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## THE RELATIONSHIP BETWEEN OBSTETRIC FACTORS AND POSTPARTUM HAEMORRHAGE MATERNAL DEATHS IN JEMBER DISTRICT

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### ABSTRACT

#### KEYWORDS

Haemoglobin Level,  
Retained Placenta,  
Uterine Atony, Perineal  
Tear, Postpartum  
Haemorrhage, Maternal  
Mortality

Maternal mortality remains public health issue. One of its leading causes is postpartum haemorrhage. The aim of this study is to test the relationship between haemoglobin levels, perineal tear, retained placenta, uterine atony, and maternal mortality from postpartum haemorrhage in Jember district, Indonesia. This case-control study comprised 43 mothers died from postpartum haemorrhage (cases), and 43 mothers survived from postpartum haemorrhage (controls) between from January 2017 and December 2019. Data were obtained from maternal verbal autopsies, complemented by birth registrations and medical records in 26 community health centres across Jember district. The chi-square, and multivariate logistic regression were administered to test the hypothesis. The results of this study indicate that Haemoglobin levels ( $p = 0.032$ , OR 6.372, 95% CI 1.172 - 34.626), retained placenta ( $p = 0.033$ , OR 4.578 95% CI 1.128 - 18.587), and atonia utery ( $p = 0.014$ , OR 4.578 95% 1.364 - 16.502) had significant relationship with maternal deaths from postpartum haemorrhage. However, perineal tear ( $p = 0.155$ , OR 0.347 95% 0.081 - 1.490) had no significant relationship with maternal deaths from postpartum haemorrhage. The conclusion in this study is Identifying obstetric factors are important. Therefore, conducting early detection screening during pregnancy is encouraged to reduce postpartum haemorrhage maternal death.

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### INTRODUCTION

Maternal mortality continues to be a public health issue worldwide. In Indonesia, the high maternal mortality rate is caused by various complications that occur during pregnancy, childbirth and the postpartum period (WHO, 2018). The majority of maternal deaths in Indonesia are caused by haemorrhage (1,280 cases in 2019).

Postpartum haemorrhage is blood loss of more than 1000 ml or more accompanied by symptoms of hypovolemia within 24 hours to 12 weeks postpartum (Watkins & Kellay, 2020). The main causes are tone, tissue, trauma and thrombin (H.Jessica L. Bienstock, 2021). Mothers with haemoglobin levels less than normal are called anaemia (Mremi et al., 2022). Mothers with haemoglobin levels below 11gr/dl will be at risk of death in pregnancy and

childbirth both at present and in the future (Allen, 2000). Anaemia causes a reduced supply of oxygen in the blood causing the uterus fails to contract (Lancaster et al., 2020). With the failure of contractions, there is a failure to expel the placenta or it is called retained placenta (Perlman & Carusi, 2019a). The level of anaemia in the mother affects the severity of postpartum haemorrhage even to death (Lancaster et al., 2020). Anaemia during pregnancy also affects uterine tone, resulting in a high risk of uterine atony, which is the biggest contributor to postpartum haemorrhage mortality (Kebede et al., 2019). In addition, anaemia in pregnancy also increases the risk of childbirth with measures such as forceps and vacuum so that the risk of tearing the birth canal increases (Omotayo et al., 2021; Mahmood et al., 2019).

East Java is the province with the second highest number of maternal deaths in Indonesia. Jember district remains having the highest Maternal Mortality Ratio (MMR) in East Java province for many years. In 2020, the maternal health indicators in the district are good; the coverage of four antenatal visits, and three postnatal visits coverage were 82% and 92.3% accordingly. Moreover, the coverage of deliveries assisted by professional birth attendants was 93.7%. However, the MMR was high (170 per 100,000 live). Postpartum haemorrhage was reported as the main cause of maternal death in the district.

## METHOD RESEARCH

This case-control study aims to identify risk factors associated with postpartum haemorrhage maternal mortality in Jember district, Indonesia. This study analyses maternal anaemia, retained placenta, atony uterine, and perineal tear.

### Study Setting

Jember, a district in East Java, comprises 31 sub-districts, which were resided by approximately two million populations. This district has 50 community health centres (In Indonesian: *Pusat Kesehatan Masyarakat*) and 135 auxiliary health centres (In Indonesian: *Pusat Kesehatan Masyarakat Pembantu*).

### Data and Sample

A case-control study of mothers who had haemorrhage from January 2017 to December 2019 was conducted in Jember district. Forty-three cases (n=43) were mothers who died from postpartum haemorrhage, and forty-three controls (n=43) were surviving mothers who had postpartum haemorrhage, acquired from maternal verbal autopsy forms.

