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Trends in Vaginal Delivery and Cesarean Section–Part I

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Abstract

Background: The rising rate of cesarean section (CS) in recent times all over the world is alarming, associated with higher maternal and neonatal morbidity and mortality compared to Vaginal Delivery (VD).

Objective: Objective of this study is to determine incidence of cesarean section and vaginal delivery and compare maternal, obstetric and newborns risk factors related CS and VD over three decades, 1983 and 2015–2017 cohorts.

Aim: To determine simple strategy for safe vaginal delivery to improve maternal and neonatal outcome

Method: Study of 2,748 consecutive singleton live births January 1st 2015 to 31st May 2017 to 4348 live births in 1983 over three decades to compare incidence of vaginal delivery versus cesarean section and associated prenatal maternal risk factors of gravida and age, intrapartum obstetric complications of Premature Rupture of Membranes (PROM), Gestational Diabetes Mellitus (GDM), Pregnancy Induced Hypertension (PIH) and neonatal factors of birth weight, prematurity, complications of birth asphyxia, sepsis, gender etc.

Sources of data were Labor room records, NICU register and neonatal charts. Logistic regression in 2015-'17 cohort, between vaginal deliveries and cesarean sections corelated to maternal, obstetric medical complications and neonatal risk factors presenting at different intensity levels as odds ratio (OR), mean difference (95% Confidence Interval), number or percent (%) by binary logistic regression, statistical significance set at <0.05 using SPSS Version 21.

Results: High incidence of 42.1% cesarean section noted in 2015-'17 cohort contrasted to low 13.2% in 1983, correspondingly vaginal delivery 52.7% in former increased to 67% in the latter cohort respectively. Risk factors in 2015-'17 cohort by cesarean section included 32% primigravida, 38% older mothers aged ≥25 years (OR 0.65 [95% CI 0.55, 0.76]; *p*<0.001), 9% PROM in cesarean section to 6% vaginal delivery (OR 1.53 [95% CI 1.13, 2.06]; *p*=0.005), 8% Gestational Diabetes Mellitus (GDM) in cesarean sections to 3% vaginal delivery (OR 2.78 [95% CI 1.93, 4.02]; *p*=<0.001). Twice higher 8% PIH in cesarean section to 4% vaginal delivery (OR 2.93 [95% CI 1.49, 2.93]; *p*<0.001). Birthweight distribution was not significant, though prematurity ≤36 weeks was significantly higher in cesarean section (OR 1.67 [95% CI 1.31, 2.14]; *p*<0.001). Up to half 46% newborns suffered from morbidity to only 22.6% born vaginal delivery (OR 2.89 [95% CI 2.44, 3.42]; *p*<0.001). Birth asphyxia was high 30% in cesarean section, common indication being fetal distress contrasted to 11.4% vaginal delivery (OR 3.29 [95% CI 2.68, 4.04]; *p*<0.001). Early onset neonatal sepsis 11% in cesarean section to 8% by vaginal delivery (OR 1.42 [95% CI 1.08, 1.86]; *p*<0.011), slightly more males were born by cesarean section. Peak 30% cesarean section at 38 weeks contrasted to 30% vaginal delivery at later 39 weeks gestation.

Conclusion: Cesarean section rate increased sharply to 42.1% in 2015-'17 being three times higher to low 13.2% during the eighties. High risk factors for cesarean section include primigravida, older mothers aged ≥25 years, obstetric complications of PROM, GDM, PIH, prematurity ≤36 weeks, and neonatal morbidity, birth asphyxia, early onset neonatal sepsis versus vaginal delivery being statistically significant. Peak 30% cesarean section took place at 38 weeks gestation contrasted to 30% vaginal delivery at 39 weeks, therefore promoting safe vaginal delivery at 38 weeks term gestation is best for improved outcome for both mother and baby.

Keywords

Cesarean section; Vaginal delivery; 38 weeks; Maternal; Obstetric and neonatal risk factors.

Introduction

Caesarean section rates have increased dramatically worldwide, trends from 7% in 1990 to 21% and projected by 2030 to be 63% in Eastern Asia, 54% in Latin America and the Caribbean, 50% western Asia, 48% North Africa 47% South Europe and 45 in Australia and New Zealand [1,2]. Currently the highest cesarean section rate is Dominican Republic 58.1%, Brazil 55.7%, Cyprus 55.3%, Egypt 51.8% and Turkey 50.8%, Romania 46.9%, while China reported around 50% to stunning 80% for private clinics in Brazil [3, 4]. India the most populated country in the world reported high 60.7% rate in Telegana followed by 42.2% in Andhra Pradesh, 41.7% in Jammu and Kashmir to 39.5% in Goa and 37.6% in Ladakh [5].

World Health Organization (WHO) recommends cesarean section rate of 10 - 15%, should have precise indication where it is mandatory for the preservation of maternal and/or fetal health [6,7]. Though, a significant number of caesarean sections performed for obstetrical indications, some are simply due to maternal request [8] may incur several risks to both mother and neonate including neonatal depression due to general anesthesia, fetal injury during hysterotomy and/or delivery, increased likelihood of respiratory distress even at term [9], as well as have increased risk of gut microbiota [10] asthma, food allergy, type 1 diabetes, obesity, respiratory, metabolic and immune diseases ,also women after LSCS are more likely to have delayed breastfeeding with poor milk production and early weaning [11]. Concurrent with the trend of increasing caesarean sections, epidemic of both autoimmune diseases such as type 1 diabetes, Crohn's disease, multiple sclerosis and allergic diseases, such as asthma, allergic rhinitis, and atopic dermatitis has been noted more common in the affluent, Western, industrialized countries [13-14].

Thus, the increased incidence of cesarean section raises concern as despite indication for clinical reasons such as breech presentation, multiple pregnancies obstetric risks of PIH etc., without medical indication includes patient preferences, practice variation in hospitals, systems and health care providers poses increase risks for both mother and newborn compared to vaginal delivery [15-17], indicates as to whether caesarean sections will soon indeed become normal delivery in the twentieth first century is appalling and needs to be stemmed.

Methods

The study comprised of two cohorts of 2,748 consecutive live births during 2015-'17 from Shifa hospital, Bangalore and 4535 live births in 1983 from CMCH, Vellore, both located 300 kms apart in South India.

Design

The incidence of cesarean section and vaginal delivery was compared over three decades and related risk factors associated to gravida, maternal age, obstetric complications due to Premature Rupture of Membranes (PROM), Gestational Diabetes Mellitus (GDM), Pregnancy Induced Hypertension (PIH) and neonatal factors such as birth weight, gestation and complications such as birth asphyxia, sepsis etc. Sources of data were Labor room records, NICU register and neonatal charts.

Statistical analysis

Association between cesarean section and vaginal delivery with various maternal, obstetric and neonatal risk factors were analyzed and statistical significance determined by binary logistic regressions. $p>|z|$ in linear regression indicates that a relationship exists between the two categorical variables vaginal delivery versus cesarean section and $p \leq 0.05$ indicates statistical significance, rejecting the null hypothesis that no relationship exists between predisposing factors and cesarean section when compared to vaginal delivery. The threshold of statistical significance set at ≤0.05 using SPSS Version 21.

Results

Rising trend for cesarean section 42.2% (n=1159/2748) was noted in a study during 2015-'17 with 52.7% (n=1450/2748) vaginal delivery, remaining 5% (n=139/2748) were by other modes of delivery. While among 4535 births during 1983 majority 69.2% (n=3138/4535) were vaginal delivery and 13.2% (n=610/4535) cesarean section while remaining 17.3% (n=787/4535) comprised other modes of delivery. Incidence of vaginal delivery and cesarean section during 1983 and 2015-'17 seen in (Figure. 1).
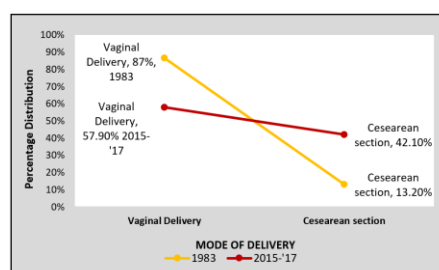

Figure 1: Incidence of cesarean sectionand vaginal delivery during 2015- '17 and 1983.

Variation in mode of delivery in 1983 and 2015-'17 revealed not only sharp increase 42% in cesarean

section during 2015-'17 but also Axis Traction Forceps (ATF) obsolete in 2015-'17 was applied to 8.3% of 4535 live births during 1983 study, contrasted to vacuum extraction increased to 3.5% in 2015-'17 from 1% in 1983. Low Perineal or Outlet Forceps decreased from 6.2% in 1983 to 1.4% in 2015-'17 in view of the increase in cesarean sections. The comparison of incidence of live births by mode of delivery in 1983 and 2015-'17 seen in (Figure 2).
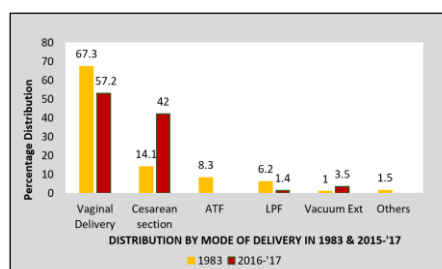

Figure 2: Incidence of births by mode of delivery in 1983 and 2015- '17.

