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Trends in postpartum Haemorrhage in a limited resource country: A review of 6 years in a tertiary care Centre of India

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Abstract
Background: Postpartum haemorrhage (PPH) is the leading cause of maternal mortality. All women who carry a pregnancy beyond 20 weeks' gestation are at risk for PPH and its sequelae. Although maternal mortality rates have declined greatly in the developed world, PPH remains a leading cause of maternal mortality elsewhere.
Methods: We reviewed the data in a tertiary care set up over 6 years from 2014 to 2019. The data source was a record book for PPH patients.
Results: There has been a significant increase in deliveries between 2014 and 2019. Atonic uterus is the most common etiology, and also the most common cause of obstetric hysterectomy. The Foleys condom tamponade has been used successfully for management of atonic uterus and as a prophylactic measure in coagulopathies. 4.7% of patients who had PPH had to undergo obstetric hysterectomy. The overall mortality rate due to PPH over 6 years is 2.54%.

Keywords: PPH, Foley s condom tamponade (FCT), tissue abnormality

Introduction
Despite of a steep decline in the maternal mortality ratio (MMR) in India, being 130 in 2014-16 to 122 in 2015-17 to 113 in 2016-18; the most common direct cause of maternal mortality continues to be the postpartum haemorrhage [1]. According to the WHO recommendation uterotonics for prevention of postpartum haemorrhage, it 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 [2]. The aim of this study was to study the trends of PPH over 6 years in a tertiary care set up.

Methods
We reviewed the data over 6 years from a PPH record book from 2014 to 2019. The record contained demographic profiles, causes, management and outcomes. PPH was defined as primary PPH as the loss of 500 ml or more of blood from genital tract within 24 hours of birth of a baby. PPH can be minor (500–1000 ml) or major (more than 1000 ml). Comparison over 6 years was made based on the etiology of PPH as atonic, traumatic, tissue abnormality (retained placenta, placenta praevia, accreta, increta, percreta), and coagulation abnormality; management being medical, condom tamponade or surgical management; and maternal mortality due to PPH was studied over 6 years. We have applied one sample t test and paired sample t test on the data.

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.
From table 1, it can be seen 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.
The age of the patients was divided into less than 18 years, 18-23years, 24-29 years, 30-35 years, and more than 35 years.

Table 1: Distribution of patients of PPH based on the gravida of pregnancy

Year	Total patients	G1	G2	G3	≥ G4
2014	327	44	52	156	75
2015	330	41	49	147	93
2016	348	69	69	97	113
2017	390	55	72	169	94
2018	327	31	92	104	100
2019	319	45	62	134	78

Table 2: Age distribution of patients of PPH over 6 years

Years	Total	<18 years	18-23 years	24-29 years	30-35 years	> 35 years
2014	327	21	42	104	121	39
2015	330	16	78	134	86	16
2016	348	12	89	118	101	28
2017	390	6	102	103	139	41
2018	327	14	42	92	111	68
2019	319	20	66	85	92	56

From Table 2, it can be observed that the majority of patients who had PPH were in the age group of 24-29 years and 30-35 years. This is the common because by the time female becomes multi gravida, she is in this age group range. This pattern has been comparable over 6 years

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.

Table 3: 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	2430	9754	-
2015	7489	2500	9989	2.35%
2016	7789	2739	10528	5.1%
2017	7944	3302	11246	6.38%
2018	8355	3306	11661	3.5%
2019	9630	3722	13352	12.6%

From Table 3 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 is an increase in both normal vaginal deliveries and caesarean section, but the increase in normal vaginal delivery is 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 percentage of PPH (total number of patients who had PPH/ total deliveries %) in 2014, 2015, 2016, 2017, 2018 and 2019 was 3.35% (327), 3.30% (330), 3.30% (348), 3.46% (390), 2.80% (327) and 2.38% (319) respectively. From the line graph (Fig 1) it can be seen that the incidence of PPH has reduced over 6 years. The main reason for this reduction is the awareness and timely action in high risk cases for management of PPH.

