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RESEARCH ARTICLE

# Improvements in the Occurrence, Management, and Outcomes of Postpartum Hemorrhage at a Teaching Hospital in Sri Lanka

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## SYNOPSIS

Using international and national standards and indicators, criteria based continuous clinical audits demonstrate that in-service training has reduced the occurrence of postpartum haemorrhage and improved its management and outcomes in a Teaching Hospital in Sri Lanka.


## ABSTRACT

**Aims:** To assess improvements in the occurrence, management, and outcomes of postpartum hemorrhage (PPH) after in-service training.

**Design, setting, and methods:** Criteria-based clinical audits at the Academic Unit of the Teaching Hospital, Mahamodara, Galle, Sri Lanka, from 2010/2011 to 2014.

**Results:** Rates of PPH declined from 0.64% in 2010/2011 to 0.4% in 2014. Instrumental vaginal delivery carried the highest risk of PPH. Postpartum hemorrhage after Cesarean sections decreased by 2014.

Postpartum transfusion of blood identified > 93% of cases of PPH. Admissions for intensive care for management of PPH increased by 2014. Augmentation of labor, induction of labor, and hypertension in pregnancy were leading risk factors and trauma an important cause for PPH. A large proportion had no risk factors for PPH. Although the use of condom catheter uterine tamponade showed a nonsignificant increase by 2014, the rate of postpartum hysterectomies remained high. By 2014 specialists were getting involved earlier, and patients were being shifted earlier to the operation theater after vaginal delivery. Documentation in case notes and checking hematological status prior to discharge from hospital were suboptimal.

**Conclusion:** The occurrence, management, and outcomes of PPH have improved.


**Keywords:** Management, Occurrence, Outcomes, Postpartum hemorrhage.

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## INTRODUCTION

In Sri Lanka, maternal mortality has decreased from approximately 2,000 per 100,000 live births in 1930 to 32.03 per 100,000 live births in 2014.[1] Primary postpartum hemorrhage (PPH) was the leading cause of maternal deaths for several decades, and obstetric hemorrhage accounted for 17.7% of maternal deaths (5.8 per 100,000 live births) in 2010.[1] This is in spite of 99.9% of women having a skilled birth attendant at delivery[2] and the routine practice of the recommended active management of the third stage of labor.[3] Maternal deaths (MD) due to PPH constitute only the tip of the much larger iceberg of morbidity. Therefore, the study of severe acute maternal morbidity (SAMM) and near-miss cases using criteria-based clinical audits should be used to improve the management and quality of care, and this would lead to reductions in maternal morbidity in general as well as in PPH.[4-7]

From 1992, the Sri Lanka College of Obstetricians and Gynaecologists (SLCOG) has been conducting "Safe Motherhood Programmes" in districts that have relatively higher maternal mortality ratios in Sri Lanka. In 2009 the SLCOG developed a specific training program, based on international and national guidelines on the prediction, prevention, early diagnosis, and management of PPH[3,8-11] for all intrapartum care givers, and since then it has been conducted in several districts, including Galle. The outcome of this in-service training is being continuously audited by using standards, based on international and national guidelines,[3,8-11] and detailed input, process, and outcome indicators,[4,5,11-13] and the quality of obstetric care, including the management of PPH, is being continuously monitored at the Academic Unit of the Teaching Hospital, Mahamodara, Galle (THMG). In 2010/2011, the rates of PPH and severe PPH were 0.64 and 0.24% respectively. Of these cases of PPH, hypotonia was the primary etiological

factor in 39% cases and trauma was a contributory cause in 59% of cases. Suboptimal management practices were detected and appropriate remedial measures were adopted.[11] In 2014, obstetric hemorrhage had decreased to become the fourth leading cause and accounted for only 10% of maternal deaths (approximately 2.3 deaths per 100,000 live births) in Sri Lanka. Nine of these cases of obstetric hemorrhage were due to PPH.[1] Re-audits and continuous surveillance are needed to identify any improvements in the occurrence, management, and outcomes of PPH after the in-service training, in order to train/retrain all intrapartum care givers in areas that need further improvements.

