



DO TRANSVERSE SKIN INCISION & ADHESION AT POST CAESAREAN DELIVERY DELAY DELIVERY OF NEONATES & INCREASE MATERNAL MORBIDITY: A COHORT STUDY

Gynaecology

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ABSTRACT

Background: The most common major abdominal operation done on women is Caesarean section. Over the past century delivery by Caesarean section has been increased in both developed and developing countries. Various abdominal incisions have been used for Caesarean delivery. Today most of the caesarean section are performed with either a vertical infra umbilical midline incision [VIUI] or Pfannenstiel incision. Both the skin incisions possess some benefits and drawbacks. **Methods:** This study was a prospective cohort study conducted in the department of Gynaecology & Obstetrics, Burdwan Medical College & Hospital, Burdwan, West Bengal a tertiary teaching institute, from July, 2017 to November, 2018. 142 mothers were included in the study after informed consent from the patient about being a part of this study. Among them, 37 were with midline vertical skin incision, 51 were with transverse skin incision, and 54 were primigravida. Categorical variables are expressed as Number of patients and percentage of patients and compared across the groups using Pearson's Chi Square test for Independence of Attributes/ Fisher's Exact Test as appropriate. **Results:** 57.41% of primigravida are in 18 to 20 years age group, 42.59 % in 21-25 years, no women was over 25 years. women with previous vertical incision 27.03% have no adhesion, 59.46 % have mild adhesion, and 13.51% have severe adhesion. In women with previous transverse incision 21.57% have no adhesion, 47.06% have mild adhesion and 31.37% have severe adhesion. 34.7% adhesion are between uterus and bladder, 26.5% adhesion are between uterus and omentum, 20.4% adhesion are between uterus and abdominal wall, 12.2% adhesion between omentum and abdominal wall, 6.2% adhesion are in others organ **Conclusions:** There was significant delay in delivery of neonates in post caesarean mothers with previous transverse skin incision than vertical incision. Previous transverse skin incision is associated with more severe adhesion than vertical skin incision

KEYWORDS

Caesarean Section, Skin Incision, Adhesion, Maternal Morbidity

INTRODUCTION

Caesarean section is one of the most common major abdominal surgeries performed in women at present throughout the world.

The rate of caesarean deliveries continues to rise worldwide particularly in developed countries. A study conducted by Declercq E and associates in 2011 comprising 22 industrialised countries assessing the pattern in the trends towards the increasing rate of caesarean section from 1987 -2007. They found that 11 countries reported overall caesarean rates of more than 25 percent, led by Italy (39%). Five countries, the Slovak Republic, Czech Republic, Ireland, Austria, and Hungary have more than doubled their caesarean delivery rate between 1992 and 2007. Comparing changes in rates across time periods, 14 countries experienced a greater increase in rates in the period between 1998 and 2002 compared with the period between 1993 and 1997.¹

Betran and colleagues conducted a study in 2016 to assess the increasing trend in Caesarean Section Rates globally. They conducted a longitudinal analysis calculating differences in CS rates as absolute change and as the average annual rate of increase (AARI) by evaluating the national records and survey reports of 1990-2014. According to the latest data from 150 countries currently 18.6% of all births occur by CS, ranging from 6% to 27.2% (least and most developed regions, respectively). Latin America and the Caribbean region have the highest CS rates (40.5%). In Asia rate is 19.2% and Africa 7.3%, the least. While analysing the trends they found that between 1990 and 2014, the global average CS rate is increased 12.4% (from 6.7% to 19.1%) with an average annual rate of increase (AARI) of 4.4%. The largest absolute increases occurred in Latin America and the Caribbean (19.4%, from 22.8% to 42.2%), followed by Asia (15.1%, from 4.4% to 19.5%). Asia and Northern America were the regions with the highest and lowest average annual rate of increase (6.4% and 1.6%, respectively).² Both of these studies show a relentless increase in the caesarean section rates in the recent past. Historically, caesarean section was performed either post-mortem or accidentally for several millennia.³ Ancient myth and legend has it that Aesculapius and Bacchus, the Gods of medicine and wine respectively, were born by caesarean section.³

The origin of the word 'caesarean' is unclear. According to Munro Kerr's text book on Operative Obstetrics, 12th edition, weak myth that Julius Caesar was born by this route is contraindicated by the fact that his mother survived his birth by many years. It is likely that the term comes from the lex regia or royal law legislated by one of the early kings in Rome, Numa Pompilius, 715 BC. This law proclaimed that women who died before delivery of their infant had to have the infant removed through the abdomen before burial. This law continued under the ruling Caesars when it was called les Caesarea.³

As stated in Munro Kerr's text book on OPERATIVE OBSTETRICS, 12th edition Caesarean delivery as a surgical procedure is described in the 15-16th century as post mortem caesarean section, to fulfil the religious edicts that proclaimed in order to save the soul of the infant by baptism.³

First medical text advocating caesarean section before maternal death and preferably before maternal extremes to improve the maternal and foetal outcome was by the French physician Francois Rousset in 1581³, though it was highly criticised by medical establishment of that time.