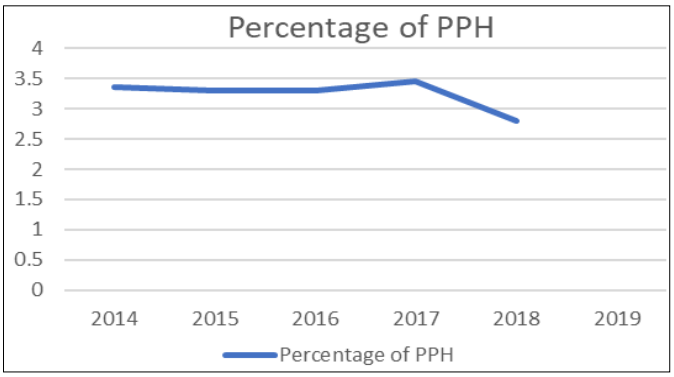

Fig 1: Line graph showing the percentage of PPH over 6 years.

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

Table 4: 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%)
Total	2041	1321 (64.72%)	463 (22.68%)	219 (10.73%)	38 (1.86%)

From table 4, 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. Another observation from this study found 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. By the paired sample t test we found that though there is an increase in both normal vaginal deliveries and caesarean section, but the increase in normal vaginal delivery is more significantly increased than caesarean sections ($p<0.05$).

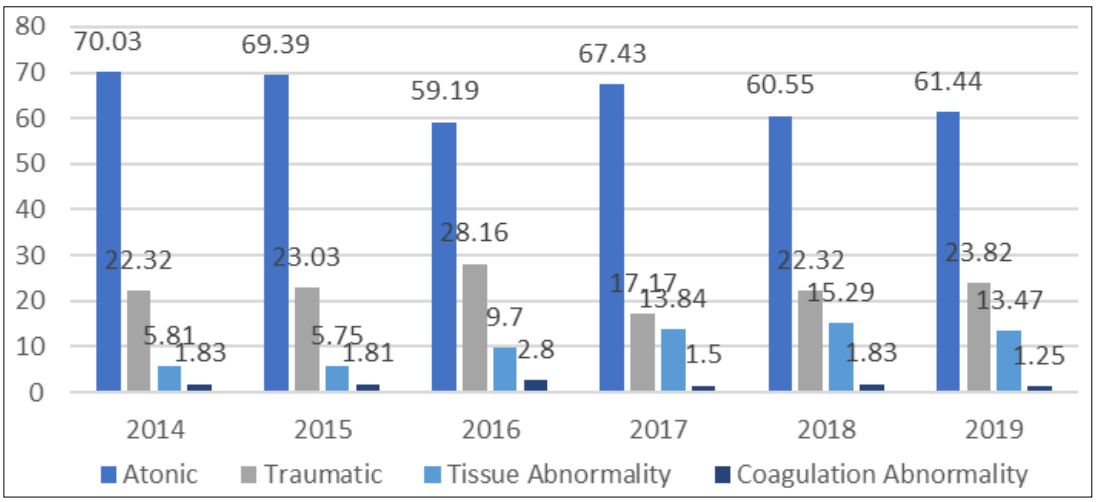

Fig 2: Percentage distribution of causes of PPH over 6 years

Over 6 years it can be concluded that atonic PPH contributes to the maximum etiology of PPH, followed by traumatic causes as the second highest cause.

