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Role of Ultrasonography in Measuring the Scar Thickness in Cases of Previous Lower Segment Caesarean Section

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Abstract: ***Introduction: The frequency of caesarean section in the world is increasing being the most common surgical procedure in obstetric health care services. It is the reason for serious concern and demands immediate international attention. While vaginal births after Caesarean (VBAC) are not uncommon today, the rate of VBAC has declined to include less than 10% of births after previous caesarean section due to concerns regarding the potential catastrophic effect of uterine rupture. Aims and objectives: This study was undertaken to evaluate the role of ultrasonography in detecting the thinning of lower uterine segment scar to decide the technical management of subsequent delivery in cases of previous LSCS and in predicting the risk or intrapartum uterine scar dehiscence. Materials and methods: 200 patients admitted in the labour room emergency of Nalanda Medical College and Hospital, Patna between September 2010 to July 2012 and had elective/emergency repeat caesarean section for various indications were included. Clinical, ultrasonographic and per operative findings of scar thickness and its integrity were compared. Results: The mean thickness of lower uterine segment in the patients with scar defects was 2.11± .93 mm and in patients with intact scar was 3.29± 0.87 mm. the difference being highly significant (P<0.01). There was no defect among 7 patients with measurement >4.5mm, 2 of the 81 patients (2.41%) with values 3.6-4.5 mm, 10 of 58 patients (17.24%) with values 2.5-3.5 mm, 12 of 38 patients (31.59%) with values 1.6-2.5 mm and in all 16 women. Prediction of scar rupture by ultrasonography taking a cut off value of 3.5mm of scar thickness was 90% sensitive, 52% specific, positive and negative predictive value being 31.2% and 95.5% respectively. Conclusion: Ultrasonographic examination of the lower uterine segment in cases with previous caesarean sections was found to be useful in assessment of scar integrity. Lower segment scar measuring more than 4.5mm were found to be intact and those measuring less than 1.6 mm always dehiscenced. Hence it is concluded that all patients with less than 1.6mm lower segment scar thickness should undergo elective caesarean section and with measurements greater than 4.5 mm should be allowed trial for vaginal delivery.***

1. Introduction

The frequency of caesarean section in the world is increasing being the most common surgical procedure in obstetric health care services.[1]It is the reason for serious concern and demands immediate international attention. While vaginal births after Caesarean (VBAC) are not uncommon today, the rate of VBAC has declined to include less than 10% of births after previous caesarean section due to concerns regarding the potential catastrophic effect of uterine rupture. [2]

Obstetricians and other caregivers differ on the relative merits of vaginal and Caesarean section following a Caesarean delivery; some still recommend a Caesarean routinely, while others do not. In the US, the American College of Obstetricians and Gynecologists (ACOG) modified the guidelines on vaginal birth after previous Caesarean delivery in 1999, 2004, and again in 2010.[3] In 2004, this modification to the guideline included the addition of the following recommendation:'Because uterine rupture may be catastrophic, VBAC should be attempted in institutions equipped to respond to emergencies with physicians immediately available to provide emergency care.'[4]

In 2010, ACOG modified these guidelines again to express more encouragement of VBAC, but maintained it should still be undertaken at facilities capable of emergency care, though patient autonomy in assuming increased levels of risk should be respected (ACOG Practice Bulletin Number 115, August 2010).[5]

2. Review of Literature

A Caesarean section, (also C-section, Caesarian section, Cesarean section, Caesar, etc.) is a surgical procedure in which one or more incisions are made through a mother's abdomen (laparotomy) and uterus (hysterotomy) to deliver one or more babies, or, rarely, to remove a dead fetus. The first modern Caesarean section was performed by German gynecologist Ferdinand Adolf Kehrer in 1881.[2]A review of over 20,000 cases of previous caesarean section has recorded the incidence of scar rupture as 5% per 1000 in spontaneous labour, 8% per 1000 with use of oxytocin infusion and 25% per 1000 with the use of prostaglandin (lydon-Rocheele et al.,2001).[6]Vaclinkova and Westin (1984) used ultrasound to examine the echostructures between the urinary bladder and the amniotic cavity. Corresponding to the scar region smooth or pathologically deformed structures were observed .[6] The sensitivity of ultrasonic methods was 67% and specificity 96%.[6]

Michealis et al.(1988) used ultrasound to diagnose defect in the lower uterine segment. Seventy patients were examined

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and delivered by caesarean section. The false positive rates for at risk patients was 7.1%, and the positive and negative predictive values 92.3% and 100% respectively.[7]

