Cite as: Cilingir IU, Sayin C, Sutcu H, Alici E, Inan C, Erzincan S, Yener C, Varol F: Comparison of postpartum sonographic findings after uneventful vaginal and cesarean section deliveries. J Ultrason 2018; 18: 310–315.

Submitted: 25.08.2018
Accepted: 28.11.2018
Published: 31.12.2018

Comparison of postpartum sonographic findings after uneventful vaginal and cesarean section deliveries

Isil Uzun Cilingir, Cenk Sayin, Havva Sutcu, Ebru Alici, Cihan Inan, Selen Erzincan, Cem Yener, Fusun Varol

Trakya University, Faculty of Medicine, Department of Perinatology, Edirne, Turkey

Correspondence: Isil Uzun Çilingir, Şükrü Paşa mah. Raif Ocak Cad. Onur Er 2, Edirne, Turkey; tel.: +90 532 514 15 26, e-mail: isiluzu@gmail.com

DOI: 10.15557/JoU.2018.0045

Keywords
sonography, postpartum, cesarean delivery, postpartum bleeding

Abstract

Objective: To prospectively determine the sonographic findings of the postpartum uterus 24 hours after vaginal delivery and cesarean section. **Methods**: Women who had uneventful vaginal delivery or cesarean section from July 2015 to May 2018 in a tertiary care hospital were prospectively included. Uterine lengths, endometrium, amout of free fluid, the distance between the uterine fundus-promontorium and uterine fundus-L5 were evaluated 24 hours after delivery. **Results**: The mean (min–max) endometrial thickness in the vaginal delivery and cesarean section groups were 13.3 (4–25) and 12.4 (4–29) mm, respectively. Fundus-cervix length was significantly higher in the vaginal delivery group compared to the cesarean section group (184.05 ± 16.8 *vs* 163.6 ± 6.7 mm, p <0.001). The measurements of anterior and anterior-posterior walls of the uterus, anteroposterior uterine length and uterine width were similar in both groups. Promontorium-fundus length was significantly higher in patients who delivered vaginally than those by cesarean section (123.3 ± 13.6 *vs* 108.7 ± 23.3 mm, p = 0.005). **Conclusion**: The measurement of L5-fundus distance is a simple and effective technique to evaluate the size of the uterus. Homogenous endometrium up to 30 mm in asymptomatic patients may be a normal finding 24 hours after delivery. The results of this study may be helpful in the decision-making process in cases of early postpartum hemorrhage or hemodynamic instability.

Introduction

The puerperium is defined as the 6–8 week period following delivery. The uterus weighs more than 1 kg immediately after delivery, and then undergoes physiological involution and finally returns to the non-pregnant state. Normal puerperal changes may affect the sonographic view of the uterus. Early postpartum hemorrhage occurs in the first 24 hours after delivery[1]. Ultrasound (USG) plays a vital role in the diagnosis of early postpartum hemorrhage and also is the front line imaging examination in woman with suspected pelvic postpartum complications both following vaginal delivery or cesarean section[2–4]. Thus, the knowledge of normal postpartum sonographic findings after vaginal delivery and cesarean section is very important to avoid misdiagnosis and inappropriate treatment. Late postpartum hemorrhage is defined as bleeding after the first 24 hours following delivery. Placental and fetal membrane residuals are well known causes of late postpartum hemorrhage[5], and placental residue associated endometritis may also cause significant bleeding in this period.

In the current study, we have investigated the sonographic findings of the uterus and pelvis after uneventful vaginal delivery and cesarean section, 24 hours after delivery.

Materials and methods

This prospective observational study was conducted between July 2015 and May 2018 in a tertiary center, Trakya University, Faculty of Medicine, Department of Perinatology. Data collection was approved by our Institutional Review Board.

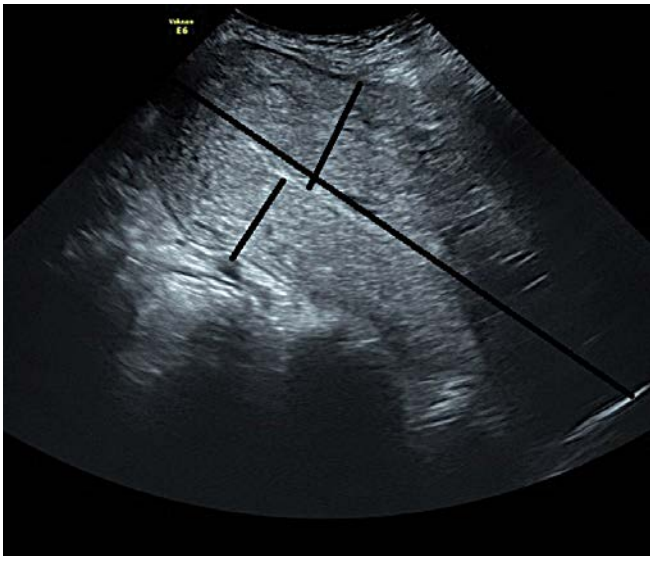

Fig. 1. *Ultrasound image of the mid-sagittal plane of the pelvis, which allows for measurement of uterine length. Fundus--cervix, anterior uterine wall, posterior uterine wall*