The first well documented caesarean section by a doctor was performed by a physician named Jeremius Trautmann in Germany in 1610.³ Throughout the 16th centuries to 18th century's caesarean section were performed rarely in some cases of extreme CPDs.³ It was almost always associated with fatal maternal outcome. This view point was summed up by the prominent Dublin obstetrician Fielding Ouldin in his book, 'A treatise of midwifery'.⁴ The important causes for this high mortality were prolonged labour, infections and non- suturing the uterus.³

Throughout the 19th century obstetricians tried different methods and techniques to try to reduce mortality and saving the uterus.³ Ferdinand Keher, an underappreciated contributor to the development of the modern caesarean section, performed a transverse lower segment caesarean section in 1881, virtually as it is performed now a days.³

Later on in 1882 Max Sanger introduced classical caesarean section in which uterus is incised and sutured in midline carefully. Introductions to closing the uterus properly, as described by Max Sanger in 1882, and

the use of aseptic technique around 1870s, were both important factors to reduce maternal mortality and improve outcome.^{3,5}

Different CS techniques have been used and described over the years. In a classical CS, midline vertical incisions of the skin and the uterus are performed. In 1926, Munro Kerr proposed a transverse incision of the lower uterine segment, which proved to be superior to a vertical incision, with reduced maternal mortality and lower risk of uterine rupture in a subsequent pregnancy.⁶

The transverse incision of the uterus did not gain acceptance until 1949 and was either combined with a midline incision of the skin or a low transverse incision- the Pfannenstiel- Kerr method. In these techniques, both visceral and parietal peritoneum layers were closed, but later clinical studies suggested that closure was not mandatory for peritoneal healing.^{6,7}

In the early 20th century the techniques described by Munro Kerr were used consistently, where skin was incised in midline vertical fashion. The inventor said by himself in his book 'Operative Midwifery' that 'the abdominal incision should possess two qualities- it should be high and it should be sufficiently long. My rule is to make the incision 8 to 10 inches [20 to 25 cm] in length...two third of this incision is made above and one third below the level of the umbilicus'.⁸ Preference for midline incision in the earlier days was probably because of the fact that midline vertical incision were less time consuming and also the fear of retraction of rectus muscle was also there.⁹

Keeping this background in mind we have performed a research to evaluate the effect of previous skin incision type and adhesions, during the next caesarean section, on neonatal delivery and subsequent maternal morbidity in a prospective manner. Post caesarean mothers, who were admitted in our medical college during a period of about one and half year were being evaluated and had undergone caesarean section. Outcomes in the form of baby delivery and adhesions were compared and they were followed till discharge to evaluate postoperative maternal morbidity.

OBJECTIVES:

The objectives of the study are as follows:

1. Comparison of incision to baby delivery time between the transverse and infra umbilical vertical skin incision that had been given in previous caesarean section, at 2nd caesarean section,
2. Comparison of the degree of adhesion that has been encountered during the operation between mothers with previous infra umbilical vertical skin incision (IUVI) and transverse skin incision.
3. Comparison of the maternal morbidity in the form of: Haematuria, Urinary bladder injury Blood transfusion, prolonged catheterisation of bladder, abdominal distension, Wound complications, and prolonged hospital stay, between the transverse and vertical skin incision group.
4. To determine superiority of the skin incision type between the above mentioned two groups in relation to the baby delivery time and adhesion.

METHOD AND MATERIALS:

Study population: Pregnant women, who will have a non-urgent caesarean delivery in the dept. of Obstetrics & Gynaecology of this institution between 37 weeks of gestation to 41 weeks of gestation

Study period: July, 2017 to November, 2018.

Study area- A prospective cohort study will be conducted in the department of Gynaecology & Obstetrics, Burdwan Medical College & Hospital.

Study design: prospective cohort study.

Sample size: 142 mothers, among them, 37 were with midline vertical skin incision, 51 were with transverse skin incision, and 54 were primigravida.

INCLUSION CRITERIA:

women with previous caesarean section: Pregnant women between 37 weeks – 41 weeks of gestation who don't have any other indication for caesarean delivery except previous caesarean delivery (both transverse and vertical skin incision group).

Primigravida: pregnant women between 37 weeks -41 weeks of gestations who don't have any urgent indication for caesarean delivery. (Like foetal distress, no progresses of labour, premature rupture of membrane, etc.)

