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ORIGINAL ARTICLE

Comparative Study of USG and MRI in Evaluation of Isthmocele

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Abstract

Objective To study the presence of isthmocele in post-cesarean women using USG and MRI and its correlation with risk factors.

Method This was a prospective observational study. A total of 90 patients were enrolled at the time of discharge of cesarean delivery and were advised to come for follow-up at 3–4 months for detection of isthmocele. A total of 82 patients reported for follow-up, and TVS and MRI Pelvis were done for visualization of isthmocele. If isthmocele was diagnosed, its correlation with risk factors was studied.

Results On TVS isthmocele was present in 11 patients and on MRI in 16 patients. Detection rate was 77.07% in comparison with previous studies. Compared to MRI, sensitivity of USG was 68.75%; however, the specificity and positive predictive value for both were 100%. The negative predictive value for USG compared to MRI was 92.96%. Shape of the isthmocele was triangular in most women. Obesity, prior history of cesarean delivery, elective cesarean, gestational diabetes, preeclampsia and prolonged active labor were associated with development of isthmocele.

Conclusion The study concluded that yield of diagnosis of isthmocele by MRI was better than TVS but not statistically significant. Further study with large sample size is needed to identify the best tool for diagnosis of isthmocele. Obesity, gestational diabetes, preeclampsia, prior history of cesarean, elective cesarean and prolonged active labor were associated with development of isthmocele.

Keywords Isthmocele · Cesarean scar defect · Magnetic resonance imaging · Ultrasonography

Introduction

Cesarean section is one of the most commonly performed surgical procedures worldwide. Increasing number of cesarean sections can lead to more number of complications [1, 2]. One of the complications is isthmocele also called cesarean scar defect or niche representing an inadequate healing of the myometrium at the site of cesarean incision. Its prevalence varies between 24 and 84%, depending on the study population and the methodology used.[3] Isthmocele is associated with various gynecological and obstetric complications. Uterine rupture, ectopic cesarean scar and morbidly adherent placenta are rare complications during pregnancy [4, 5]. It can also lead to postmenstrual spotting, dysmenorrhea, dyspareunia or chronic pelvic pain and infertility [3, 6, 7]. Additionally, it may increase the risk for complications in procedures such as intrauterine device placement, evacuation and embryo transfer [8]. Isthmocele can be diagnosed by transvaginal sonography (TVS), sonohysterography, HSG, Hysteroscopy and Magnetic resonance imaging (MRI). TVS is a simple, low cost, and noninvasive investigation, the unskilled operator or the use of low-resolution ultrasound machine could miss the defect during routine scan. MRI imaging of isthmocele has not been commonly done because 'MRI though noninvasive is an expensive imaging tool but can detect and define the extent of defects'. The purpose of

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our study was to arouse interest in using MRI in evaluation of isthmocele.

Method

A prospective observational study was conducted in the Department of Obstetrics and Gynaecology ESI PGIMSR New Delhi India from January 2019 to February 2020. Ethical clearance was taken from institution ethical committee. In the study, women, who delivered by cesarean section were counseled and enrolled, were evaluated and asked to come for follow-up visit at 3–4 month for detection of isthmocele with imaging with TVS and MRI pelvis. Women who did not consent, less than 18 years, pregnant at the time of follow-up imaging or who had metallic implants or intrauterine device were excluded from the study. A total of 90 patients were enrolled in the study at the time of discharge. A total of 82 patients reported for follow-up imaging. At follow-up, TVS and MRI Pelvis were done for visualization of uterine scar. A T2-weighted scan of uterus was done by using Philips machine, magnetic field 1.5 T. If a scar was detected on imaging, following parameters were analyzed: depths, width, residual myometrial thickness (RMT) overlying the isthmocele and adjacent myometrial thickness fundal to the isthmocele in the midsagittal plane and the length of the isthmocele was measured in the transverse plane [9] (Fig. 1). The collected data were entered in an MS Excel spreadsheet systematically, and analysis was done by using statistical package for the social science system version SPSS 16.0.

