
	B	p-value	Adjusted odds ratio	95% confidence interval	
				Lower	Upper
Age 26-35 (years)	0.394	0.03	1.48	1.02	2.14
Age ≥ 36 (years)	1.64	<0.05	5.16	2.39	11.26
Socioeconomic status	-0.001	0.995	0.99	0.69	1.44
BMI: 18.5-24.9 kg/m^2 (Reference)	-	-	1.00	-	-
BMI: 25.0-29.9 kg/m^2	0.742	0.025	2.10	1.09	4.02
BMI: 30.0-35.0 kg/m^2	0.239	0.613	1.27	0.503	3.20
BMI: >35 kg/m^2	1.92	<0.05	6.85	2.70	17.40
Gestational age: 37-40 weeks	-0.857	0.001	0.42	0.261	0.691
Gestational age: >40 weeks	-1.86	<0.05	0.15	0.082	0.292
Antenatal comorbidity: Hypertension	-0.08	0.73	0.91	0.56	1.50
Antenatal comorbidity: Diabetes mellitus	1.33	<0.05	3.79	2.03	7.07
Induction of labour performed	1.15	<0.05	3.17	2.16	4.64
Caesarean section type emergency	-1.02	0.015	0.36	0.15	0.82

[Table/Fig-4]: Binary logistic regression of factors associated with Primary Caesarean Section (PCS).

On comparing the maternal morbidity and PCS, mothers who underwent PCS had higher odds of developing maternal morbidity (AOR=4.19) with a statistically significant association. Neonates born to mothers who underwent PCS had higher odds of admission to the NICU (AOR =2.2), and the association was statistically significant [Table/Fig-5].

Parameters	B	p-value	Adjusted odds ratio	95% confidence interval	
				Lower	Upper
Maternal morbidity	1.43	0.002	4.19	1.68	10.45
Baby birth weight (1.5-2.5 kg)	-1.29	0.007	0.27	0.10	0.69
Baby birth weight (2.5-3.5 kg)	-1.65	<0.05	0.19	0.078	0.47
Birth weight (>3.5 kg)	-2.26	<0.05	0.104	0.033	0.32
Need of admission at NICU	0.79	0.004	2.20	1.28	3.80

[Table/Fig-5]: Binary logistic regression of outcomes associated with PCS.

DISCUSSION

The overall prevalence of PCS in the present study was 32%, which is comparable to the 36% rate reported by Priyadarsene P et al., [11]. In this study, advanced maternal age (>35 years) was significantly associated with increased odds of PCS. This is consistent with the systematic review by Bayrampour H et al., which included 21 studies [12]. All studies demonstrated an increased risk of caesarean birth among women at advanced maternal age compared with younger women, for both nulliparas and multiparas (relative risk varied from 1.39 to 2.76). Similarly, higher BMI (>35 kg/m^2) among women undergoing PCS was associated with higher odds of PCS, which is in agreement with the study by Saadia Z et al., where obese women undergoing CS delivery are at higher risk of several CS delivery complications. Also, they had a longer hospital stay and higher birth weight for their neonates compared with non obese women [13].

Diabetes mellitus emerged as a significant antenatal comorbidity, demonstrating higher odds of PCS (AOR 3.79; $p<0.05$) in this study. This finding is consistent with Remsberg KE et al., who

demonstrated that after controlling for confounders, including birth weight, caesarean delivery was strongly associated with both preexisting diabetes {OR (95% CI) 6.20 (4.47-8.61)} and gestational diabetes (1.71 [1.41-2.07]) [14].

The present study found a significant association between gestational age and parity. This observation is consistent with Saurabh S et al., who demonstrated that the incidence of postdated pregnancy was higher in primigravida [15]. The incidence of foetal distress and NICU admissions increased as the period of gestation increased.

Foetal distress (35.5%) was the leading indication for CS in both primigravidae and multigravidae, with a higher prevalence in primigravidae. These findings are consistent with those of Begum T et al., [16] and Chugh A et al., [6] who identified foetal distress as the most frequent indication for PCS, reported at 21%, 27.3%, and 34.2%, respectively. Caesarean delivery on maternal request accounted for 8.1% of all PCS in our study, which is lower than the 18.65% reported by Shrestha D et al., [17].

The present study also provides valuable insights from a tertiary care center, where a diverse set of obstetric cases are managed, improving the generalisability of the results within similar settings.

Limitation(s)

Primarily, the retrospective nature of the research restricts the ability to draw causal inferences. Additionally, the study was based on data from a single-centre, which may not fully represent the broader population of women undergoing caesarean deliveries in different regions or healthcare settings. Future studies with prospective cohort designs across multiple centers would help validate these findings and offer a more comprehensive understanding of the factors influencing PCSs.

CONCLUSION(S)

The PCS remains a major contributor to rising caesarean rates. Factors such as advanced maternal age, high BMI, diabetes mellitus, and induction of labour significantly increase the likelihood of PCS. Targeted strategies, including adherence to evidence-based guidelines, judicious labour management, and regular audits, are essential to reduce unnecessary PCSs while ensuring maternal and neonatal safety.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Mar 07, 2026
- Manual Googling: May 19, 2026
- iThenticate Software: May 21, 2026 (1%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

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: **Jan 05, 2026**
Date of Peer Review: **Mar 09, 2026**
Date of Acceptance: **May 23, 2026**
Date of Publishing: **Oct 01, 2026**