Data from medical records and birth registers in 26 community health centres, where the childbirth from the mothers who died from postpartum haemorrhage were taken to complement the data. Cases were obtained through total sampling, while controls were taken using purposive sampling. We excluded women with comorbidities, or other complications.

Maternal verbal autopsy reports were conducted through an audit by Maternal Perinatal Audit team, who identify the causes of maternal and infant morbidity and mortality to prevent future morbidity and mortality. As a result, maternal and infant mortality rates will decrease. Maternal Verbal Autopsy (MVA), which was developed by The Ministry of Health, is used in the audit. This MVA consists of questions and potential factors that contributed to the maternal death.

Postpartum haemorrhage maternal death was the outcome. The risk factors included anaemia, retained placenta, perineal tear, and uterine atony. The measurements of the variables are based on the Maternal verbal autopsy reports. Maternal anaemia is haemoglobin levels  $<9$  gr/dl (Yes/ No), while retained placenta is the failure of the placenta in spontaneously separate during the third stage of labour (Yes/No) (Combs et al., 1991; Dombrowski et al., 1995; Nikolajsen et al., 2013). Uterine atony is a failure of the uterus to contract adequately following delivery (Yes/No) (Cunningham, 1997), while perineal tear is the tear in the area between vaginal opening and anus (Yes/No) (RCOG, 2022).

### Data analysis

The hypothesis were examined using bivariate and multivariate logistic regression analysis to find out the relationship between risk factors and postpartum haemorrhage maternal death. Data were analysed using SPSS for Windows 25.0.

## RESULT AND DISCUSSION

### A. RESULT

**Table 1. Table of respondent characteristics and bivariate analysis**

Risk factor	Cases (N = 43)	Controls (N = 43)	OR (95% CI)	p-value	Contingency Coefficient (C)
<b>Haemoglobin level</b>				0.001*	0.338
< 11g/dL	41 (95.3%)	29 (67.4%)	9.897		
11g/dL	2 (4.7%)	14 (32.6%)	(2.088 – 46.910)		
<b>Uterine atony</b>			3.795	0.004*	0.297
Yes	23 (53.5%)	10 (23.3%)	(1.502 – 9.591)		
No	20 (46.5%)	33 (76.7%)			
<b>Retained placenta</b>			3.703	0.009*	0.271
Yes	18 (41.9%)	7 (16.3%)	(1.347 – 10.179)		
No	25 (58.1%)	36 (83.7%)			
<b>Perineal tear</b>			0.191	0.004*	0.295
Yes	4 (9.3%)	15 (34.9%)	(0.057 – 0.639)		
No	39 (90.7%)	28 (65.1%)			

Table 1 shows the number of cases (n=43) and the control group (n=43). The majority of mothers experienced anaemia in both the case and control groups with a total of 41 (95.3%) and 29 (67.4%) accordingly. The association is statistically significant as  $p = 0.001$ . Therefore, the null hypothesis is rejected and thus restated as there is a significant relationship between anaemia and postpartum haemorrhage maternal mortality.

In addition, the majority of mothers in the case group experience uterine atony (53.5%), while in the controls, the majority of the mothers did not (76.7%). The association is statistically significant as  $p = 0.004$ . Therefore, the null hypothesis is rejected and thus restated as there is a significant relationship between uterine atony and postpartum haemorrhage maternal mortality.

The majority of mothers in both groups did not experience retained placenta, which constituted (58.1%) and (83.7%) respectively. The association is statistically significant as  $p = 0.009$ . Therefore, the null hypothesis is rejected and thus restated as there is a significant relationship between retained placenta and postpartum haemorrhage maternal mortality. Finally, the majority of mothers in both groups did not experience lacerations; cases (90.7%) and controls (65.1%). The association is statistically significant as  $p = 0.004$ . Therefore, the null hypothesis is rejected and thus restated as there is a significant relationship between perineal tear and postpartum haemorrhage maternal mortality.

**Table 2 . Multivariate logistic regression analysis**

Risk factor	B	p- value	Odd Ratio	95% CI
Haemoglobin Level	1.852	0.032*	6.372	1.172 – 34.626
Uterine atony	1.557	0.014*	4.744	1.364 – 16.502
Retained Placenta	1.521	0.033*	4.578	1.128 – 18.587
Perineal tear	-1.057	0.155	0.347	0.081 – 1.490
Constant	-1.455	0.210	0.233	
Probability			91.82%	

Table 2 presents mothers with haemoglobin level  $< 11\text{g/dL}$  are at greater odds of dying from postpartum haemorrhage than those who are not anaemia (OR 6.372, 95% CI 1.172 – 34.626). This means anaemia is associated with postpartum haemorrhage maternal mortality, and mothers with anaemia have an increased risk of 9.897 times experiencing death from postpartum haemorrhage compared to those who do not have anaemia.