Antenatal factors–gravida

The overall distribution of births in relation to gravida revealed majority 32% (n=811/2575) were primigravida, 55% (n=446/811) had vaginal delivery to 45% (n=365/811) cesarean section. Among 30% (n=780/2575) were second gravidas 57.6% (n=450/780) had vaginal delivery and 42.3% (n=330/780) cesarean section. Followed by 21.9% (n=565/2575) third gravida mothers with almost equal 50.9% (n=288/565) vaginal delivery to 49% (n=277/565) cesarean section. Fourth gravida mothers 10.3% (n=266/2575) had 59% (n=157/266) vaginal delivery to 41% (n=109/266) cesarean section. Low incidence of 5.9% (n=153/2575) multi-5+ gravida mothers had maximum 60.2% (n=92/153) vaginal delivery to lower 39.8% (n=61/153) cesarean section in 2015-'17 cohort. The distribution of births by vaginal delivery and cesarean section in relation to gravida seen in Table 1 and percentage distribution of births by vaginal delivery and cesarean section in relation to gravida during 2015-'17 seen in (Figure 3).

Gravida	Vaginal Delivery	Caesarean Section	Total
1	446	365	811
2	450	330	780
3	288	277	565
4	157	109	266
5+	92	61	153
Total	1433	1142	2575

Table 1: Distribution of births by vaginal delivery and cesarean section in relation to gravida 2015-17.
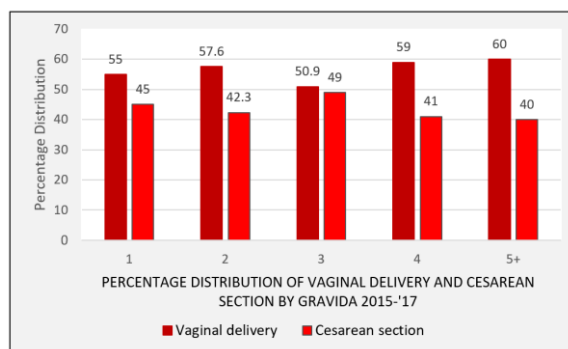
Figure 3: Percentage distribution of vaginal delivery and cesarean section by gravida 2015-'17.

Contrasted sharply to 1983 cohort with 30% (n=1231/4083) primigravida mothers who had high 97.6% (n=1203/1232) vaginal delivery to 2.3% (n=28/1231) cesarean section. Among 22.9% (n=935/4083), second gravida mothers, 81.5% (n=769/935) had vaginal delivery to 18.5% (n=28/1231) cesarean section. For 27.3% (n=1113/4083) third gravida mothers 93% (n=1035/1113) had vaginal delivery to 7% (n=78/1113) cesarean section. Among 12% (n=493/4083) fourth gravida mothers 93% (n=459/493) had vaginal delivery to 7% (n=34/493) cesarean section. While 7.6% (n=311/4083) 5+ multi para, 94% (n=292/311) had vaginal delivery and 6% (n=19/311) cesarean section. Distribution of births by vaginal delivery and cesarean section in relation to gravida seen in Table 2 and percentage distribution during 1983 seen in (Figure 4).

Gravida	Vaginal Delivery	Cesarean Section	Total
1	1203	28	1231
2	762	173	935
3	1035	78	1113
4	459	34	493
5+	292	19	311
Total	3751	332	4083

Table 2: Distribution of births by vaginal delivery and cesarean section in relation to gravida 1983.
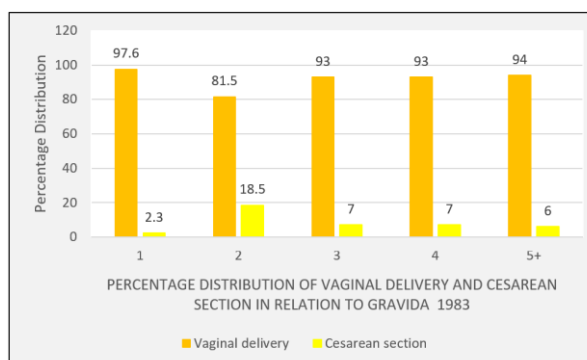

Figure 4: Percentage distribution of vaginal delivery and cesarean section by gravida 1983.

Incidence of births in relation to gravida between 2015-'17 cohort and 1983 cohort revealed almost equal distribution 32% and 30 % respectively for primigravida subsequently dipped to 22.9% in 1983 with a peak of 27.3% for third gravida mothers in 1983 cohort while 2015-'17 cohort showed steady decline with increasing parity. Indicating a demographic shift from large family in 1983 to small family norm with one to two children in 2015-'17. The distribution of births in relation to gravid in 2015-'17 and 1983 seen in (Figure 5).
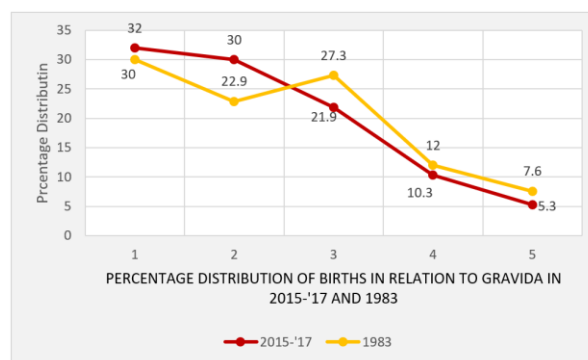

Figure 5: Percentage distribution of births in relation to gravida in 2015-17 and 1983.

Gestation in relation to gravida

Peak 30% births occurred among third gravida mothers as also 27% second gravida while 22.5% fourth gravida mothers in contrast majority primigravida peaked later at 39 weeks and multi fifth gravida mothers had biphasic peaks of 26.5% at 37 weeks and 22.5% at 39 weeks gestation in 2015-'17 cohort. Gestation at birth in relation to gravida 2015- '17seen in (Figure 6).
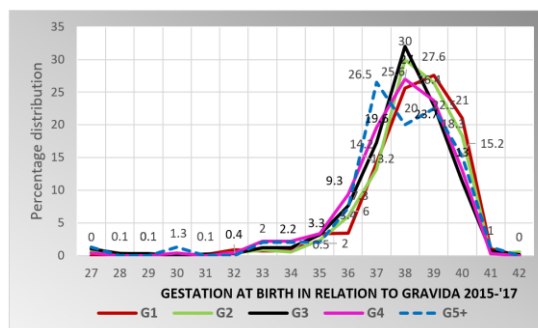

Figure 6: Gestation at birth in relation to gravida 2015-17.

Logistic regression

Logistic Regression for vaginal delivery and cesarean section during 2015-'17 in relation to primigravida and gravida 2+ and above was not statistically significant as percentage distribution of 68% vaginal delivery to 32% cesarean section was almost similar in both categories. Logistic Regression in relation to Gravida for vaginal delivery and cesarean section 2015-'17 seen in (Table 3).

GRAVIDA					
Category Gravida	Vaginal delivery No. (%)	Cesarean Section No. (%)	Odds Ratio	(95% Conf. Interval)	p>|z|
1	446 (31.12)	365 (31.96)	1.03	0.87, 1.22	0.649
2+	987 (68.88)	777 (68.04)	Ref		

Table 3: Logistic Regression in relation to gravida for vaginal delivery and cesarean section 2015-17.

Maternal age

During 2015-'17 among 2483 consecutive live births, 8.6% (n=214/2483) teen aged mothers ≤ 19 years, most 61.6% (n=132/214) had vaginal delivery to 38.3% (n=82/214) cesarean section. Young mothers aged 20-24 years 38.9% (n=967/2483), also most 61.8% (n=598/967) had vaginal delivery to 38.2% (n=367/967) cesarean section, while older 25-29 years 34.7% (n=862/2483) had almost similar distribution of 51.7% (n=446/862) vaginal delivery to 48.3% (n=416/862) cesarean section similarly those aged 30-35 years 15.9% (n=396/2483) had 51% (n=104/369) vaginal delivery to 49% (n=194/369) cesarean sections, while elderly mothers ≥35 years comprising only 1.8% (n=44/2483) had slightly higher incidence 52% (n=23/44) cesarean section compared to 48% 51% (n=21/44) vaginal delivery. Thus, older mothers ≥ 25 years were subjected to slightly more cesarean sections than younger mothers. Distribution of births in relation to maternal age groups by vaginal delivery and cesarean section in 2015-'17 seen in Table 4 and percentage distribution of births by vaginal delivery and cesarean section in relation to maternal age 2015-17 seen in (Figure 7).

