

## ORIGINAL RESEARCH ARTICLE

# The Effectiveness of a Collector Bag for Measurement of Postpartum Hemorrhage

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## Abstract

The aim of the study was to assess sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) of collector bag and its correlation with hemoglobin (Hb) and hematocrit (Ht) variations. This study, carried on 100 women referred for admission to labor ward of Shohada hospital in Orumeyeh City, Iran, from April to November, 2007. Serum Hb and Ht were measured after admission; a collecting bag placed under the pelvis just after birth and was weighted after delivery. Hb and Ht were again assessed at 8 hr after delivery. PPH was defined as blood loss >500 ml following vaginal delivery. Each 500 ml blood loss accounts for approximately a 3% change in the Ht level or a falling in Hb of 1 g/dl. With this cut off our noted Sensitivity=80%, Specificity=95.7%, PPV= 88.9% and NPV= 91.8%. The collector bag is a rapid and precise instrument to diagnose of postpartum hemorrhage in the delivery room. It also enables a visual, quantitative and objective estimation of blood loss. (*Afr J Reprod Health* 2017; 21[1]: 99-103).

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**Key words:** Collector bag, Estimating, Laboratory Test, Postpartum Hemorrhage

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## Résumé

Le but de l'étude était d'évaluer la sensibilité, la spécificité, la valeur prédictive positive (VPP), la valeur prédictive négative (VPN) du sac collecteur et sa corrélation avec les variations de l'hémoglobine (Hb) et de l'hématocrite (Ht). Cette étude a porté sur 100 femmes envoyées aux spécialistes au service de travail de l'hôpital Shohada dans la ville d'Orumeyeh, en Iran, d'avril à novembre 2007. Les taux de Hb et Ht sériques ont été mesurés après l'admission; Un sac de collecte placé sous le bassin juste après la naissance a été pondéré après l'accouchement. Hb et Ht ont de nouveau été évalués 8 heures après l'accouchement. La PPH a été définie comme une perte de sang >500 ml après l'accouchement vaginal. Chaque perte de sang de 500 ml représente approximativement une variation de 3% du niveau Ht ou une baisse de Hb de 1 g / dl. Avec ceci comme point minimum, nous avons noté la Sensitivité = 80%, Spécificité = 95.7%, VPP = 88,9% et VPN = 91,8%. Le sac collecteur est un instrument rapide et précis pour diagnostiquer une hémorragie post-partum dans la salle d'accouchement. Il permet également une estimation visuelle, quantitative et objective de la perte de sang. (*Afr J Reprod Health* 2017; 21[1]:99-103).

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**Mots clés:** Sac collecteur, estimation, analyse de laboratoire, hémorragie postpartum

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## Introduction

Postpartum hemorrhage (PPH) is one the major causes of maternal mortality and morbidity globally<sup>1-4</sup>. In developed countries, sever PPH occurs in about one percent of deliveries<sup>5, 6</sup> and based on WHO report, about 25% of maternal mortalities are associated to sever PPH<sup>7</sup>. In Iran based on the Health Ministry Report in 2006, maternal mortality rate (MMR) was 25% and PPH was the main cause of maternal mortality<sup>8</sup>.

Predicting and diagnosing severe PPH remains challenging and most deaths due to sever PPH involve delay in the diagnosis and management of hemorrhage<sup>9, 10</sup>. Underestimation of blood loss at delivery time is one the reasons of the delayed diagnosis of blood loss. Many studies indicate that assessment of post-partum blood loss following a vaginal delivery is difficult and visual estimation of blood loss is frequently inaccurate<sup>11-13</sup>. Another method for measuring postpartum blood loss is calculated of Ht and Hb variations before and after

delivery, but these variations take time about 8-12 hr after delivery<sup>14</sup>. Therefore, diagnosis of postpartum blood loss by using Hb and Ht is a retrospective method and, also it is not a clinical procedure. Based on this assumption if blood loss objectively measured rather than visually or by Hb and Ht variation, before a massive hemorrhage, with an early diagnosis and appropriate management, the incidence of severe PPH will reduce.

