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Interpregnancy Interval and Adverse Birth Outcome in Term Premature Rupture of Membrane, 2017

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Abstract

The objective of this study is to assess the effect of interpregnancy interval on fetal outcome among women with term premature rupture of membrane in public hospitals, Ethiopia, 2017. Facility based follow up study was conducted in Southern Ethiopia public hospitals from February 30, 2017 to August 20, 2017. Among 150 observed mothers with interpregnancy interval of less two years, 46.67 % (95% CI: (7.170, 29.93) of them experienced adverse birth outcome, but among 173 women with interpregnancy interval of two and above years, 5.78% (95% CI: (7.170, 29.93) of them experienced adverse birth outcome. The odds of adverse birth outcome were more among women with interpregnancy interval of less than two years (AOR=17.899, 95%CI: [6.425, 49.859]. The effect of interbirth interval of less than two years on adverse birth outcome of newborn was increased by length labor of >=24 hours, induction of labour and cesarean section delivery. Interpregnancy interval of less than two years, in collaboration with other risk factors, is the main predictor of adverse birth outcome. Therefore especial attention should be given to mothers with birth spacing by using family planning methods to reduce adverse birth outcome.

Keywords: Interpregnancy interval, adverse birth outcome, term premature rupture of membrane

Major classification: Health Science.

1. Introduction

Inter-pregnancy interval (IPI) refers to how soon after a prior pregnancy a woman becomes pregnant again in short and long interval that in turn brings health risks for the mother and the fetus in both events. But, the majority of health risks are associated with short IPI (Shachar & Lyell, 2012).

Extension of inter pregnancy interval at least 24 months and six months after a live birth and miscarriage or abortion respectively help to reduce the risk of adverse maternal, perinatal and fetal outcomes (CSA, 2012; World Health Organization, 2007). Other evidence suggested that optimal birth spacing yields the greatest health, social, and economic benefits, and also an interval of at least two years between two consecutive births ensure maximum health benefits for mothers, newborns, and older children (WHO, 2005).

On the other hand, short birth interval has a high risk of fetal, neonatal, infant and under-five mortalities (Conde-Agudelo & Belizán, 2000; Rutstein, 2000; Setty-Venugopal & Upadhyay, 2002). In this respect, short interpregnancy interval was the main determinants of preterm birth, placental abruption, low birth weight, small for gestational age, labor dystocia, maternal morbidity and mortality and premature rupture of membrane (PROM)(Fuentes-Afflick & Hessol, 2000; Miller, Trussell, Pebley, & Vaughan, 1992). A short birth interval is also associated with high rates of third-trimester bleeding, anemia, and puerperal endometritis which puts women at high risk of death primary by hemorrhage (de Bocanegra, Chang, Howell, & Darney, 2014; Fuentes-Afflick & Hessol, 2000). Inter-pregnancy intervals shorter than 6 months were associated with 2-3 times increased risk of uterine rupture, major morbidity, and blood transfusion during vaginal delivery in mothers with at least one prior C-section (Stamilio, DeFranco, Paré, Odibo, Peipert, Allsworth, & Macones, 2007).

In developing countries, children born two years or early after an older sibling were at a 60% increased risk of death in infancy, while those born between two to three years had a 10% increase, compared with those born after intervals of four to five years (Rutstein, 2005).

Various organizations, including the World Health Organization (World Health Organization, 2007) have identified birth spacing as an important area of public health intervention. Just like the action of the above organization, the Federal Ministry of Health (FMOH), reproductive health department and health bureaus of respective regions have made concerted effort not only to reduce fertility and promote the health of the women and their children but also to alleviate the burden of short IPI on economic status of the family and nation as the whole. However, women in Ethiopia still experience shorter interpregnancy intervals (WHO, 2005).

Different previous studies concluded that short interpregnancy interval is the main risk factor of adverse birth outcome (Kangatharan, Labram, & Bhattacharya, 2016; Smits, Elzenga, Gemke, Hornstra, & van Eijsden, 2013; Zhang, Dang, Bai, Mi, Wang, & Yan, 2018). Its effect on adverse birth outcome is increased by other confounding variables like duration labor, rout of delivery and induction of labour (Gahwagi, Benali, Bettamer, & Zubi, 2017; Li, Zhang, Ling, & Jin, 2011; Sandström, Altman, Cnattingius, Johansson, Ahlberg, & Stephansson, 2017). But the other studies indicated that there is no relation between adverse birth outcome and inter pregnancy interval (Hanley, Hutcheon, Kinniburgh, & Lee, 2017).