Maternal Age	Vaginal Delivery	Cesarean Section	Total
≤ 19	132	82	214
20-24	598	369	967
25-29	446	416	862
30-35	202	194	396
≥35	21	23	44
Total	1399	1084	2483

Table 4: Distribution of Vaginal delivery and Cesarean section by maternal age groups 2015-17.
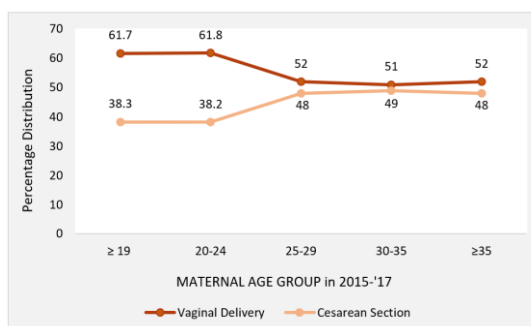

Figure 7: Percentage distribution of vaginal delivery and cesarean section in relation to maternal age 2015- '17.

In contrast during 1983 cohort, 13% (*n*=457/3481) teenaged mothers 89.3% (*n*=408/457) had vaginal delivery to 10.7% (*n*=49/457) cesarean section, while 15.9% (*n*=554/3481) aged 20-24 years had 88.8% (*n*=492/554) vaginal delivery, 11.2% (*n*=62/554) cesarean section, contrasted to peak 50% (*n*=1739/3481) aged 25-29 years with 87.6% (*n*=1523/1739) by vaginal delivery to 12.4% (*n*=216/1739) cesarean section, however older mothers 30-34 years comprised 16.2% (*n*=565/3481), still 80.7% (*n*=456/565) had vaginal delivery to 19.3% (*n*=109/565) cesarean section. While among 4.8% (*n*=166/3481) elderly mothers aged ≥35 years, 79.6% (*n*=132/166) were vaginal delivery to 20.4% (*n*=34/166) cesarean section. Distribution of vaginal delivery and cesarean section by maternal age groups in 1983 seen in Table 5 and percentage distribution of vaginal delivery and cesarean section by maternal age 1983 seen in (Figure 8).

Maternal Age	Vaginal Delivery	Cesarean Section	Total
≤19	408	49	457
20-24	492	62	554
25-29	1523	216	1739
30-34	456	109	565
≥35	132	34	166
Total	3011	470	3481

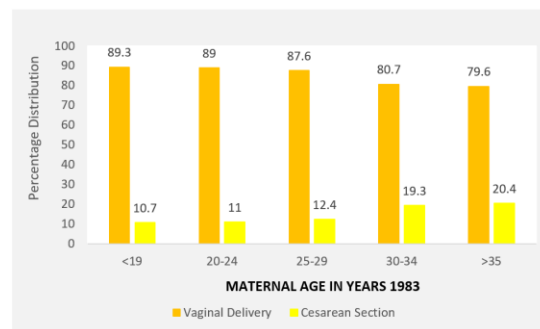**Table 5:** Distribution of vaginal delivery and cesarean section by maternal age groups 1983.

Figure 8: Percentage distribution of vaginal delivery and cesarean section by maternal age 1983.

The comparison of peak delivery of 38.9% were in young mothers aged 20-24 years followed by 34.7% in mothers aged 25-29 years during 2015-'17 with progressive decline of older mothers indicating small family norm in young mothers contrasted to peak 50% or half of all births to older mothers aged 25-29 years with 15.9% and 16.2% for maternal ages 20-24 years and 30-34 years. The comparison of percentage distribution of births in relation to maternal age groups in 2015-'17 and 1983 seen in (Figure 9).
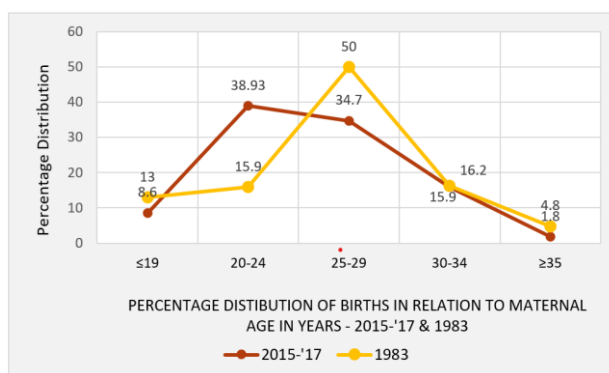
Figure 9: Comparison of percentage distribution of births in relation to maternal age groups in 2015- '17 and 1983.

Perinatal Mortality Rate (PMR) by mode of delivery in relation to maternal age in 1983, revealed vaginal delivery had least PMR 27.5 ‰ in 25-29-year-old mothers followed by 36.8‰ for younger 20-24 years with highest 66.7‰ in elderly >35 years of age, contrasted to least PMR of 17.4‰ in young 20-24 years that progressively increased to 60.6‰ for elderly >35 years. Instrumental delivery by low perineal forceps delivery was low 10.8‰ also in young mothers 20-24 years. Vaginal breech delivery had extremely high 62.5‰ up to 600‰ hence cesarean section advocated in breech presentation. The PMR according to mode of delivery in relation to maternal age 1983 seen in (Table 6).

Mode of Delivery	PMR per 1000 births				
Maternal Age	≤19	20-24	25-29	30-34	≥35
Vaginal delivery	57.1	36.8	27.5	59.4	66.7
Caesarean Section	40.8	17.4	44.8	45.8	60.6
Forceps ATF	0	18.2	50.8	31.3	0
LPF	0	10.8	13.3	0	0
Breech	307.7	200	314.3	62.5	600.7

Table 6: PMR according to Mode of delivery in relation to maternal age 1983.

Logistic regression

Logistic regression for vaginal delivery in relation to maternal age ≤24 years being 52% (n=730/1399) to ≥25 years 48% (n=669/1399) compared to cesarean section in ≤24 years with 42% (*n*=451/1044) contrasted to ≥25 years old with 58% (*n*=633/1399) being highly statistically significant (OR 0.65 [95% CI 0.55,0.76]; *p*<0.001) Thus, older mothers had higher incidence of cesarean section. Logistic Regression between vaginal delivery and cesarean section in relation to maternal age in 2015-'17 seen in (Table 7).

MATERNAL AGE					
Category Maternal Age	Vaginal delivery No. (%)	Cesarean Section No. (%)	Odds Ratio	(95% Conf. Interval)	p>|z|
≤24	730 (52.18)	451 (41.61)	0.65	0.55, 0.76	<0.001
≥25	669 (47.82)	633 (58.39)	Ref		

Table 7: Logistic Regression between vaginal delivery and cesarean section in relation to maternal age 2015-17.

Obstetric complications-premature rupture of membranes (PROM)

Premature Rupture of Membranes (PROM) before onset of labor occurred in 7.2% (*n*=188/2609) total births contrasted to 6% (*n*=86/1450) vaginal delivery majority 94% had intact membranes. In contrast 9% (*n*=102/1159) had PROM among cesarean sections with 91% intact membranes in 2015-'17 cohort. Incidence of PROM in vaginal delivery and cesarean section during 2015-'17 seen in (Figure 7).
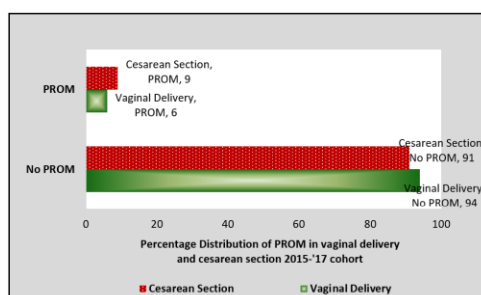

Figure 10: Incidence of PROM in vaginal delivery and cesarean section during 2015-17.

Logistic regression

Logistic Regression of PROM in vaginal delivery to cesarean section revealed higher 9% incidence PROM among 1159 cesarean section to 6% of 1450 vaginal delivery being highly statistically significant (OR 1.53 [95% CI 1.08, 1. 1.13, 2.06]; *p*=0.005). Logistic Regression between vaginal delivery and cesarean section with and without PROM in 2015-'17 seen in (Table 8).

PREMATURE RUPTURE OF MEMBRANES (PROM)					
Category PROM	Vaginal Delivery No. (%)	Cesarean Section No. (%)	Odds Ratio	(95% Conf. Interval)	p>|z|
Yes	44 (5.93)	102 (8.80)	1.53	1.13, 2.06	0.005
NIL	1364 (94.07)	1057 (91.20)	Ref		

Table 8: Logistic Regression between vaginal delivery and cesarean section with and without PROM 2015-17.

Gestational diabetes mellitus (GDM)

The overall incidence of GDM was 5.2% (*n*=137/2609) live births however, among 1450 vaginal delivery only 3% (*n*=44/1450) had complications of GDM contrasted to nearly three times 8% (*n*=93/1159) for cesarean sections in 2015-'17 cohort being highly statistically significant *p*<0.001. Majority 94.7% (*n*=2472/2609) were healthy pregnancy.