Rozenberg et al.(1996) evaluated the usefulness of sonographic measurement of the lower uterine segment before labour in predicting the risk of intrapartum uterine rupture. With a cut off value of 3.5mm ,the sensitivity of ultrasonographic measurement was 88% the specificity 73.2%, positive predictive value 11.8% and negative predictive values 99.3%.Their results showed that the risk of a defective scar was directly related to the thinning of the lower uterine segment at around 37 weeks of pregnancy.[8]

3. Aims and Objectives

This study was carried out with the following aims and objectives:

1) To measure the thickness of scar and to see other defects (herniation) in scar of lower segment caesarean section ultrasonographically.
2) To confirm the ultrasonographic findings during repeat lower segment caesarean section.
3) To compare clinical, ultrasonographic and per operative findings of scar thickness and its integrity.

4. Materials and Methods

200 patients admitted in the labour room emergency of NALANDA MEDICAL COLLEGE AND HOSPITAL, Patna between September 2010 to July 2012 and had elective/emergency repeat caesarean section for various indications were included. Clinical, ultrasonographic and per operative findings of scar thickness and its integrity were compared.

The following selection criteria were used to include the patient in the study.

1) Patients between 34-42 weeks of pregnancy with previous lower segment caesarean section.
2) Patients of repeat caesarean section with malpresentation (breech,transverse lie) and with other obstetric complications like APH,PIH).

Exclusion Criteria

The following patients were excluded from the study:

1) Hemodynamically unstable patients in a state of shock.
2) Patients who presented in the late second stage of labour or with obstructed labour.
3) Patients who were kept for a trial of vaginal delivery and who delivered vaginally.

The mode of delivery, whether an elective repeat caesarean or a trial of vaginal delivery was decided by the attending obstetric consultant according to the standard indications.

A detailed history was taken especially for ascertaining the type of the previous section, the place where it was done and the post operative period to assess the strength and integrity of the scar. A thorough general physical examination followed by obstetric examination was done. Clinical signs of scar rupture were looked for and routine investigation were done as per proforma (Annexure 1).A progress of labour chart was maintained for those patients who were kept for a trial of vaginal delivery.

Routine transabdominal ultrasonography was done in all cases for fetal well being, for fetal maturity, the liquor pocket, the placental profile and to rule out any congenital malformation of fetus. Ultrasound with full bladder was done for good imaging of the entire lower uterine segment from its upper limit (top of the bladder) to the cervix as full bladder provides acoustic window for neighboring structures. Ultrasound was done with 5 Megahertz linear or convex probe. A longitudinal transverse scan was done to search for any symptomless dehiscence of the lower segment. Sagital sections were then measured exclusively to search for the thinnest zone of the lower segment scar. The measurements were done with the cursors at the interface of the urine and bladder and the amniotic fluid and decidua. The lowest value measured was used to described the thickness of the lower segment scar. According to the scar thickness of the lower uterine segment, cases were divided into five categories (i)>4.5mm, (ii)3.6-4.5mm, (iii)2.6-3.5mm, (iv)1.6-2.5 mm and (v)<1.6 mm. Ultrasonography for the lower uterine segment done nearest to the time of repeat section was considered the most optimal for study.

Sonographic findings were compared with assessment of the uterine scar by the obstetrician at the time of repeat caesarean section.

Grade I:

The scar was defined as intact when there was no thinning of the lower uterine segment and the integrity of endomyometrium was maintained.

Grade II:

Dehiscence was defined as subperitoneal separation of the uterine scar with chorioamniotic membrane being visible through the peritoneum.

Grade III:

A rupture was defined as the complete separation of the uterine scar of any length resulting in communication between the uterine and peritoneal cavity.

The association between a uterine scar defect during LSCS and the thickness as measured at sonography was assessed and the sensivity, specificity, positive predictive value were calculated. The risk of uterine rupture according to the thickness of the lower uterine segment scar were then quantified.