Defect of at least 2.0 mm deep was a criterion to diagnose isthmocele [6, 10]. In case > 1, defect was found, the largest one was measured. Women without isthmocele had RMT of > 3.0 mm because without isthmocele, myometrium thickness remains unchanged. Isthmocele was considered large if the ratio between the depth of the isthmocele and the adjacent myometrial thickness was > 0.50. If isthmocele was diagnosed, its correlation with risk factors was studied.

Result

A total of 90 patients were enrolled in this study. Out of these, 82 patients reported for follow-up imaging – TVS and MRI pelvis hence analysis was done for 82 patients. Mean age of patients was 25.29 ± 3.57 years ranging from 19 to 37 years. Mean height, weight and BMI were 153.77 ± 4.84 cms, 56.00 ± 7.38 kg and 23.72 ± 3.31 kg/mtr^2, respectively. The mean gestational age was 38.14 ± 1.98 weeks. Multiple pregnancies were present in 4 (4.9%) patients and there were singleton pregnancies in 78 (95.1%) patients. Labor was induced in 36 women and there was spontaneous labor onset in 36 women and 10 women were planned for elective cesarean section. Term delivery was among majority of patients (87.8%), and preterm delivery was among 10 (12.2%) patients. The duration of active labor was 1–2 h among more than half of patients (21 patients) who went in active labor (32 patients); followed by 3 h (3 patients) and > 3 h (8 patients). The mean duration of active labor was 2.46 ± 1.34 h ranging from 1 to 5 h. Out of 82 patients, P1 parity was found among 45 patients followed by P2 (26), out of these 26, 8 women had history of previous 1 cesarean and 18 had previous 1 vaginal delivery and Parity 3 was in 11 patients, (previous 1 cesarean in 1 woman and previous 2 cesarean in 4 women). Obesity was present in (8/82, 9.75%), gestational diabetes in (5/82, 6.1%) and preeclampsia in (4/82, 4.88%).

On TVS isthmocele was present in 11 patients (13.4%), and on MRI isthmocele was present in 16 patients (19.5%) (Figs. 2 and 3). On TVS, the mean of length of scar was 2.9 ± 0.38 mm; mean width 3.5 ± 0.489 mm, mean depth was 2.489 ± 0.38 mm; mean residual myometrial thickness was 2.62 ± 0.489 mm and mean adjacent myometrial thickness

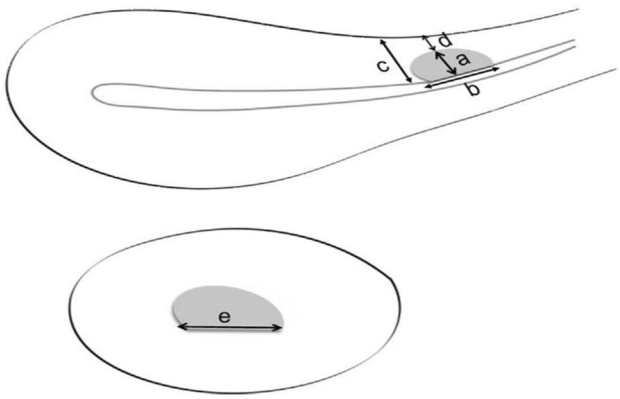

Fig. 1 Isthmocele measurements. In longitudinal plane: **a** depth; **b** width of isthmocele; **c** thickness of adjacent myometrium and **d** residual myometrium. In transverse plane: **e** length of isthmocele

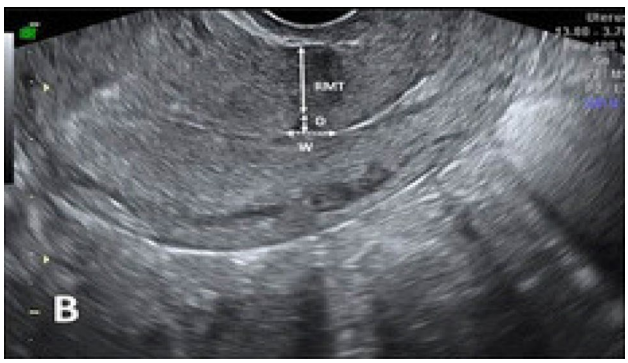

Fig. 2 Ultrasound measurement of isthmocele—The assessed cesarean section scar parameters: RMT, residual myometrial thickness; *W* width; *D* depth