Similarly, mothers experiencing uterine atony are at greater odds of dying from postpartum haemorrhage than those who do not experience uterine atony (OR 4.744, 95% CI 1.364 – 16.502). This means uterine atony is associated with postpartum haemorrhage maternal mortality, and mothers with uterine atony have an increased risk of 4.744 times experiencing death from postpartum haemorrhage compared to those who do not have uterine atony.

Regarding retained placenta, mothers with retained placenta are at greater odds of dying from postpartum haemorrhage than those who do not have retained placenta (OR 4.578, 95% CI 1.128 – 18.587). This means retained placenta is associated with postpartum haemorrhage maternal mortality, and mothers with uterine atony have an increased risk of 4.578 times experiencing death from postpartum haemorrhage compared to those who do not have retained placenta.

Lastly, mothers with perineal tear are at greater odds of dying from postpartum haemorrhage than those who do not have retained placenta (OR 0.347, 95% CI 0.081 – 1.490). This means perineal tear is associated with postpartum haemorrhage maternal mortality, and mothers with perineal tear have an increased risk of 0.347 times experiencing death from postpartum haemorrhage compared to those who do not have perineal tear.

## B. DISCUSSION

Our findings show significant relationship between haemoglobin levels and maternal deaths from postpartum haemorrhage. Half of the population of pregnant women in the world is anaemic (Lumbanraja et al., 2019). Delivery with anaemia (haemoglobin level <11 g/dl) will result in disruption of uterine muscle function directly so that it cannot cause adequate contractions. Anaemia is considered a direct cause of postpartum haemorrhage (Omotayo et al., 2021; Mahmood et al., 2019).

(Nur et al. (2021) reported that mothers who experience anaemia will have a risk of developing postpartum haemorrhage of 7.8 than mothers who give birth without anaemia. Mothers with anaemia are closely associated with death (Lancaster et al., 2020). Moreover, mothers with postpartum haemorrhage were found to have significantly lower haemoglobin levels than mothers with postpartum haemorrhage who survived. Mothers died from postpartum haemorrhage had an average Hb level of 6.2 g/dL, while survived mothers had an average of 9.2 g/dL. Mothers who previously had a history of postpartum haemorrhage were found to be anaemic in subsequent pregnancies with an average haemoglobin level of 6.2 g/dL (Lancaster et al., 2020). In a study conducted by (Smith et al., 2019) discovered that anaemia was greater in mothers with a high risk age such as younger < 20 years and older or 40 years. With the age of the mother being included in a high risk if the mother also has anaemia, the death from postpartum haemorrhage will be much greater depending on the severity of anaemia (Smith et al., 2019).

Anaemia has been shown to affect myometrial contractility, which is associated with decreased transport of haemoglobin and oxygen into the uterus, leading to cellular dysfunction and impaired enzymes in tissues (Bazirete et al., 2020). There is a relationship between anaemia and the risk of death from postpartum haemorrhage, namely the first is the role of changes in the physiology of red blood cells that trigger the occurrence of postpartum haemorrhage, in a preliminary study carried out that lower than normal red blood cells in the blood circulation will change the frictional force, so it will reduce the interaction of platelets with the walls of blood vessels which will lead to the ability to close vascular (Lancaster et al., 2020). Second, there is evidence that chronic hypoxia caused by anaemia may increase the susceptibility of the placenta and uterus to vascular damage during postpartum haemorrhage. Third, anaemia is associated with uterine atony (Lancaster et al., 2020). The fourth assumption that blood loss <500 mg that does not meet the criteria of postpartum haemorrhage is often ignored by health workers and the individual himself, but blood loss <500 will actually have a bad impact on sufferers with severe anaemia (Lancaster et al., 2020). So it is necessary to classify the severity of anaemia for pregnant and childbirth women (Lancaster et al., 2020). If pregnant and giving birth mothers experience anaemia, it will cause death in pregnancy and or childbirth in the future (Allen, 2000).

The failure of the uterus to contract is called uterine atony, which occurs because the relaxed myometrium fails to constrict blood vessels (Khan, R. U., & El-Refaey, 2006). At term 1/5 of the maternal cardiac output or 1000 mL/min enters the uteroplacental circulation. Postpartum haemorrhage can cause exsanguination (blood loss both externally and internally) in a short time (Khan & El-Refaey, 2006). The presence of uterine atony predominates with retained placenta (Khan, R. U., & El-Refaey, 2006). The retained placenta plays a role in inhibiting uterine contractions which is strong enough in the process of constricting the placental blood vessels. In the case of postpartum haemorrhage with atony, it is more associated with retained placenta so that contraction failure is more common (Khan, R. U., &

El-Refaey, 2006). The cause is not clearly known except for the presence of uterine fibroids, in which the source of distension cannot be removed by uterine contractions, resulting in atony. Multiple pregnancy, polyhydramnios is also a cause of uterine distension which correlates with postpartum haemorrhage.