EXCLUSION CRITERIA:

- All the pregnant women who will have urgent indication for caesarean section.
- Women who had foetal demise.
- Expectant mothers who had previous abdominal surgery other than caesarean section.
- Intrauterine growth retardation and ante partum haemorrhage.
- PIH mothers,

Study variables

- Type of skin incision (transverse vs. vertical) in previous caesarean delivery,
- Pelvic adhesion and its severity encountered during operation,
- Baby delivery time
- Maternal morbidity And the outcome is assessed according to these variables

Parameters to be noted

- Number of women distributed in three groups (women with previous vertical skin incision, women with previous transverse skin incision, and primigravida).
- Age of the women,
- Period of gestation at the time of delivery,
- Types of skin incision (transverse or vertical), used in previous caesarean section,
- Presence and severity of pelvic adhesion during operation.
- Incision to baby delivery time.
- Gradation of adhesions (no adhesion, mild adhesion & severe adhesion).
- Maternal morbidity immediately after delivery (blood transfusion, haematuria).
- Maternal morbidity at the end of 1st week (wound complications, prolonged catheterisations, bladder injury, abdominal distension, prolonged admission, and mortality).

STATISTICAL METHODS: Categorical variables are expressed as Number of patients and percentage of patients and compared across the groups using Pearson's Chi Square test for Independence of Attributes/ Fisher's Exact Test as appropriate.

Continuous variables are expressed as Mean, Median and Standard Deviation and compared across the groups using Mann-Whitney U test.

The statistical software SPSS version 20 has been used for the analysis. An alpha level of 5% has been taken, i.e. if any p value is less than 0.05 it has been considered as significant.

In the post operative period women were reviewed at regular intervals. They were examined thoroughly, wound was followed regularly, and stitches were removed after 5 days if wound was found healthy. Wound with serous discharge, pus discharges were treated with regular dressing and up gradation of antibiotics and were removed after the wound became dry. Wound dehiscence or gaps were managed with secondary suturing. Post operative complications in the form of haematuria, need for blood transfusion, prolonged catheterisation, abdominal distension, wound complications, bladder laceration noted and recorded. Prolonged hospitalisation, as defined by more than 5 days of hospitalisation, was also noted.

RESULTS:

A prospective cohort study was conducted in the department of Gynaecology and Obstetrics of Burdwan Medical College and Hospital between 2017 -2019. Total 142 mothers were included. Among them, 88 women had history of previous one caesarean section. Among the post cs mothers 37 had history of midline vertical skin incision and 51 had low transverse skin incision. 54 primigravida were included. All patients had undergone caesarean section through transverse skin incision. Incision to baby delivery time noted and adhesions noted and categorised. They had been followed till discharge for any post operative complications as mentioned earlier. Results of the collected data are documented in tables and summarised also pictorial presentations done.

Table 1: Distribution of mothers, in three different groups according to their age group and parity in numbers (%).

		SKIN Incision			Total	p Value		
		None	Vertical	Transverse		None & Vertical	None & Transverse	Vertical & Transverse
Age	18-20	31(57.41)	1(2.7)	1(1.96)	33(23.24)	<0.001	<0.001	0.526
	21-25	23(42.59)	9(24.32)	10(19.61)	42(29.58)			
	26-30	0(0)	23(62.16)	38(74.51)	61(42.96)			
	31-35	0(0)	4(10.81)	2(3.92)	6(4.23)			
Total		54(100)	37(100)	51(100)	142(100)			
		SKIN Incision			Total	p Value		
		None	Vertical	Transverse		None & Vertical	None & Transverse	Vertical & Transverse
Parity	0+0	54(100)	0(0)	0(0)	54(38.03)	<0.001	<0.001	NA
	1+0	0(0)	37(100)	51(100)	88(61.97)			
Total		54(100)	37(100)	51(100)	142(100)			

Table 1 showing 57.41% are in 18 to 20 years age group, 42.59 % in 21-25 years, no women was over 25 years; in vertical group 62.16 % in 26 - 30 years and 24.32 % in 21 -25 yrs, 10.81 % in >30 yrs age. In transverse they are 74.51%, 19.61%, and 4% respectively.

Table 2: Showing mean and median age distribution of the mother according to the type of previous skin incision and period of gestation in primigravida and post caesarean mother with standard deviation and p values.

SKIN Incision (previous skin incision)		Age
None	Mean	20.65
	Median	20.00
	Std. Deviation	1.63
Vertical	Mean	27.41
	Median	28.00
	Std. Deviation	2.64
Transverse	Mean	26.96
	Median	27.00
	Std. Deviation	2.29
None & Vertical	p Value	<0.001
None & Transverse	p Value	<0.001
Vertical & Transverse	p Value	0.445
SKIN Incision (post caesarean mother)		Period of Gestation
None	Mean	39.33
	Median	39.00
	Std. Deviation	1.13
Vertical	Mean	38.05
	Median	38.00
	Std. Deviation	1.03
Transverse	Mean	38.24
	Median	38.00
	Std. Deviation	0.84
None & Vertical	p Value	<0.001
None & Transverse	p Value	<0.001
Vertical & Transverse	p Value	0.268

Table 2 showing distribution of mothers according to the mean age of distribution. Primigravida have a mean of 20.65 years, vertical incision group has a mean of 27.41 yrs, and transverse have 26.96 years.