The problems such as macrosomia with large babies and other indications of fetal distress are probable causes for high cesarean section rates among GDM. Incidence of GDM by vaginal delivery and cesarean section 2015-'17 seen in (Figure 11).
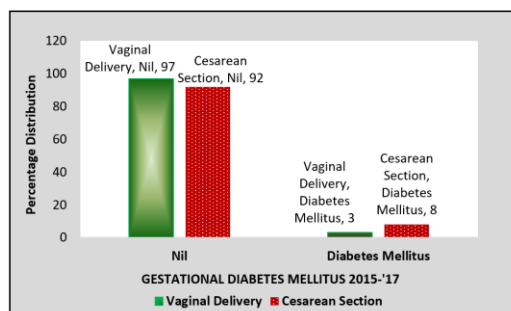
Figure 11: Incidence of GDM by vaginal delivery and cesarean section 2015-17.

Logistic regression

Logistic regression between 3% (n=44/1450) vaginal delivery complicated by GDM compared to 8% (n=83/1159) cesarean section was highly statistically significant (OR 2.78 [95% CI 1.93,4.02]; p<0.001). However, problems due to GDM with macrosomia causing CPD or intrauterine sepsis due to maternal infections such as urinary tract infections etc. with indication of fetal distress for cesarean section. Logistic regression with and without GDM in vaginal delivery and cesarean section in 2015-'17 seen in (Table 9).

GESTATIONAL DIABETES MELLITUS					
Category GDM	Vaginal Delivery No. (%)	Cesarean Section No. (%)	Odds Ratio	(95% Conf. Interval)	p>|z|
Yes	44 (3.03)	93 (8.02)	2.78	1.93, 4.02	<0.001
No	1406 (96.97)	1066 (91.98)	Ref		

Table 9: Logistic Regression for gestational diabetes in vaginal delivery and cesarean section in 2015-17 cohort.

Pregnancy induced hypertension (PIH)

Overall incidence of pregnancy Induced Hypertension (PIH) was 5.8% (*n*=151/2609). However, low 4% (*n*= 58/1450) vaginal delivery was complicated with PIH contrasted to twice higher 8% (*n*=93/1150) in cesarean section. Incidence of PIH by vaginal delivery and cesarean section seen in (Figure 12).

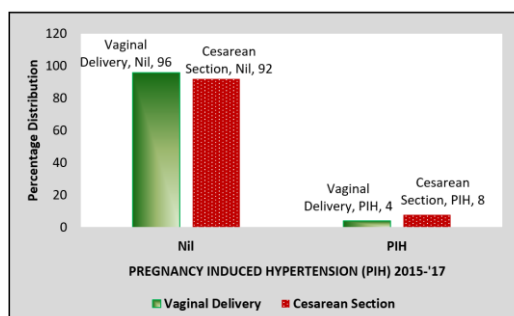**Figure 12:** Incidence of PIH in vaginal delivery and cesarean section in 2015-17.

Logistic regression

Among 2609 births, of 1450 vaginal delivery 4% (*n*=58/1450) complicated with PIH, contrasted to twice as much 8%, (*n*=93/1159) cesarean section, being highly statistically significant (OR 2.09 [95% CI 1.49, 2.93]; *p*<0.001). Logistic Regression in pregnancy section with and without PIH in relation to vaginal delivery and

cesarean section during 2015-'17 seen in (Table 10).

PREGNANCY INDUCED HYPERTENSION (PIH)					
Category PIH	Vaginal Delivery No. (%)	Cesarean Section No. (%)	Odds Ratio	(95% Conf. Interval)	P>|z|
Yes	58 (4.00)	93 (8.02)	2.09	1.49, 2.93	<0.001
No	1392 (96.00)	1066 (91.98)	Ref		

Table 10: Logistic Regression of PIH in relation to vaginal delivery and cesarean section 2015-17.

Neonatal factors –birthweight

Among total 2584 births in 500g birthweight categories, majority 38% (*n*=985/2584) weighed between 2500-2599g more 57% (*n*=567/985) were vaginal delivery compared to lower 42.4% (*n*=418/985) caesarean section, similarly also 34% (*n*=882/2540) newborns in the birthweight category 3000-3499g, most 57.3% (*n*=506/882) were vaginal delivery with slightly lower 42% (*n*=376/882) by caesarean section and increasing birthweight 7.3% (*n*=188/2584) weighing 3500-3999g majority 59.6% (*n*=110/188) were cesarean section contrasted to lower 41.5% (n=78/188) vaginal delivery. Similarly, 0.8% (*n*=21/2584) weighing ≥ 4000g had nearly three quarters 71.4% % (*n*=15/21) cesarean section to 28.5% % (*n*=6/21).

Indicating increased birthweight causing undetected CPD with fetal distress resulted in obstetric surgical intervention. While 2.4% (n=62/2584) weighing 1500-1999g had equal distribution of 50% each for cesarean section and vaginal delivery, however extremely low birth weight ≤999 comprised only 0.6% (n=16/2584) with 62.5% (n=10/16) vaginal delivery to one-third 37.5% (n=6/21) cesarean section as well as very low birth weight 1.2% (n=31/2584) weighing 1000-1499g most 54.8% (n=17/31) were vaginal delivery to 45.1% (n=14/31) cesarean section and 15.4% (n=399/2584) weighing 2000-2499 had 56% (n=244/399) vaginal delivery and 43.8% (n=175/399) cesarean section. Distribution of births by birthweight by vaginal delivery and cesarean section seen in Table 11 and percentage distribution of births by vaginal delivery and cesarean section by 500g Birthweight category during 2015-'17 seen in (Figure 10).

Birthweight In grams	Vaginal delivery	Cesarean section	Total
≤999	10	6	16
1000-1499	17	14	31
1500-1999	31	31	62
2000-2499	224	175	399
2500-2999	567	418	985
3000-3499	506	376	882
3500-3999	78	110	188
≥4000	6	15	21
Total	1439	1145	2584

Table 11: Distribution of births by birthweight in relation to vaginal delivery and cesarean section 2015-17.
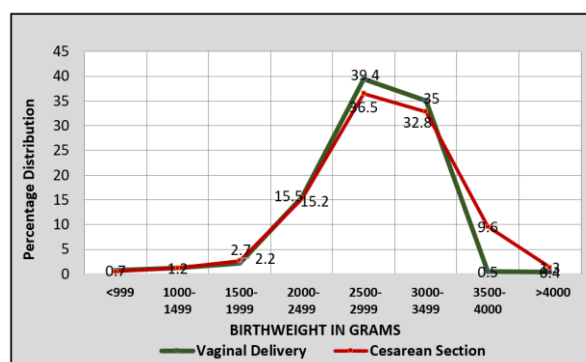
Figure 13: Percentage distribution of vaginal delivery and cesarean section by 500g Birthweight category 2015- '17.

However distribution of live births in relation to birthweight in the 1983 cohort revealed similarly a majority 42.9% (*n*=1915/4348) weighed 2500-2999g, next 22.6% (*n*=1009/4348) in birthweight category 3000-3499g, followed by 21.5% (*n*=961/4348) weighing 2000-2499g and 4.6% (*n*=205/4348) weighed 3500-3999g. Extremely low birth weigth 0.8% (*n*=351/4348), very low birthweight 1000-1499g 2% (*n*=89/4348) and 5% (*n*=112/4348) weighed 1500-1999g while 5.1% (*n*=227/4348) weighed ≥3500g. While biphasic pattern of 38% and 34% in 2500-2999g and 3000-3499g birthweight category in 2015-'17 cohort, indicate improved nutrition in recent times resulting in higher birthweight compared to 22.6% in 1983 in 3000-3499g category. The comparision of birthweight distribtuion in 2015-'17 and 1983 is seen in (Figure 14).
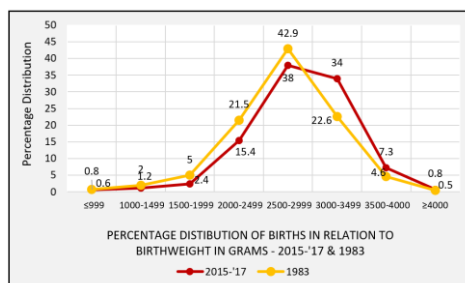
Figure 14: Percentage distribution of birthweight in 2015-'17 and 1983 cohorts.

Logistic regression

Among 1,439 vaginal delivery 20% were Low Birth Weight (LBW) weighed ≤2499 g similarly also among 1,145 cesarean section 20% were ≤2499 g, hence not of statistical significance. The Logistic Regression for LBW ≤2499g and ≥2500g in relation to vaginal delivery and cesarean section - 2015-'17 seen in (Table 12).