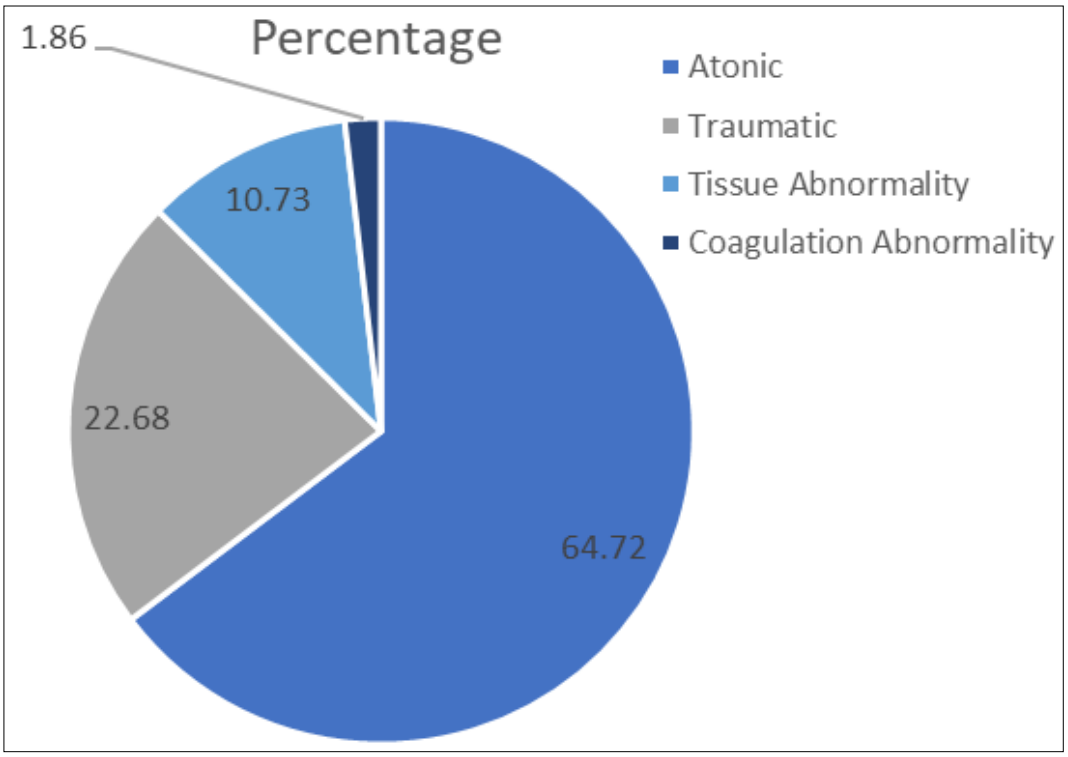

Fig 3: Percentage distribution of causes of PPH over 6 years.

The management of Atonic uterus causing PPH was divided into medical (using uterotonics like syntocinon, misoprostol, carboprost, methergine); using foley s condom tamponade and surgical (compression sutures, devascularization and hysterectomy).

Table 5: Management of Atonic PPH

Year	Total Atonic Uterus (n)	Medical management	FCT	Surgical management			
				Total	Devascularization	Compression sutures	Hysterectomy
2014	229	178	16	17	6	4	7
2015	229	184	29	16	6	2	8
2016	206	133	45	28	12	8	8
2017	263	179	64	20	9	5	6
2018	198	98	71	29	13	12	4
2019	196	99	77	20	5	2	13

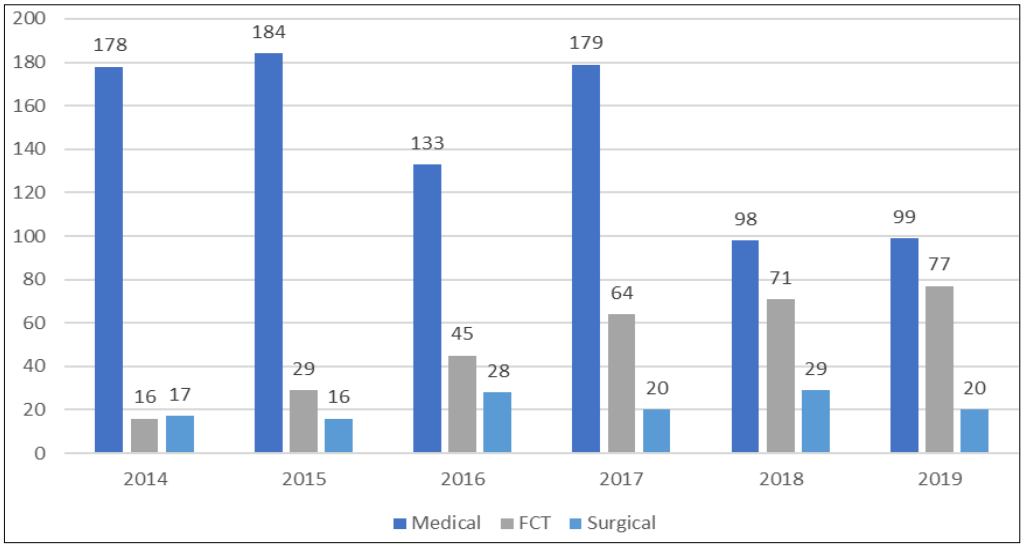

Fig 4: Management of Atonic PPH

From figure 4 and Table 5, it can be seen that the medical management in atonic uterus was successful in most of the cases. Another observation was made that the number of Foley s Condom Tamponade (FCT) has been increased over 6 years, from just 16 used in 2014 to 77 in 2019, and has been successful in management of atonic PPH.