It is shown that there is no significant difference in age distribution among the mothers with previous vertical and transverse skin incision ($p=0.445$). But primigravida are of significantly lower age group than the post caesarean mothers ($p<0.001$).

distribution of mothers according to the period of gestation at the time of delivery. Mean period of gestation of primigravida, mothers with previous vertical incision & mothers with previous transverse incision are 39.33, 38.05, 38.24 weeks respectively. Median are 39.00, 38.00, 38.00 weeks.

Among the primigravida mothers the median period of gestation at the time of delivery was 39 weeks which is significantly lower ($p<0.001$) than the post caesarean mothers in whom the median period of

gestation was at 38 weeks. No significant difference ($p=0.268$) in the period of gestation is found between the vertical and transverse skin incision group

Table 3: Showing distribution of adhesion according to their severity among post caesarean mothers.

		SKIN Incision		p Value	Significance
		Vertical	Transverse		
Adhesion	No	10(27.03)	11(21.57)	0.557	Not Significant
	Mild	22(59.46)	24(47.06)	0.245	Not Significant
	Severe	5(13.51)	16(31.37)	0.038	Significant
Total		37(100)	51(100)		

Table 3 showing that among the women with previous vertical incision 27.03% have no adhesion, 59.46 % have mild adhesion, and 13.51% have severe adhesion. In women with previous transverse incision 21.57% have no adhesion, 47.06% have mild adhesion and 31.37% have severe adhesion.

No significant difference ($p=0.245$) is found in mild adhesion between the vertical and transverse skin incision group. Severe adhesion was significantly more ($p=0.038$) in the transverse skin incision group. No adhesion was found in the primigravida mothers

Table 4: Distribution of mothers with vertical skin incision according to the patterns of adhesion and previous transverse skin incision according to the patterns of adhesion

Vertical skin incision Total 30 (100)	Uterus and bladder	Uterus and anterior abdominal wall	Uterus and omentum	Omentum and anterior abdominal wall	Others
No. of instances	13	3	4	8	2
Percentage	43.3	10	13.3	26.6	6.8
Transverse skin incision Total 49 (100)	Uterus and bladder	Uterus and anterior abdominal wall	Uterus and omentum	Omentum and anterior abdominal wall	Others
No. of instances.	17	10	13	6	3
Percentage	34.7	20.4	26.5	12.2	6.2

Table 4 shows distribution of adhesions in vertical incision group according to the pattern of adhesion. 43.3% adhesion was between uterus and bladder, 26.6% adhesion between omentum and abdominal wall, 10% of adhesion between uterus and abdominal wall, 13.3% adhesion between uterus and omentum, others types of adhesions are 6.8% (including adhesion between bladder and abdominal wall).

Distribution of adhesion in transverse incision group. 34.7% adhesion are between uterus and bladder, 26.5% adhesion are between uterus and omentum, 20.4% adhesion are between uterus and abdominal wall, 12.2% adhesion between omentum and abdominal wall, 6.2% adhesion are in others organ

Table 5 : Shows comparison of incision to delivery time interval between vertical & transverse skin incision group according to the severity of adhesions and comparison of incision to delivery time interval between vertical & transverse skin incision group according to the severity of adhesions in minutes and seconds

Incision to delivery time(sec)				
SKIN Incision		Mean	Median	Std. Deviation
Vertical	No	313.70	300.00	46.29
	Mild	337.68	345.50	79.65
	Severe	451.20	508.00	127.06
	p Value	0.114		
	Significance	Not Significant		
Transverse	No	335.18	330.00	65.37
	Mild	398.54	387.50	84.49
	Severe	664.25	614.50	112.85
	p Value	<0.001		
	Significance	Significant		
Incision to delivery time in minutes				
Skin incision		Mean	median	Std. Deviation
Vertical	No	5min 13 sec	5 min	46sec
	mild	5 min37 sec	5min45sec	1min19sec

	Severe	7min 31sec	8min27sec	2m07sec
	P value	0.114		
Transverse	No	5min34sec	5min30sec	1min04sec
	Mild	6min38sec	6min27sec	1min24sec
	Severe	11min04sec	10min14sec	1min52sec
	p value	<0.001		

Table 5 showing comparison of incision to delivery time according to severity of adhesion among vertical and transverse skin incision group. In women with previous vertical incision though the baby delivery time lengthen with increasing severity but there is no significant correlation between the incision to delivery time and severity of adhesion ($p=0.114$).

In women with previous transverse incision baby delivery time lengthen with increasing severity of adhesion and it is significantly related with the severity of adhesion ($p<0.001$).

Table 6 : Shows incidence of different parameters among three groups: none, vertical, and transverse.