BIRTH WEIGHT					
Category Birthweight	Vaginal Delivery No. (%)	Caesarean Section No. (%)	Odds Ratio	(95% Conf. Interval)	p>|z|
≤2499 g	282 (19.60)	226 (19.74)	1.00	0.83, 1.22	0.929
≥2500 g	1157 (80.40)	919 (80.26)	Ref		

Table 12: Logistic Regression for LBW ≤2499g and ≥2500g in relation to vaginal delivery and cesarean section - 2015-17.

Gestational age

Gestational age at birth majority 30% (n=324/1086) cesarean section, peaked at earlier 38 weeks term gestation followed by peak 30% (n=416/1384) at later 39 weeks among vaginal delivery followed by 27% (n=377/1386) at 38 weeks term gestation. However, at 37 weeks gestation more 19.6% (n=213/1086) cesarean section contrasted to only 13% (n=185/1384) vaginal deliveries. Though, overall, most 56% (n=1384/2472) were vaginal delivery. However, at 40 weeks gestation more 19% vaginal delivery contrasted to 14% cesarean section. Distribution of births by vaginal delivery and cesarean section by gestation in 2015-'17 cohort seen in (Figure 11).
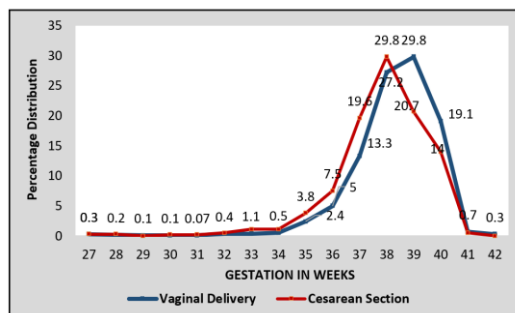

Figure 15: Percentage distribution of vaginal delivery and cesarean section in relation to Gestation in 2015-17cohort.

Mean gestation

The mean gestation in 1983 cohort for vaginal delivery was 38.3 weeks, S.D 2.42 while cesarean section was 37.94, weeks, SD 2.48. The, 50th% being 38.6 and 38.2 weeks for vaginal delivery and cesarean section resp. while instrumental delivery, vacuum extraction and Outlet forceps applied late during prolonged traumatic vaginal to cut short second stage was at later 38.4 weeks and 38.75 weeks respectively with 50th % being 39 weeks for both. The mean gestation at birth and 25th%, 50th% and 75th% during 1983 seen in (Table 13).

Gestation	Mean	S.D.	25th%	50th%	75th%
Vaginal delivery	38.3	2.42	38	38.6	39.5
Cesarean Section	37.94	2.48	37.2	38.2	39.2
Vacuum Extraction	38.4	1.34	38	39	39.6
Outlet Forceps	38.75	1.34	38.1	39	40

Table 13: Mean gestation at birth and 25th%, 50th% and 75th%according to mode of delivery 1983.

Logistic regression

Logistic regression in 2015-'17 cohort revealed preterm newborns ≤36 weeks, most 15% (n=163/1086) were born by cesarean section to 10% (n=132/1386) vaginal delivery. Contrasted for term newborns ≥37 weeks, more 90% (n=1254/1386) were vaginal deliveries to 85% (n=923/1086) cesarean section, highly statistically significant p <0.001. Logistic Regression in relation to preterm ≤36 weeks and term ≥37 weeks gestation by vaginal delivery and cesarean section - 2015-'17 cohort seen in (Table 14).

GESTATION IN WEEKS					
Category Gestation	Vaginal Delivery No. (%)	Caesarean Section No. (%)	Odds Ratio	(95% Conf. Interval)	p>|z|
≤36 weeks	132 (9.52)	163 (15.01)	1.67	1.31, 2.14	<0.001
≥37 weeks	1254 (90.48)	923 (84.99)	Ref		

Table 14: Logistic Regression in relation gestation for vaginal delivery and cesarean section for preterm <37 weeks and term ≥37 weeks 2015-17.

Neonatal complications

Among a total 2609 births with neonatal complications at birth, majority 46% (n=532/1159) newborns born by cesarean section included birth asphyxia, sepsis, transient, tachypnea of newborn, meconium aspiration syndrome etc as common indication was fetal distress with maternal or obstetric risks for emergency section or elective section, only 54% (n =627/1159) were healthy babies. Low incidence of 22.6% (n=329/1450) among vaginal delivery had neonatal morbidity with relatively good outcome in 77% (n=1121/1450) being healthy newborns. Distribution of neonatal complications in newborns born by vaginal delivery and cesarean section seen in (Figure. 16).
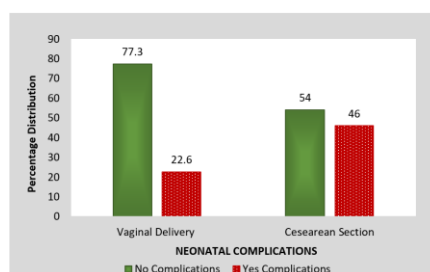
Figure 16: Percentage distributions with neonatal complications among vaginal delivery and cesarean section 2015- '17.

Logistic regression

Increase incidence 46% neonatal complications occurred among cesarean section births, fetal distress being a common indication for emergency section was highly statistically significant p<0.001, compared to 22% complications in vaginal delivery, 77% being healthy newborns to only 54% cesarean section deliveries. Logistic regression for neonatal complications among vaginal delivery and cesarean section in 2015-17 cohort seen in (Table 15).

NEONATAL COMPLICATIONS					
Category Complications	Vaginal delivery No. (%)	Cesarean Section No. (%)	Odds Ratio	(95% Conf. Interval)	p>|z|
Yes	329 (22.69)	532 (45.90)	2.89	2.44, 3.42	<0.001
No	1121 (77.31)	627 (54.10)	Ref		

Table 15: Logistic Regression for newborns with and without neonatal complications by vaginal delivery and cesarean section - 2015- '17.

Birth asphyxia

Among 2609 births overall 19.6% were asphyxiated at birth, however a high 30% (*n*=346/1159) cesarean section had birth asphyxia as fetal distress due to hypoxia being a common indication for emergency section while 70% (*n*= 813/1159) were healthy. In contrast a low 11.4% (*n*=166/1450) suffered birth asphyxia by vaginal delivery, the majority 88.5% (*n*=1284/1450) being healthy. The distribution of birth asphyxia among vaginal delivery and cesarean section in 2015-'17 seen in (Figure 17).
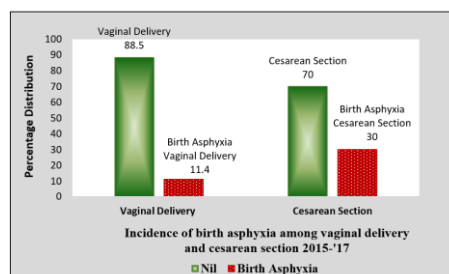
Figure 17: Incidence of birth asphyxia in vaginal delivery and cesearean section 2015- '17.

Logistic regression

Among 2609 births by caesarean section 30% (n=346/1159) suffered from birth asphyxia, being nearly three times higher to vaginal delivery with 11.4% (n=166/1450) being highly statistically significant p<0.001. Logistic regression for newborns with and without birth asphyxia by vaginal delivery and cesarean section – 2015-17 seen in (Table 16).

BIRTH ASPHYXIA					
Category Birth Asphyxia	**Vaginal delivery No. (%)**	**Cesarean Section No. (%)**	**Odds Ratio**	**(95% Conf. Interval)**	**p>|z|**
Yes	166 (11.4)	346 (29.85%)	3.29	2.68, 4.04	<0.001
No	1284 (88.5)	813 (70.15%)	Ref		

Table 16: Logistic Regression for newborns with and without birth asphyxia by vaginal and cesarean section – 2015- '17.

Early onset neonatal sepsis (Eons)

Overall incidence was 8.7% (*n*=227/2609) of early onset neonatal sepsis, however a lower incidence of 7.4% (n=108/14500 was noted in vaginal delivery compared to high incidence of 10.3% (n=119/1159) cesarean section, as fetal distress due to intrauterine infections may be indication for cesarean section. The distribution of early onset neonatal sepsis among vaginal delivery and cesarean section 2015-'17 seen

in (Figure 16).
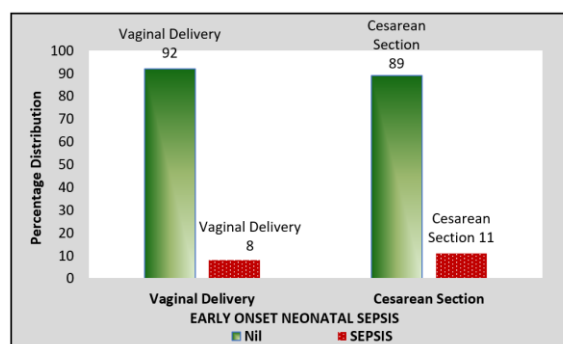
Figure 18: Incidence of early onset neonatal sepsis in vaginal delivery and cesarean section 2015- '17.

