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## Original Research Article

# Impact of increase of caesarean section on postpartum hemorrhage in a tertiary care center of India over 6 years

Shikha Madan<sup>1</sup>, Neetu Sangwan<sup>1\*</sup>, Smiti Nanda<sup>1</sup>, Daya Sirohiwal<sup>1</sup>,  
Pushpa Dahiya<sup>1</sup>, Savita Singhal<sup>1</sup>, Tarun Arora<sup>2</sup>

<sup>1</sup>Department of Obstetrics and Gynaecology, <sup>2</sup>Department of Community Medicine, PGIMS, Rohtak, Haryana, India

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**\*Correspondence:**

Dr. Neetu Sangwan,

E-mail: shikhamadan85@gmail.com

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### ABSTRACT

**Background:** PPH (postpartum hemorrhage) is the leading cause of maternal mortality. Despite of all the medical advancement, maternal mortality rates have declined greatly in the developed world, PPH remains a leading cause of maternal mortality elsewhere. Caesarean section is an obstetric intervention where, normal delivery can pose a risk for mother or foetus. The rate of caesarean section has increased worldwide. A survey conducted by WHO found that the worldwide rate of caesarean section increased from 26.4% between 2004 to 2008, to 31.2% between 2010 to 2011.

**Methods:** We collected data of the caesarean sections and patients who developed PPH over 6 years. We studied the association of temporal increase of caesarean section with PPH.

**Results:** Uterine atonicity continues to be the most common etiology of PPH each year, however, there is an increase in tissue abnormality (retained placenta, placenta praevia, accreta, increta, percreta) over years as there is a significant increase in the incidence of caesarean section. Atonic uterus was the most common cause for obstetric hysterectomies and mortality due to PPH every year.

**Conclusions:** Family planning advise is essential in developing country like ours to counsel patients to prevent multiparity, thus reducing PPH. It is also important to train all the health workers in periphery and referral centers to manage the third stage of labor and atonic uterus to save the mothers. Sagacious attitude towards the decision of caesarean section is needed to prevent maternal morbidity and mortality.

**Keywords:** Caesarean section, Postpartum hemorrhage, Tissue abnormality

### INTRODUCTION

A survey conducted by WHO found that the worldwide rate of caesarean section increased from 26.4 % between 2004 to 2008, to 31.2 % between 2010 to 2011.<sup>1</sup> Despite of a steep decline in the maternal mortality ratio (MMR) in India, the most common direct cause of maternal mortality continues to be the postpartum haemorrhage.<sup>2</sup> According to the WHO, PPH affects approximately 5% of all women who give birth. It is not only associated with nearly one quarter of all maternal deaths but also the leading cause of maternal mortality in low income countries.<sup>3</sup> Caesarean section is an obstetric intervention where normal delivery can pose a risk for mother or

foetus. The recommendations by WHO in 1985 were to limit national caesarean section rate to 10-15%.<sup>4</sup> This rate however did not take into account the morbidity both fetal and maternal. In 2015, WHO issued a new statement that caesarean section to be provided to the women in need, rather than to achieve any specific rate.<sup>5</sup> This study was conducted to know the impact of temporal increase of caesarean section on postpartum haemorrhage in a limited resource country.

### METHODS

We conducted a retrospective observational study in Obstetrics and Gynecology department of PGIMS,

Rohtak from January 2014 to December 2019. All the patients who had PPH were included in the study. They were divided into four groups (G1) those with unscarred uterus, group 2 (G2) those with previous one caesarean section, group 3 (G3) those with previous 2 caesarean section and group 4 (G4) those who have had more than or equal to 3 caesarean section. Each group G 1, 2, 3, 4 was then divided based on the etiology of PPH. Comparisons were made and conclusions drawn on the impact of increased sections on PPH. We have applied one sample t test and paired sample t test on the data. Ethical approval was not taken since it was a retrograde observational study.

## RESULTS

The demographic profile of patients from 2014 to 2019 were comparable. The patients who had PPH were divided into gravida 1, gravida 2, gravida 3, gravida 4 and above. It was observed that most of the patients who had PPH were either gravida 3 or more than or equal to gravida 4. This observation was same in all 6 years.