## MATERIALS AND METHODS

Re-audits were conducted at the THMG during the periods February 1 to September 30, 2013, and January 1 to December 31, 2014. Inclusion criteria for the identification of maternal morbidity and mortality from PPH, additional criteria used to assess the management process and outcome, and the definition of indicators to monitor the quality of care in the management of PPH were the same as in 2010/2011.[10] The results were compared with those of the audit in 2010/2011. Ethical approval has been obtained from the Ethical Review Committee of the Faculty of Medicine, University of Ruhuna, to conduct this ongoing audit and to disseminate the findings outside the THMG. The data were stored confidentially in an ongoing, password-protected computer software database and analyzed using the Statistical Package for the Social Sciences (SPSS) version 11 (SPSS Inc., Chicago, Illinois, USA). Means with 95% confidence intervals and medians with interquartile ranges were used to describe parametrically and non-parametrically distributed continuous variables respectively. Proportions were used to describe categorical data and compared using the chi-square test. The level of significance was considered as $p < 0.05$.

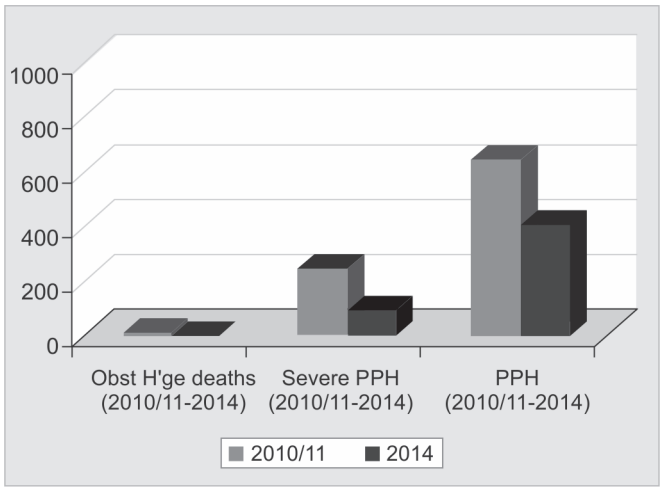
## RESULTS

During the three periods of study, there were 61, 31, and 26 cases with PPH. There were no significant differences in the mean ages of the cases, but there was a nonsignificant decrease in the proportion of primigravidae from 52% in 2010/2011 to 30.8% in 2014 (Table 1).

**Table 1:** Patient characteristics

| | *2010 (n = 61)* | *2013 (n = 31)* | *2014 (n = 26)* | *p-values* |
|---|---|---|---|---|
| *Age in years* | | | | |
| Range | 17–40 | 21–46 | 18–39 | |
| Mean | 29.2 | 32.0 | 31.6 | NS |
| (95% CI) | (27.6–30.7) | (29.7–34.2) | (29.7–33.4) | |
| *Parity* | | | | |
| Range | 1–7 | 1–5 | 1–5 | |
| Median (IQR) | P1 (2) | P2 (2) | P2 (1) | NS |
| Primigravidae (%) | 52.5 | 38.7 | 30.8 | NS |
| Parity > 4 (%) | 4.9 | 3.2 | 3.8 | NS |

95% CI: 95% confidence interval; IQR: Inter-quartile range; NS: Not significant




**Graph 1:** Occurrence of postpartum hemorrhage and maternal deaths from obstetric hemorrhage per 100,000 deliveries

Morbidity and severe morbidity due to PPH and severe PPH were markedly greater in comparison with the national mortality rates for PPH (Graph 1).

More than 93% of cases with PPH were identified by the need for blood transfusion in all three periods of study. Other methods of identification are described in Table 2.