Logistic regression

Among vaginal delivery 7.4% (*n*=108/1450) presented with early onset neonatal sepsis, while higher 10.3% (*n*=119/1159) caesarean section being statistically significant *p*=0.011. Logistic regression for newborns with and without early onset neonatal sepsis by vaginal delivery and cesarean section – 2015-17 seen in (Table 17).

EARLY ONSET NEONATAL SEPSIS					
Category EONS	Vaginal delivery No. (%)	Cesarean Section No. (%)	Odds Ratio	(95% Conf. Interval)	p>|z|
Yes	108 (7.45)	119 (10.27)	1.42	1.08, 1.86	0.011
No	1342 (92.55)	1040 (89.73)	Ref		

Table 17: Logistic regression for Early Onset Neonatal Sepsis (EONS) by vaginal and cesarean section 2015- '17.

Sex distribution

Among consecutive live births there was almost equal distribution of 49.98% (*n*=1288/2577) males to 50% (*n*=1,289/2577) females a difference of 0.1%. However, among vaginal deliveries more 51.7% (*n*=746/1433) females as opposed to less 48.7% (n=697/3 males. Significantly more males 52.1% (*n*=591/1134) among cesarean section as opposed to females 47.88% (*n*=543/1134) born by cesarean section. The distribution of male and female birth by vaginal delivery and cesarean section seen in (Figure 9).

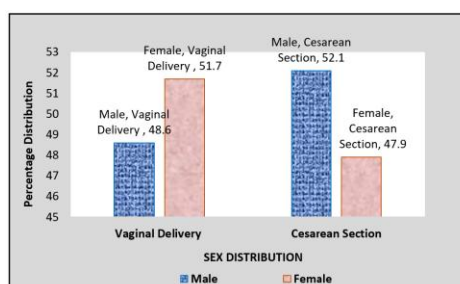**Figure 19**: Sex distribution in vaginal delivery and cesarean section 2015-17.

Discussion

The incidence of cesarean section increased dramatically threefold to 42.1% noted in 2015-'17 cohort compared to only 13.2% during 1983. The overall cesarean section rate in India is 21.5%, however it varies from state to state with perinatal mortality rate (PMR) of 18.97‰ in 2022 [5]. Upward trend is also observed world-wide, United States reported an increase to 32.1% in 2022 from 22.7% in 1996 with one in three women giving birth by cesarean section and 31.2% were primigravidae, however, the rapid increase in cesarean birth rates from 1996 to 2022 without clear evidence of concomitant decreases in maternal or neonatal morbidity or mortality raises significant concern that cesarean delivery is overused [18, 19]. The 2021 PMR in US being 5.5‰ in declining from 30‰ in the fifties [20]. Similarly, in UK the cesarean section rate is 31% in 2022 but latest rates are inching towards 42% with most 28% in age group 25-34 years opting for Cesarean section with around 16% elective section and the PMR being 5.04‰ [21].

The perinatal mortality rate in 1983 cohort was 33.4‰ for vaginal delivery to high 45.3‰ for cesarean section. A gradual increase in vaginal delivery from 50% in primigravida to 85% for 5+ multi gravida was noted with corresponding increase in PMR from 50.2‰ to 86% for 5+ multi gravida in 1983 cohort. In contrast incidence of cesarean section in 1983 cohort was 18.3% in primigravida decreased to 7% in 5+ multigravida associated with dramatic increase in PMR from 57.8‰ for primigravidae to 230‰ in 5+gravida indicating grave risks in multigravidas. While third gravida mothers in 1983 cohort registered low PMR 19.5‰ for vaginal delivery and 25.6‰ for cesarean section [22].

The incidence of births in relation to gravida between 2015-'17 cohort and 1983 cohort revealed almost equal distribution 32% and 30 % respectively for primigravida subsequently dipped to 22.9% in 1983 with a peak of 27.3% for third gravida mothers in 1983 cohort while 2015-'17 cohort showed steady decline with increasing parity. Indicating a demographic shift from large family in 1983 to small family norm with one to two children in 2015-'17.

However, majority 32% in 2015-'17 cohort were primigravida of whom 55% had vaginal delivery to 45% cesarean section. Second gravidas in 30% most 57.6% had vaginal delivery to 42.3% cesarean section. While third gravida mothers 21.9% had almost equal 50.9% vaginal delivery to peak 49% cesarean section. Fourth gravida comprising 10.3% had 59% vaginal delivery to 41% cesarean section. Low incidence of 5.9% multi-5+ gravida mothers had maximum 60.2% vaginal delivery to lower 39.8% cesarean section. Contrasted sharply to 1983 cohort with 30% primigravida mothers who had high 97.6% vaginal delivery to 2.3% cesarean section. Among 22.9%, second gravida mothers, 81.5% had vaginal delivery to peak 18.5% cesarean section. For 27.3% third gravida mothers 93% had vaginal delivery to 7% cesarean section. Among 12% fourth gravida mothers 93% had vaginal delivery to 7% cesarean section. While 7.6%, multi para 5+, 94% had vaginal delivery and 6% cesarean section. Thus, cesarean section remained above 40% regardless of gravida in 2015-'17 cohort but decreased with increasing gravida in 1983 cohort.

Peak gestation 30% births in third gravida mothers occurred at 38 weeks, indicating better maternal and neonatal outcome, followed by 27% second gravida and 22.5% fourth gravida mothers at 38 weeks gestation, contrasted to majority 27.6% primigravida peaked later at 39 weeks with difficult vaginal delivery with resort to emergency cesarean section. Multigravida 5+ show biphasic peaks of 26.5% at 37

weeks and 22.5% at 39 weeks gestation in 2015-'17 cohort.

Teenagers comprised 8.6% during 2015-'17, most 61.6% had vaginal delivery to 38.3% cesarean section. Young 38.9% mothers aged 20-24 years, 61.8% had vaginal delivery to 38.2% cesarean section, while 34.7% older 25-29 years mothers had similar distribution of 51.7% vaginal delivery to 48.3% cesarean section. Similarly, 15.9% aged 30-35 years, nearly equal 51% vaginal delivery to 49% cesarean sections, while 1.8% elderly mothers ≥35 years had slightly higher incidence 52% cesarean section compared to 48% vaginal delivery. Thus, older mothers ≥ 25 years were subjected to slightly more cesarean sections than younger mothers.

In contrast 13%, teenaged mothers in 1983, majority 89.3% had vaginal delivery to 10.7% cesarean section, while 15.9% aged 20-24 years had 88.8% vaginal delivery to 11.2% cesarean section, contrasted to peak 50% older 25-29 years mothers who had 87.6% vaginal delivery to 12.4% cesarean section, however mothers aged 30-34 years comprised 16.2%, more 80.7% had vaginal delivery to 19.3% cesarean section. While among 4.8% elderly mothers aged ≥35 years, 79.6% were vaginal delivery with peak 20.4% cesarean section.

The percentage distribution of births in relation to maternal age and mode of delivery in 1983 cohort revealed that nearly 40% of mothers in the age group 25 to 29 years had the highest incidence 73.3% of cesarean section. High PMR was noted for cesarean section of 40.8‰ in teenagers decreased to a minimum 17.4‰ for 20-24 years; thereafter increase to 44.8‰ in 25-29 years age group, to 45.8‰ for 30-34 years to a high 60.6‰ above 35 years mothers. In contrast PMR for vaginal delivery ranged from 57.1‰ in teenagers, to 36.8‰ for 20-24 years with least 27.5‰ in 25-29 years age group, thereafter increased to 59.6‰ for 30-34 years and to 66.7‰ for 35 years and above. The incidence of cesarean section increased with maternal age from 10.7% in teenagers to 20% in those above 35 years associated with high PMR ranging from 50-70. Risk for Cesarean section increased with maternal age in 1983 cohort from 10% to 20% while incidence of vaginal delivery was maximum 73% for 25-29 years increased with maternal age. Thus, increase maternal age is at increased risk for cesarean section [23].

Thus higher 43% cesarean section was noted for mothers aged 20-24 years and 34% in 25-29 years, while teenage and older mothers above 30 years also had higher incidence of cesarean section compared to vaginal delivery. Thus, older mothers were more subjected to cesarean sections. Logistic Regression for cesarean section and vaginal delivery between young mothers below and above 25 years was highly statistically significant OR 0.65 [95% CI 0.55,0.76]; p<0.001. In fact, older mothers had higher incidence cesarean section when compared to younger mothers below 24 years who had higher 52% vaginal delivery to 34.7% cesarean section. Other studies show increased cesarean section rates 43.1% above 40 years and only 11.6% younger than 25 years [8, 23].

The comparison of peak delivery in 2015-'17 revealed 38.9% were young mothers aged 20-24 years followed by 34.7% in mothers aged 25-29 years with subsequent progressive decline of older mothers, contrasted to peak 50% or half of all births to older mothers aged 25-29 years with 15.9% and 16.2% for maternal ages 20-24 years and 30-34 years. Indicating that in recent times there is a demographic shift of

small family norm in younger mothers.

