Analysis Of Caesarean Section Rate Over a Ten Year Period at a Tertiary Care Teaching Hospital in Gujarat, India According to Robson's Ten Group Classification

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Abstract
Background and objectives: There has been an increase in the rate of Caesarean section (CS) over the last 5 decades, so it is a matter of concern. According to Robson's Ten Group Classification System, we have examined Caesarean section rate (CSR) over a 10-year period at our institute. **Materials and Methods:** In this retrospective study, all deliveries (Vaginal + CS) carried out at our institute over a 10-year period from 2010 to 2019 were analyzed and classified according to Robson's Ten Group Classification System. **Results**: Groups I and II represented 27.21% of the total obstetric population. Overall CSR during the 10-year study period was 35.47% (17,820 out of 50,244 total deliveries). Largest contribution (47.48%) to overall CSR was by Group V (CSR of 65.44%) and second largest contribution (24.16%) was by Group I(CSR of 24.16%), while group VII contributed least to overall CSR (0.8%). **Conclusion**: Groups V and I are the largest contributors to CSR. Standardization of indication of CS, regular audits and definite protocols in hospitals can decrease the overall CSR.

Keywords: caesarean section, Robson's ten group classification, caesarean section rate, trial of labour after caesarean

Introduction
Caesarean section (CS) is the most performed surgery in obstetrics. World Health Organization in the year 1985 stated that "There is no justification for any region to have a Caesarean Section rate higher than 10-15%" and "Every effort should be made to provide Caesarean sections to women in need rather than striving to achieve a specific rate".[(1)] Caesarean Section Rate is an important indicator of health care quality at both national and world levels and an increase in Caesarean Section rate has been observed in the last 5 decades.

The Caesarean Section rate in India increased from 8.5% in 2005-06 to 17.6% in 2015-16.[(2)] The data available from 169 countries worldwide showed that Caesarean Section rate was about 12% in 2000 and has nearly doubled to about 21% in 2015. [(3)] High Caesarean Section rate leads to increase in the hospital stay for the mother and child, and subsequent complications related to surgery, thus increasing maternal morbidity and mortality. [(4)] This also leads to economic burden on the individual and the health system.[(5)] There are benefits and risks of Caesarean Sections. Improvement in clinical obstetrics have been observed when caesarean sections were performed.
In 2001, Michael Robson introduced Robson's ten group classification system (RTGCS) to assess, monitor

and compare caesarean section rate for better obstetrics care.This classification system is based on 10 obstetric characteristics (nulliparous, multiparous, previous CS, fetal maturity, onset of labor, presentation of fetus and no of fetus)

Aim

Aim of the study was to analyze a 10 year period Caesarean section rate at the Obstetrics and Gynecology Department, NHL Municipal Medical College, Ahmedabad, based on Robson's Ten Group Classification System.

Materials and Method

This retrospective study was conducted to collect data of a 10 year period from January 2010 to December 2019. Data was collected from the Obstetrics and Gynecology Department of our hospital. All Caesarean Section deliveries and vaginal deliveries were included in the analysis after taking due permission from IRB (NHLIRB/19/4/2021/15 dated 30/03/2021). All relevant obstetric information (nulliparous, multiparous, mode of previous deliveries, previous CS and indications, fetal maturity, onset of labor, spontaneous or induced labor, presentation of fetus, number of fetus) were collected. Data entry was done in M.S Excel and results were analyzed.

Indications of Caesarean Section as per Robson's TGCS are as follows:

1) Nulliparous, single cephalic, >37 weeks in spontaneous labor
2) Nulliparous, single cephalic, >37 weeks, induced or CS before labor
3) Multiparous (excluding previous CS), single cephalic, >37 weeks in spontaneous labor
4) Multiparous (excluding previous CS), single cephalic, >37 weeks induced or CS before labor
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 abnormal lies (including previous CS)
10) All single, cephalic, <36 weeks (including previous CS)

Results

During 2010-2019 (10 years), a total of 50,244 deliveries were conducted at our center, of which 17,820 (35.47%) were CS deliveries (Table 1, 2) and 32,424 (64.53%) were vaginal deliveries (Table 1,3). Overall CSR for the 10 year period was 35.47% in the current study (Table 1). Mean maternal age was 26.32 ±5.30 years. Out of 50,244 deliveries; 23,216 (46.21%) were nulliparous women and 27,027 (53.79%) were multiparous women. In nulliparous women, Caesarean section rate was 24.69% (5732 out of 23,216) and vaginal delivery rate was 75.31 % (17,484 out of 23,216). In multiparous women, CS rate was 44.73% (12,088 out of 27,027) and vaginal delivery rate was 55.27% (14,939 out of 27,027). In the 10-year study period, total deliveries increased from 2970 (2010) to 5595 (2019) along with an increase in Caesarean Section rate from 22.66% (2010) to 43.34% (2019).

