Study of Obstetric and Foetal Outcome in Women with Short Interpregnancy Interval after Previous Caesarean Delivery

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Abstract

Objective: To study the effect study of obstetric and foetal outcome in women with short interpregnancy interval after previous caesarean delivery.

Methods: All patients admitted for MTP, abortion, and delivery after short inter pregnancy interval with previous caesarean delivery will be included with consideration of inclusion and exclusion criteria. Anemia, scar dehiscence, uterine rupture, PPH, PROM, and premature delivery were all associated to mothers' short IPI. Low birth weight, preterm, IUFD, stillbirth and neonatal death were foetal problems associated to short IPI.

Results: This study emphasizes the gloomy attitude of family spacing among couples. It was directly correlated with several demographic characteristics, including low levels of literacy, rural residents, and lower socioeconomic class. The most frequent causes of short IPI included poor antecedent birth outcomes, child sex preference, unintended pregnancies, non-use of family planning methods, contraceptive failure, lack of understanding regarding recommended birth intervals, and female gender of antecedent birth. Anemia, scar dehiscence, uterine rupture, PPH, PROM, and premature delivery were all associated to mothers' short IPI. Low birth weight, preterm, IUFD, stillbirth and neonatal death were foetal problems associated to short IPI.

Conclusion: Social initiatives like raising the educational level of the population and expanding access to contraception will support appropriate IPI and enhance mother outcomes. It will be possible to attain the best maternal health by further enhancing the education campaigns on contraception and encouraging couples to adopt sufficient spacing with the support of primary care physicians. The study's findings will help policymakers further educate healthcare professionals at all levels about the need of promoting the ideal inter-pregnancy interval, as stressed by the WHO.

Keywords: Inter Birth Interval (IBI), Inter- pregnancy intervals (IPI) and Inter-outcome intervals (IOI).

Introduction

A well-known, but poorly understood health intervention is birth spacing. [1] Various indicators related to spacing between pregnancies to explain adverse pregnancy outcome are used such as Inter Birth Interval (IBI), Inter- pregnancy intervals (IPI) and Inter-outcome intervals (IOI).Inter-pregnancy interval is defined as

the interval from the date of outcome from preceding pregnancy to date of last menstrual period of index pregnancy. [2] While Inter birth Interval is defined as the interval between two consecutive births. Inter-outcome intervals is the sum of Interpregnancy intervaland the duration of gestation of the index pregnancy. Inter pregnancy interval is associated with adverse pregnancy outcomes as compared to inter birth interval which ignores pregnancies resulting in miscarriage, abortion, and stillbirths between two consecutive live births. On the other hand the estimated effect of Inter outcome interval would be the same as the effect of IPI. [3,4]

Pregnancy spacing refers to the practice of maintaining a gap between two consecutive births, of two or more years.The Inter pregnancy interval, as recommended by the World Health Organization (WHO), should be at least 24 months in order to avoid any unfavourable pregnancy outcomes after a live birth. [5]

WHO recommendation to reduce the risk of adverse maternal and perinatal outcomes are:-After a live birth, the recommended minimum interval before attempting the next pregnancy is at least 24 months. After a miscarriage or induced abortion, the recommended interval to next pregnancy is at least six months. According to Recent data, IPI of 16.7 months is suggested. Average IPI in India is much shorter than in countries with similar or lower levels of socio-economic development. Despite existing interventions such as expanding access to and availability of family planning options for birth spacing, the percentage ofwomen with short IPI remains high. [6,7]

According to studies, women with shorter inter-pregnancy intervals are more likely to have complications such as antepartum haemorrhage, anaemia, and hypertensive disorders of pregnancy as well as maternal mortality. Additionally, it raises the risk of

unfavourable outcomes for the woman, including premature rupture of membrane (PROM), placental abruption, placenta previa, uterine rupture (for women who previously gave birth via caesarean section), gestational diabetes (GDM), maternal anaemia, mortality, and morbidity. [8,9]

At present modern obstetric practice there is high rise in number of caesarean sections within last two decades, maternal morbidity and mortality has raised by two folds with caesarean delivery compared with vaginal delivery. Due to the slow generation of fibroblasts and the replacement of myometrium by connective tissues, short Inter Pregnancy Interval reduces wound healing and increases the risk of uterine rupture from the previous scar. In the following pregnancy, this poor healing of the uterine scar results in the renewal of the uterine isthmus and very thin lower segment, and this very thin scar segment has a high likelihood of rupturing during childbirth. [10]

A woman can recover from prior pregnancies, childbirth, and lactation with the right amount of time in between. It also requires necessary physical and emotional preparations for her subsequent birth. Additionally, short inter pregnancy interval raises the risk of unfavorable pregnancy outcomes such as preterm delivery, low birth weight,small for gestational age and low Apgar score. It increases the likelihood of newborn to experience low birth weight, stunting, developmental delay, and intellectual disability, as well as problems related to poor nutrition. [11] Our goal is to investigate the causes of short pregnancy intervals after caesarean sections as well as maternal and foetal outcomes, including perinatal and neonatal mortality, in light of India's shifting demographics and an increase in the proportion of longer birth intervals. [12]

Materials and Methods

Study Design: Prospective observational study.

Study Site: Department of Obstetrics and Gynecology, Sultania Zanana Hospital & GandhiMedical College, Bhopal.

Study Duration: One year (1 January 2021- 31 august 2022)

Study Participants: All patients admitted for MTP, abortion, and delivery after short inter pregnancy interval with previous caesarean delivery to Department of Obstetrics and Gynaecology, Sultania Zanana Hospital & Gandhi Medical College, Bhopal will be included with consideration of inclusion and exclusion criteria.