The management of traumatic PPH was divided into repair of cervico-vaginal tears, drainage of vulvo-vaginal hematoma, repair of rupture uterus and hysterectomy.

Table 6: Management of traumatic PPH

Year	Total Traumatic PPH	Repair of cervico-vaginal tears	Drainage of vulvo-vaginal hematoma	Repair of Rupture Uterus	Hysterectomy
2014	73	41	21	8	3
2015	76	53	15	5	3
2016	98	68	19	9	2
2017	67	45	16	5	1
2018	73	50	10	9	4
2019	76	54	15	5	2

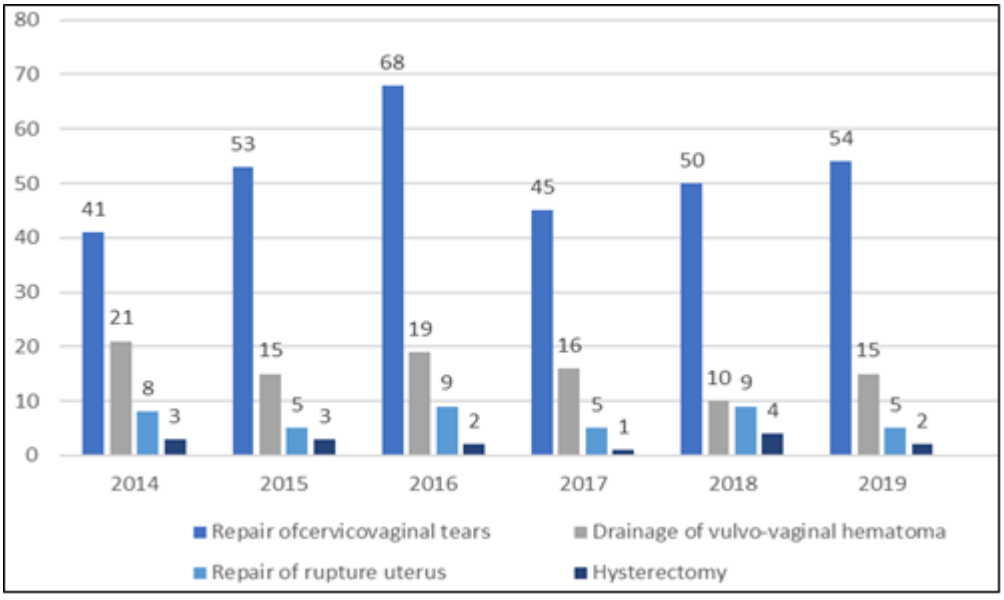

Fig 5: Management of Traumatic PPH over 6 years

From Table 6 and Fig 5 it can be seen that the trend of management of traumatic PPH over 6 years remains the same with majority being repair of cervico-vaginal tears, followed by drainage of vulvo-vaginal hematoma, repair of rupture uterus and hysterectomy respectively.

The management of tissue abnormality (retained placenta, placenta praevia, placenta accrete, increta and percreta) was divided into MRP (manual removal of placenta), medical management (use of uterotonics), use of Foley s Condom Tamponade (FCT), devascularization, compression suture application and hysterectomy.

Table 7: Management of PPH due to tissue abnormality.

Year	Total Tissue Abnormality (n)	MRP	Medical management	FCT	Devascularization	Compression sutures	Hysterectomy
2014	19	10	2	3	2	1	1
2015	19	5	4	2	3	3	2
2016	34	11	4	2	2	5	10
2017	54	10	11	12	6	6	9
2018	50	14	7	12	5	5	7
2019	43	10	6	9	6	6	6