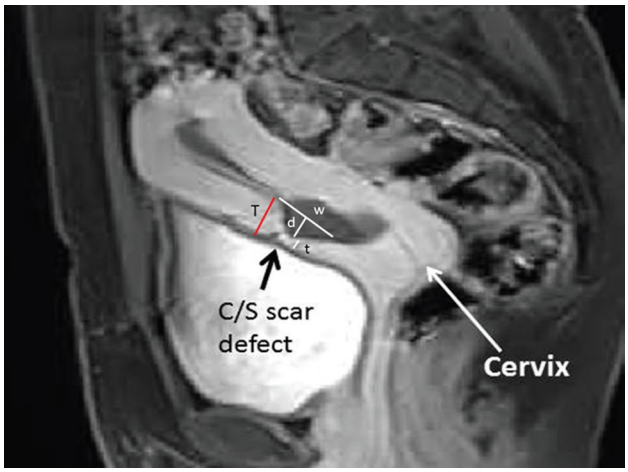

Fig. 3 Magnetic resonance imaging measurement of Cesarean scar defect: D = Depth of the defect; w = Width of the defect; t = Thickness of scar myometrium; T = Adjacent myometrial thickness

was 5.2 ± 0.62 mm. When this was compared to MRI; mean of length was 3.06 ± 0.505 mm; width was 3.64 ± 0.649 mm; depth was 2.60 ± 0.519 mm; residual myometrial thickness was 2.62 ± 0.259 mm and the adjacent myometrial thickness was 5.49 ± 0.642 mm.

Table 1 shows comparison of yield of our study with prior published studies having detection rate average 25.3%, the detection rate or sensitivity of our study is calculated as 77.07%.

Table 2 shows that USG detected isthmocele in 11 cases (13.4%) whereas MRI detected isthmocele in 16 cases (19.5%). Compared to MRI, sensitivity of USG was only 68.75%; however, the specificity and positive predictive value for both USG and MRI were 100%. The negative predictive value for USG compared to MRI was 92.96%.

Out of 16 isthmocele that were diagnosed on MRI there were 3 large isthmocele and, however, only 2 were visualized on TVS. One large isthmocele was totally missed on TVS could be due to low resolution of USG machine. On TVS, the shape of the isthmocele was triangular in 10 out of 11 patients, and oval in only one patient. By MRI, shape of isthmocele was triangular in 13 out of 16 patients and shape was oval in 3 patients. In the study, there were 9 women who had history of previous one cesarean section, 55.56% had isthmocele (5/9, 55.56%) and there were 4 women who had history of previous 2 cesarean sections and all of them had isthmocele. Hence, history of prior cesarean delivery was significantly associated with development of isthmocele (p value < 0.0001). Obese women (4/8, 50%) (p value 0.045), GDM (4/5, 80%) (p value 0.0004), preeclampsia (3/4, 75%) (p value 0.004) had isthmocele, parity 3 (p value 0.019) and women who underwent elective cesarean (p value 0.009) were also significantly associated with development of isthmocele. This association of multiparity and elective cesarean with development of isthmocele could be due to previous cesarean section and other associated comorbid factors like obesity, preeclampsia and gestational diabetes mellitus. In the study, all woman with a duration of active labor > 3 h developed isthmocele. Thus, there was a significant association of duration of active labor with development of isthmocele.