Sample Size: 510.

Operational definition: We measure Inter pregnancy Interval as the number of months between the date of the outcome of preceding pregnancy and date of last menstrual period for the pregnancy under study.

Sampling Technique: All patients admitted for MTP, abortion, and delivery after short inter pregnancy interval with previous caesarean delivery to Department of Obstetrics and Gynaecology, Sultania Zanana Hospital & Gandhi Medical College, Bhopal will be included with consideration of inclusion and exclusion criteria till the completion of study sample.

Inclusion Criteria:

- All the patients coming to Sultania Zanana Hospital, Bhopal withprevious 1 and previous 2 Caesarean section are included in the study.
- Short inter pregnancy interval less than 18-24 months

Exclusion Criteria:

- Previous normal delivery
- Patient with chronic medical disorder.
- Long inter pregnancy interval more than 24 months.
- Those who are not willing to give written informed consent to participate in the study
- Grandmultiparity, multiparity with parity >3,
- Previous 3 caesarean section.

Tools for Assessment:

Pretested and pre-structured questionnaire was employed for data collection.

Questionnaire contained info such as

- General demographic details
- Obstetric history: Gravida, parity, abortion, live birth
- Calculation of inter pregnancy interval and its causes
- Menstrual history
- General examination: Pulse, Bp, Spo2, RR and urine output
- Investigation details: Hb, Blood group, RBS, LFT, RFT, USG and other special investigation if required.
- Maternal and foetal outcomes

Method of data collection-

- ➢ Permission from the institutional ethics committee and university clearance was obtained.
- ➢ Meeting and rapport building with the study participants.The patients were provided with the study information sheet and consent form and were explained about the relevant details about the study in a language best understood by them.
- ➢ Informed written consent was obtained after explaining about the purpose, nature and process of the study and then data collection was started.
- ➢ All women under study were subjected to a detailed history as per the pre-set proforma including age, occupation, socioeconomic status, dietary habits, family history, previous obstetric history, period of amenorrhea, bleeding pervagina, pain abdomen, hyperemesis, pedal oedema, passing vesicles per vagina, neurological symptoms, respiratory symptoms.

➢ Inter-pregnancy interval from birth of last baby to conception of index pregnancy was calculated.

➢ Reason for short pregnancy interval was asked.

If patient admitted at third trimester then we will measure foetal outcome in terms of pre maturity, low birth weight, live birth or still birth.

Outcome variables:

A] Obstetric outcome was measured as follows:

• Number of MTP out of total Sample size

• Antenatal complications such as Anaemia, PROM, APH like placental abruption & placenta previa, scar dehiscence and ruptured uterus.

• Preterm delivery and term delivery.

B] Foetal outcome- prematurity, low birth weight, live birth or still birth orneonatal morbidity or mortality.

Data Analysis: Data was collected and entered simultaneously in statistical package for social sciences (SPSS) version 23 and coded appropriately. The data was analysed keeping in view the aim and objectives of the study. Descriptive statistics were calculated to summarize the sample characteristics in terms of frequency and percentage. Graphs and Charts were made. Analytical and inferential analysis was done. Significant was set at standard 0.05.

Consent- Written informed consent was taken from the patient. All the study participants were explained in detail about the purpose of the study in their own language which they could understand. They were also explained that they could withdraw from study any time. They were assured about confidentiality of their information which would be strictly maintained. They were also explained that there is no possible risk in the study.

Observation Chart

Present study was an observational conducted at Sultania Zanana Hospital & Gandhi Medical College, Bhopal. In this study total of 510 patients were included according to inclusion and exclusion criteria .

Table 1: Distribution of patients based on interpregnancy interval

Groups	Inter pregnancy Interval	Sample size Total patients (510)	Percentage (100%)
Group 1 (Ultrashort Inter pregnancy interval)	< 6 Months	75	14.7%
Group 2	6 - 18 months	189	37.1%
Group 3	18 - 24 months	246	48.2%

Table 2: Distribution of patients according to history of failed contraception due to inaccurate use of contraception after previouscaesarean with interpregnancy interval

Contraception	Total (%)	Inter pregnancy interval		
		Group 1	Group 2	Group 3
		< 6 Months	6 - 18 months	18-24 months
		No. (%)	No. (%)	No. (%)
Barrier method	50(36.2%)	18(75%)	12(31.5%)	20(26.3%)
Contraceptive Pills	20(14.4%)	0(0%)	6(4.3%)	14(18.4%)
Injectables	12(8.6%)	2(8.3%)	4(2.8%)	6(7.8%)
IUCD expelled orremoved	56(40.5%)	4(16%)	16(42.10%)	36(47.3%)
Total	138/510(100%)	24(100%)	38(100%)	76(100%)

Table 3: Distribution of patients according to antecedent birth outcomewith interpregnancy interval

Antecedent Birth Outcome	Count	Interpregnancy Interval			P value
		Group 1	Group 2	Group 3	
		< 6 Months	6–18 months	18–24 months	
		No. (%)	No. (%)	No. (%)	
Live	322(63.1%)	30 (40%)	123 (65%)	169 (68.6%)	0.01
Still birtth	117 (23%)	21 (28%)	40 (21.1%)	56 (22.7%)	
Neonatal Death/ Infantdeath	71(13.9%)	24 (32%)	26 (13.7%)	21 (8.5%)	
Total	510(100%)	75 (100%)	189 (100%)	246 (100%)	