**Table 2:** Inclusion criteria

| *Criterion/Year* | *2010/2011 (n = 61)* | *2013 (n = 31)* | *2014 (n = 26)* | *p-value* |
|---|---|---|---|---|
| Transfusion of blood or colloids n (%) | 59 (97) | 30 (97) | 25 (96) | NS |
| Admission to ICU due to PPH n (%) | 21 (34) | 14 (45) | 18 (69) | < 0.05 |
| Shifted to OT after vaginal delivery n (%) | 20 (33) | 7 (23) | 13 (49) | NS |
| Major surgical interventions (excluding CS) n (%) | 16 (26) | 6 (19) | 7 (27) | NS |
| Return to OT after CS n (%) | 3 (5) | 1 (3) | 2 (8) | NS |
| Use of condom catheter tamponade n (%) | 3 (5) | 5 (16) | 4 (15) | NS |
| Retained placenta n (%) | 3 (5) | – | 2 (8) | NS |
| Uterine rupture n (%) | 1 | 1 (3) | 2 (8) | NS |

ICU: Intensive care unit; OT: Operation theater; CS: Cesarean section; PPH: Postpartum hemorrhage; NS: Not significant

**Table 3:** Occurrence of postpartum hemorrhage according to mode of delivery

| | *n* | | | *PPH%* | | | | *Severe PPH%* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *2010/2011* | *2013* | *2014* | *2010/2011 (n = 61)* | *2013 (n = 31)* | *2014 (n = 26)* | *p-value* | *2010/2011 (n = 61)* | *2013 (n = 31)* | *2014 (n = 26)* | *p-value* |
| ND | 6,505 | 2,731 | 4,257 | 0.57 | 0.37 | 0.40 | NS | 0.17 | 0.11 | 0.07 | NS |
| CS | 2,846 | 1,230 | 2,029 | 0.74 | 1.30 | 0.30 | < 0.01 | 0.39 | 0.89 | 0.15 | < 0.01 |
| IVD | 151 | 120 | 145 | 1.99 | 4.2 | 2.0 | NS | 0.66 | 1.67 | – | NS |
| TD | 9,502 | 4,132 | 6,431 | 0.64 | 0.75 | 0.40 | < 0.05 | 0.24 | 0.39 | 0.09 | NS |

PPH: Postpartum hemorrhage; ND: Normal deliveries; CS: Cesarean sections; IVD: Instrumental vaginal deliveries; TD: Total deliveries; NS: Not significant

**Table 4:** Pattern of blood transfusions

| *No. of packs/ Year* | *2010/2011 (n = 61)* | *2013 (n = 31)* | *2014 (n = 26)* | *p-value* |
|---|---|---|---|---|
| < 3 n (%) | 37 (60) | 16 (51) | 16 (62) | NS |
| 3–4 n (%) | 10 (16) | 9 (29) | 6 (23) | NS |
| ≥ 5 n (%) | 10 (16) | 5 (16) | 3 (12) | NS |
| Total n (%) | 57 (93) | 30 (97) | 25 (96) | NS |

NS: Not significant

**Table 5:** Risk factors for postpartum hemorrhage

| *Risk factor* | *2010/2011 (n = 61)* | *2013 (n = 31)* | *2014 (n = 26)* | *p-value* |
|---|---|---|---|---|
| Augmentation of labor n (%) | 11 (18) | 7 (23) | 5 (18) | NS |
| Induction of labor n (%) | 10 (16) | 3 (10) | 1 (4) | NS |
| Hypertension in pregnancy n (%) | 6 (10) | 5 (16) | 2 (7) | NS |
| Placenta accreta n (%) | 4 (7) | 3 (10) | – | NS |
| Prolonged stage I n (%) | 3 (5) | – | – | – |
| Prolonged stage II n (%) | 3 (5) | 1 (3) | – | NS |
| Macrosomia n (%) | 3 (5) | 2 (7) | 1 (4) | NS |
| Instrumental vaginal delivery n (%) | 3 (5) | 4 (13) | 4 (14) | NS |
| Grande multiparity n (%) | 3 (5) | 1 (3) | – | NS |
| Placenta previa n (%) | 2 (3) | – | 1 (4) | NS |
| Multiple pregnancy n (%) | 2 (3) | 2 (7) | 2 (7) | NS |
| Retained products n (%) | 1 (2) | – | 1 (4) | NS |
| Abruptio placentae n (%) | 1 (2) | 1 (3) | – | NS |
| Anemia n (%) | 1 (2) | 2 (7) | – | NS |
| None n (%) | 24 (39) | 8 (26) | 16 (62) | < 0.05 |