Obstetrical complication of pre-labor rupture of membranes PROM) is more frequent in developing countries with increased risk for cesarean section is an important problem in obstetric practice. In the present study overall PROM occurred in 7.2% consecutive live births in 2015-'17 cohort, however, among vaginal delivery PROM was only 6% compared to higher 9% for caesarean sections as PROM is often an indication due to prolonged labor, fetal distress, malpresentation, cephalopelvic disproportion, failed induction, birth asphyxia, sepsis etc. Logistic Regression of PROM between cesarean section and vaginal delivery being highly statistically significant OR 1.53 [95% CI 1.08, 1. 1.13, 2.06]; p=0.005. PROM being an indication for cesarean section more so if meconium-stained liquor and fetal distress.

PROM is abnormal prior to the onset of clinically apparent labor contractions while spontaneous rupture of membranes (ROM) is a normal component after onset of labor. Etiology of PROM is probably infection and may be preventable with proper antenatal screening and treating of genito-urinary infections etc. Literature also reports that PROM is associated with an increased risk of cesarean delivery common indications being fetal distress, malpresentation, cephalopelvic disproportion and failed induction [24], another study reported high 28% PROM among cesarean section in Iran [25] similarly also West Bengal 26.6% [26]   Common maternal complications of PROM are chorioamnionitis, retained placenta, endomyometritis, wound infection, pelvic abscess, bacteremia and postpartum hemorrhage while early onset neonatal sepsis has serious consequences [27].

The management of PROM includes immediate labor induction in pregnant woman at term in absence of other maternal and fetal contraindications however pre-term PROM is more complex and carries risk of prematurity and other related fetal complications [28, 29]. However, planned early birth resulted in decrease risk of maternal infections such as chorioamnionitis and/or endometritis than expectant management following term prelabour rupture of membranes. Randomized controlled trials of planned early birth are more likely to have their labor induced compared with expectant management in women with PROM at 37 weeks' gestation or later included ten trials assessing intravenous oxytocin; twelve trials assessed prostaglandins (six trials in the form of vaginal prostaglandin E2 and six as oral, sublingual or vaginal misoprostol) without an apparent increased risk of caesarean section [30].

Gestational Diabetes Mellitus with overall incidence of 5.2% among 2609 live births, contrasted 8% in cesarean section being nearly three times higher to 3% vaginal delivery in 2015-'17 cohort. Thus, logistic regression of GDM between cesarean section to vaginal delivery is highly statistically significant OR 2.78 [95% CI 1.93,4.02]; p<0.001. Though vaginal delivery is possible the increased risk of a large baby with shoulder dystocia, perineal laceration, primary postpartum hemorrhage (PPH), sepsis, or undetected genitourinary tract infections predisposes to early onset neonatal sepsis, fetal distress etc. are often indication for cesarean section results in improved maternal and neonatal outcome [31, 32].

Pregnancy Induced Hypertension (PIH) overall incidence of 5.8% had high 8% among Cesarean section as compared to one-half of 4% in vaginal delivery was highly statistically significant p<0.001 in the 2015-'17 cohort. PIH defined as systolic blood pressure ≥140 mmhg or diastolic blood pressure ≥90 mmhg or both

after 20 weeks of gestation and broadly classified as gestational hypertension, proteinuria ≥300mg/24 hours or protein/creatinine ratio ≥0.3mg/dl, pedal edema as pre-eclampsia with convulsions as eclampsia. Severe hypertension increases mother's risk of cardiac failure, heart attack, renal failure and cerebrovascular accidents, in addition fetus is at risk for poor placental transfer of oxygen, growth restriction, preterm birth, placental abruption, stillbirth and neonatal death and a main cause of maternal mortality if appropriate preventive measures are not undertaken. Complications like seizures (eclampsia), placental abruption and fetal distress or even death due to placental dysfunction during vaginal delivery can be mitigated, as the only cure for preeclampsia is birth of baby [33].

 The overall incidence of pregnancy Induced Hypertension (PIH) in 2015-'17 cohort was 5.8%. Low incidence of 4% by vaginal delivery contrasted with twice higher 8% in cesarean section being highly statistically significant, OR 2.09 [95% CI 1.49, 2.93]; p<0.001. Early delivery by cesarean section preferably elective section as opposed to emergency section is safer for both mother and baby. Thus, PIH significantly increases like hood of cesarean section compared to vaginal delivery with potential for early induction of labor [33].

Neonatal factor of birthweight among total 2584 births, majority 38% weighed between 2500-2599g, with 57% vaginal delivery to 42.4% caesarean section, similarly also 34% weighing 3000-3499g, also 57.3% were vaginal delivery to 42% caesarean section, however, increasing birthweight 3500-3999g in 7.3%, majority 59.6% were cesarean section contrasted to 41.5% vaginal delivery. Similarly, 0.8% with ≥ 4000g had nearly three quarters 71.4% cesarean section to 28.5%. vaginal delivery. Indicating increased birthweight causing undetected CPD with fetal distress resulted in obstetric surgical intervention. Thus, cesarean section was more common in larger babies weighing >3500g usually due cephalo-pelvic disproportion with macrosomic fetuses presenting with prolonged labor, fetal distress with resort to cesarean section However low birth weights below 2499g had almost equal vaginal delivery and cesarean section rates but not statistically significant.

In 1983 cohort most 42.9% weighed 2500-2999g, next 22.6% in higher 3000-3499g, followed by 21.5% with 2000-2499g contrasted to almost biphasic pattern of 38% and 34% in 2500-2999g and 3000-3499g birthweight category in 2015-'17 cohort indicating improved nutrition in recent times with higher birthweight compared to 22.6% in 1983 in 3000-3499g category.

Gestation had significant influence on outcome on mode of delivery, most 30% cesarean section, peaked at 38 weeks with 20.7% at 39 weeks, while 19.6% had preterm 36 weeks gestation. In contrast peak 30% vaginal delivery occurred at 39 weeks and 27% at 38 weeks with 19% at 40 weeks, indicating difficult vaginal delivery due to increase fetal weight gain due to prolonged gestation. The mean gestation in 1983 cohort for vaginal delivery was 38.3 weeks, S.D 2.42 while cesarean section was 37.94, weeks, SD 2.48. The, 50th% being 38.6 and 38.2 weeks for vaginal delivery and cesarean section resp. while instrumental delivery, vacuum extraction and Outlet forceps applied late during prolonged traumatic vaginal to cut short second stage was at later 38.4 weeks and 38.75 weeks respectively with 50th % being 39 weeks for both. Logistic regression in 2015-'17 cohort among 15% preterm ≥36 weeks by cesarean section to 9.5% vaginal delivery contrasted to 90.5% term newborns by vaginal delivery to 85% cesarean section being

highly statistically significant, OR 1.67 [95% CI 1.31, 2.14]; p<0.001. Thus, low birthweight is 1.24-fold higher to normal birthweight as well as preterm gestation have higher chances for cesarean section due to potential complications of higher risks for both baby and mother complicated by PIH, GDM, sepsis etc. [34, 35]

Neonatal complications among newborns by vaginal delivery was 22.6% majority 77.3% being healthy, contrasted to high 46% morbidity in cesarean section, as fetal distress is a common indication for emergency section is highly statistically significant OR 2.89 [95% CI 2.44, 3.42]; p<0.001.Study has reported high 69% neonatal mortality in cesarean section with no prior labor complications or procedures when compared planned vaginal delivery assumes importance given the rapid increase in the number of primary cesarean sections without a reported medical indication [36]. Maternal and neonatal adverse outcomes were more so in emergency operative deliveries including elective and emergency cesarean section, associated with three times moderate blood loss compared to unassisted vaginal delivery and twice as likely in operative vaginal delivery [37]. The risk of shoulder dystocia associated with increased birthweight, diabetes, induction of labor, use of epidural analgesia at delivery, prolonged labor, forceps-assisted and vacuum-assisted delivery, parity and gestation but not with post-term delivery reported in Norway [38]. Thus, both maternal and neonatal morbidity and mortality were higher in cesarean section rather than vaginal delivery [37]. Neonatal complication by cesarean section compared to vaginal delivery was highly statistically significant, OR 2.89 [95% CI 2.44, 3.42]; p<0.001 in 2015-'17 cohort.

The overall incidence of birth asphyxia was 20% among 2750 consecutive live births, however incidence of birth asphyxia was low 11.4% for vaginal delivery with 88.5% healthy newborns, contrasts to cesarean sections with high 30% asphyxiated newborns. Thus, birth asphyxia being three times higher in cesarean section compared to vaginal delivery was highly statistically significant OR 3.29 [95% CI 2.68, 4.04]; p<0.001 in 2015-'17 cohort, common indication for cesarean section often being fetal distress.