Table 4: Distribution of patients according to cause of shortInterpregnancy Interval

Causes of short inter pregnancy interval	Number (%)	Inter pregnancy interval		
		Group 1	Group 2	Group 3
		<6 months	6-18 months	18-24 months
Death of previous child	188(36.8%)	45 (23.9%)	66 (35.1%)	77 (40.9%)
Male child preference after female child	124(24.3%)	20 (16.1%)	32 (25.8%)	72 (58%)
Pressure by husband and family	167(32.7%)	25 (14.9%)	60 (35.9%)	82 (49.1%)
Conceived in lactat ional amenorrhoea and extended amenorrhoea due to breastfeeding	120(23.5%)	48 (40%)	32 (26.6%)	40 (33.3%)
Inaccurate use of Contraceptive	138(27%)	24 (17.3%)	38 (27.5%)	76 (55%)
Conceived by mistake after return of menses & menstrual irregularity	112(21.9%)	18 (16%)	48 (42.8%)	46 (41%)

Table 5: Obstetric outcome in women with short inter pregnancy interval

Pregnancy outcome		Samplesize (%)	Inter pregnancy interval		
			Group 1	Group 2	Group 3
			IPI<6 months	IPI 6-18 months	IPI 18-24 months
			No. (%)	No. (%)	No. (%)
Medical termination of pregnancy		206 (40.39%)	50	55	101 (41%)
A) First trimester		190 (37.25%)	(66.6%)	(29.1%)	91
B) Second trimester		16(3.13%)	48(64%)	51(26.9%)	10(4%)
			2 (2.6%)	4 (2.11%)	
Delivery (304)	LSCS	270 (52.9%)	20 (26.6%)	124 (65.6%)	126 (51.2%)
	VBAC	26 (5%)	0 (0%)	8 (4.2%)	18 (7.3%)
	Laparotomyfor (Ruptureduterus)	8(1.5%)	5(6.6%)	2(1%)	1(0.4%)
Total		510 (100%)	75 (100%)	189 (100%)	246 (100%)

Table 6: Distribution of patients according to mode of MTP

Mode of MTP	Sample size (%)	Inter pregnancy interval		
		Group 1	Group 2	Group 3
		<6 months	6-18 months	18-24 months
		No. (%)	No. (%)	No. (%)

Intake of abortifacients drugsby herself	82(39.8%)	44(56.4%)	15(22%)	23(38.3%)
MTP on demand after consulting health worker	124(60.1%)	34(43.5%)	53(77.8%)	37(61.6%)
Total	206(100%)	78	68	60

Table 7: Distribution of patients according to reason for MTP in different inter pregnancy interval

Reasons of MTP	Sample size (206) %	Interpregnancy Interval		
		Group 1	Group 2	Group 3
		< 6 Months	6-18 months	18 - 24 months
		No. (%)	No. (%)	No. (%)
Failure of contraception due to inaccurate use	86 (42%)	32 (53.3%)	14 (20.5%)	40 (51.28%)
Missed Abortion	69 (33%)	10 (16.6%)	23 (33.8%)	36 (46.15%)
Conceived in lactational amenorrhoea or by mistake after the return of menses	51 (25%)	18 (30%)	31 (45.5%)	2 (2.5%)
Total	206 (100%)	60 (100%)	68 (100%)	78 (100%)

Table 8: Distribution according to complications of MTP

Complications	Samplesize (%)	Inter pregnancy interval			P value
		Group 1	Group 2	Group 3	
		< 6months	6-18 months	18-24 months	
		No. (%)	No. (%)	No. (%)	0.01
Incomplete abortion	58 (28.1%)	32 (55.17%)	14(24.1%)	12(20.6%)	100%
Sepsis	10 (4.8%)	5(50%)	3(30%)	2(20%)	100%
Haemorrhage	78 (37.8%)	28(35.8%)	26(33.3%)	24(30.7%)	100%
Anaemia	102 (49.5%)	56 (54.9%)	22 (21.5%)	24 (23.5%)	100%
Requirement of blood transfusion	112 (54.3%)	58(51.7%)	28 (25%)	26 (23.2%)	100%
No complications	52 (25.2%)	8(15.3%)	10(19.2%)	34(65.3%)	100%

Table 9: Distribution of patients according to gestational age at delivery

Gestational Age		Mode of Delivery	Sample Size (%)	Interpregnancy Interval			P value
				Group 1	Group 2	Group 3	
				< 6 Months	6 - 18 months	18 - 24 months	
				No. (%)	No. (%)	No. (%)	
Preterm (<37 weeks)		LSCS	155 (50.9%)	15 (60%)	78 (58.21%)	62 (42.7%)	0.00
		Vaginal (VBAC)	20 (6.58%)	0 (0%)	5 (3.73%)	15 (10.34%)	
	176 (57.8%)	Ruptured uterus	1 (0.3%)	1 (0.04%)	0 (0%)	0 (0%)	
Term (>37 weeks)		LSCS	115 (37.8%)	5 (20%)	46 (34.3%)	64 (44.1%)	
	128 (42.2%)	Vaginal (VBAC)	6 (1.97%)	0(0%)	3 (2.2%)	3 (2.07%)	
		Ruptured uterus	7 (2.3%)	4 (16%)	2 (1.4%)	1 (0.68%)	
Total			304 (100%)	25 (100%)	134 (100%)	145 (100%)	

Table 10: Distribution of patients according to antenatal complicationsin women with short inter pregnancy interval

