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Original Research Article

Impact of interpregnancy interval on maternal and perinatal outcomes

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ABSTRACT

Background: Inter-pregnancy interval (IPI) refers to the duration between the birth of one baby and the conception of the next pregnancy. In developing countries, a short inter-pregnancy interval (SIPI) poses a significant challenge, leading to higher risks of maternal and neonatal mortality. Aim was to determine the impact of SIPI on maternal and perinatal outcomes.
Methods: This prospective observational comparative study was carried out from October 2020 to May 2022. Non-probability convenient sampling was used, and the minimum sample size was calculated to be 140. Primigravida, multiple gestations, molar pregnancies, and those with major complications were excluded. The study compared two groups: cases (70 women with IPI ≤18 months) and controls (70 women with IPI between ≥19 months to ≤59 months). A p value <0.05 was considered statistically significant.
Results: Higher proportion of younger mothers had lower IPI as compared to those who were older. Higher proportion of mothers with short IPI had anaemia (p value- 0.017) while lower proportion had pregnancy induced hypertension (PIH) (p value- 0.001). On logistic regression analysis, patients with SIPI had lesser risk of PIH (p value- 0.036, OR: 0.266), higher risk of obstetric cholestasis (p value- 0.006, OR: 4.186) and higher risk of scar dehiscence/tenderness (p value- 0.003, OR: 10.666).
Conclusions: Mothers with a short interpregnancy interval of 18 months or less experienced significant morbidity and adverse perinatal outcomes, such as scar dehiscence and obstetric cholestasis. However, the incidence of pregnancy-induced hypertension (PIH) was notably lower in this group.

Keywords: Interpregnancy interval, Normal interpregnancy interval, Short interpregnancy interval

INTRODUCTION

Inter pregnancy interval (IPI) is defined as the time period from the birth of the previous baby to the conception of the current pregnancy. The spacing between births plays a significant role in influencing population growth rates and the socio-economic conditions of communities. It holds considerable potential for safeguarding maternal health and enhancing the outcomes of future pregnancies.[1]

A short inter-pregnancy interval (SIPI) is a period between delivery of the previous infant and conception of the current pregnancy of less than or equal to 18 months.[2] This remains to be a major challenge among women in developing countries associated with increased risk for maternal and neonatal mortality.[2,3] The normal inter-pregnancy interval (NIPI) refers to the time frame of 19 to 59 months between the birth of a previous infant and the conception of the current pregnancy.

To address a SIPI, various contraceptive methods must be employed as a solution.[4] Despite efforts to promote and prioritize women's healthcare, women with SIPI continue to experience high rates of maternal and fetal adverse outcomes.[5] Public health researchers have long observed that the time between child delivery and the next pregnancy (inter-pregnancy interval or IPI) or birth (inter-birth interval) impacts subsequent pregnancy outcomes.[6] Birth spacing's impact on maternal and child health has long interested researchers and policymakers.

Short and long intervals between births both correlate with negative pregnancy outcomes, though through distinct causal pathways. Longer intervals, indicative of reduced fertility, are tied to poorer pregnancy outcomes. Conversely, shorter intervals increase risks of maternal, infant, and child mortality due to "maternal depletion syndrome", where inadequate time between pregnancies hinders replenishment of vital nutrients.[7] Breastfeeding practices also influence the recovery period. Particularly for women who were malnourished prior to pregnancy, the energy demands of breastfeeding prolong the time needed for complete recovery before the next conception.[7]

Socioeconomic status (SES) can complicate the study of physiological effects of pregnancy intervals, as both short and long intervals are associated with other factors. IPI length is influenced by factors like sexual activity, breastfeeding, and contraception for women with normal fertility. In high-fertility populations, shorter IPIs are tied to higher fertility rates. As a result, increasing IPI length is a key goal of population and family planning programs led by international health agencies.[8,9] Given the well-documented adverse effects of SIPIs on maternal, infant, and child health, advocates for family planning have recognized the importance of increasing IPIs as a shared objective of maternal and child health initiatives and family planning programs.