The incidence of early onset neonatal sepsis was 8.7% for total live births, however high incidence of 10.3% noted among cesarean section compared to 7.4% vaginal delivery, being statistically significant OR 1.42 [95% CI 1.08, 1.86]; p<0.01. An almost equal sex distribution, male to female ratio of 1:1 with slightly more 52.1% males born by cesarean section as opposed to 51.7% more females by vaginal delivery.

Cesarean section also increases adverse neonatal outcomes such as neonatal intensive care unit admission, including perinatal deaths with higher 1.77 per 1,000 live births 1.77 per 1,000 live births neonatal mortality in cesarean section contrasted to 0.62‰ in vaginal delivery [39]. In fact, cesarean section with no labor complications or procedures has a 69 percent higher risk more so in emergency operative deliveries than planned vaginal deliveries is of importance. Moderate blood loss was three times higher in elective and emergency cesarean section than in unassisted vaginal delivery and twice as likely in operative vaginal delivery. Therefore, cesarean section should only be practiced when conditions clearly demand it, given the recent rapid increase in the number of primary cesarean deliveries without a reported medical indication as well as relationship between cesarean delivery rate and high maternal and neonatal mortality [40].

Usually, labor is heralded by rupture of membranes and/or onset of uterine contractions initially occasional gradually increases both in intensity and frequency. Labor is divided into three stages: first, second and third stage, though fourth stage may also be included. The first stage is further subdivided into latent and active phase [41]. False labor pains or spurious labor occur more common in primigravida usually appearing one or two weeks prior to onset of true labor pain, or a few days earlier in multipara. prelabor or "lightening" occurs when the head sinks into the pelvic outlet or gets engaged. False labor pains are distinguished by its dull, continuous pain or discomfort usually confined to the lower abdomen and unrelated to hardening of the uterus with no effect on dilation of the cervix, usually relieved by sedation or enema. Often uterine contraction in ethnic Asian between 34-37 weeks of pregnancy is considered as 'false labor pains and pregnancy prolonged to 40 weeks EDD, however labor be allowed to progress with delivery of small, healthy baby, who after birth will feed avidly and gain extra uterine weight, instead of intrauterine weight gain predisposing to difficult vaginal delivery with cephalopelvic disproportion leading to emergency cesarean section with indication of fetal distress.

The latent phase or early labor starts with maternal perception of regular contractions causing effacement the cervix which gradually effaces or thins out and dilates from 1 to 4 cm. normal duration varies from 8– to 12 hours and prolonged when it exceeds 20 hours in primiparous and 14 hours in multiparous women. On average, active labor usually lasts about four to eight hours cervical dilates normally from about 4 to 10 centimeters or about 1-1.5 cm every hour.

Cervical dilation occurs as a result of uterine contractions and the counter pressure applied by the bag of membranes and the presenting part. A well flexed fetal head closely applied to the cervix favors efficient dilation and pressure applied evenly to the cervix causes the uterine fundus to respond by contractions. Cervix will not dilate until effacement is complete. Effacement is the inclusion of the cervical canal into the lower segment; this may usually occur late in pregnancy or after labor begins. In primigravida the cervix will not dilate until effacement is complete. In multigravida effacement and dilation may occur simultaneously.

The active phase has a more rapid rate of 1-1.5 cm cervical dilation per hour. However, an interval of arrest of 4 hours was significant only after 6 cm dilation as cervical dilation is not related to time. Abnormalities of active phase labor include protraction disorders with slower progress than normal and cervical dilatation <1.2 cm/h in primigravida and <1.5 cm/h in multigravida or arrest with no cervical change for 2 hours or more in the presence of adequate uterine contractions and cervical dilation of at least 4 cm. However, from 4–6 cm both primigravida and multigravida dilated at essentially the same rate but beyond 6 cm, multiparous women dilated more rapidly. The maximal slope in the rate of change of cervical dilation over time in active phase often does not start until at least 6 cm, full dilation of cervix equates to about 10 cm diameter [42].

Diagnosis of failure to progress is the most common indication for intrapartum cesareans section based on assessment of cervical dilation and station over time and fetal descent earlier according to labor curves of Friedman with cervical dilation to time derived from mothers with spontaneous onset of labor however with induction of labor, new labor curves of dilation and station improve the accuracy of predicting labor

progress. Two labor disorders arrest of dilation and arrest of descent are primary indication in nearly 50% of all intrapartum cesarean section however not just time alone though women with labor dystocia may deliver vaginally a longer first stage of labor is associated with adverse maternal and neonatal outcome.

The last part of active labor when the cervix dilates from 8 to 10 centimeters is called transition phase because it marks the shift to the second stage of labor. pitocin generally speeds up the active phase, while epidural anesthesia, tend to make it last longer. The cervix finishes dilating and makes the transition from opening to pushing. Contractions are now powerful and efficient so this phase is usually short, less than one hour with full cervical dilation and ends with the birth of the baby has two phases, propulsive phase, fetus moves down the birth canal due to the pressure exerted by the contracting uterus referred to as the "pushing" phase when "crowning" occurs and the expulsive phase with delivery of the baby.

Thus, increasing rate of cesarean delivery has significantly decreased the rates of operative vaginal deliveries viz vacuum or forceps and in low-risk pregnancies, cesarean section poses greater risk of maternal morbidity and mortality compared to vaginal delivery as placenta previa increases threefold from one prior cesarean section to three or more prior cesarean section and further complicated with around 40% placenta accrete [43]. Though prolonged labor is high in vaginal delivery, wound infection, surgical injury, maternal death was high in cesarean section, particularly when performed in labor however postpartum hemorrhage occurred regardless of mode of delivery [37]. Cesarean sections are absolutely critical to saving infant lives where vaginal delivery pose risks, though unnecessary surgical procedure can be harmful, both to mother and baby [40, 43].

The average Asian woman is comparatively small when compared to the tall, well-built Caucasian women. In the U.S., only 5 % of mothers had pregnancy weight less than 45.5 kg and 16 % less than 50 kg, compared to 37 % and 68 % of Indian women who weighed less than 46 kg and 51 kg respectively [45]. Correlation between "small' women and high perinatal loss is well documented. Studies have shown that those weighing 45 to 50 kg had a perinatal mortality of 60%. While in those weighing above 52 kg the mortality it was only 7.5 % [46, 47]. The outcome of labor depends on the fetal weight, often small Asian women have small babies with peak 28.1% delivery at 38 weeks, Asian Due Date (ADD) ideally should be at 38 weeks term gestation. Thus, delivery even prior to ADD as early as 34-37 weeks with spontaneous onset of uterine contractions though often termed as false labor pains should be allowed to progress with birth of a healthy small baby and mother instead of prolonging pregnancy to EDD or 40 weeks gestation, well suited for ethnic Caucasian population with peak delivery 31% at 41 weeks gestation [48-50].

Other studies in the west have also noted risks of maternal morbidity such as chorioamnionitis, endometritis, wound infection, uterine atony and/or blood transfusion and cesarean delivery significantly beyond 39 weeks however adverse neonatal outcomes included death, respiratory distress syndrome (RDS), transient tachypnea of newborn (TTN), seizure, sepsis, intraventricular hemorrhage (IVH), hypoglycemia, intubation and ventilator support, 5-min Apgar score ≤3, hypoxic ischemic encephalopathy (HIE) and neonatal ICU admission though not statistically significant if delivered after 39 weeks [51]. While cesarean delivery is firmly established as the safest route of delivery but low-risk, cesarean delivery poses greater risk of maternal morbidity and mortality than vaginal delivery it is important to assess indication

between cesarean and vaginal delivery to prevent overuse of cesarean delivery, particularly primary cesarean delivery [52, 53].

Thus, delivery at 40 weeks gestation proves detrimental to the small Asian fetus with increased mortality [22], hence delivery at 38 weeks term gestation at ADD has best outcome for both mother and baby. Onset of spontaneous contractions from 34 weeks upto 38 weeks, labor should be allowed to progress or induction at 38 weeks [54], facilitating vaginal delivery of a small healthy newborn who after birth will feed avidly and gain extrauterine weight, recommended, as opposed to intrauterine weight gain by prolonging pregnancy up to 40-41 weeks gestation fraught with complications and high maternal and neonatal morbidity and mortality [55].

Conclusion

Rising 42.1% cesarean section rate noted in 2015-'17 from low 13.2% during 1983, high risk factors for cesarean section include primigravida, older mothers ≥25 years (p<0.001), obstetric complications of PROM (p=0.005), GDM (p=0.005), PIH (p<0.001), neonatal factors of prematurity ≤36 weeks (p<0.001) and low birth weight, neonatal complications 46% (p<0.001), birth asphyxia 30% (p<0.001), neonatal sepsis 11% (p<0.001) including male gender. Though peak 30% cesarean section mainly elective took place at 38 weeks gestation, peak 30% vaginal delivery occurred later at 39 weeks gestation. Hence it is recommended that vaginal delivery at 38 weeks term gestation will improve outcome for both mother and baby.

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