Table 1 Total deliveries conducted at NHL Municipal Medical College, Ahmedabad during 2010 to 2019

Year	Total deliveries	Vaginal deliveries	Caesarean sections	Caesarean section rate (%)
2010	2970	2297	673	22.66
2011	3529	2634	895	25.36
2012	3767	2625	1142	30.31
2013	5451	3787	1664	30.53
2014	6534	4547	1987	30.41
2015	5277	3270	2007	33.53
2016	5986	3518	2468	41.23
2017	5444	3187	2257	41.46
2018	5691	3389	2302	40.45
2019	5595	3170	2425	43.34
Total	50,244	32,424	17,820	35.47

Table 2 Caesarean sections conducted at NHL Municipal Medical College, Ahmedabad during 2010 to 2019

Year/ group	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
I	151	186	202	295	390	378	502	340	355	357	3156
II	122	84	129	176	195	198	228	182	188	192	1694
III	18	29	33	35	41	34	39	47	38	42	356
IV	38	41	73	75	89	74	82	74	60	96	702
V	188	369	378	603	764	1003	1277	1272	1290	1406	8550
VI	10	9	28	24	15	27	42	35	50	35	275
VII	5	8	4	8	5	12	20	16	52	12	142
VIII	41	38	52	57	88	47	46	49	45	55	518
IX	48	52	60	53	70	62	66	65	70	78	624
X	52	79	183	338	330	172	166	177	154	152	1803
Total	673	895	1142	1664	1987	2007	2468	2257	2302	2425	17,820

Table 3 Vaginal deliveries conducted at NHL Municipal Medical College, Ahmedabad during 2010 to 2019

Year/ Group	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
I	864	656	716	1043	1382	972	1172	966	1067	1071	9909
II	306	395	403	603	810	614	766	656	682	673	6908
III	331	333	379	401	476	396	445	342	372	366	3841
IV	251	349	405	464	553	486	503	458	490	452	4411
V	172	386	441	1074	1006	432	239	278	300	188	4516
VI	2	2	4	8	3	5	10	8	10	3	55
VII	4	3	6	6	7	8	13	10	32	5	94
VIII	4	14	12	17	6	11	30	35	30	9	168
IX	3	6	3	5	2	3	4	7	6	3	42
X	360	490	256	166	302	343	336	427	400	400	3480
Total	2297	2634	2625	3787	4547	3270	3518	3187	3389	3170	32424

Table 4 shows that rate of Caesarean section in Group V (previous CS) was 65.44% (8550 out of 17,820 women), which had largest contribution to overall caesarean rate at 47.98%.
Second group with largest contribution to overall CSR was group I, (n=13,605), of whom 24.16% (n= 3156) had caesarean sections. Contribution of this group to CSR was 17.71%. Third largest contributor to overall CSR was group X (n=5283), of whom 34.13% (n=1803) were delivered using CS. Contribution to overall CSR was 10.12%.

Table 4 Relative contribution of different groups to total CSR according to Robson's Ten Group Classification System

RTGCS group	Total delivery	Vaginal delivery	Caesarean section	Contribution to total CSR(%)
I	13,065	9909 (75.84%)	3156 (24.16%)	17.71
II	7602	5908 (77.72%)	1694 (22.28%)	9.5
III	4197	3841 (91.52%)	356 (8.48%)	2.0
IV	5113	4411 (86.27%)	702 (13.73%)	3.94
V	13,066	4516 (34.56%)	8550 (65.44%)	47.98
VI	330	55 (19.67%)	275 (80.33%)	1.54
VII	236	94 (39.83%)	142 (60.17%)	0.80
VIII	686	168 (24.49%)	518 (75.51%)	2.91
IX	666	42 (6.31%)	624 (93.69%)	3.50
X	5283	3480 (65.87%)	1803 (34.13%)	10.12
Total	50,244	32424 (64.53%)	17,820 (35.47%)	100