Retained placenta is one of the aetiology of postpartum haemorrhage. This is a condition in which the placenta or retained placenta is not delivered more than 30 minutes after the birth of the baby (Perlman & Carusi, 2019a). In our study, retained placenta has a significant relationship with the incidence of postpartum haemorrhage death. The results of the calculation of the odds ratio (3,464) also strengthen this relationship, so it can be interpreted that mothers who experience retained placenta have a risk of death from postpartum haemorrhage 3,464 times greater than mothers who do not experience retained placenta. The relationship between retained placenta was also found by several previous studies which stated that the absence of the placenta or retained placenta for more than 30 minutes would have an impact on the incidence of postpartum haemorrhage death (Erickson et al., 2020 ; Rottenstreich et al., 2021).

Tiruneh et al., (2022) stated that mothers with retained placenta had four times the risk of death. This is supported by (Edwards, 2018) who argues that retention is the biggest cause of postpartum haemorrhage which leads to death. In his research, Edward looked for the causes and predictions of postpartum blood loss, where retained placenta contributed to more blood loss, namely 1000 ml as much as 34%, 1500 ml as much as 47%, 2000 ml as much as 53%. The most when compared to uterine atony and lacerations (Edwards, 2018). Another study from (Liu et al., 2021) stated that retained placenta contributed to the incidence of postpartum haemorrhage by 55.83%, greater than the 10% reported by WHO (Liu et al., 2021).

(Perlman & Carusi, 2019b) stated that there are three main causes of retained placenta, one of which is caused by the uterus failing to contract or uterine atony, causing failure to separate and expel the placenta (Perlman & Carusi, 2019b). In the accompanying risk factors, anaemia is correlated with the incidence of retention and postpartum haemorrhage, namely anaemia causes the uterine muscles to not contract properly, so this will result in uterine atony in postpartum mothers. Poor contractions or the appearance of atony will result in the remaining placenta not being properly detached from the uterine wall so that the risk of bleeding is greater (Lancaster et al., 2020).

A study by (Endler et al., 2016) reported that mothers with retained placenta tend to have low levels of GPX1 protein concentration in placental tissue which leads to oxidative stress (Endler et al., 2016). Retention of the placenta is a death factor associated with secondary postpartum haemorrhage and is associated with anaemia, malnutrition during pregnancy and the lack of adequate transportation facilities to health care centres, the number of deliveries at home also contributes to the higher severity of cases (Abrar et al., 2016). The threshold for expulsion of the placenta is only at 30 minutes and at 15 and 20 minutes the rest are at risk for postpartum haemorrhage (Edwards, 2018), the longer the duration of the third stage, the higher the risk of postpartum haemorrhage. Some of the placental tissue can be left in the mother's uterus, whether consciously or not by health workers. It can appear as abnormal bleeding days to weeks after delivery and is the biggest cause of secondary postpartum haemorrhage (Perlman & Carusi, 2019).

The results of our study found that perineal tear had no significant relationship with the incidence of postpartum haemorrhage. This result is different from the findings of previous researchers who stated that tears of the vagina, the perineum, and episiotomy were all associated with severe postpartum haemorrhage. Of the three studied genital tract tears, vaginal tearing >3 cm was the most common reason for severe postpartum haemorrhage with a twofold risk of occurring in 8% of the women. Vaginal tearing is rarely measured or discussed in the scientific literature and may therefore be underestimated in general. It is well known that genital tract tears are associated with severe postpartum haemorrhage as it is included as one of the four classical causes of severe postpartum haemorrhage uterine atony, genital tract tears, retained placenta, and coagulation disorders. As genital tract tears have a strong association with postpartum haemorrhage, timely identification and management by the birth attendant may reduce the amount of postpartum haemorrhage. Restricted use of episiotomy only with foetal indication is recommended, and slowing down the birth of the infant's head by assisting the parturient in breathing the baby's head out between contractions or at the end of a contraction to avoid sphincter tears (Graugaard & Maimburg, 2021). The differences of the results in this study suspected due to the lack of research samples and the presence of other concomitant factors that require further research. Although it showed insignificant results, the incidence of birth canal lacerations cannot be underestimated as one of the causes of postpartum haemorrhage so it still requires proper attention and treatment to reduce mortality and morbidity due to postpartum haemorrhage (Pourali et al., 2019).

## CONCLUSION

The results of this study provide important findings that there was a significant relationship between anaemia, retained placenta and maternal mortality from postpartum haemorrhage. Early detection of such obstetric factors is crucial in order to prevent postpartum haemorrhage deaths. Qualitative study exploring the risk factors for postpartum haemorrhage deaths among healthcare providers is encouraged

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