Tourne et al<sup>15</sup> showed that a collecting plastic bag, put under the pelvis of the mother just after delivery is a quantitative and objective method of measuring postpartum blood loss. In Tourne's study postpartum hemorrhage was defined by a fall of Ht more than 10 points (delta Ht), or by a fall of Hb >3g/dl (delta Hb) that were assessed at three days after delivery.

The aim of this study was to assess the sensitivity, specificity, PPV and NPV of collector bag with a postpartum hemorrhage definition >500ml blood loss, or a fall of Ht >3% or by a fall of Hb > 1g/dl, was assessed at 8 hr after delivery. The correlation between bag's volume and Hb and Ht variation was also examined.

## Methods

This was an analytic-diagnostic study that was carried out on 100 women with unique pregnancy at term that undergoing a vaginal delivery in the Labor Ward of Shohada Hospital in Orumeyeh City, Iran. The hospital records more than 200 vaginal deliveries annually. Breech presentations and women with a previous postpartum hemorrhage were excluded.

Serum Hb and Ht were measured after admission for labor and were again assessed at 8 hours after delivery. Postpartum hemorrhage was defined by a blood loss >500 ml or a fall of Ht > 3%, or a fall of Hb >1g/dl.

A plastic bag (in size 84\*28 cm and thickness of 70 microns) was placed under the mother as soon as the baby was born and before delivery of the placenta and was weighted after delivery.

Data were collected using a checklist filled out for each vaginal delivery, and included information on the woman's age, induction of labor, mode of delivery, number of babies and their birth weight, and outcome data. For deliveries with severe PPH, data regarding the PPH management of obstetric were recorded.

We assessed the sensitivity and specificity of collecting bag using the following thresholds: blood loss >500 ml or a fall of Ht > 3%, or a fall of Hb >1g/dl (standard definitions) at each of the following time, after admission and 8 hour postpartum. Finally, we calculated the positive and negative predictive values of each volume lost in collecting bag method, assuming PPH prevalence to assess the clinical utility of each measure.

Statistical analyses were performed using SPSS version 13 and Chi square and t-tests were used. The significance level was set at  $p < 0.05$ .

Written informed consent was obtained from each woman before the study. Each woman was assigned an ID code, ensuring data set anonymity. Women could withdraw from the study at any point. The study design was approved by the institutional Ethics Committee of Ahvaz Jundishapur University of Medical Sciences.

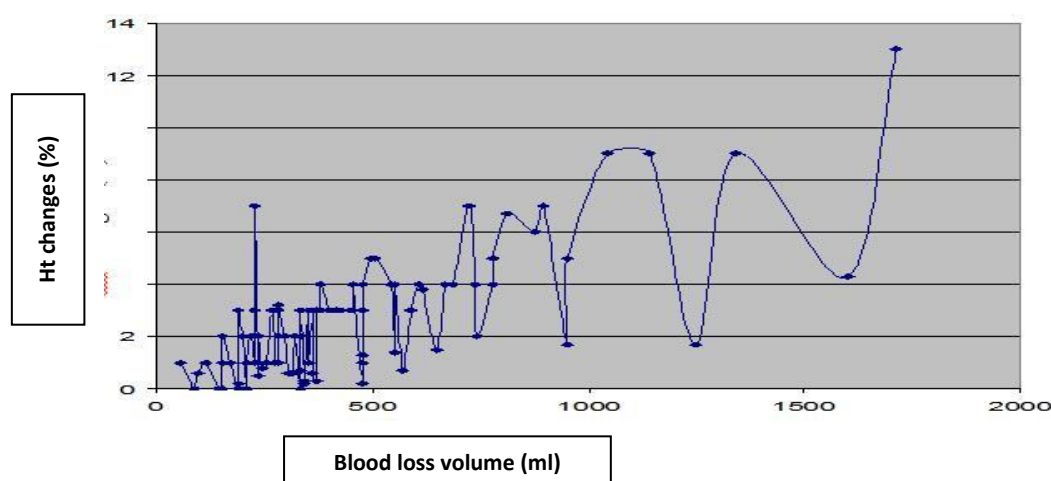
## Results

The results showed collector bag accuracy in assessing postpartum hemorrhage in comparison to Hb and Ht variation. In the third stage of labor 73% of mothers had a PPH <500 ml at 2 hours after delivery and 27% of mothers had a PPH  $\geq$ 500 ml (table 1). The mean volume of blood loss was  $299 \pm$