Inconsistent previous evidences in other countries, and little known about the effect of interpregnancy interval on fetal outcome among mothers with term PROM in Ethiopia, initiates us to deal this problem. Therefore, the aim of this study is to assess the effect of interpregnancy

interval on adverse birth outcome among mothers with term Premature Rupture of Membrane in southern Ethiopia public hospitals.

2. Methodology

2.1. Study setting, design and population

Facility based follow up study was conducted in Southern Ethiopia hospitals from February 30, 2017 to August 20, 2017. Among Southern Ethiopia, hospitals which are found in Gamo Gofa, Yesegen Hizboch and South Omo zones were included in the study site. The administrative center of Gamo Gofa, Yesegen Hizboch and South Omo is Arba Minch, Gumaidie and Jinka respectively.

2.2. Sampling procedure

Five public hospitals from Southern Ethiopia were selected by simple random methods. These Hospitals are a flagship zonal and district hospitals that serves their respective town and other nearby districts and villages. Then, based on the number of clients who visited each hospital during the previous one year, the total sample size was proportionally allocated to each hospital. The number of women who visited each hospital per day was picked in a successive way in delivery wards, and spontaneous term PROM was confirmed in multi gravida mothers. Then all the multi gravida mothers with term PROM were observed from the time of diagnosis of it until the time of discharge or develop newborn complications. Among all observed mothers, 150 of them had interpregnancy interval of < two years and 173 of them had interpregnancy interval of > = two years at the time of term PROM diagnosis during the study period. At the end the abnormal and normal outcomes of the fetus were determined from all 323 multi gravida term PROM mothers.

2.3. Measurements

Five trained midwives collected data from the participants by interviewer administered questionnaire, observational checklist and physical measurements. The interviewer administered questionnaire contained four parts, namely socio-demographic variables, obstetric history, maternal and fetal outcomes, was prepared. The observational checklist was used to gather data on fetal 1^{st} and 5^{th} minute Apgar score, which is classified as with asphyxia (< 7 scores) and no asphyxia (>=7 scores). This value is the commutative score of skin color (coded as 0=blue-pale, 1-body pink-limb pale and 2=body and limb pink), muscle tone (coded as 0=absent-limp, 1= some flexion of extremities and 2=active), heartbeat (coded as 0=absent, 1= <100 and 2= >100), respiration (coded as 0=absent, 1=week cry and2= strong cry) and response to stimuli (coded as 0=absent, 1=slight and 2=good sneeze). .

Inter pregnancy interval, length of labor, PROM and the latency period of PROM was measured by time. Interpregnancy interval, main classifying variable, is the interval between the most recent previous childbirth and the starting time of pregnancy for current child as reported by the mother at the time of contact. It was classified as IPI of less than two years and IPI of two and above 2 years. Length of labor the time from initiation of labor to the end of the third stage of labor, and it was categorized as >=24 hours and < 24 hours. Rupture of membrane before initiation of

labor, which is PROM, was classified as preterm (occurred before 37 weeks of gestation) and term PROM (occurred after 37 weeks of gestation) based on gestational age. On the other hand, latency period of PROM was measured from time of reported rupture of membranes until time of delivery in hours which is categorized as long (>=24hrs) and short (<24hrs) latency period.

Physical measurements were used to obtain data on Mid Upper arm circumference (MUAC) of mothers, gestational age of mothers, blood sugar level of mother and weight of newborn. In this regard MUAC of each woman was measured at the midpoint between the tips of the shoulder and elbow of the left arm using non-elastic, non-stretchable MUAC tapes. Measurements were recorded to the nearest 0.1 cm. In this study, poor nutritional status of the mother, defined as MUAC < 23 cm (Van Zutphen, 2011). Similarly, gestational age of participants was determined by tape meter and also if there was confusion confirmed by ultrasonography. Blood pressure was measured by syphgnomanometry and it is considered as hypertension when BP of the mother is 140/90 mHg and above in two consecutive measurements which are 6 hours apart. Mothers with 140/90 mHg and above BP without proteinuria, with proteinuria and proteinuria and coma that developed after 20 weeks of gestation are called gestational hypertension, preeclampsia and eclampsia respectively. On the other hand, blood glucose level was measured by glucometer and it is called as gestational DM when the fasting blood glucose level is 92 mg/dl or higher. Weigth of newborn was measured by been balance and classified as < 2500gm and >=2500gm.