S NO.	Antenatal complications	Sample size (%)
10 (a)	Anaemia	250 (82.2%)
10 (b)	Premature rupture ofmembrane	104 (34.2%)
10 (c)	Antepartum haemorrhage Placenta previa Abruptio placentae	156 (51.3%) 80 (26.3%) 76 (25%)
10 (d)	Requirement of blood transfusion	182 (59.8)
10 (e)	Preterm labour pain	196 (64.4%)
10 (f)	IUFD	36 (11.8%)
10 (g)	IUGR	96 (35.1%)

Table 11: Distribution of patients according to indication of LSCS

Indication	Sample size (%)
Ultrashort IPI <6 months leading to repeat LSCS	20 (7.4%)
Scar tenderness	186 (68.8%)
Scar dehiscence	84 (53.8%)
PROM	104 (38.5%)
Antepartum haemorrhage	156 (57.7%)

Table 12: Distribution of patients according to intraoperativecomplications

Complications	Sample size (%)	Inter pregnancy interval		
		Group 1	Group 2	Group 3
		<6 months	6-18 months	18-24 months
		Number(%)	Number (%)	Number(%)
Scar dehiscence	84 (27.6%)	18 (72%)	46 (34.3%)	20 (13.7%)
Ruptured uterus	8 (2.63%)	4 (16%)	3 (2.2%)	1 (0.6%)
Bladder injury	4 (1.3%)	2 (8%)	2 (1.4%)	0 (0%)
None	208 (68.4%)	1 (4%)	83 (61.9%)	124 (85.5%)
Total	304 (100%)	25 (100%)	134 (100%)	145 (100%)

Table 13: Distribution of patients according to postpartum haemorrhage

Postpartum Haemorrhage	Count (%)	Interpregnancy Interval		
		Group 1	Group 2	Group 3
		< 6 Months	6 – 18 months	18 – 24 months
		Number(%)	Number (%)	Number (%)
Yes	103 (33.8%)	15 (60%)	58 (43.2%)	30 (20.6%)
No	201 (66.1%)	10 (40%)	6 (56.7%)	115 (79.3%)
Total	304 (100%)	25 (100%)	134 (100%)	145 (100%)

Table 14: Distribution of patients according to weight at birth

Birth Weight	Sample size (%)	Interpregnancy Interval		
		< 6 Months	6 - 18 months	18 – 24 months
		Number (%)	Number (%)	Number (%)
Normal (>2.5 kg)	102 (33.5%)	4 (16%)	56 (41.7%)	42 (28.9%)
Low birth weight (<2.5 kg)	108 (35.5%)	8 (32%)	46 (34.3%)	54 (37.2%)

Very low birth weight (<1.5 kg)	68 (22.3%)	7 (28%)	24 (17.9%)	37 (25.5%)
Extremely low birth weight (<1 kg)	26 (8.5%)	6 (24%)	8 (5.9%)	12 (8.2%)
Total	304 (100%)	25 (100%)	134 (100%)	145 (100%)

Table 15: Distribution of patients according to foetal outcome

Foetal outcome	Sample size (%)	Inter pregnancy interval		
		Group 1	Group 2	Group 3
		IPI < 6 months	IPI 6-18 months	IPI 18-24 months
		Number (%)	Number (%)	Number (%)
IUFD	36 (11.8%)	5 (20%)	10(7.4%)	21 (14.4%)
Congenitalanomaly	12 (3.9%)	2 (8%)	4 (2.9%)	6 (4.1%)
Stillborn	18 (5.9%)	6 (24%)	5 (3.7%)	7 (4.8%)
Early neonataldeath	38 (12.5%)	4 (16%)	24 (17.9%)	1 (6.8%)
NICU stay >7days	120 (39.4%)	7 (28%)	54 (40.2%)	59 (40.6%)
Alive &healthy	80 (26.3%)	1 (4%)	37 (27.6%)	42 (28.9%)
TOTAL	304(100%)	25(100%)	134(100%)	145(100%)

Results

In present study total number of cases were divided into 3 groups based on Inter pregnancy interval there were 48.2% cases in IPI 18-24 Months i.e. (group 3) 37.1% cases in IPI 6-18 months (group 2) and 14.7% cases in IPI <06 months (group 1).

In our study about 52.9% cases who had short inter pregnancy interval underwent caesarean section , 40.39% cases underwent MTP, 05% cases had VBAC delivery and total of 08 patients had laparotomy for ruptured uterus.

In our study 40.3% cases underwent MTP out of which 39.8% took abortifacient drug by herself and 60.1% had MTP on demand after consulting a doctor. Maximum 37.8% cases that underwent MTP were in IPI <06 months,33% in IPI 06-18 months and 29.1% in IPI 18-24 months. 12.The most common complications associated with MTP was requirementof blood transfusion seen in 54.5% cases. Other complications were anaemia in 49.5% cases, haemorrhage in 37.8% cases, incomplete abortion in 28.1% cases and sepsis in 4.8% cases.

Majority of patients with short IPI 57.8%

cases had preterm delivery and 42.2% cases had term delivery. In preterm delivery, 50.7% cases underwent LSCS 6.5% had VBAC and only 1 patient had ruptured uterus.In term delivery (>37 weeks) about 37.8% cases underwent LSCS 1.97% had VBAC and 7 patients had laparotomy for ruptured uterus. This shows that as IPI increases chances of term delivery and VBAC also increases asscar repairing of previous caesarean scar is adequate.