**Table 1: Distribution of normal vaginal deliveries and caesarean section over 6 years.**

Year	Normal vaginal deliveries	Caesarean sections	Total	Increase % of total deliveries each year
2014	7324 (75.09%)	2430 (24.91%)	9754	-
2015	7489 (74.98%)	2500 (25.02%)	9989	2.35%
2016	7789 (73.99%)	2739 (26.01%)	10528	5.1%
2017	7944 (70.64%)	3302 (29.36%)	11246	6.38%
2018	8355 (71.65%)	3306 (28.35%)	11661	3.5%
2019	9630 (72.13%)	3722 (27.87%)	13352	12.6%

The age of the patients was divided into less than 18 years, 18-23 years, 24-29 years, 30-35 years, and more than 35 years. Majority of patients who had PPH were in the age group of 24-29 years and 30-35 years. This is

common because by the time female becomes multi gravida, she is in this age group range. This pattern has been comparable over 6 years.

**Table 2: Distribution of patients with PPH in 4 groups (G1 unscarred uterus, G2 previous 1 caesarean section, G3 previous 2 caesarean section, G4 equal to or more than previous 3 caesarean section).**

Year	Total PPH	G1	G2	G3	G4
2014	327	236 (72.17%)	89 (27.21%)	2 (0.62%)	0 (0%)
2015	330	217 (65.75%)	108 (32.72%)	4 (1.21%)	1 (0.32%)
2016	348	210 (60.34%)	127 (36.49%)	10 (2.87%)	1 (0.3%)
2017	390	266 (68.20%)	116 (29.74%)	8 (2.05%)	0 (0%)
2018	327	216 (66.05%)	96 (29.35%)	15 (4.59%)	0 (0%)
2019	319	196 (61.44)	111 (34.79%)	11 (3.44%)	1 (0.31%)

The total number of vaginal deliveries and caesarean sections in 2014 were 9754, in 2015 were 9989, in 2016 were 10528, in 2017 were 11246, in 2018 were 11661 and in 2019 were 13352.

From Table 1 it can be observed that the total number of normal deliveries and the total number of caesarean sections have increased over 6 years, from being 9754 in 2014 to 13352 in 2019. There has been an increase in delivery percentage each year. By one sample t test the increase in normal delivery and caesarean section were both significant ( $p < 0.05$ ). By the paired sample t test we found that though there was an increase in both normal vaginal deliveries and caesarean section, but the increase in normal vaginal delivery was more significantly increased than caesarean sections ( $p < 0.05$ ). This increase is attributed to both increase in population and increase in the incidence of institutional deliveries. The average caesarean section of our institute in 6 years was 26.92%. This high rate of caesarean section was because ours is the prime referral centre in the state and also in adjoining areas.

**Table 3: Etiology of PPH.**

Year	Total	Atonic	Traumatic	Tissue abnormality	Coagulation abnormality
2014	327	229 (70.03%)	73 (22.32%)	19 (5.81%)	6 (1.83%)
2015	330	229 (69.39%)	76 (23.03%)	19 (5.75%)	6 (1.81%)
2016	348	206 (59.19%)	98 (28.16%)	34 (9.7%)	10 (2.8%)
2017	390	263 (67.43%)	67 (17.17%)	54 (13.84%)	6 (1.5%)
2018	327	198 (60.55%)	73 (22.32%)	50 (15.29%)	6 (1.83%)
2019	319	196 (61.44%)	76 (23.82%)	43 (13.47%)	4 (1.25%)
<b>Total</b>	2041	1321 (64.72%)	463 (22.68%)	219 (10.73%)	38 (1.86%)

The total number of patients who had PPH in 2014, 2015, 2016, 2017, 2018 and 2019 was 327, 330, 348, 390, 327 and 319 respectively. These patients were divided into four groups (G1) those with unscarred uterus, group 2 (G2) those with previous one caesarean section, group 3 (G3) those with previous 2 caesarean section and group 4 (G4) those who have had more than or equal to 3 caesarean section.