However, when considering women with two or three children, the length of the inter-pregnancy interval can be influenced by factors such as the age at first childbirth and cultural beliefs. For instance, in India, where population control has traditionally been promoted through sterilization, the average IPI remains relatively short even among families with two or three children.[10] Thus, to maintain a programmatic affinity between maternal and child health and family planning in lower-fertility settings, it would be important to show strong evidence that short IPIs cause poor pregnancy outcomes irrespective of number of previous births.

METHODS

The present study was carried out in the department of obstetrics and gynaecology at Holy Family Hospital, New Delhi. Holy Family Hospital is one of the multispecialty hospital founded by Medical Mission Sisters in 1953. It is a 345 bedded tertiary care centre with well-equipped departments and efficient staff managed by the Delhi Catholic Arch Diocese. The hospital caters to population from New Delhi and neighbouring districts and the clientele comprises of patients from various different socio-economic background. Institute ethical committee clearance certificate was sought and obtained before the study was begun and written informed consent was obtained from all the study participants before including them in the study.

All multigravida, who attended the antenatal (ANC) clinic-booked, unbooked or referred at the study hospital irrespective of previous pregnancy outcome comprised the study population. The present study was conducted as a prospective observational comparative study comprising 140 pregnant women during the period starting from October 2020 to May 2022. Non probability convenient sampling technique was used to select study participants from all those in the study population who are eligible to participate in the study. The required sample size was calculated to be 140, considering the proportion of LBW babies from the study by Lewis et al, for an alpha error of 5% and power of 80%.[11]

All primigravida, mothers with multiple gestations, molar pregnancy and those with previous pregnancies with Major complications [i.e. Severe pregnancy induced hypertension (PIH), chronic cardio-vascular disorders, chronic respiratory disorders and uncontrolled gestational diabetes mellitus (GDM) etc.] were excluded from the study.

For the study, two groups of pregnant women were considered who fit into the inclusion criteria and exclusion criteria. The pregnancy outcomes along with maternal and fetal complications in these two groups of women were studied. For cases, 70 pregnant women with an interpregnancy interval of ≤18 months after previous delivery and ≤6 months after previous abortion as SIPI, were included in the study. For controls, 70 pregnant women with an Interpregnancy Interval between ≥19 months to ≤59 months as NIPI, were included in the study. All the study participants were followed up from ANC Booking up till their delivery and early perinatal period.

Data entry was carried out in MS Excel 2016 and data analysis was carried out using IBM Statistical Package for Social Sciences (SPSS), Armonk, NY, version 23.0. Means and proportions were calculated for continuous and categorical variables. Difference in proportions were tested for statistical significance using chi square test. Binary logistic regression analysis was carried out after univariate analysis identifying potential confounders and adjusting for the same. A p value <0.05 was considered statistically significant.

RESULTS

Maximum of the study participants were in the age group of 26-30 years (46.4%). The mean age of the study participants was observed to be 30±3.9 years. Higher proportion of younger mothers had lower IPI as compared to those who were older. Also, this association was found to be statistically significant (p value- 0.019). No significant association was observed between IPI and gravida (p value- 0.521), first ANC visit (p value- 0.093), booking status of pregnancy (p value- 0.297) (Table 1).

Higher proportion of mothers with short IPI had anaemia (59% versus 41%, p value- 0.017). Lower proportion of mothers with short IPI had PIH (21.4% versus 78.6%, p value- 0.001). No significant association was observed

between presence of GDM and IPI (p value- 1.0). Higher proportion of mothers with short IPI has obstetric cholestasis (70.6% versus 29.4%, p value- 0.006). Higher proportion of patients with short IPI had scar dehiscence/tenderness (85.7% versus 14.3%, p value- 0.001) (Table 2).

Table 1: Association between IPI and baseline patient characteristics (n=140).