5. Results

Thickness of lower uterine segment scar according to ultrasonography and scar integrity

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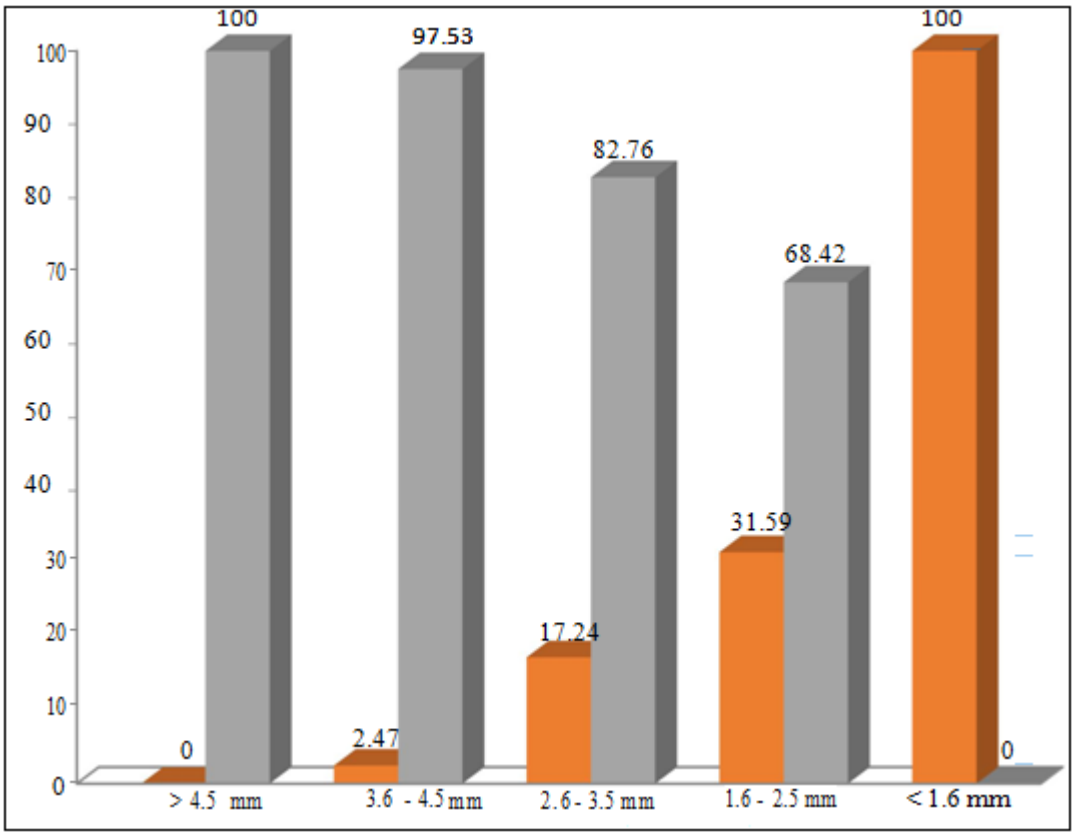

	Scar dehiscence %	Scar Intact %	P-value
> 4.5 mm	0	100	<0.01
3.6 - 4.5 mm	2.47	97.53	
2.6 - 3.5 mm	17.24	82.76	
1.6 - 2.5 mm	31.59	68.42	
< 1.6 mm	100	0	
	20	80	

The thickness of lower uterine segment measured by ultrasound among the 200 patients in this study ranged from 1 mm - 5mm. The mean thickness was 3.121+0.97 mm. Around 243 ultrasounds were done, the thickness measured at time closest to that of repeat section was taken for the purpose of analysis.

In this study, overall frequency of defective scars was 20% (all 20% dehiscences).The mean thickness of lower uterine segment in the patients with scar defects was 2.11± 93 mm and in patients with intact scar was 3.29±0.87 mm. the difference between the mean thickness of the lower uterine segment in the two groups was found to be highly significant (P<0.01). The frequency of defects was found to increase as the thickness of the lower uterine segment decreased. There was no defect among 7 patients with measurement >4.5mm, 2 of the 81 patients (2.41%) with values 3.6-4.5 mm,10 of 58 patients (17.24%) with values 2.5-3.5 mm, 12 of 38 patients (31.59%) with values 1.6-2.5 mm and in all 16 women with value < 1.6mm.