From Table 2 it can be clearly seen that the most common group to have PPH was G1 with unscarred uterus, followed by G2 with previous one caesarean section. This pattern was common in all 6 years. It was also observed that the percentage of patients having PPH in G3 (those with previous 2 caesarean section) increased from 1.21% in 2015 to 2.87% in 2016.

In 6 years, patients with unscarred uterus had incidence of PPH of 2.03%, whereas, those with previous caesarean section had incidence of 3.03%.

The etiology of PPH was divided into atonic, traumatic, tissue abnormality (retained placenta, placenta previa, accrete, increta and percreta) and coagulation abnormality.

From Table 3, it can be seen that the most common cause of PPH continues to be atonic uterus, however the percentage of atonic uterus declined from 70.03% to 61.44 % over 6 years. This drop has occurred due to the strategy adopted in LR to assure administration of uterotonics immediately after birth of baby.

**Table 4: Distribution of patients in G1 (unscarred uterus).**

Year	Total patients G1	Atonic uterus	Traumatic	Tissue abnormality	Coagulation abnormality
2014	236	188	43	2	3
2015	217	168	39	4	6
2016	210	143	55	5	7
2017	266	205	38	18	5
2018	216	134	52	26	4
2019	196	114	51	28	3
<b>Total</b>	1341	952 (70.99%)	278 (20.73%)	83 (6.19%)	28 (2.09%)

**Table 5: Distribution of patients in G2 (previous one caesarean section).**

Year	Total patients G2	Atonic uterus	Traumatic	Tissue abnormality	Coagulation abnormality
2014	89	41	29	16	3
2015	108	61	36	11	0
2016	127	61	41	22	3
2017	116	54	27	34	1
2018	96	57	15	22	2
2019	111	77	21	13	0
<b>Total</b>	647	351 (54.25%)	169 (26.12%)	118 (18.23%)	9 (1.40%)

**Table 6: Distribution of patients in G3 (previous two caesarean section).**

Year	Total patients G3	Atonic uterus	Traumatic	Tissue abnormality	Coagulation abnormality
2014	2	0	1	1	0
2015	4	0	1	3	0
2016	10	2	2	6	0
2017	8	4	2	2	0
2018	15	7	6	2	0
2019	11	5	3	2	1
<b>Total</b>	50	18 (36%)	15 (30%)	16 (32%)	1 (2%)

From Table 2 it can be seen that PPH is more commonly seen in unscarred uterus and Table 3 shows that the most common etiology is atonic uterus over 6 years. It was seen that the patients who are gravida 3 or more than or equal to gravida 4 had higher number of PPH. This pattern clearly indicates that multigravida patients are more prone to have PPH due to atonic uterus than those

who have underwent previous caesarean section, this is because caesarean section patients are duly counselled and they are more motivated for tubal ligation during caesarean sections.

Another observation from Table 3 was that there was an increase in the number of tissue abnormality (retained

placenta, placenta praevia, accrete, increta, percreta). This was 5.81% in 2014 which increased to 13.84% in 2017 and was 13.47% in 2019. This increase in tissue abnormality was because of the increase in caesarean

section rates from 2014 to 2019. However, our institute advocates TOLAC (trial of labour after caesarean section) and maintains an audit on the indications of sections to keep this number under scrutiny.

**Table 7: Distribution of patients in G4 (previous 3 or more caesarean section).**

Year	Total patients G4	Atonic uterus	Traumatic	Tissue abnormality	Coagulation abnormality
2014	0	0	0	0	0
2015	1	0	0	1	0
2016	1	0	0	1	0
2017	0	0	0	0	0
2018	0	0	0	0	0
2019	1	0	1	0	0
<b>Total</b>	<b>3</b>	<b>0</b>	<b>1 (33.33%)</b>	<b>2 (66.66%)</b>	<b>0</b>