Most common adverse complication in women with short IPI was anaemia seen in 82.2% cases. 59.8% cases required blood transfusion, 64.4% cases had preterm labour pain and 34.2% cases had PROM. Moderate anaemia was seen in 30.2% cases with short Inter pregnancy interval. There were 24% cases in IPI <06 months, 29.8% cases in 06-18 months and 31.7% cases in IPI 18-24 month with moderate anaemia.

Among patients who underwent delivery about 34.2% cases had PROM. There were 64% cases in IPI <06 months, 29.8% in IPI 6-18 months and 33% cases in IPI 18-24 months with PROM. This could be due to incomplete cervical remodelling as a mechanism for cervical shortening in subsequent pregnancies resulting in Premature rupture of membranes.

Antepartum haemorrhage was seen in 51.3% cases out of which 25% cases were placenta previa and 26.3% cases were abruptio placentae, majority of cases with these complications were seen in cases having ultrashort Inter pregnancy interval of <06 months.

There can be multiple indication for a repeat LSCS in a single patient most common indication for LSCS was found to be scar tenderness seen in 68.8 % cases. Other indications were antepartum haemorrhage in 57.7% cases, scar dehiscence in 53.8% cases, PROM in 38.5% cases, IUGR in 35.5% cases and ultra-short IPI in 7.4% cases.

Intraoperative complications were seen in about 30.2% cases. Scar dehiscence was seen in 27.6% cases, ruptured uterus in 2.63% cases and bladder injury in 1.3% cases. These complications were more common in IPI <6 months and 6-18 months. In IPI <6 months 72% cases of scar dehiscence, 16% cases of ruptured uterus and 08% cases of bladder injury were noted. In IPI 6-18 months there were 34.3% cases of scar dehiscence, 2.2% cases of ruptured uterus and 1.4% cases of bladder injury were seen.

Postpartum haemorrhage was seen in 33.8% cases. There were about 60% cases with PPH in IPI <06 months. Majority of patients with short IPI had low birth weight in 35.5% cases. Low birth weight babies in IPI <6months, 6-18 months and 18-24 months were, 32%, 34.3% and 37.2% receptively. This could be due to maternal complications related to short IPI and deficiency of various micronutrients such as folate, vitamin B12.

Various foetal complications seen in patients with short IPI are requirement of NICU stay >7 days seen in 39.4% babies, early neonatal death in 12.5% cases IUFD in 11.8% cases, anomalous baby in 3.9% cases and still born in 5.9% cases. It was seen that all the adverse outcomes were more common in short interpregnancy

interval as compared to recomended interpregnancy interval.

Statistical Analysis: The collected data was summarized by using frequency, percentage, mean & S.D. To compare the qualitative outcome measures Chi-square test or Fisher's exact test was used. To compare the quantitative outcome measures independent t test was used. If data was not following normal distribution, Mann Whitney U test was used. SPSS version 22 software was used to analyse the collected data. p value of <0.05 was statistically significant.

Discussion

Present study was an observational study conducted at Sultania Zanana Hospital & Gandhi Medical College, Bhopal. Patients admitted for MTP, abortion, and delivery after short inter pregnancy interval with previous caesarean delivery were included in our study. Keeping in mind aim and objectives, statistical analysis was carried out. Salient results of the study are discussed below-Interpregnancy Interval is defined as the period between delivery of previous child and conception of current pregnancy. Following a live birth, it is advised to wait at least 24 months before trying for another pregnancy, while at least six months is advised following a miscarriage. [12] A short interpregnancy interval is linked to a number of adverse health and nutrition outcomes for the mother and the unborn child. An increased risk of adverse pregnancy outcomes, such as preterm delivery, low birth weight, small for gestational age, maternal anaemia, uterine rupture, maternal morbidity, and mortality, is associated to short IPI after a caesarean delivery. Short interpregnancy intervals put women at higher risk for PPH, scar rupture and failed VBAC attempts. The American College of Obstetricians and Gyanecologists (ACOG) suggested that an Inter pregnancy interval of < 19 months reduced the success rate of VBAC. [13]

In present study total 510 patients were included according to inclusion and exclusion criteria and categorised according to inter pregnancy interval into 3 groups. Majority of the study participants 48.2% were in Inter pregnancy interval 18-24 months (group 3) followed by 37.1% in IPI 6-18 months (group 2) and 14.7% were in IPI< 6 months (group 1). Agrawal et al in their study reported that majority of women, i.e., 3336 of 4812 women (69.3%), had IPI from 6 to <24 months, followed by 1144 of 4812 women (23.7%) who had IPI > 24 months. Niazi et al. in their study reported that out of 1768 females: 1,323 (74.8%) had ≥ 24 months IPI, 257(14.5%) had 18–24 months IPI while 188 (10.6%) had < 18 months IPI. [14]

Association of antecedent birth outcome and Inter pregnancy interval

In our study 36.8% patient had poor foetal outcome in previous pregnancy as 23% had still birth and 13.9% had neonatal death or infant death. In IPI <6 months 32% patients had history of neonatal or infant death and 28% patient had stillborn. In IPI 6-8 months 13.7% had neonatal death or infant death and 21.1% had stillborn. This shows bad foetal outcome in previous pregnancy is responsible for desire of next child to overcome emotional trauma of losing a child leads to short interpregnancy interval. According to Roble et al , having a history of neonatal death, women who had a history of previous neonatal death (aOR=2.15), sex of preceding baby (aOR=3.69) and Women whose preceding birth was a female was found to be a strong predictor associated with short birth interval. In IPI 18-24 months 68.6% had live births this indicates good foetal outcome of previous delivery leads to longer IPI. [15-19]