Fourth largest group contributing to overall CSR was group II (n=7602), of whom 22.28% (n= 1694) were delivered using CS. Overall contribution to CSR was 9.5%. The highest rate of caesarean section was in Group IX (93.69%) followed by group VI (80.33%) and group VIII (75.51%) but contribution of these groups to total CSR was 3.5%, 1.54% and 2.91% respectively. Rate of caesarean section in group VI (nulliparous

breech) and group VII (multiparous breech) was 80.33% and 60.17% respectively while their contribution to overall CSR was 1.54% and 0.80% respectively. Rate of caesarean section in group III (Multiparous, spontaneous delivery) was least (8.48%), while rate of caesarean section in group IV (multiparous, induced) was 13.73%.Contribution of these groups to total CSR was 2% and 3.94% respectively. In our study CS for post date pregnancy and fetal distress were main indications in Group I and Group IV.

In current study, birth weight more than 3.5 kg was associated with highest rate of caesarean section (70.03%),birth weight less than 1.5 kg was associated with caesarean section rate of 12.8% (418/3258) ,while birth weight between 1.5-2.5kg and 2.5-3.5 Kg had CSR of 40.7% (7557/18525) and 31.9% (8448/26,466) respectively.

Table 5 shows neonatal mortality rate (NMR) for CS delivery varied from 23.93% live birth in 2010 to 32.5% live births in 2019.

Table 5 Neonatal Mortality Rate observed at NHL Municipal Medical College, Ahmedabad during 2010 to 2019

Year	Live births	Neonatal deaths	Neonatal Mortality Rate
2010	2925	70	23.93%
2011	3477	111	31.92%
2012	3701	125	33.74%
2013	5374	142	26.4%
2014	6438	133	20.6%
2015	5218	124	23.76%
2016	5909	128	21.66%
2017	5359	124	23.13%
2018	5616	174	30.98%
2019	5530	180	32.5%

Table 6 Comparison of CS rates observed in different groups with Robson's guidelines

Group	Robson's guidelines (%)	Our study (%)
I	<10	24.16
II	20-35	22.28
III	3	8.48
IV	15	13.73
V	50-60	65.44
VI	--	80.33
VII	--	60.17
VIII	60	75.51
IX	100	93.69
X	30	34.13

Discussion

Caesarean section rate is an important indicator for maternal and fetal health with regards to access to essential obstetric care. CS rate according to RTGCS helps to audit the CS at healthcare facilities.

In our study, the overall CSR was 35.47%. A study conducted from 2010 to 2018 across 154 countries which covered 94.5% of live births across the world, showed that 21.1% of women gave birth by caesarean section worldwide. The rate ranges from 5% births in Sub-Saharan Africa to 42.8% births in Latin America and the Caribbean.[6]

In nulliparous women, CS rate was 24.69% (5732/23,216) and vaginal delivery rate was 75.31 % (17,484/23,216) while in multiparous women, CS rate was 44.73% (12,088/27,027) and vaginal delivery rate was 55.27% (14,939/27,027).This can be attributed to planned intervention in group V and X. Also, majority of women are referred from periphery for better operative facility and neonatal care to our center. In our study, CS for Postdate and fetal distress were main indication in group I and group IV.

Table 1 shows that increased rate of caesarean section in group I and III leads to planned intervention in group V. The rising trend observed in these groups are highly significant. A similar finding was observed in the study by AberaKenay Tura et al, which suggested that both primary (Group I and III) and secondary (Group V) CS have a high CS rate.[7]

Ours is a tertiary care teaching center with an added obstetrics critical care unit since last 5 years. Due to this, number of referrals of complicated antenatal and intranatal cases has increased.

Robson stated that CSR in group I should be below 10% and in group III should be below 3 %. In our study, rate of CS were 24.16% in group I and 8.48% in group III, which may be due to non-reassuring fetal heart rate pattern, while the rate in group II (22.28%) and IV (13.73%) were comparable to Robson's classification.