Predictive value of ultrasonography for rupture of scar, according to thickness

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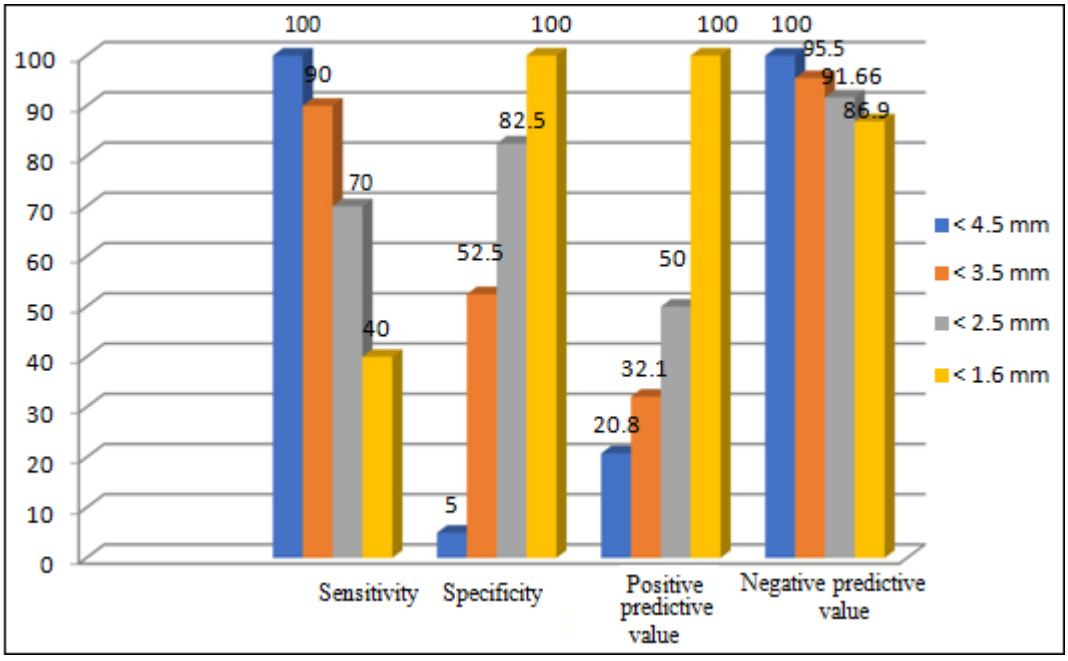

Scar thickness	Sensitivity	Specificity	Positive predictive value	Negative predictive value
< 4.5 mm	100	5	20.8	100
< 3.5 mm	90	52.5	32.1	95.5
< 2.5 mm	70	82.5	50	91.66
< 1.6 mm	40	100	100	86.9

This table gives the sensitivity, specificity, positive predictive value and negative predictive value for each cut off thickness. Patients with a lower uterine thickness less than 1.6 mm had a dehiscenced scar at the time of repeat section.

When a cut off value of 3.5mm of scar thickness the ultrasonographic measurement was 90% sensiitivity, 52% specificity, positive predicyive value was 31.2% and negative predictive value 95.5%.

6. Discussion

The overall frequency of defective scars was 20% (all 20% dehiscences).The mean thickness of lower uterine segment in the patients with scar defects was 2.11± .93 mm and in patients with intact scar was 3.29± 0.87 mm. Difference between mean thickness of the lower uterine segment in the two groups was found to be highly significant (P<0.01). The frequency of defects was found to increase as the thickness of the lower uterine segment decreased. There was no defect among 7 patients with measurement >4.5mm, 2 of the 81 patients (2.41%) with values 3.6-4.5 mm,10 of 58 patients (17.24%) with values 2.5-3.5 mm, 12 of 38 patients (31.59%) with values 1.6-2.5 mm and in all 16 women (100%) with values <1.6 mm had scar defects.

As regards to the time of performing USG for scar thickness, USG performed just before doing repeat caesarean section was best recommended by Michealis et al.(1988)[7] and Rozenberg et al.(1996).[8] Michealis et al. (1988) recommended that 29 to 36 weeks of gestation was the most preferable time to perform ultrasound to know the lower uterine segment thickness as the lower uterine segment is not well formed, liquor is adequate in amount and the presenting part is not deep down in pelvis.[7] Rozenberg et al.(1996) recommended ultrasonography to be done at 37 weeks of gestation.[8]

Araki and Inooka(1982) observed that among 21 patients with scarred uterus, three had dehiscence when the interval from bladder wall to foetal surface was 0 mm.[9] Mild thin scars measured between 3mm and 5mm, and normal scars were from 4mm to 7mm in their study. They also concluded that ultrasonography is useful to detect incomplete dehiscence, but difficult to detect mild thin caesarean scars.[9]

In the study by Fukuda et al.(1988) among 70 patients, 46 patients had lower uterine thickness greater than 3 mm and 14 patients had thickness less than 2 mm. Four patients with thickness

> 2mm and 9 patients with thickness < 2mm had grade II scars at the time of repeat section, and 5 patients with thickness < 2mm had grade III scars.[10] The lower segment scar thickness of 2mm was taken as cut off point, below which scars were found to be defective. Similarly in this study, thickness less than 1.6mm was found to be associated with defective scars. Fukuda et al.(1988),[10] opined that the thickness of scars measuring more than 3mm could not be ascertained ultrasonographically, as 4 scars with thickness more than 3mm were found to have ruptured at the time of repeat caesarean section. Similarly in the present study the lower uterine segment measuring between1.6-4.5 mm fond to be in a relatively gray zone relating to the prediction of scar rupture, although the incidence of scar rupture was found to be increased with the decrease in the thickness of the lower uterine segment scar.