**Table 8: Total number of hysterectomy due to PPH over 6 years.**

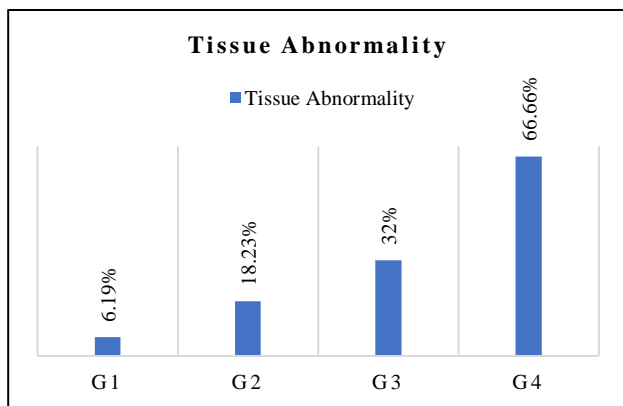
Year	Atonic	Traumatic	Tissue abnormality	Total
2014	7	3	1	11
2015	8	3	2	13
2016	8	2	10	20
2017	6	1	9	16
2018	4	4	7	15
2019	13	2	6	21
<b>Total</b>	<b>46 (47.91%)</b>	<b>15 (15.62%)</b>	<b>35 (36.4%)</b>	<b>96</b>

From Tables 4, 5, 6, and 7, it can be seen that atonic uterus was the most common etiology in G1 (unscarred uterus), G2 (previous one caesarean section), G3 (previous two caesarean section), this was followed by traumatic uterus in G1 and G2. However, in G4 (more than or equal to previous three caesarean sections) tissue abnormality was the most common etiology and second common cause in G3. Also, when we compared the tissue abnormality (retained placenta, placenta previa, placenta accreta, increta, percreta) in all the groups (Figure 1), we found that there was an increasing trend with the increase in number of caesarean sections.

The total hysterectomies due to PPH over 6 years was 96. The most common etiology of PPH was atonic uterus, followed by tissue abnormality and then traumatic cause.

From Table 8 it can be seen that the number of hysterectomies increased in 2016 and 2019. In 2016, the number of hysterectomies increased due to tissue abnormality (retained placenta, placenta praevia, accreta, percreta, increta), whereas in 2019, the most common cause of hysterectomies was atonic uterus. Over all in 6 years atonic uterus was the most common reason for hysterectomy due to PPH.

The overall mortality rate due to PPH over 6 years was 2.54%.



**Figure 1: Comparison of tissue abnormality in G1, G2, G3 and G4.**

**Table 9: Mortality due to PPH.**

Year	No. of mortality due to PPH	Total PPH	Percentage
2014	6	327	1.83
2015	10	330	3.03
2016	8	348	2.29
2017	8	390	2.05
2018	11	327	3.36
2019	9	319	2.82
<b>Total</b>	<b>52</b>	<b>2041</b>	<b>2.54</b>

From Table 9, it can be seen that the mortality due to PPH ranges from as low as 1.83% in 2014 to highest 3.36% in 2018. The impact of caesarean section on mortality due to PPH was compared between the 4 groups (Table 10).

**Table 10: Comparison of mortality between G1, G2, G3 and G4.**

Year	Total mortality	G1	G2	G3	G4
2014	6	4	1	1	0
2015	10	7	2	1	0
2016	8	5	2	1	0
2017	8	7	0	1	0
2018	11	7	3	1	0
2019	9	7	2	0	0
<b>Total</b>	52	37 (71.15%)	10 (19.23%)	5 (9.61%)	0

From Table 10, it can be seen that the mortality rate was highest in G1 group, this was found because atonic uterus was the most common etiology and atonic uterus was commonly present in multiparous patients. Doing a caesarean section gives an opportunity to do tubal ligation and prevents further pregnancies. However, the mortality in G2 and G3 cannot be ignored, these groups also had mortalities due to complications of previous caesarean sections like placenta accreta, increta and percreta. Hence, a continuous scrutiny and a wiser approach of making an indication of caesarean is needed.