Characteristics	IPI		Total n (%)	P value*
	≤18 months n (%)	≥19 to ≤59 months n (%)		
Age (in years)				
20-25	11 (68.8)	5 (31.3)	16 (100.0)	0.019
26-30	37 (56.9)	28 (43.1)	65 (100.0)	
31-35	15 (31.9)	32 (68.1)	47 (100.0)	
36-40	7 (58.3)	5 (41.7)	12 (100.0)	
Gravida				
2	36 (48.6)	38 (51.4)	74 (100.0)	0.521
3	24 (57.1)	18 (42.9)	42 (100.0)	
4	8 (47.1)	9 (52.9)	17 (100.0)	
5	2 (28.6)	5 (71.4)	7 (100.0)	
Gestational age at first ANC				
6-12 weeks	49 (52.7)	44 (47.3)	93 (100.0)	0.093
12-24 weeks	6 (28.6)	15 (71.4)	21 (100.0)	
>24 weeks	15 (57.7)	11 (42.3)	26 (100.0)	
Booking status				
Booked	53 (47.7)	58 (52.3)	111 (100.0)	0.297
Unbooked	17 (58.6)	12 (41.4)	29 (100.0)	
Total	70 (50.0)	70 (50.0)	140 (100.0)	

* Chi square test was applied

Table 2: Association between IPI and clinical characteristics (n=140).

Clinical characteristics	IPI		Total n (%)	P value*
	≤18 months n (%)	≥19 to ≤59 months n (%)		
Anaemia				
Absent	24 (38.7)	38 (61.3)	62 (100.0)	0.017
Present	46 (59.0)	32 (41.0)	78 (100.0)	
PIH				
Absent	64 (57.1)	48 (42.9)	112 (100.0)	0.001
Present	6 (21.4)	22 (78.6)	28 (100.0)	
GDM				
Absent	51 (50.0)	51 (50.0)	102 (100.0)	1.0
Present	19 (50.0)	19 (50.0)	38 (100.0)	
Obstetric cholestasis				
Absent	46 (43.4)	60 (56.6)	106 (100.0)	0.006
Present	24 (70.6)	10 (29.4)	34 (100.0)	
Scar dehiscence/tenderness				
Absent	10 (41.7)	14 (58.3)	24 (100.0)	<0.001
Present	24 (85.7)	4 (14.3)	28 (100.0)	
Total	70 (50.0)	70 (50.0)	140 (100.0)	

*Chi square test was applied

No significant association was observed between IPI and preterm delivery (p value- 0.412), premature rupture of membranes (PROM) (p value- 0.441), need for induction of labour (p value- 0.618), neonatal intensive care unit (NICU) stay duration (p value- 0.122) and post-natal complications (p value- 0.401). Higher proportion of mothers with short IPI had lower segment caesarean section (LSCS) (65.4% versus 34.6%, p value- 0.019. Higher proportion of neonates born to mothers with shorter IPI had low birth weight (100% versus 0%, p value- 0.015) (Table 3).

Table 3: Association between IPI and perinatal characteristics (n=140).

Perinatal Characteristics	IPI		Total n (%)	P value*
	≤18 months n (%)	≥19 to ≤59 months n (%)		
Preterm delivery				
Absent	61 (48.8)	64 (51.2)	125 (100.0)	0.412
Present	9 (60.0)	6 (40.0)	15 (100.0)	
Premature rupture of membranes (PROM)				
Absent	65 (48.9)	68 (51.1)	133 (100.0)	0.441
Present	5 (71.4)	2 (28.6)	7 (100.0)	
Mode of delivery				
Vaginal delivery	32 (41.6)	45 (58.4)	77 (100.0)	0.019
LSCS	34 (65.4)	18 (34.6)	52 (100.0)	
Vaginal birth after caesarean (VBAC)	4 (36.4)	7 (63.6)	11 (100.0)	
Need for induction of labour				
Absent	22 (43.1)	29 (56.9)	51 (100.0)	0.618
Present	14 (37.8)	23 (62.2)	37 (100.0)	
Perinatal outcome				
Absent	42 (44.21)	53 (55.79)	95 (100.0)	0.009
Preterm birth	25 (62.50)	15 (37.50)	40 (100.0)	
Low birth weight	13 (76.47)	4 (23.53)	17 (100.0)	
IUGR	4 (66.67)	2 (33.33)	6 (100.0)	
Birth weight				
1.5-2.49	13 (100.0)	4 (0.0)	17 (100.0)	0.015
2.5-3.5	54 (47.0)	61 (53.0)	115 (100.0)	
3.6-4	3 (37.5)	5 (62.5)	8 (100.0)	
NICU stay				
Absent	54 (47.0)	61 (53.0)	115 (100.0)	0.122
Present	16 (64.0)	9 (36.0)	25 (100.0)	
Postnatal complication				
Absent	58 (47.9)	63 (52.1)	121 (100.0)	0.401
Post partum haemorrhage (PPH)	7 (58.3)	5 (41.7)	12 (100.0)	
Sepsis	5 (71.4)	2 (28.6)	7 (100.0)	
Total	70 (50.0)	70 (50.0)	140 (100.0)	