NS: Not significant

Rates of PPH had declined from 0.64% in 2010/2011 to 0.4% in 2014 ($p < 0.05$). Instrumental vaginal delivery (IVD) continued to carry the highest risk of PPH (1.9–4.2%) from 2010/2011 to 2014. The risk of PPH and severe PPH from Cesarean sections (CS) decreased from 0.74 and 0.39% in 2010/2011 to 0.3 and 0.15% respectively in 2014 ($p < 0.01$). The risk of PPH from vaginal delivery ranged from 0.57% in 2010/2011 to 0.37% in 2013 and 0.4% in 2014 (Table 3).

During the three periods of study, 18 (15%) of cases required five or more units of blood transfusion (Table 4). One patient who was 40 years old and a para 7 received 15 units of blood, 10 units of fresh frozen plasma (FFP), and 14 packs of platelets but survived in 2010/2011. A primigravida who was 23 years old and had HELLP syndrome, disseminated intravascular coagulation, and hepatic failure died in spite of receiving 12 units of blood, 10 units of FFP, and 14 packs of platelets in 2013. No patients received O rhesus negative blood.

Augmentation of labor (AOL) was the leading risk factor for PPH and was associated with 18 to 23% of cases of PPH during the three periods of study. The association of induction of labor (IOL) as a risk factor for PPH showed a nonsignificant decrease from 16% in 2010/2011 to 4% in 2014. Hypertension in pregnancy was associated with PPH in 7 to 10% of cases during the three periods of study. The proportion of cases with no risk factors for PPH increased from 39% in 2010/11 to 62% in 2014 ($p < 0.05$). Between 16 and 26% of women with PPH had two or more risk factors for PPH (Table 5).

Detection of PPH within 15 minutes showed a nonsignificant increase from 30% in 2010/2011 to 50% in 2014, but detection of PPH being delayed for > 60 minutes ranged from 23 to 35%. The first blood transfusion delayed for > 60 minutes showed a nonsignificant decrease from 59% in 2010/2011 to 42% in 2014. The involvement of a specialist within 30 minutes increased from 23% in 2010/2011 to 50% in 2014 ($p < 0.05$), and the involvement of a specialist delayed for > 60 minutes showed a nonsignificant decrease from 36% in 2010/2011 to 23% in 2014. Nonrecording of the time of specialist involvement showed a nonsignificant decrease from 23% in 2010/2011 to 12% in 2014. Of the cases shifted to the operation theater (OT) after vaginal delivery, the proportion of cases shifted to the OT within 60 minutes increased from 25% in 2010/2011 to 69% in 2014 ($p < 0.05$). Of the cases shifted to the OT, the timing of the anesthetist being informed was not recorded in 35% cases in 2014. Nondocumentation of the routine use of an oxytocic for the active management of the third stage of labor showed significant variations during the three periods of study and ranged from 13 to 48% of cases of PPH. The nondocumentation of the use of therapeutic oxytocics ranged from 19 to 35% of cases of PPH during the three periods of study. The use of tranexamic acid increased upto 65% in 2014 ($p < 0.05$). Nondocumentation of the