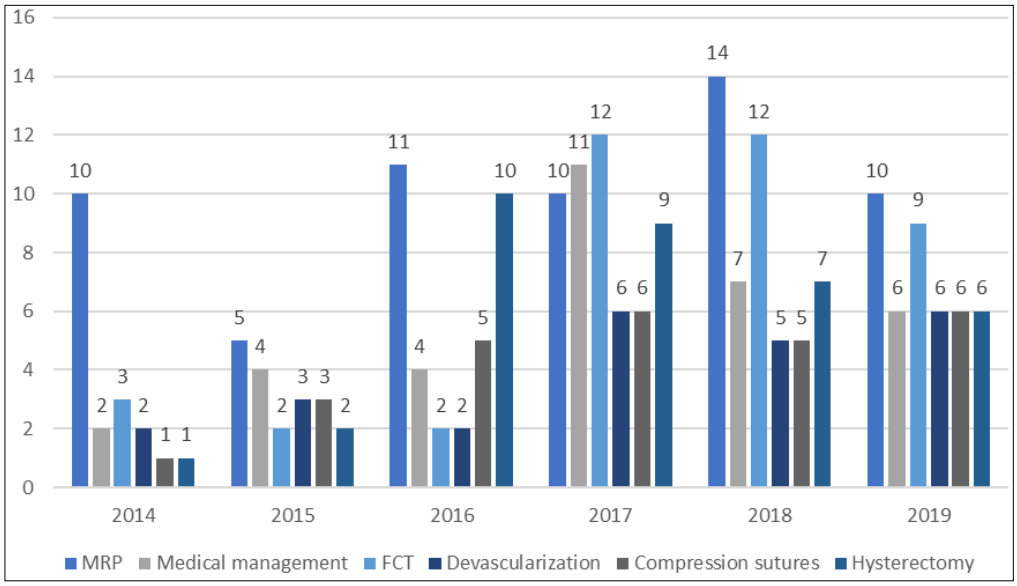

Fig 6: Management of tissue abnormality leading to PPH over 6 years.

From table 7 and Fig 6 it can be clearly seen that MRP is most frequently used in tissue abnormalities as retained placenta is very common. The year 2016 had significant increase of hysterectomy from 2 in 2015 to 10 in 2016. This increase was because of the increased number of tissue abnormalities from 19 in 2015 to 34 in 2016, which as a result was due to increase in caesarean section rate (Table 1). The year 2017 had maximum cases of PPH (Table 2), this year also had an increase in caesarean section rate (Table 1), Foleys condom tamponade was significantly used in 2017. The hysterectomy incidence between 2016 and 2017 was comparable.

Management of coagulation abnormalities was divided into medical management (uterotonics, blood products) and FCT.

Table 8: Management of PPH due to coagulation disorders.

Year	Total Coagulation abnormalities (n)	Medical Management	FCT
2014	6	4	2
2015	6	1	5
2016	10	3	7
2017	6	3	3
2018	6	2	4
2019	4	1	3

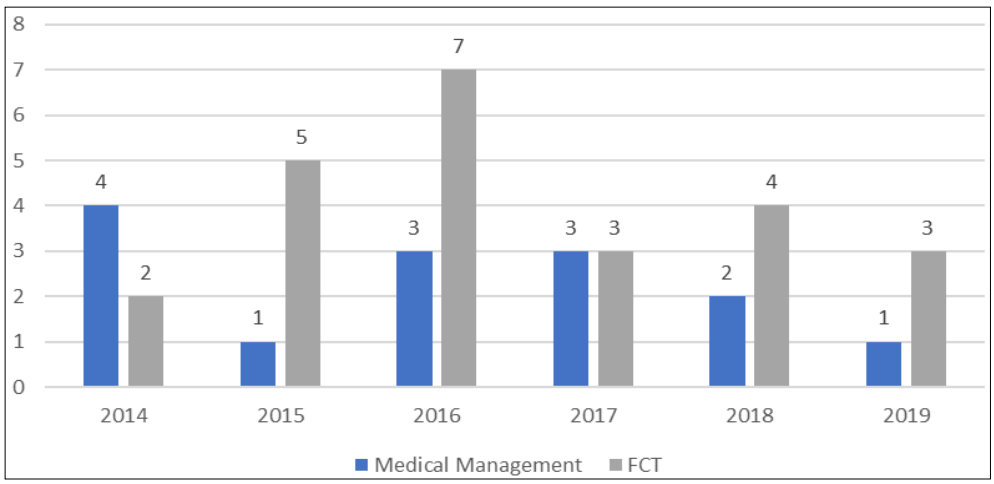

Fig 7: Management of coagulation disorder leading to PPH over 6 years.