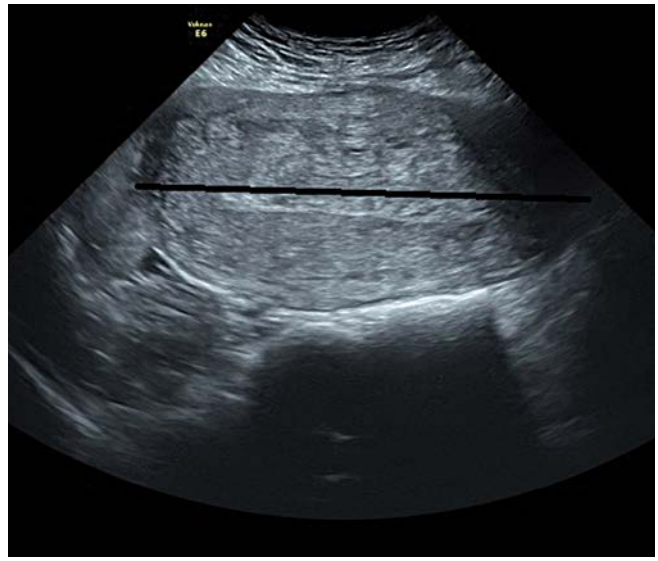

Fig. 2. *Axial plane of the uterus: Measurement of uterine width*

Patients

Women who had uneventful delivery were included. The patients were divided into two groups according to mode of delivery: Group 1 (uneventful vaginal delivery) and Group 2 (uncomplicated cesarean section).

Uneventful delivery was defined using the following criteria:
- uncomplicated vaginal delivery or cesarean section;
- singleton pregnancy;
- term pregnancy >37 weeks gestation.

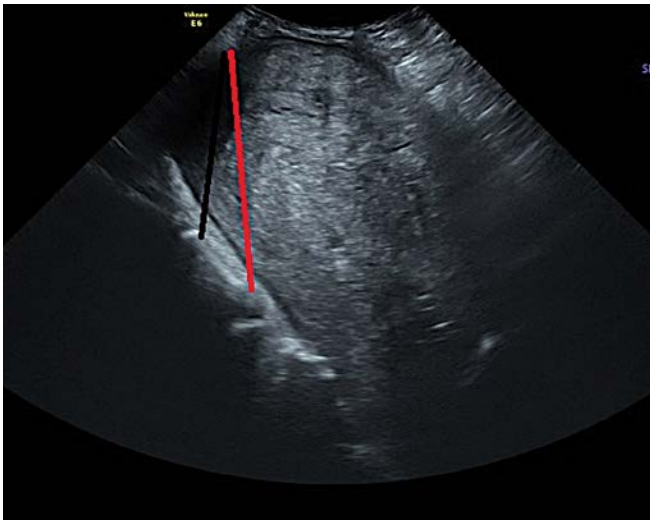

Fig. 3. *Ultrasound image of the mid-sagittal plane of the uterus, showing sites for the measurement of the distances between the uterine fundus and promontory (red line) and vertebra L5 (black line)*

Exclusion criteria included instrumental delivery using forceps or vacuum extraction, post-term pregnancy, preterm delivery, postpartum hemorrhage (defined as women who needed extra medical or surgical therapy for postpartum bleeding, women who required blood or fresh frozen plasma transfusions), need for pelvic arterial embolization, associated surgical procedures like ovarian-paraovarian cystectomy or myomectomy during or following cesarean section, blood loss >1000 mL, multiple pregnancy, homeostasis disorders, abnormal placentation, uterine leiomyoma.

Delivery procedures

All women received oxytocin; those who had cesarean section received 5 units of oxytocin immediately after placental removal, 20 units of oxytocin during surgery and 20 units of infusion in saline over the first 12 hours following surgery, and those who had vaginal delivery received 10 units of oxytocin just after placenta removal and 20 units in saline during the first 2 hours. Women who needed extra oxytocin or additional methylergonovine maleate doses than those mentioned were also excluded from the study. Uterine cavity was checked routinely in all cesarean sections during the operation, following the delivery of the placenta. If any, placental remnants and blood clots were removed from the uterine cavity by using absorbent gauze sponge.

Sonography

All scans were performed transabdominally by two experienced operators (I.C.,H.S) using commercially available real time machines (Voluson 730 Expert/Voluson E6, General Electric, Tiefenbach, Austria) with a 4-to-8-mHz

probe (RAB 6D). Ultrasound was performed 24 hours after delivery.