**Table 6:** Interventions for management of postpartum hemorrhage

| *Method* | *2010/2011 (n = 61)* | *2013 (n = 31)* | *2014 (n = 26)* | *p-value* |
|---|---|---|---|---|
| Vaginal packing n (%) | 29 (48) | 16 (52) | 17 (65) | NS |
| Condom catheter uterine tamponade n (%) | 3 (5) | 5 (16) | 4 (15) | NS |
| Intra-umbilical vein oxytocin injection for retained placenta n (%) | 3 (5) | – | 1 (4) | NS |
| Manual removal of retained placenta n (%) | 3 (5) | 1 (3) | 2 (8) | NS |
| Postpartum evacuation of retained products of conception n (%) | 1 (2) | – | – | – |
| B lynch/compression sutures n (%) | 2 (3) | – | – | – |
| Systematic devascularization n (%) | 2 (3) | 3 (10) | – | – |
| Postpartum hysterectomies (includes Cesarean hysterectomies) n (%) | 13 (21) | 7 (23) | 7 (27) | NS |
| Bilateral internal iliac artery ligation n (%) | 5 (8) | – | 1 (4) | NS |
| Admission to intensive care unit n (%) | 21 (34) | 14 (45) | 18 (69) | < 0.05 |

NS: Not significant

**Table 7:** Quality of care indicators

| *Indicator/Year* | *2010/2011 (TD = 9,502)* | *2013 (TD = 4,132)* | *2014 (TD = 6,431)* | *p-value* |
|---|---|---|---|---|
| Severe Acute Maternal Morbidity (SAMM) | 21 (0.22%) | 14 (0.34%) | 18 (0.28%) | NS |
| Maternal Death (MD) | – | 1 | – | – |
| Women with Life-Threatening PPH (WLTPPH) | 21 (0.22%) | 15 (0.36%) | 18 (0.28%) | NS |
| SAMM Incidence Ratio | 2.2 | 3.3 | 2.8 | NS |
| Severe Maternal Outcome Ratio | 2.2 | 3.6 | 2.8 | NS |
| SAMM:MD | – | 14 | – | – |
| Maternal Mortality Index | – | 0.07 | – | – |
| Perinatal deaths | Not known | 3 | – | – |

TD: Total deliveries; NS: Not significant (adapted from the WHO Maternal Near Miss Audit[5])

volume of crystalloids transfused ranged from 15 to 45%, and the proportion of cases transfused with colloids prior to blood transfusion ranged from 19 to 43% during the three periods of study. Trauma was a contributory factor from 45 to 59% of cases, and hypotonia was associated with 29 to 42% of cases during the three periods of study. From 2010/2011 to 2014, there was a significant decrease in the checking of both hemoglobin (Hb) prior to blood transfusion (66–23%, $p < 0.001$) and of Hb prior to discharge from the hospital (85–58%, $p < 0.05$).

The use of condom catheter uterine tamponade showed a nonsignificant increase from 5% in 2010/2011 to 16 and 15% in 2013 and 2014 respectively. However, in > 50% of cases, the condom catheter insertion was delayed by > 60 minutes. In three of the four cases in 2014, the timing of this intervention was not documented. The rate of postpartum hysterectomies for the management of PPH remained high, ranging from 21% in 2010/2011 to 27% in 2014. Admission for intensive care increased from 34 to 69% ($p < 0.05$) (Table 6).

There were three perinatal deaths and one maternal death due to PPH in 2013, giving a SAMM:MD of 14 and a Maternal Mortality Index of 0.07 in 2013. There were no significant differences in the SAMM and Women with Life-threatening PPH, both of which ranged from 0.22 to 0.36% during the three periods of study. There were no significant differences in the SAMM Incidence Ratios and the Severe Maternal Outcome Ratios, both of which ranged from 2.2 to 3.6 during the three periods of study (Table 7).