*Chi square test was applied

Table 4: Binary logistic regression analysis for short IPI.

Parameter	p value	OR	95% CI of OR
Age*	0.201	1.076	0.962-1.203
Mode of delivery			
LSCS	0.960	1.037	0.250-4.303
VBAC	0.984	0.982	0.175-5.505
Anaemia	0.109	2.073	0.851-5.051
PIH	0.036	0.266	0.077-0.917
GDM	0.459	0.703	0.277-1.786
Obstetric cholestasis	0.006	4.186	1.502-11.668
Scar dehiscence/tenderness	0.003	10.666	2.208-51.537
Preterm	0.126	2.917	0.739-11.515
PROM	0.440	2.251	0.287-17.679
Birth weight*	0.582	1.353	0.461-3.975
NICU stay	0.705	0.767	0.195-3.023
Postnatal complications			
PPH	0.411	2.265	0.323-15.891
Sepsis	0.642	1.762	0.161-19.238

*Continuous variable

On binary logistic regression analysis, after adjusting for various confounders it was noted that patients with SIPI had lesser risk of PIH (p value -0.036, odds ratio (OR): 0.266, 95% CI =0.077-0.917), higher risk of obstetric cholestasis (p value- 0.006, OR: 4.186, 95% CI =1.502-11.668) and higher risk of scar dehiscence/ tenderness (p value- 0.003, OR: 10.666, 95% CI =2.208-51.537) (Table 4).

DISCUSSION

The present study was a prospective observational comparative study which was carried out with an aim to study the impact of SIPI (≤18 months) on maternal and perinatal outcomes. Study participants were divided into two groups based on IPI and pregnancy outcomes were compared among the groups.

Patients in both groups in our study were comparable in terms of age, booking status, gravidity, gestational age at first ANC visit, immediate previous pregnancy outcome and mode of delivery in present pregnancy.

Maximum number of the study participants were in the age group of 26-30 years (46.4%). The mean age of the study participants was observed to be 30±3.9 years. The patients in young age group had more chances of SIPI which was found to be statistically significant (p value- 0.019). Similar results were found by Elumalai et al and Nausheen et al in their studies.[12,13] Gravidity, gestational age at first ANC and booking status, did not show any significance between SIPI and NIPI. Similar findings were also observed in the study by Lewis et al.[11]

In our study anemia was observed as the most common complication in both the groups but it was statistically highly significant in patients with SIPI (p value- 0.017). Maternal nutrient depletion which is the negative change in maternal nutritional status during a reproductive cycle may pose biological competition between mother and the growing fetus.[14] SIPI don't allow mothers enough time to recover from the nutritional burden and stress of their previous pregnancy. Within six months after giving birth, approximately 20% of mothers still have below-normal folate levels. If these mothers conceive again during this period, they face a higher risk of folate deficiency at the time of conception and throughout their subsequent pregnancy. As a result, mothers are at risk of developing anemia, while their offspring face increased risks of growth restriction, preterm birth, and birth defects. A study by Klerman and coworkers reported that women with SIPI and poor nutritional status had high adverse pregnancy outcomes.[15] Similar results were obtained by Sanga et al, Shreya et al and Lewis et al.[11,16,17]

In our study we observed that PIH was a complication which was more associated with NIPI (78.6%) as compared to SIPI (21.4%) which was found to be statistically significant (p value- 0.001). Similar results were obtained by Sanga et al in their study.[16] In another study by Shreya et al, it was observed that women with long interpregnancy interval were associated with increased risk of pregnancy induced hypertension and post-datism.[17] This was observed in mothers with NIPI in our study.