Causes of short inter pregnancy interval

There are multiple factors and more than 1 cause responsible for short IPI. In present study most common cause is found to be death of previous child 36.8%. Followed by pressure by husband and family members

32.7% followed by inaccurate use of contraceptives in 27% cases. Male child preference in 24.3% cases and conceived in lactational amenorrhoea in 23.5% cases. According to Roble et al., history of previous neonatal death (aOR=2.15) and sex of the preceding baby (female) (aOR=3.69) were found to be a strong predictor associated with short birth interval. In a qualitative study, de Jonge et al suggested that an adverse outcome might influence women to hurry into the next pregnancy without fully recovering from the last pregnancy. (AOR 1.42, 1.22-1.65) Early researchers on child mortality and fertility described this phenomenon as replacement: "replacement would be the response to experienced mortality. [20-24] If children die very young and the mother can have another child, the same life cycle can be approximated by replacement." The duration of breastfeeding, the receptors in the breast nipple will be stimulated, and this initiates a signal to the hypothalamus: which in turn signals the pituitary gland, thereby inhibits ovulation by reducing the release of gonadotrophic hormone needed for ovulation, which results in post-partum amenorrhea. Government of India recommends 6 months of exclusive breast-feeding and continued breast feeding up to two years of age. [25] Roble et al in their study reported that among women with short pregnancy interval, among them 47% did not practiced exclusive breast feeding, 17% never utilized modern contraceptive methods and 35% mention that their husbands strongly disagree with family planning. Hailemeskel et al in their study reported that contraceptive use, optimal breast feeding, having male preceding child and knowing duration of optimum birth interval correctly were significant determinants of short birth interval. [26-29]

Obstetric score and obstetric outcome & inter-pregnancy interval

In the current study, majority of the study participants 48.2% were G2P1 with previous caesarean delivery. 41.5% patients

were G3P2 with either vaginal delivery followed by caesarean or previous two caesarean delivery. Around 10% were G4P3 with either two vaginal deliveries followed by caesarean section or vaginal delivery followed by two caesarean section. In IPI<6 months 37.3% were G2P1. In IPI 6-8 months 53.4% and 47.5% in IPI 18-24 months. This data depicts that interpregnancy interval increases with multiparity as awareness among women increases. Since she is more and more exposed to health care professionals, becomes more aware about health risks of short IPI and is counselled about various family planning methods.

Ishaque et al in their study reported that the women in the long IPI group (>18 months) had significantly lower cesarean rates than nulliparous women [12.2% and 14.3%, respectively; a OR = 0.5 (95% CI 0.4-0.7)]. [30]

Table no.13 shows majority of patients 52.9% who had short interpregnancy interval underwent caesarean section followed by MTP in 40.3% cases, 5% had VBAC and eight patient (1.5%) had laparotomy for ruptured uterus. In IPI<6months 26.6% had repeat LSCS, no VBAC and 5 patient (6.6%) had ruptured uterus and 66.6% underwent MTP while in IPI 18-24 months 51.2% underwent repeat LSCS. 7.3% had VBAC and 1 patient had ruptured uterus and 41% underwent MTP. Short IPI associated with maternal nutritional deficiencies, poor wound healing, thin scar due to poor scar repair were associated with high rate of LSCS and rupture. As IPI increases chances of VBAC delivery also increases. Lewis et al in their study reported that 54% of the study participants had LSCS, 45.6% were delivered vaginal and in 1 study participant VABC was done. Shreshtha et al in their study reported that study participants who had < 18 months of interpregnancy interval, 83.3% had vaginal delivery and 16.6% had LSCS. According to Agrawal et al, 55% of women in IPI 6 to <24 months had lower

segment caesarean section and those with < 6 months IPI 60% had LSCS. Lilungulu et al in their study reported that failure of vaginal birth after caesarean section (VBAC) was 29.3% among study participants with short pregnancy interval.

Medical termination of pregnancy and short interpregnancy interval

In the current study, about 40.3% participants have undergone MTP. Of these, about 66.6% had IPI <6 months, 29.1% had IPI 6-18 months and 41% had IPI 18-24 months. Those underwent MTP37.2% were in first trimester, 3.11% in second trimester and the reason for second trimester MTP being anomalous baby or IUFD. Out of 206 patients who underwent MTP 39.8% took abortifacient drugs by themselves and 60.1% wanted MTP on demand after consultation from doctors. In the present study, intake of abortifacient drugs without consultation was mainly reported among those with IPI <6 months 56.4% as the mother wanted adequate birth spacing between two live babies.

Reasons for MTP were- failure of contraception due to inaccurate use (42%), missed abortion (33%) and conception during lactational amenorrhoea or by mistake after return of menses (25%). Missed abortion was seen in 33% cases, this can be due to folate deficiency, vitamin B12 and other nutrients deficiency in mothers conceiving in short inter pregnancy interval resulting in defective DNA genesis and hence missed abortion. Sharma et al in their study reported the most common reason for MTP among the women was failure of contraception (83.2%). In the current study, the most common complications associated with MTP was requirement of blood transfusion in 54.1% cases, haemorrhage in 37.8%, incomplete abortion in 28.1% and sepsis in 4.8% cases.