**Table 1:** Frequency of Blood Loss Volume after Delivery to 2 Hours Later

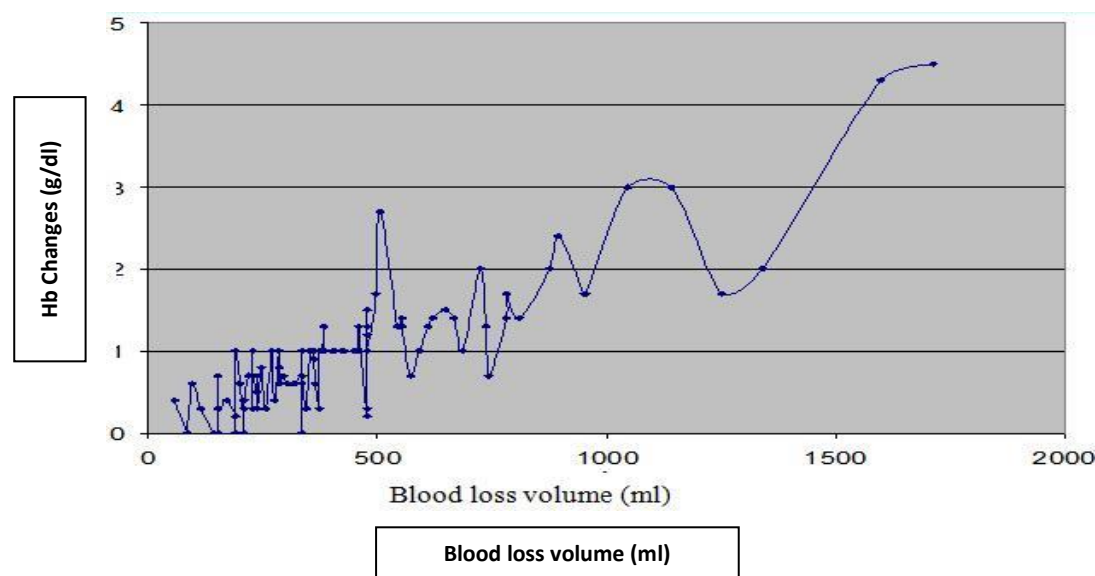
Blood loss volume (ml)	Number (%)
<500	73(73%)
500-999	21(21%)
1000-1499	4(4%)
$\geq 1500$	2(2%)
Total	100(100%)
Mean(SD)	299( $\pm$ 210)
Min	57
Max	1713

210 ml (57- 1714) ml. Also the results showed that 70% of women had a fall in Ht < 3% 8 hours after delivery by comparing to before delivery. Thus, based on the PPH definition they had a normal blood loss, and only 30% of cases had a fall in Ht  $\geq$ 3%. The mean fall in Ht was  $2.9 \pm 2.8$  (0-13) percent (table 3). Also, 71% of women had a fall in Hb < 1 g/dl, and only 29% of mothers had a fall in Hb  $\geq$ 1 g/dl. The mean fall in Hb was  $0.9 \pm 0.8$  g/dl (0-4.5) (table 3). Based on table 2 the sensitivity of collecting bag for Hb was 79.3%, for Ht was 80% and for Hb-Ht was 82%. The specificity of the test for Hb was 94.4%; of Ht was 95.7% and for Hb-Ht



**Figure 1:** The Relation between blood loss volume and Ht changes

The plot is linear and shows the proportional of the collection bag volume with drop in hematocrit after hemorrhage. This chart also shows that there is a direct relation between changes in pre and postpartum hematocrit and blood loss volume collected in bag.