Fetal outcomes, the outcome variable, were classified as normal (alive without complication) and abnormal (newborn experience complications or died). The new born complication was measured by color of liquor (clear/meconium stained), first minute Apgar score (<7/>=7), birth weight (< 2500gm/>=2500gm), need NICU (yes/no), infection (yes/no), jaundice (yes/no), conjunctivitis (yes/no) and intraventricular hemorrhage (yes/no).

2.4. Data Quality assurance

A questionnaire was prepared in English and translated to Amharic, and re translated back to English to make sure the consistency of the questionnaire. Pre-test of the tool was performed outside the study area to readjust the questionnaire. Intensive training for data collectors was given for two days. Continuous supervision of data collection process was carried out to assure the quality of data. Finally, the collected data was carefully checked on daily basis for completeness, outlier and missing value as well as consistencies.

2.5. Data analysis

The collected data were entered, cleaned, coded and analyzed using SPSS version 20. Frequency distribution for selected variables was performed. Cleaning of the data was performed before analysis. To check the statistical significance between the dependent and independent variables, chi-square test was performed. In order to know the crude association between independent and dependent variables, crude odds ratio (COR) of PROM with 95% Confidence interval was calculated. Those variables, with P<0.2 from the bivariate analysis were considered for binary logistic regression.

Logistic regression analysis was performed to see the association between predictor and outcome variables. Adjusted odds ratio (AOR) with 95% CI was calculated for each independent

variable to check the adjusted association between independent variables and adverse birth outcomes. The statistical significance was set at P<0.05.

3. Results

3.1. Socio-Demographic and obstetric Profile

Overall, 323 women were enrolled in the study making a response rate of hundred percent (100%). Among these women, 133(41.2%) of the respondents were found in the age range of 20-24 years. Regarding their educational status, majority 99 (30.7%) of the participants attended grade 9-12. Housewives, 144 (48.3%), have got higher scores concerning the occupational status of the respondents. Regarding to residence 194(60.1%) of participants resided in the urban area. One hundred eight (33.4%) of respondents had very rich wealth index. Four (1.2%) of mothers were underweight (table 1).

Table 1: Socio-demographic profiles of respondents in selected public hospitals, Southern Ethiopia, 2017 (n=323).

Variable		Frequency	Percent
Age	15-19 year	41	12.7
	20-24 year	133	41.2
	25-29 year	95	29.4
	30-34 year	26	8.0
	35-39 year	26	8.0
	40-44 year	2	0.6
Occupational status	Housewife	144	48.3
	Farmer	29	9.7
	Government Employee	57	19.1
	Merchant	26	8.7
	Student	42	14.1
Marrietal status	Married	268	89.9
	Not married	15	5.0
	Divorced	10	3.4
	Widowod	2	0.7
	Separated	3	1.0
Educational status	Non-educated	45	13.9
	Read and write	7	2.2
	Grade 1-6	51	15.8
	Grdae 7-8	43	13.3
	Grade 9-12	99	30.7
	Above grade 12	78	24.1
Residence	Urban	194	60.1
	Rural	129	39.9
Wealth index	Very poor	23	7.1
	Poor	14	4.3
	Rich	75	23.2
	Medium	103	31.9

	Very rich	108	33.4
Middle upper arm circumference	Equal and above 23 cm	319	98.8
	Less than 23 cm	4	1.2

3.2. Health service utilization and obstetrics related issue

All but fifteen women had visited antenatal clinics from hospital, health center and health post during neonate pregnancy. One hundred eighteen (36.5%) respondents visited the antenatal clinic four and above times. Regarding to the time of ANC initiation, 166(51.4%) of them initiated the ANC visit within four months of conception. Two hundred seventy two (84.2%) PROM case mothers initiated labor spontaneously, but from all cases, 274(84.8%) of them took 24 and above hours. Seventy (28.3%) mothers delivered via C/s. Of the 323 women with term PROM, 4 (1.2%), 9 (2.8%) and 12 (3.7%) developed oligo hydraminous, polyhydramnios, and pregnancy induced hypertension respectively. Similarly, among all women, 14(4.3%), 7(2.2%), and 4(1.2%) experienced hemorrhage; chorioamnitis and puerperal sepsis respectively (table 2).

Table 2: Health service utilization and obstetrics related issues among respondents in selected public hospitals, Southern Ethiopia, 2017 (n=323).