## DISCUSSION

In the unit, morbidity due to PPH has decreased significantly from 2010/2011 to 2014 but continues to be far greater than the national mortality rates due to PPH. This emphasizes the need to continuously carry out audits of this nature. More than 93% of cases of PPH were identified by the need for blood transfusion alone and a further 3% by the use of colloids, and this is the easiest method of identifying and enumerating cases of significant PPH after the event. Every case with a retained placenta need not have a clinically significant PPH. Although in the WHO Near Miss Audits, the requirement of ≥5 units of blood transfusion is considered to be a severe PPH and a criterion for SAMM,[5] in a Lankan pregnant woman at term whose body weight is 50 to 55 kg, even a 1.5 to 2 L blood loss may have serious adverse effects. Therefore, the requirement of three or more units of blood transfusion was considered to be a significant PPH. The fact that no women had O rhesus negative blood transfused confirms that all the women who required a blood transfusion very urgently had their blood group recorded on the case notes prior to delivery, as it should be, enabling the transfusion of group-specific uncross matched blood for a dire emergency.

Although only one maternal death due to PPH occurred during the three periods of study, 18 (15%) cases required more than five units of blood transfusion, and they could have succumbed to the PPH if their management was suboptimal. The progressive increase in the proportion of cases admitted for intensive care from 2010/2011 to 2014, without a concomitant increase in the proportion of cases requiring five or more units of blood transfusion, probably indicates a greater emphasis on monitoring these patients after management of the PPH. Although the total numbers have decreased significantly, the rates of PPH and severe PPH progressively increased from vaginal delivery to CS to instrumental vaginal delivery in 2010/2011 as well as in 2013. However, the rates of PPH and severe PPH after CS have decreased by 2014, and there were no cases of severe PPH associated with IVD in 2014. As AOL was the leading risk factor, with IOL and hypertension in pregnancy being the next two important risk factors for PPH, it is important to anticipate and prevent PPH in women who require AOL and to properly select women who require IOL, instrumental vaginal delivery, and CS. Although vaginal packing was carried out in a large proportion of patients, not all of them may have been indicated, as the underlying cause was considered to be uterine hypotonia in some of them. However, as trauma (especially vaginal and cervical tears) continues to account for a large proportion of cases of PPH, and IVD is also associated with a high risk of PPH, intensive skills training for all care givers involved in conducting vaginal deliveries is required.

Approximately one in two to three cases of PPH being detected within 15 minutes emphasizes the importance of close monitoring of the mother immediately after delivery. However, one in four to five being detected more than 1 hour after delivery is a cause for concern. The inclusion of the Modified Early Warning System chart on the reverse side of the National Partogram, for routine monitoring of all postpartum women, is expected to improve this aspect in the future. Good trends toward earlier detection of PPH, earlier commencement of blood transfusions, earlier involvement of a specialist, and earlier shifting to the OT after vaginal delivery were noted from 2010/2011 to 2014. However, further improvements in these aspects are needed. Although some improvements were noted in recording the case notes of the time of specialist involvement, the overall record-keeping needs to be improved. Although there was a possible increased tendency to try a condom catheter for uterine tamponade, resorting to this intervention appeared to be delayed and the timing of such insertion was also not documented in several cases. This needs to be improved. The reasons for the rates of postpartum hysterectomies for PPH continuing to be high needs an in-depth analysis. The decrease in the proportion of cases where pre-transfusion Hb was checked is acceptable, because in the presence of a severe acute hemorrhage, a clinical decision is made and the pre-transfusion Hb is often not checked. However, the decrease in the proportion of cases where the Hb was checked prior to discharge from the hospital is of great concern. This has to be corrected. The indicators suggest that the quality of care has been satisfactory during the three periods of study.

## CONCLUSION

The occurrence of PPH has significantly decreased from 2010/2011 to 2014, and there have been some improvements in the suboptimal management processes identified in 2010/2011. However, further improvements are needed.

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