		SKIN Incision			Total	p Value		
		None	Vertical	Transverse		None & Vertical	None & Transverse	Vertical & Transverse
Haematuria	No	54(100)	35(94.59)	46(90.2)	135(95.07)	0.163	0.024	0.694
	Yes	0(0)	2(5.41)	5(9.8)	7(4.93)			
Total		54(100)	37(100)	51(100)	142(100)			
Blood transfusion	No	54(100)	37(100)	46(90.2)	137(96.48)	NA	0.024	0.071
	Yes	0(0)	0(0)	5(9.8)	5(3.52)			
Total		54(100)	37(100)	51(100)	142(100)			
Prolonged catheter	No	54(100)	35(94.59)	46(90.2)	135(95.07)	0.163	0.024	0.694
	Yes	0(0)	2(5.41)	5(9.8)	7(4.93)			
Total		54(100)	37(100)	51(100)	142(100)			
Abdominal distension	No	48(88.89)	33(89.19)	44(86.27)	125(88.03)	0.964	0.684	0.755
	Yes	6(11.11)	4(10.81)	7(13.73)	17(11.97)			
Total		54(100)	37(100)	51(100)	142(100)			
Wound complications	No	48(88.89)	32(86.49)	44(86.27)	124(87.32)	0.753	0.684	0.977
	Yes	6(11.11)	5(13.51)	7(13.73)	18(12.68)			
Total		54(100)	37(100)	51(100)	142(100)			
Bladder Injury	No	54(100)	37(100)	50(98.04)	141(99.3)	NA	0.486	0.392
	Yes	0(0)	0(0)	1(1.96)	1(0.7)			
Total		54(100)	37(100)	51(100)	142(100)			

Table 6 shows, among the women with previous vertical incision 2 women developed haematuria (5.41%). Among the women with previous transverse skin incision 5 developed haematuria (9.8%). No significant difference ($p=0.694$) in incidence of haematuria found between women with previous vertical and transverse skin incision group ($p=0.694$). No primigravida developed haematuria.

Comparison of need for blood transfusion among women in the three groups according to previous skin incision type. No women with previous vertical skin incision needed blood transfusion. Among women with previous transverse skin incision 5 women needed blood transfusion (9.8%). Need for blood transfusion was not significantly different between the transverse and vertical skin incision group ($p=0.071$).

It is also seen that there is significant difference in need for blood transfusion between the primigravida and post caesarean mother with previous transverse skin incision ($p=0.024$).

Among 51 women with previous transverse skin scar, 5 women had prolonged catheterisation for more than 72 hours (9.8%). In the vertical skin incision (37 women) group 2 women had prolonged catheterisation (5.41%). No primigravida needed prolonged catheterisation.

No significant difference in the form of prolonged catheterisation found between the women with previous vertical and transverse skin incision ($p=0.694$), but significant difference was found between the primigravida and mothers with previous transverse skin incision ($p=0.024$).

Among 51 women with previous transverse skin scar, 7 women had abdominal distension (13.73%). In the vertical skin incision (37 women) group 4 women had abdominal distension (10.81%). Among 54 primigravida women 6 (11.11%) needed prolonged catheterisation. No significant difference in the form of abdominal distension found

between the women with previous vertical and transverse skin incision and primigravida mothers.

Among 51 women with previous transverse skin incision, 7 women had wound complications (13.73%). In the vertical skin incision (37 women) group 5 women had wound complications (13.51%). Among 54 primigravida women 6 (11.11%) had wound complications.

No significant difference, in the form of wound complications is found among the women with previous vertical and transverse skin incision and primigravida mothers.

Wound complications are defined as wound gaping, serous discharge from the wound, pus discharge from the wound. Most of the woman had serous discharge from the wound, one woman in vertical incision had wound gap, and two women had pus discharge. It also shows that single woman had bladder injury. Only one woman had bladder injury during the study period. Fortunately no one died during this study period.

DISCUSSION

In this study post caesarean mothers are compared according to their skin incision type in previous pregnancy. They were divided in two groups. One group had previous infra umbilical vertical skin incision and other group had previous low transverse skin incision. Only the elective caesarean sections were included. Cases with emergency indications were excluded. They were compared in terms of incision to baby delivery time, intra abdominal adhesion during operation and followed up to discharge from hospital to compare the post operative morbidity. Primigravida mothers without any previous skin incision are also included for comparison with post caesarean mother to decrease the confounding factors.

No significant difference was found between women with previous vertical and previous transverse skin incision according to their age. The median age of the vertical incision group was 28 years and in

transverse incision group median age was 27 years. ($p=0.526$).

In a study conducted by B.J. Wylie and associates¹⁰, they also didn't find any difference in age group among the post caesarean mothers (vertical 26.5 years, transverse 26.9 years).

Among the primigravida mothers the median period of gestation at the time of delivery was 39 weeks which is significantly higher ($p<0.001$) than the post caesarean mothers in who the median period of gestation was at 38 weeks. There was no significant difference ($p=0.268$) in the period of gestation between the vertical and transverse skin incision group. It was 38 weeks as median period of gestation. Same is found in another study¹³. But in their study they found that median period of gestation was 37 weeks in both the groups.