Discussion

On extensively searching published literature, this appears to be an isolated study where the dimensions of the isthmocele scar are described. Detection rate/sensitivity of TVS for diagnosis of isthmocele was low as compared to MRI, which could be because of low resolution of USG machine and MRI on the other hand has better soft tissue visualization. Our study detected more patients with isthmocele compared to Wong et al. [11] (Table 1). The differences in various studies could be because of different characteristics of the study population and associated risk factors, inclusion and exclusion criteria. Osser et al. reported that 83% of niches were triangular, 2% were round, 4% were oval and 10% showed no remaining myometrium over the defect on TVS. The same group demonstrated that the shape did not

Table 1 Comparison of detection rate of isthmocele compared to previous studies

	Sample size	Diagnostic modality	Detection rate
Current study	82	MRI Pelvis	19.5%
Wong et al. [12]	158	MRI Pelvis	6.3%
Armstrong et al. [13]	32	TVS	24%
Antila Langsjo et al. [14]	371	TVS	45.6%

Table 2 Comparison of yield of detection of isthmocele using USG vs. MRI in the study

Isthmocele	MRI present	MRI absent	Sensitivity	Specificity	PPV	NPV
USG present	11	0	68.75%	100%	100%	92.96%
USG absent	5	66				

change when evaluated by SHG [12]. It is thus seen that the majority of the isthmocele had triangular shape similar to that of ours. On MRI there were 3 large isthmocele and out of these 3 large isthmocele only 2 were visualized on TVS. One large isthmocele was totally missed on TVS, this might be due to low resolution of USG machine. This correlated with the findings of Ofili- Yebovi et al. [13]. In the study, the mean age of patients were 25.29 ± 3.57 years. However, there was no significant association of isthmocele with age of patients. This correlated with the findings of Van der Voet et al. (mean age 31.5 years) [14]. Antila Langsjo et al. (mean BMI of patients having isthmocele as 27.1 kg/m2) [9] who quoted that every additional unit of BMI raised the risk of development of isthmocele by 6%. The similar finding was observed in this study, which may be explained by the fact that obesity is associated with impaired wound healing [15]. Antila Langsjo et al. [9] reported that increasing parity was significantly associated with development of isthmocele. However, in this study, the relation of isthmocele with multiparity was due to prior cesarean section than just the birth order. Park et al. reported a negative correlation of isthmocele with twin pregnancy [16]. Vervoort et al. [17] reported that prior history of cesarean delivery was significantly associated with development of isthmocele similar to that of ours. The findings of Karli et al. showed that there was relation of isthmocele with elective cesarean section but not significant enough [18]. People with induced labor had proportionately more isthmocele but the difference was not significant, however, there was no relation of spontaneous labor with development of isthmocele. This could be because of effects of other emergent factors contributing to isthmocele, as correlated by Antila-Langsjo et al. [9] Presence of GDM was significantly associated with the development of Isthmocele. In this study, presence of preeclampsia was significantly associated with the development of Isthmocele this correlates with findings of Van der Voet et al. [14] All woman with a duration of active labor > 3 h had isthmocele, whereas woman who had active labor 0–3 h did not develop isthmocele. Thus, there was a significant association of duration of active labor with development of isthmocele. This correlates with the findings of Antila-Långsjö et al. [9].

Conclusion

In the present study, the feasibility of diagnosis of isthmocele by comparing TVS and MRI imaging was done. The study was conducted in women with comparable demographics like age, period of gestation. Due note was made of the obstetric history and associated comorbidities. It was observed that yield of diagnosis of isthmocele by MRI was better than TVS in the study but the difference in identification was not statistically significant. Further research involving larger sample size is needed to help in identifying the best tool for diagnosis of an isthmocele.

The shape was triangular in majority similar to international studies. The factors that were associated with development of isthmocele in the study were obesity, GDM, preeclampsia, multiparity, prior history of cesarean section, elective cesarean section and prolonged duration of active labor > 3 h.

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Compliance with Ethical Standards

Conflict of interest The author declares that they have no conflict of interest.

Ethical Approval All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national). An ethical clearance has also been taken from the institutional ethical committee.

Informed Consent Informed Consent in Studies with Human Subjects All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5). Informed consent was obtained from all patients for being included in the study. This article does not contain any studies with animal subjects.

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