The high CS rates in groups I (24.16%) and II (22.28%) (nulliparous women) indicate that we are dealing with patients with presence of risk factors. Caesarean section rate in National Maternity Hospital in Dublin in 2006 in group I and II was 6.7%[2]and 14.8% in New Jersey in 2009 but is closer to the WHO global survey in Latin America (27.7%).[8] The second and third largest contributors to the overall CSR were nulliparous women in group I and group II which were responsible for 18.3 and 15.3% of all caesarean deliveries respectively. In our study, groups I and II (nulliparous) has 27.21% contribution to total caesarean sections. Le Ray et al [9] in a study conducted in France in 2015, found out that out of all CS performed, almost one third were contributed by nulliparous women with cephalic, singleton, fetuses. Barber et al noted that the caesarean section rate increased from 26% in 2003 to 36.5%in 2009, due to increase in primary caesarean section (50%).[10] Among the major indications, fetal distress, arrest of dilatation, multiple gestation, pre-eclampsia, suspected macrosomia and maternal preference for CS have increased over time while arrest of descent, malpresentation, maternal-fetal indications and other indications like cord prolapse, antepartum hemorrhage have not not increased.[11]

In our study, largest contributors to overall CSR were groups V, I, X and II. Lithorp et al in their study reported that the three largest groups (group I, III and V) contributed most to the total CSR during a study period of 12 years from 2000 to 2011 covering 1,37,094 deliveries.[12] In our study, CSR increased from 22.63% to 43.34% over a period of ten years as compared to Lithrop et al study which showed increased rate from 19.0% to 49.0% over period of 12 years.[12] In the study by Howell et al at Queensland, CSR of public and private sector was found to be 26.9% and 48.0% respectively, while the major contributing groups were groups V, II and I during a study period of 1997 to 2006.[10] Women in group I and II (singleton pregnancy at term, who entered labor spontaneously) comprised 60% of total population.

In the present study, Group V (previous CS, single cephalic, >37 weeks) had the overall CSR of 65.44% and largest contribution to the overall CS rate (47.98%). This may be due to CS elected for repeat CS. Discussion of Trial Of Labour After Caesarean (TOLAC) and repeat caesarean section should include individual characteristics that can affect the changes of TOLAC associated complications and elective repeat CS; so that a women can choose her intended route of delivery. [13] Advantages of Vaginal birth After Caesarean(VBAC) include avoidance of major abdominal surgery , lower rates of hemorrhage, thromboembolism and infection, and a shorter recovery period compared to women who undergo an elective repeat CS. [14] VBAC has declined

over years in women having previous CS due to fear of uterine scar rupture.

The least number of contributions to CSR was group VII(0.8%), even though the CS rate in the group was 60.17%. The group, however included least number of women (n=236).

Overall caesarean section rate in our study was 35.47%. Women in group V were the largest contributor to overall CS (26.7% of all CS) in the current study, even though they were only 11.4% of study population. A WHO global survey using the TGCS found that the overall CSR was 35.4%[1]. The 3-year study of Mittal et al from 2018-20 reported that CS rate was 22.4%, 23.5% and 25.5% respectively year-wise and major contributing group was Group V.[11]

Also, birth weight more than 3.5 kg was found to be associated with higher rate of caesarean section (70.03%) in the current study. A study by Lawoyin et al, reported that the risk of caesarean section was considerably higher in larger newborns with 3.8 kg.[15]

In our study, neonatal mortality rate increased from 23.93/1000 live births to 32.5/1000 live births over a 10-year study period, while it increased from 25/1000 live births to 26.8/1000 live births in 2013.[16] The neonatal mortality rate for babies delivered by caesarean section has not improved with a rise in CSR. WHO in a publication has stated that perinatal mortality declines are steep until the CSR reaches approximately 8% of deliveries, after which the relationship becomes less clear.[17] Goldenberg et al and Stanton et al observed a small non-significant increase in intrapartum still birth for each percent increase in caesarean sections. Proper training of health workers and counseling of women helps to reduce the caesarean section rates.

Our results show that regular audits and feedback are needed for better clinical practice and in reducing caesarean section rates. Group V is a major contributor of total cesarean sections, and cutting down on primary cesarean sections would lower repeat cesarean deliveries.[18]American College of Obstetrician and Gynecologist(ACOG) survey on professional liability done from 2012-2014, reflect a negative liability environment. Due to fear of professional liability claims or litigations, obstetricians have made changes to their practices. 17% obstetricians have reportedly increased performing caesarean sections and 13.4% stopped promoting VBACs due to professional liability claims.[19]

Conclusions

As per RTGCS, group V was found to be the most contributing group in our study. To decrease the CSR, it is recommended to reduce the primary CS and counsel the women regarding risk and benefit of VBAC. Training of resident doctors regarding labor analgesia, instrumental delivery, external cephalic version and breech vaginal delivery and providing fearless working environment is needed to reduce CSR.

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