Gestational age at delivery, Obstetric complication and short pregnancy interval

A short inter-pregnancy interval (IPI) is a

well-known risk factor for preterm birth. In the present study, preterm birth was reported in 57.8% cases, and term delivery was seen in 42.2% cases. In preterm delivery <37 weeks 50.9% patients underwent repeat LSCS, 6.5% had VBAC and one patient had ruptured uterus. In IPI <6 months 60% cases, In IPI 6-18 months 58.2% and in IPI 18-24 months 42.7% underwent preterm LSCS. Among those who delivered at term i.e. >37 weeks, 37.8% underwent LSCS, 1.9% had VBAC and 7 patient had ruptured uterus. In term delivery, In IPI <6 months 4 patient had ruptured uterus, in IPI 6-18 months 2 patient and only 1 patient in IPI of 18-24 months. This suggests that as IPI increases chances of term delivery and rate of VBAC also increases as scar repairing of previous caesarean scar is adequate. Rodrigues et al in their study reported that stronger effect of short interpregnancy interval on very preterm (less than 33 weeks) than on late preterm (33–36 weeks). These results suggest that different causes may account for preterm delivery at different gestational age. Shreshtha et al in their study reported 25% preterm in women with IPI of < 18 months. Ting Xu et al reported that short IPI of less than 6 months was associated with higher risks of PTB (adjusted OR, 1.96).

Obstetric complications and short interpregnancy interval

In our study most common antenatal complication in women with short IPI was anaemia 82.2% and women requiring blood transfusion were 59.8%. preterm labour was seen in 64.4% cases and PROM in 34.2% cases. About 51.3% cases with short IPI had antepartum haemorrhage and 11.8% had IUFD. The estimated incidence of anaemia among pregnant women in India is 50%. In our study, 28.2% had mild anaemia, 30.2% had moderate anaemia and 23.6% had severe anaemia in women with short interpregnancy interval. In IPI <6 months 64% patients had severe anaemia which is significantly higher than the national average. This might be explained

by the maternal depletion syndrome. The main reason behind this is deficiency of various macro and micro nutrients such as folate, vitamin B12 etc., that are lost at the time of precious delivery and during ongoing lactational period but are not replenished or restored due to physical stress of current pregnancy posing various health risk on mother and on foetus as there are higher chances of anaemia, preterm birth, IUGR, low birth babies and IUFD. According to Lewis et al, incidence of anaemia was found to be 66% in women with short interpregnancy interval. Similarly Shreshtha et al reported 25% anaemia in their study.

PROM was reported in 34.2% participants and was most commonly observed inthose with < 6 month IPI (64%), in IPI 6-18 months 29.8% and in IPI 18-24 months 33.1%. This can be explained by the fact that short IPI (especially ≤6 months) may contribute to incomplete cervical remodelling as a mechanism for cervical shortening in a subsequent pregnancy, thus potentially increasing the risk for preterm membrane rupture. Lilungulu et al in their study reported that among study participants with short inter pregnancy interval, 45.3% had pre mature rupture of membrane. Cervical incompetency might result in uterine dilatation so that part of a fetal membrane may pass through the amniotic sac that further allows rupturing of membrane.

In the present study, 26.32% participants reported abruption placentae and in 25% cases placenta previa was reported. Majority of cases with abruption placentae were reported in participants with IPI <6 months. The short inter pregnancy interval there are more chances of complications like placenta previa and placental abruption because of maternal depletion syndrome and folate, vitamin B12 deficiency in short IPI associated with placental abruption and poor decidual reaction leading to placental previa. In our study maximum 270 patients had repeat LSCS, The main reason behind

this is weak previous scar and poor wound healing in cases with short IPI. As IPI increases chances of repeat LSCS decreases and trial of VBAC increases.

Indication of LSCS and inter pregnancy interval

There can be multiple indications for repeat LSCS in a single patient. Most common indication in our study was scar tenderness seen in 68.8% cases. Other indications were antepartum haemorrhage in 57.7%, scar dehiscence in 53.8% cases, PROM in 38.5% and ultrashort IPI following previous caesarean leadingto repeat LSCS in 7.4% cases. [30]

Intraoperative complications and short interpregnancy interval

The incidence of uterine scar dehiscence ranges between 0.2 and 4.3% of all pregnancies with previous caesarean. In our study, scar dehiscence was found inabout 27.6% with short pregnancy interval. Among those with scar dehiscence, majority 72% were in IPI <6 months followed by 34.3% in IPI 6-18 and 13.7% in IPI 6-18 months. Uterine rupture was reported in 2.6% cases. [31] Most of the uterine rupture 16% were reported with IPI < 6months followed by 2.2% in IPI 6-18 months. Uterine rupture in present study was most associated with ultrashort inter pregnancy interval. As short IPI is associated with poor scar healing and ultimately dehiscence during further pregnancy and early rupture during labour pain. All these women present late in our institute with ruptured uterus. About 4% patient had bladder injury along with ruptured uterus. Similar results were reported by Lewis et al, where authors reported scar dehiscence in 16% of study participants. According to Niazi et al, among study participants with IPI ≥24months, 18-23months and <18months, uterine rupture occurred in 1.3%, 1.9% & 4.8% cases, respectively. In multivariate analysis, IPI<18months had significant rise in frequency of uterine rupture.