Adhesion in subsequent caesarean delivery is a matter of concern. Severity of adhesion also increases with increasing number of caesarean delivery^{11,12}. Adhesion also varies along with the mode of abdominal entry.

Among the mother with previous vertical incision 27.03% have no adhesion, 59.46 % have mild adhesion, and 13.51% have severe adhesion. In women with previous transverse incision 21.57% have no adhesion, 47.06% have mild adhesion and 31.37% have severe adhesion. Severe adhesion was significantly more ($p=0.038$) in the transverse skin incision group.

From the above result it is found that adhesions tend to be more severe in woman with previous transverse skin incision than women with previous vertical skin incision.

Shunji Sujuki and associates conducted a retrospective cohort analysis of women who had non urgent caesarean delivery at 37-41 weeks of gestation. They found that overall incidence of severe adhesion is low (3.8%). But in women with previous vertical incision 3.4% have severe adhesion, whereas 4.5% of women with previous transverse incision had severe adhesion. They also found that severity of adhesion was strongly related to delayed delivery of neonates¹⁴.

Some studies compare the incidence of adhesion during laparoscopy. In a study conducted by AI Bill and collaborates to determine the incidence of adhesion during laparoscopy in women with previous laparotomy, they found that presence of adhesion in patients with previous obstetric surgeries was not affected by type of skin incision type at previous surgery¹⁵.

Regarding distribution of adhesion there is variation among the vertical and transverse incision group in this study.

In women with previous vertical incision, we found that adhesion between the uterus and bladder; and adhesion between the omentum and anterior abdominal wall were more frequently occurring. Whereas, in women with previous transverse skin incision, we found that, adhesion between the uterus and bladder; and adhesion between the uterus and omentum, were more frequently occurring.

In women with previous transverse incision ,34.7% adhesion are between uterus and bladder; 26.5% adhesion are between uterus and omentum; 20.4% adhesion are between uterus and abdominal wall; 12.2% adhesion are between omentum and abdominal wall, and 6.2% adhesion are in other organs.

In women with previous vertical incision, 43.3% adhesion was between uterus and bladder; 26.6% adhesion, between omentum and abdominal wall; 13.3% adhesions, between uterus and omentum; 10% of adhesions, between uterus and abdominal wall; and, others types of adhesions are 6.8% (included adhesion between bladder and abdominal wall).

Mahale Arun Ramkrishnarao and associates conducted a prospective study among the women with previous caesarean delivery to find intra operative difficulties in repeat caesarean section. In their study they tabulated the distribution of adhesions. They found that 17.75% adhesion was between uterus and bladder, 10.79% adhesion was between uterus and omentum, 6.62% adhesions was between uterus and abdominal wall, 4.87% adhesions were between omentum and abdominal wall, 4.51% adhesions was with other organs.¹⁷ They haven't separately distributed the adhesion between the transverse and

vertical group. In our study we found more prevalence of adhesion. The pattern of distribution of adhesion in the vertical incision group correlates with their study.

Baby delivery time in subsequent pregnancy differs according to the type of skin incision in previous caesarean delivery. In our study incision to baby delivery time in women with previous vertical skin incision was significantly less than the women with previous transverse skin incision ($p<0.001$).

In this study women in vertical group have a mean time of 5minutes 45 seconds (346.54 sec) for incision to baby delivery; median was 5minutes 45 seconds, Std Deviation was 1min 28sec. Incision to delivery time of neonates is significantly more ($p<0.001$) in transverse skin incision group. In them mean was 7 minutes 48 seconds (468.24sec) with Std Deviation of 2 min 42sec and median was 7 minute 09 seconds; in primigravida mean incision to delivery time was 4minutes 45 seconds (285.17 sec), median was 4 minutes 54 seconds.

This finding is corroborative with other studies.^{10,14,18} Few other studies didn't find any significant delay in incision to baby delivery time between the vertical and transverse skin incision group, though in them average incision to delivery time was less in women with previous vertical skin incision.^{15,19}

Incision to baby delivery time also lengthens with increasing severity of adhesion.

In this study, among women with previous vertical skin incision, though the incision to delivery time increases with increasing severity of adhesion, this lengthening is not statistically significant in relation to the severity of adhesion found in this group of women. But in women with previous transverse skin incision, baby delivery time significantly lengthens with increasing severity of adhesion ($p<0.001$). In them mean incision to delivery time with no adhesion, mild adhesion & severe adhesion was 5min34sec, 6min38sec, and 11min04sec respectively.

This finding signifies that transverse skin incision and adhesion in previous caesarean delivery delay the delivery of neonates. This finding correlates well with other studies.^{10,14}

In this study, incision to delivery time also significantly lengthens with increasing severity of adhesion ($p<0.001$) irrespective of the type of previous skin incision.