Variables		Frequency	Percent
Gestation	Singleton	314	97.2
	Multiple	9	2.8
Utilization of ANC services	No	14	4.3
	Yes	309	95.7
Number of ANC visit	One visit	18	5.6
	Two visit	93	28.8
	Three visit	80	24.8
	Four and more visit	118	36.5
Time of ANC initiation	16 weeks and below	166	51.4
	After 16 weeks	145	45
Initiation of labor	Spontaneous	272	84.2
	Induced	51	15.8
Length of labor	<24 hours	274	84.8
	>=24 hours	49	15.2
Route of labor	C/s	253	78.3
	Vaginal	70	21.7
Hydramnios	Normal-hydramnios	310	96.0
	Oligo-hydraminous	4	1.2
	Poly-hydraminous	9	2.8
Presence of gestational Hypertension	No	311	96.3
	Yes	12	3.7
Presence of gestational DM	No	315	97.5
	Yes	8	2.5
Latency period	>= 24 hours	244	75.5
	<24 hours	79	24.5
Meconium stained	Yes	17	5.3

	No	306	94.7
Asphyxia	Yes	33	10.2
	No	290	89.8
Birth weigth	Below 2500gm	26	8.0
	>=2500gm	297	92.0
Need NICU	Yes	22	6.8
	No	311	93.2

3.3. Fetal outcome in term PROM

Among 150 observed mothers with IPI of < two years, 46.67 % (95% CI: (7.170, 29.93) of them experienced adverse birth outcome, but among 173 women with IPI of > = two years, 5.78% (95% CI: (7.170, 29.93) of them experienced adverse birth outcome such as low birth weight, asphyxia and need to admit NICU. This indicated that the prevalence of adverse birth outcome is higher in IPI < two years than IPI > = two years. In these regards, babies delivered from mothers with IPI of less than two years were more likely to be low birth weight (p=0.000), asyphaxic (0.004) and admitted to NICU (p=0.002) (table 3).

Table 3: Prevalence of adverse birth outcome with interpregnancy interval among term PROM in selected public hospitals, Southern Ethiopia, 2017.

	Groups					
Outcome variable	IPI <2 years (n=150)		IPI>=2 years (n=173)			
	No	%	No	%	P-value	COR(95%CI)
Adverse birth outcome	71	46.67	10	5.78	0.000	14.65(7.170, 29.93)
Low birth weight	22	14.67	4	2.31	0.000	7.26(2.4, 21.59)
Asphyxia	20	13.33	7	4.05	0.004	3.65(1.497, 8.89)
Need to admit NICU	18	12	4	2.31	0.002	5.76(1.90, 17.43)

3.4. Factors associated with fetal outcome

After adjustment for the potential confounders such as place mid upper arm circumference (MUAC), hypertension, wealth index, initiation of labor, length of labor and route of delivery, the association between the IPI and birth outcome of newborns was remained significant. The odds of adverse birth outcome were more among women with IPI of less than two years as compared to mothers with IPI of two and above years (AOR=17.899, 95%CI: [6.425, 49.859] (table 4).

Initiation of labor, length of labor and the route of delivery was also independent predictor of birth outcome in multiple logistic regression analysis. The effect of interbirth interval of less than two years on adverse birth outcome of newborn was increased by Twenty four and above hours length of labor (AOR: 4.637, 95% CI: [1.359, 15.819]) , inducing of labour (AOR: 4.748, 95% CI: [1.388, 16.245]) and cesarean section delivery (AOR: 5.595, 95% CI: (1.607, 19.477]) (table 4).

Table 4: Interpregnancy interval and adverse birth outcome in relation to other confounding variables in selected public hospitals, Southern Ethiopia 2017.

Variables		COR(95% CI)	AOR(95%CI)
Inter birth interval	>=two years	1	1
	< two years	14.649(7.170, 29.930)*	17.899(6.425, 49.859)*
Mid upper arm circumference	>= 23 cm	1	1
	< 23 cm	9.269(0.950, 90.399)*	6.792(0.547, 84.327)
Hypertension	No	1	1
	Yes	6.521(1.909, 22.276)*	1.554(0.197, 12.281)
Wealth index	Very poor	1	1
	Poor	0.687(0.180, 2.620)	2.161(0.222, 20.998)
	Rich	0.141(0.049, 0.405)	1.774(0.295, 10.687)
	Medium	0.249(0.097, 0.640)	1.332(0.237, 7.493)
	Very rich	0.369(0.147, 0.924)*	0.979(0.177, 5.433)
Initiation of labor	Spontaneously	1	1
	Induction	13.695(6.838, 27.427)**	4.637(1.359, 15.819)**
Length of labor	< 24 hour	1	1
	>=24 hours	18.558(8.803, 39.125)*	4.748(1.388, 16.245)*
Route of delivery	Vaginal	1	1
	C/s	28.250(14.227, 56.094)*	5.595(1.607, 19.477)*

*Statistically significant at p<0.05, **statistically significant at p<0.00.