Michealis et al.(1988) also found that the mean longitudinal and transverse thickness of the lower uterine segment was significantly less for patients with scar defects as compared to those patients with intact scars.[7]

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Rozenberg et al.(1996)[8] mentioned that among patients with a scarred uterus the risk of defect during subsequent defect during subsequent labour is directly correlated to the degree of lower segment thickness at around 37 weeks. They defined four categories of lower uterine segment thickness as measured ultrasonographical: more than 4.5mm, 3.6-4.5mm, 2.6-3.5mm and 1.6-2.5mm. none of the 278 women with lower uterine segment scar thickness of 4.5mm or more had dehiscence or rupture, a finding similar to the present study. Among the 3.6-4.5mm group there were 177 patients, of whom three (2%) had defects (2 dehiscences and one rupture), whereas 2.47% defects (2 dehiscences) were encountered in the present study. 14 out of 136 patients (10%), with thickness 2.6-3.5mm had defects (five dehiscences and nine ruptures) as compared to 17.24% defects(10 dehiscences) in our study. In the group with thickness 1.6-2.5mm there were 8 defects (16%), (three dehiscences and five rupture). However in this study 31.59% scar dehiscence (12 dehiscences) were found. In Rozenberg's study there was no patient with less than 1.6mmthickness but in this study 16 patients had less than 1.6 mm scar thickness and all of them had scar dehiscence(100%).

In the present study with a cut off value of 3.5mm of scar thickness the ultrasonographic measurement was 90% sensitivity, 52% specificity, positive predictive value was 31.2% and negative predictive value 95.5% (Table XIII).

Michealis et al.(1988) assessed the lower uterine segment by it's symmetry, thickness, movement, ballooning, and the presence of wedge defects. Class I patients were considered normal; class 2 patients had abnormalities, with either an obvious defect or abnormal thinning, which were considered classic windows; class 3 patients were considered separately because their defects were well circumscribed and appeared to be unrelated to thickness or movement. Class 2 and 3 were considered pathologic. The sensivity and specificity for all patients examined were 100 and 98.2%. The Positive predictive value for an abnormal test was 92.3% and negative predictive value was 100%.

Dhake et al.(1996) had a sensitivity of 100% and specificity of 98.2% in their study of lower uterine segment scar but ultrasonography when the fore mentioned parameters were studied as suggested by Michealis et al.(1998) [11]

Rozenberg et al(1996)[8] found that when 3.5mm was taken as the cut off value the sensitivity of ultrasonographic measurement for detection of scar dehiscence was 88%the specificity was 73.2% , the positive predictive value 11.8% and negative predictive value 99.3%.The odds ratio was 20, when the lower segment was 3.5 mm or less. The finding of present work are comparable to that of Rozenberg et al.(1996).

The excellent sensitivity, specificity, positive and negative predictive value achieved by Michealis et al.(1998) could be probably due to multiple parameters examined ultrasonographically, as contrasted to the present study where only one parameter of scar thickness was used and al predictive values were much lower.[12]

	Cut off value	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Michealis (1988) etal.	<5mm	100%	98.20%	92.30%	100%
Dhake etal (1995) etal.	<5mm	100%	98.20%	-	-
Rozenberg (1996) etal.	<3.5mm	88%	73.20%	11.80%	99.30%
Present study etal.	<3.5mm	90%	52.50%	32.10%	95.50%

7. Conclusion

Ultrasonographic examination of the lower uterine segment in cases with previous caesarean sections was found to be useful in assessment of scar integrity. Lower segment scar measuring more than 4.5mm were found to be intact and those measuring less than 1.6 mm always dehiscenced. Hence it is concluded that all patients with less than 1.6mm lower segment scar thickness should undergo elective caesarean section and with measurements greater than 4.5 mm should be allowed trial for vaginal delivery. The lower uterine segment scar measuring between the range between 1.6mm to 4.5mm lies in a gray zone and each case must be individualized considering the other risks factors although with a decrease in the thickness of the lower uterine segment scar there is an increase in the incidence of scar dehiscence.

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