**Figure 2:** The Relation between blood loss volume and Hb changes

The plot is linear and shows the proportional of the collection bag volume with drop in hemoglobin after hemorrhage. This chart also shows that there is a direct relation between changes in pre and postpartum hemoglobin and blood loss volume collected in bag.

was 95.7%. Also PPV of collector bag for Hb was 85.2%, for Ht was 88.9% and for Hb-Ht was 100% and NPV of collecting bag for Hb was 91.8%, for Ht was 91.8% and for Hb-Ht was 98.5%.

## Discussion

The collector bag had a high sensitivity, specificity, positive predictive value and negative predictive value in the diagnosis of postpartum hemorrhage. At the time this study was conducted, there was only one published study regarding the use of collecting

bags in predicting PPH<sup>15</sup>. In Tourne study the Hb-Ht was measured after admission and again three days after delivery and post- partum hemorrhage was defined by a fall of Ht more than 10 points or by a fall of Hb more than 3 g/dl. The results showed the sensitivity of collector bag for Hb was 38.77% and for Ht was 34.21%, that was lower than the sensitivity in our study.

It was probably due to blood loss during three days after delivery that although was low, but it could lead to PPH. In specificity, PPV and NPV in

**Table 2:** Sensitivity, Specificity, PPV and NPV of Blood Loss Measurement by Collector Bag Compared to Reference Standard of Hb-Ht

Collector bag Validity (%)	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value	Precise
Hemoglobin	79.3%	94.4%	85.2%	91.8%	90%
Hematocrit	80%	95.7%	88.9%	91.8%	91%
Hb-Ht	82.1%	95.7%	100%	98.5%	89%

**Table 3:** Frequency of True Positive, False Positive, True Negative and False Negative of Collector Bag for Hemoglobin and Hematocrit

Collector Bag (ml)	Hematocrit (%)		Hemoglobin (g/dl)	
	<3 (n=70)	≥3 (n=30)	<1 (n=71)	≥1 (n=29)
<500(n=73)	67	6	67	6
>500(n=27)	3	27	4	23

the two studies were comparable. Zhang *et al*<sup>16</sup> studied the effectiveness of using a transparent plastic collector bag for measurement of postpartum blood loss in 25381 women in 13 European countries. Results showed that the incidence of severe PPH was 1.71% in the intervention group (Collecting bag) compared to 2.06% in the control group. The difference was not statistically significant and it concluded that the use of a collector bag after vaginal delivery did not reduce the rate of severe PPH as compared to visual estimation of postpartum blood loss<sup>16</sup>.

However, prior studies have had mixed results in comparing the accuracy of measured blood loss to quantify methods of blood loss. Patel and colleagues<sup>17</sup> found a positive correlation between measured blood loss and other laboratory methods of measuring blood loss by photo spectrometry. Their study was limited by a relatively small sample size (n = 10). Other studies have reported promising correlations between measured blood loss and laboratory methods that quantify the blood loss using absorbent paper or sanitary pads and photometric measurement of alkaline hematin<sup>18</sup>.

## Conclusion

Future studies are needed to test the effectiveness of collector bag in randomize trials in developing countries. Based on this study results the collector pelvic bag is a rapid and precise procedure and it also enables a visual, quantitative, and objective estimation of blood loss and because of the simplicity of collector bag to diagnose of post-partum hemorrhage and its very low cost, it is

suggested that the collector pelvic bag be used widely as a routine preventive measure in delivery rooms. Midwives should be educated on the use of collector bags.

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## Declaration of Authorship

This study was Master's thesis by LV, who participated in acquisition, analysis, and interpretation of data and drafting of the manuscript. ZA was the supervisor of the thesis and participated in the conception and design of the study, data analysis and interpretation, drafting and revision of the manuscript.

## Competing Interests

All authors declare: no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous 3 years; no other relationships or activities that could appear to have influenced the submitted work.

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