From table 8 and Fig 7, it can be observed that over 6 years condom tamponade was being used for management of coagulation abnormalities.
The Total hysterectomies due to PPH over 6 years is 96. The most common etiology of PPH is atonic uterus, followed by tissue abnormality and then traumatic cause.

Table 9: 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
Total	46 (47.91%)	15 (15.62%)	35 (36.4%)	96

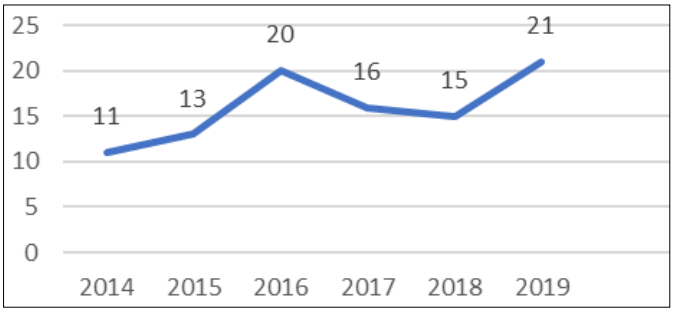

Fig 8: Graph showing the hysterectomies due to PPH over 6 years.

From Table 9 and Fig 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), where as 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 is 2.54%.

Table 10: 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%
Total	52	2041	2.54%

From Table 10, 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. This increase is due to more referrals and more reporting of deaths due to PPH.

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 [3, 4] population stood at 1,352,642,280. India's population growth rate is 1.13% [5]. 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 [6]. 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% [5]. 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 [7]. WHO states that PPH affects 5% of all women who give birth [2]. There has been a decline in the percentage of women who had PPH who delivered in our institute in 6 years. The main reason for this reduction is the awareness and timely action in high risk cases for management of PPH. The most common etiology of PPH continues to be atonic uterus throughout 6 years, we observed that 64.72% of women of PPH had 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. Another observation from this study found 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. Same studies also reported as atonic uterus as the major cause of PPH [7]. Medical management in atonic uterus was successful in most of the cases. Another observation was made that the number of Foley s Condom Tamponade (FCT) has been increased over 6 years, from just 16 used in 2014 to 77 in 2019, and has been successful in management of atonic PPH. Uterine tamponade using intrauterine balloons appears to be an effective tool in the management of PPH. Overall, from the case reports, retrospective [8, 9, 10] and prospective studies [11, 12] 97/106 (91.5%) cases were successful when the various balloons have been used. The treatment of traumatic PPH was mostly the repair of cervico-vaginal tears, and in tissue abnormality (retained placenta, placenta praevia, accrete, increta, percreta) was manual removal of placenta. The year 2016 had significant increase of hysterectomy from 2 in 2015 to 10 in 2016. This increase was because of the increased number of tissue abnormalities from 19 in 2015 to 34 in 2016, which as a result was due to increase in caesarean section rate. From 2014 to 2019, 96 patients had hysterectomy, which was 4.7% of total 2041 patients of PPH. The most common etiology leading to hysterectomy was atonic uterus. This percentage was however lower than the incidence found by Huque *et al*. who stated that mothers in Asia had a higher hysterectomy incidence (7%) than mothers in Africa (5%) [13]. The overall mortality rate over 6 years due to PPH was 2.54%. PPH is the leading cause of maternal mortality in low-income countries, and the primary cause of nearly one quarter of all maternal deaths globally [14].

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 each year, however, there is an increase in tissue abnormality (retained placenta, placenta praevia, accrete, increta, percreta) over years as there is a significant increase in the incidence of caesarean section. Foleys condom tamponade was successfully in atonic uterus for management and in coagulation disorders as a prophylactic measure. Atonic uterus was the most common cause for obstetric hysterectomies every year. The mortality rate due to PPH was variable being as low as 1.83% in 2014 to highest 3.36% in 2018. This increase was due to more referrals and more reporting of deaths due to PPH. International initiatives to improve outcomes have invested in training birth attendants (traditional or otherwise) and nurse midwives on the active management of the third stage of labour. Most efforts focus on uterine atony, which is the primary cause of postpartum hemorrhage. Peripheral basic non-invasive management, and timely referrals can decrease the figures of PPH and thereby decreasing the maternal mortality rates.

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