Mean Incision to delivery time with no adhesion, mild adhesion and severe adhesion are 5min24sec, 6min09sec and 10min 13sec respectively. Median incision to delivery time with no adhesion, mild adhesion and severe adhesion are 5 min 10 sec, 6 min 10 sec and 10min respectively ($p<0.001$). Std. Deviation of incision to delivery time was 56 sec, 1min 26sec, 2min 26sec for no adhesion, mild adhesion, and severe adhesion respectively.

M. B. Greenberg and colleagues²⁰ conducted a study to compare the incision to delivery time with severity of adhesion. They found that incision to delivery time is 19.8min in adhesion with a score ≥ 3 , and an incision to delivery time of 15.6min with adhesion score <3 . They concluded that severity of adhesion may delay the delivery of neonates. This study also correlates with them. Other studies also had shown the same findings.^{14,21}

Maternal morbidity

Increase in maternal morbidity in repeated caesarean delivery is a matter of concern among the Obstetricians. Maternal morbidity differs according to the type of skin incision given during primary caesarean section. Among the post caesarean mothers maternal morbidity and mortality may also differ according to the type of skin incision in previous caesarean section. But very few studies had addressed it.

In this study maternal morbidity is compared on the basis of haematuria, need for blood transfusion, prolonged catheterisation, bladder injury, abdominal distension, wound complication and prolonged hospital stay among the mothers with either previous transverse or vertical skin incision.

During this study period 88 women had undergone 2nd caesarean section with non urgent indications between 37 to 41 weeks of

gestation. Among them 37 were with previous vertical skin incision and 51 were with previous transverse skin incision.

Haematuria: Among the women with previous vertical incision 2 women developed haematuria (5.41%). Among the women with previous transverse skin incision 5 developed haematuria (9.8%). No significant difference ($p=0.694$) in incidence of haematuria was found between women with previous vertical and transverse skin incision ($p=0.694$).

Need for blood transfusion: In this study no women with previous vertical skin incision needed blood transfusion. Among women with previous transverse skin incision 5 women needed blood transfusion (9.8%). Need for blood transfusion was not significantly different between the transverse and vertical skin incision group ($p=0.071$).

It is also found that there is significant difference in need for blood transfusion between the primigravida and post caesarean mother with previous transverse skin incision ($p=0.024$).

Prolonged catheterisation: In my study, among 51 women with previous transverse skin incision, 5 women had prolonged catheterisation for more than 72 hours (9.8%). In the vertical skin incision (37 women) group 2 women had prolonged catheterisation (5.41%). No primigravida needed prolonged catheterization.

No significant difference in the form of prolonged catheterisation found between the women with previous vertical and transverse skin incision ($p=0.694$).

But significant difference was found between the primigravida and mothers with previous transverse skin incision ($p=0.024$).

Abdominal distension: In this study among 51 women with previous transverse skin incision, 7 women had abdominal distension (13.73%). In the vertical skin incision (37 women) group 4 women had abdominal distension (10.81%). Among 54 primigravida women 6 (11.11%) needed prolonged catheterization.

No significant difference in the form of abdominal distension found between the women with previous vertical and transverse skin incision and primigravida mothers.

Wound complications: Wound complications were defined as wound gaping, serous discharge from the wound, pus discharge from the wound. In this study overall rate of wound complications are also found to be same among all the women. No statistically significant difference was found. Average rate was 11% to 13 %.

Prolonged hospital stay: The average duration of hospital stay was same in all the groups. The median days of hospital stay was 5 days. There is slight variation in mean but not significant.

Only one woman had bladder injury.

From the above discussion it can be stated that there is no significant difference in the post operative maternal morbidity among the woman with either previous vertical or transverse skin incision.

Other few studies also didn't found any significant difference in maternal morbidity.^{15,19,22}

CONCLUSION:

- There was significant delay in delivery of neonates in post caesarean mothers with previous transverse skin incision than vertical incision.
- Previous transverse skin incision is associated with more severe adhesion than vertical skin incision.
- Baby delivery time was also prolonged with increasing severity of adhesion
- Short term maternal morbidity is not significantly higher with previous transverse skin incision than vertical skin incision

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REFERENCES:

1. Declercq E, Young R, Cabral H, Ecker J. Is a rising cesarean delivery rate inevitable? Trends in industrialized countries, 1987 to 2007. *Birth* 2011; 38(2):99-104.
2. Betran AP, Ye J, Moller AB, Zhang J, Gulmezoglu A, Torloni MR. The Increasing Trend in Caesarean Section Rates: Global, Regional and National Estimates: 1990-2014. *PLoS one* 2016; 11(2): e0148343 [accessed on 29th October 2018].
3. Baskett TF, Calder AA. Munro Kerr's Operative Obstetrics: Caesarean Section. 12th ed. India: Reed Elsevier India Private limited; 2015.
4. Congo LD. Classic pages in obstetrics and gynecology. A treatise of midwifery. In three parts by Sir Fielding Ould, Dublin, O. Nelson & C. Connor, 1742. *Am J Obstet Gynecol*, 1976 Mar; 124(6): 656.
5. Lurie S: Spencer Wells and uterine sutures at caesarean section. *The Lancet* 2012; 380(9853):1558.
6. Kerr JM. Technique of Lower Segment Caesarean Section, More Especially in "Suspect" and Infected Cases: (Section of Obstetrics and Gynaecology). *Proceedings of the Royal Society of Medicine* 1936; 29(12): 1645-1647.
7. Irion O, Luzuy F, Beguin F. Nonclosure of the visceral and parietal peritoneum at caesarean section: a randomised controlled trial. *British journal of obstetrics and gynaecology* 1996; 103(7):690-694.
8. Kerr JM. *Operative Midwifery*. 1st ed. New York: Elsevier Ltd; 1908.
9. Brukel JJ. Incisions for Gynecologic Surgery. *Te Linde's Operative Gynecology*, 11th ed p 230-236, New Delhi: Wolters Kluwer (India) Pvt Ltd; 2015.
10. Wylie BJ et al.. Comparison of Transverse and Vertical Skin Incision for Emergency Cesarean Delivery. *Obstetrics & Gynecology*: 2010; 115(6): 1134-1140. doi: 10.1097/AOG.0b013e3181d937f. [accessed on 6th November 2018].
11. Tulandi T, Aqdi M, Zarel A, Meiner L, Sikirika V. Adhesion development and morbidity after repeat caesarean delivery. *Am J Obstet Gynecol*. 2009 Jul; 201(1): 56.e1-6. DOI: 10.1016/j.ajog.2009.04.039.
12. Hamel KJ. Incidence of adhesion at repeat caesarean delivery. *Am J Obstet Gynecol*. 2007 May; 196(5): e31-32. DOI: 10.1016/j.ajog.2006.09.011.
13. Bell J, Bell S, Vahratian A, Awonuga OA. Abdominal surgical incisions and perioperative morbidity among morbidly obese women undergoing caesarean delivery. *European Journal of Obstetrics & Gynecology & Reproductive Biology*. 2011 Jan; 154(1):16-19. DOI: <http://doi.org/10.1016/j.eogrb.2010.07.043>.
14. Suzuki S, Hiraizumi Y, Miura A, Miyake H. Factors associated with delayed delivery of infant in caesarean section. *THE JOURNAL OF MATERNAL -FETAL & NEONATAL MEDICINE*. 2011 Jun; 24(6). DOI: 10.3109/14767058.2012.733745.
15. Shi Z, Ma L, Yang Y, Wang H, Schreiber A, Li X et al. Adhesion formation after previous caesarean section -meta analysis and systemic review. *BJOG*. 2011 March; 118(4):410-422. DOI: <http://doi.org/10.1111/j.1471.0528.2010.02808.x>
16. Bill AI, Nezhat F, Nezhat CH, Nezhat C. The incidence of adhesion after prior laparotomy: a laparoscopic appraisal. *Obstet Gynecol*. 1995 Feb; 85(2): 269-272. doi: 10.1016/0029-7884(94)00352-E.
17. Ramkrishnarao MA, Popat UG, Eknath BP, Panditrao SA. Intra Operative Difficulties in Repeat Caesarean sections- A Study of 287 Cases. *J Obstet Gynecol India*. 2008; 58(6): 507- 510.
18. Palatnik A, Grobman A, Williams GA. The association of skin incision type at caesarean with maternal & neonatal morbidity for women with multiple prior caesarean delivery. *European Journal of Obstetrics & Gynecology & Reproductive Biology*. 2015 Aug
19. Puttanavijarn L, Phupong V. Comparison of the morbid outcomes in repeated caesarean sections using midline & pfannenstiel incision. *J Obstet Gynecol Res*. 2013 Dec; 39(12): 1555- 1559. DOI : 10.1111/jog.12112. [accessed on 13th nov 2018].
20. Greenberg MB, Daniels K, Blumerfeld YJ, Caughey AB, Lyell DJ. DO adhesion at repeat caesarean delivery delay delivery of newborn? *Am J Obstet Gynecol*, 2011; 205(4):308e1-5. doi: 10.1016/j.ajog.2011.06.088.
21. Pearson GA, Mackenzie IZ. Factors that influence the incision delivery interval at caesarean section and impact on the neonate: a prospective cohort study. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2013 Jul; 169(2): 197-201. DOI: <http://doi.org/10.1016/j.ejogrb.2013.02.021>.
22. Mokha WF, Fathuddin MA. Choice of abdominal incision and risk of trauma to the urinary bladder and bowel in multiple caesarean sections. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2006; 125(1):50-53. DOI : - <http://doi.org/10.1016/j.ejogrb.2005.06.017>