Postpartum haemorrhage and short inter pregnancy interval

In present study, PPH was reported in 33.8% cases, of which 60% had IPI of <6 months, 43% IPI of 6-18 months and in 20.6% cases IPI of 18-24 months.It is yet unknown exactly how short IPI contributes to PPH. However, it is hypothesised based on the theory of maternal depletion, which contends that brief intervals between pregnancies prevent the mother from recovering from abnormal conditions during the preceding pregnancy and childbirth, such as abnormal endometrial vessel remodelling and incomplete healing of uterine scars, which further contribute to utero-placental bleeding disorders like retained placenta, uterine atony, and uterine rupture. Shreshtha et al. in their study reported 10 cases of PPH, among them 5 were in women with IPI 24-59 months followed by 3 cases in women with IPI of > 59 months, one case each in IPI of < 18 months and 18-23 months. Lilungulu et al in their study reported that among study participants with short inter pregnancy interval, 19.3% had post-partum haemorrhage. Jena et al in their study reported that women who had a pregnancy <24 months after the preceding childbirth were nearly three times (AOR = 2.97) more likely to experience primary PPH as compared to those who had >24 months intervals, which means about 66% of primary PPH was attributed to IPI <24 months as compared to 24–60 months.

Birth weight and short interpregnancy interval

In the present study, about 35.5% newborn had low birth weight, 22.3% had very low birth weight, 8.5% had extremely low birth weight which was most commonly seen in 34.3%. In IPI of 6-18 months followed by 37.2% in IPI 18- 24 months and 32% in IPI of < 6 months. The explanation of low birth weight is the maternal nutritional depletion hypotheses that close succession of pregnancies and

lactation worsens the maternal nutritional status as there is lesser time to recover from the physiological stresses of the preceding pregnancy before she is subjected to the stress of then next pregnancy. Promoting spacing methods of family planning is an option that India may consider for increasing the IPI and thereby reducing LBW births. Kannaujiya etal in their study reported that 17% of the births in our sample were LBW, and more than half (57.6%) of these were accompanied with IPI less than 18 months. Prevalence of LBW births was highest among mother's who had IPI less than six months (19.4%).

According to Shreshtha et al., Risk of low birth weight (<2500 g) babies, NICU admission was higher in short inter-pregnancy interval of less than 18 months. Lilungulu et al in their study reported that among women with short inter pregnancy interval, 26.7% babies were low birth weight, 29.3% were premature, 26.7% were small for gestational age and 82% of babies required long hospital stay.

Foetal complication and short pregnancy interval

In present study it was found that majority of babies 39.4% required NICU stay of >7 days. Early neonatal death was seen in 12.5% cases. 11.8% cases were IUFD. 3.9% babies had congenital anomaly and 5.9% were stillborn. The interval between conceptions has been related to preterm birth and other advent IPI <6 months babies of maximum 28% patients required longer hospital stay followed by 24% babies were stillborn and 20% were IUFD.

Adverse outcomes such as abortion, congenital malformations, intrauterine growth restriction and perinatal or infant death. In present study, significant association was found between foetal status at birth. However, it has been demonstrated that short IPI increases the risk of uterine rupture in womenattempting vaginal birth after caesarean, premature rupture of membranes, endometritis, third trimester

bleeding, placenta previa, placental abruption, maternal death, and anaemia, leading to adverse foetal outcomes.

Ceccati et al in their study found that short intervals (<6 months) wereassociated with a greater risk of low birth weight (odds ratio: 1.74; 95% CI: 1.18–2.55), and preterm birth (1.56; 1.01–2.46). Fuentes-Afflick et al. women with IPI of < 8 months were 14-47% more likely to have very premature and moderately premature infants than werewomen with intervals 18->24 months. The precise mechanism by which having a short IPI causes adverse perinatal outcomes is not fully understood. The likelihood of maternal nutritional depletion syndrome is one well-known reason in the literature that may cause these unfavourable results. Ensuring recommended iron and folic acid tablets/equivalent syrup and Td injections for every pregnant woman may offset the adverse consequences of shorter IPI.

Conclusion

India is a large country with a significant unmet need for contraception. Most women had IPIs that were shorter than 24 months, which is the minimum interval advised by the WHO. This study emphasises the gloomy attitude of family spacing among couples. It was directly correlated with several demographic characteristics, including low levels of literacy, rural residents, and lower socioeconomic class. The most frequent causes of short IPI included poor antecedent birth outcomes, child sex preference, unintended pregnancies, non-use of family planning methods, contraceptive failure, lack of understanding regarding recommended birth intervals, and female gender of antecedent birth. Anaemia, scar dehiscence, uterine rupture, PPH, PROM, and premature delivery were all associated to mothers' short IPI. Low birth weight, preterm, IUFD, stillbirth and neonatal death were foetal problems associated to short IPI. Social initiatives

like raising the educational level of the population and expanding access to contraception will support appropriate IPI and enhance mother outcomes. It will be possible to attain the best maternal health by further enhancing the education campaigns on contraception and encouraging couples to adopt sufficient spacing with the support of primary care physicians. The study's findings will help policymakers further educate healthcare professionals at all levels about the need of promoting the ideal inter-pregnancy interval, as stressed by the WHO.

Declarations:

Funding: None.

Availability of data and material: Department of Obstetrics and Gynaecology, Sultania Zanana Hospital & Gandhi Medical College, Bhopal.

Code availability: Not applicable.

Consent to participate: Consent taken.

Ethical Consideration: There are no ethical conflicts related to this study.

Consent for publication: Consent taken.

Limitations of the Study

Since our study is a hospital-based study conducted in a tertiary referral centre, it does not truly reflect the actual effect of IPI on the population in the community. A further study is needed to explore the relation of IPI with maternal and perinatal outcomes in health facility at community level. There was a possibility of social desirability bias while interviewing the study participants regarding the usage of contraceptive methods and intention for continuation of pregnancy. Those patients, whose last normal menstrual period was unknown and early ultrasound report was missed in her chart, were not possible to enroll and it was difficult to estimate their gestational age.

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