4. Discussion

This facility based follow up study with the objective of the effect of interpregnancy interval on fetal outcome among term premature rupture of membrane was conducted in five selected public hospitals, Southern Ethiopia. Hence, the main findings of the study is that having of IPI<2 years is the main predictor for adverse birth outcome of newborn independent of place of residence, wealth index, ANC status, gestation, initiation of labor, length of labor, latency period of PROM and initiation of labor. Mothers with short inter birth interval were more likely to face abnormal outcome than mothers with an optimal interpregnancy interval. This finding is in an agreement with the other studies (Kangatharan, Labram, & Bhattacharya, 2016; Smits, Elzenga, Gemke, Hornstra, & van Eijsden, 2013; Zhang et al., 2018). This event can be occurred as a result of a negative effect of short IPI on Mom's body had no enough time to replace nutrient stores before getting pregnant again, and also families can have a high financial stress to obtain balanced diet and obstetrics related service for the prevention of nutritional deficiencies and other related infection and diseases. This cumulatively leads to high risk of abnormal fetal outcome in case of mothers with short IPI. On the other hand, the previous study reported that there would not be

associations between short interpregnancy intervals and adverse neonatal outcomes (Hanley et al., 2017).

Participants with length of labor 24 hours and above were more likely experienced adverse birth outcome than mothers with labor length of less than 24 hours. This finding is consistent with the study conducted by Sandström A. et al (Sandström et al., 2017). The other evidence also stated that the longer the length of second stage of labor, the lower score of Apgar scale for infants in 1 min, and the higher the incidence of asphyxia (Li, Zhang, Ling, & Jin, 2011). Facing of high adverse birth outcome in long duration of labor can be occurred as a result of meconium aspiration and suffocation of the fetus in the uterus. This finally brings deprivation of oxygenated blood, birth adverse outcome and even death of the newborn.

Likewise, initiation of labor by induction increased abnormal outcome of fetus as compared with spontaneous initiation of labor which is coincided with other study (Gahwagi et al., 2017). This finding is different from other study which stated that labour induction was associated with fewer perinatal problems (Gülmezoglu, Crowther, Middleton, & Heatley, 2012).

Similarly, route of delivery is the key factor for abnormal fetal outcome. In this case newborn who were delivered via C/s experience had high fold of abnormal outcome than neonate which was delivered via the vagina. This finding coincides with the study by Massarwa A et al (Massarwa, Caughey, & Lee, 2014), but it is different from the study conducted by Mahyavanshi, Patel, Nayak, Patel, Parmar, and Patel (2018) which stated that the patient's chance of a normal delivery without an increase in fatal and/or maternal morbidity is high in preterm fetus in the absence of other risk factors (Mahyavanshi et al., 2018). The difference can be due to demographic and survey variation. In addition to this the above difference can be happened due to variation in hospital setup for preterm baby and availability of instruments for the management of PROM.

5. Conclusion

Abnormal fetal outcomes were higher in mothers with interpregnancy interval of less than two years short. Interpregnancy interval of less than two years, in collaboration with other risk factors, is the main predictor of adverse birth outcome. Therefore especial attention should be given to mothers with birth spacing by using family planning methods to reduce adverse birth outcome.

Abbreviations : PROM: Premature Rupture of Membrane, **IPI**: Inter Pregnancy Interval, **SGA**: Small for Gestational Age, **MUAC**: Middle Upper Arm circumference, **BP**: Blood Pressure, **AOR**: Adjust Odd Ratio, **NICU**: Neonatal intensive Care Unit, **CI**: Confidence Interval.

Ethical Clearance : The study was approved by the Scientific, Ethical Review Committee of Arba Minch University, and Gamo Gofa zone health office. Informed consent was obtained from the mothers after a detailed explanation of the purpose of the study. Any involvement of the mothers was after their complete consent. Mothers were told as they would have the right to withdraw from the study at any time during the interview.

Competing interests : The authors declare that they have no competing interest.

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Authors' contributions: YW had the primary responsibility in all steps of the study and supervised field work together with **EA,** and **MD. YW, EA** and **MD** developed the study design and analysed data together. All authors were involved the writing of the manuscript and have approved the final version of the manuscript.

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