In our study, we did not find a significant link between gestational diabetes mellitus (GDM) and IPI. However, other studies have reported significant findings in this regard. It is likely that women who conceive within 12 months after delivery will have a higher weight at the beginning of their next pregnancy. This elevated weight increases the risk of obesity and potentially developing gestational diabetes in the subsequent pregnancy. Interestingly, some excluded studies have suggested that the risks of obesity and gestational diabetes may actually rise with longer interpregnancy intervals, rather than shorter ones.[18] Gebremedhin et al and Hanley et al in their independent studies observed that SIPI were significantly associated with increased risk of gestational diabetes.[19,20]

Our study revealed a significant association between SIPI and obstetric cholestasis, with a prevalence of 70.6% (p value: 0.006). Despite an extensive search across various platforms, we found no published articles investigating the link between obstetric cholestasis and interpregnancy interval.

Another notable observation in our study was a higher proportion of patients with a history of cesarean section in a previous pregnancy who had SIPI (85.7%). These patients exhibited scar dehiscence or tenderness, which was a statistically significant finding (p value <0.001). Moreover, this was the most common indication for cesarean section in patients with SIPI. Lewis et al reported similar findings.[11]

In our study, we did not observe any significant association between preterm delivery and IPI. However, SIPI is linked with greater risks of preterm birth, low birth weight, fetal growth restriction, perinatal, infant and child mortality.[2,21] This is observed in other studies by Haq et al, Mahande et al, Elumalai et al, Ekin et al and Thapalia et al.[12,22-25] SIPIs may not provide women with enough time to shed the excess weight they gained during pregnancy. Maternal overweight or obesity may result in increased risk of inflammatory up-regulation, and increased levels of inflammatory proteins (cytokines) which lead to cervical ripening and cause weakening of the membranes and preterm myometrial contractions through prostaglandin activation.[26] Even though we did not observe any significant association between PROM and IPI, some studies like that of Shree et al have found significant associations.[27]

In our study, patients with SIPI were observed to have significantly higher incidences of low birth weight (p value- 0.015) and IUGR (p value 0.009). Similar results were seen in the studies by Thapalia et al, Haq et al, Appareddy et al, Mahande et al and Adam and

colleagues.[22,23,25,28,29] It was observed in our study that there is a higher risk of NICU stay for neonates born to mothers with SIPI as incidence of low birth weight and IUGR were high with SIPI. Similar observation was done by Appareddy et al in their study.[28]

Post-natal complications were not significant in women with SIPI in our study. A study by Sanga et al noted that as IPI increases, chances for post-partum hemorrhage decreases.[16] Overall, PPH was the most common postnatal complication (8.6%), followed by sepsis (5%) in our study but no significant association was found between these postnatal complications and IPI. Chandana et al also noted similar postnatal complications in their study.[30] SIPIs have been linked to various complications including congenital malformation, maternal anemia, premature rupture of membranes, placental abruption, placenta previa, and uterine rupture, especially in women who have had a previous cesarean section and are attempting a vaginal delivery.[21,31,32]

Some of the possible limitations of the present study are that the potential adverse perinatal outcomes could be more beyond the list studied in the present research work. However, this was limited considering the scope, feasibility of long term follow up/investigations and available time for the study. Due to the limited study period, not enough patients with long interpregnancy interval were collected. Hence, this study was focused on patients with short interpregnancy interval. Being a hospital based study, the findings may not be completely generalizable.

CONCLUSION

Considerable morbidity and adverse perinatal outcomes were observed in the form of scar dehiscence and obstetric cholestasis among pregnant mothers with a short interpregnancy interval of 18 months or less. However, incidence of PIH was significantly less among these groups.

It is important to provide suitable information about the importance of the IPI and the need for spacing the pregnancies to the patient. Also, it is vital to provide guidance in terms of contraception usage, as spacing pregnancies allows enough time for the mother to recover the resources lost during pregnancy and childbirth. Thereby, making an effort in reducing the morbidity and adverse perinatal outcomes associated with SIPI.

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