## DISCUSSION

India is the second most populated country in the world with nearly a fifth of the world's population. According to the 2019 revision of the world population prospects population stood at 1,352,642,280.<sup>6,7</sup> India's population growth rate is 1.13%.<sup>8</sup> One of the major causes of maternal mortality in India continues to be PPH. We collected data over 6 years in our institute. When the demographic profiles of the patients were compared, majority of patients who had PPH were in the age group of 24-29 years and 30-35 years. This age group is common in India because when a female in reproductive age group reaches this age, she is multigravida. This correlation has been found in other studies as well.<sup>9</sup> There has been an exponential increase in the percentage of delivery annually in our institute from 2.35% from 2014 to 2015 to 12.6% from 2018 to 2019. This increase in the percentage of delivery is because of the expanding population of the country and also due to increasing number of hospital deliveries due to more education and awareness. The average growth rate of population in India is 1.13%.<sup>8</sup> Over a period of 6 years, 66,530 patients delivered in our institute both by normal vaginal delivery and by caesarean section. Out of these 2041 patients (3.06%) had PPH. In 2014, 2015, 2016, 2017, 2018 and 2019 the percentage of women who delivered and had

PPH were 3.35% (327), 3.30% (330), 3.30% (348), 3.46% (390), 2.80% (327) and 2.38% (319) respectively. Devi et al also found a similar result that postpartum hemorrhage (PPH) is a frequent complication of delivery and its incidence is commonly reported as 2-4% after vaginal delivery and 6% after caesarean section with uterine atony being the cause in about 50% cases.<sup>10</sup> In 6 years patients with unscarred uterus had incidence of PPH of 2.03%, whereas, those with previous caesarean section had incidence of 3.03%. Also, we found that overall, the most common cause of PPH continues to be atonic uterus, however the percentage of atonic uterus declined from 70.03% to 61.44% over 6 years. The multigravida patients are more prone to have PPH due to atonic uterus than those who have undergone previous caesarean section, this is because caesarean section patients are duly counselled and they are more motivated for tubal ligation during caesarean sections. There are studies which also have the same findings of multigravida as a risk factor for PPH.<sup>11,12</sup> Atonic uterus was the most common etiology in patients with unscarred uterus, previous one caesarean section, previous two caesarean section, this was followed by traumatic uterus in patients with unscarred uterus and patients with previous one caesarean section. However, in patients with more than or equal to previous three caesarean sections tissue abnormality was the most common etiology and second common cause in patients with previous two caesarean sections. Also, when we compared the tissue abnormality (retained placenta, placenta previa, placenta accreta, increta, percreta) in all the groups, we found that there was an increasing trend with the increase in number of caesarean sections from 6.19% in patients with unscarred uterus to 66.66% in patients with more than or equal to previous 3 caesarean sections. There are studies which have found an increase in placenta accreta with increase in caesarean sections. For women with placenta previa, the risk of placenta accreta is 3%, 11%, 40%, 61%, and 67%, for the first, second, third, fourth, and fifth or more cesarean, respectively.<sup>13</sup> The mortality rate of PPH is highest due to atonic uterus, most commonly in multiparous patients, however the mortality rates in patients with previous caesarean section complications with PPH cannot be ignored. These results strongly suggest the need of active management of atonic uterus and a contemplative decision of caesarean sections.

## CONCLUSION

We studied the data of PPH of 6 years in our institute, and observed certain trends. The total number of vaginal deliveries and caesarean section have significantly increased each year. Uterine atonicity continues to be the most common etiology of PPH every year, however, there is an increase in tissue abnormality (retained placenta, placenta praevia, accreta, increta, percreta) over years as there is a significant increase in the incidence of caesarean section. Atonic uterus was the most common cause for obstetric hysterectomies and mortality due to PPH every year. Family planning advise is essential in

developing country like ours to counsel patients to prevent multiparity, thus reducing PPH. It is also important to train all the health workers in periphery and referral centers to manage the third stage of labour and atonic uterus to save the mothers. Sagacious attitude towards the decision of caesarean section is needed to prevent maternal morbidity and mortality.

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