Mid-sagittal and/or axial planes of the uterus were used to measure the thickness of the anterior and posterior uterine walls, the endometrial thickness and the uterine width (Fig. 1, Fig. 2). The distance between the uterine fundus and promontorium and between the uterine fundus and L5 vertebra was also measured in the mid-sagittal plane of the uterus (Fig. 3). The mid-sagittal plane of the pelvis was also used to measure the length of the uterus, from the external os of the cervix to the fundus and the maximal pocket of fluid, if any, in the pelvic cavity. USG examination was feasible and the measurements were possible in all women.

Postpartum follow-up

Clinical examination to detect abnormal bleeding was performed in each patient prior to ultrasound scanning. All women were followed-up for six weeks after delivery. The patients received postnatal care visits at six weeks following childbirth. Any abnormal bleeding episode in the first six weeks after delivery was also an exclusion criterion, but none of the patients in our cohort had a bleeding episode.

Statistical analyses

Statistical analyses were performed using SPSS Version 21.0 statistic software package. Data were analyzed using descriptive statistical methods (mean, median, frequency, standard deviation, minimum, and maximum). The Student's t test was used to compare normally distributed variables, while the Mann–Whitney U test was used to compare variables, which were not normally distributed. Fisher's exact and Yates' continuity correction tests were used to compare the data. Pearson's correlation test was used to establish the correlation between the variables. $P < 0.05$ was considered to be statistically significant. A correlation coefficient of 0.3 is considered a weak positive correlation ($p < 0.05$), a the correlation coefficient values between 0.3 and 0.5 is considered as moderate correlation. Correlation coefficient values higher than 0.5 are considered a strong positive correlation ($p < 0.01$).

Results

Forty seven patients, with a mean (min–max) age of 26.5 (18–41) years, who had delivered at ≥37 weeks were prospectively included. Twenty women (42.5%) delivered vaginally, whereas 27 (57.4%) by cesarean section. The most common indication for cesarean section was repeat cesarean section ($n = 19$). Other indications included breech presentation ($n = 3$), macrosomia ($n = 1$), dystocia ($n = 2$) and non-reassuring fetal cardiotocography ($n = 1$). Sixteen women (34%) were primiparous and 31 (65.9%) were multiparous. Demographic characteristics, mean gestational age at delivery, parity and birth weight were similar in the groups (Tab. 1).

The distance between uterine fundus and cervix was significantly higher in the vaginal delivery group compared to the

	Vaginal delivery ($n = 20$)	Cesarean section ($n = 27$)	*P*
Parity	1.3 ± 0.9	1.4 ± 0.8	NS
Age	25.0 ± 5.04	27.7 ± 4.9	NS
Birth weight (g)	3275 ± 390	3085 ± 401	0.111
Fundus-cervix length (mm)	184.05 ± 16.8	163.6 ± 6.7	<0.001
Uterine width (mm)	123.3 ± 16.8	119.7 ± 12.4	0.431
Anteroposterior length (mm)	75.6 ±14.1	79.8 ± 10.3	0.263
Anterior wall (mm)	34.7 ± 6.7	36.1 ± 6.4	0.465
Posterior wall (mm)	36.9 ± 7.9	34.8 ± 7.1	0.360
L5-fundus length (mm)	92.7 ± 15.3	85.1 ± 14. 3	0.089
Promontorium-fundus length (mm)	123.3 ± 13.6	108.7 ± 23.3	0.005
Endometrium	13.3 ± 6.3	12.5 ± 7.1	0.697
NS – not significant			

Tab. 1. *The clinical characteristics, laboratory parameters and perinatal outcomes of women who delivered by vaginal route and by cesarean section*

	End	Fn-cervix	Ant wall	Post wall	L5-Fn	Pr-Fn	Uterine width	Ant-post	Parity
End	1.00	0.131	0.235	0.304*	0.315*	0.169	0.104	0.423**	0.123
Fn-cervix		1.00	0.157	0.289*	0.304*	0.169	0.418**	0.121	0.161
Ant wall			1.00	0.433**	0.276	0.195	0.286	0.687**	0.201
Post wall				1.00	0.483**	0.116	0.217	0.551**	0.129
L5-Fn					1.00	0.632**	0.170	0.356*	0.09
Pr-Fn						1.00	0.091	0.068	0.075
Ut width							1.00	0.408**	0.304*
Ant-Post								1.00	0.215
Parity									1.00

* p <0.05; ** p <0.01
Pr – promontorium, Fn – fundus, End – endometrium, Ut – uterus

Tab. 2. *Correlations between sonographic parameters in the whole study group*

cesarean section group (184.05 ± 16.8 *vs* 163.6 ± 6.7 mm, p <0.001). The measurements of anterior and anterior-posterior walls of the uterus, anteroposterior uterine length and uterine width were similar in the groups (Tab. 1). Promontorium-fundus length was significantly higher in patients who delivered vaginally *vs* cesarean section (123.3 ± 13.6 – 108.7 ± 23.3 mm, p = 0.005). L5-fundus length was also greater in the vaginal delivery group (92.7 ± 15.3 – 85.1 ± 14.3 mm), but this difference did not reach the significance level.

There was a significant correlation between fundus-cervix length and L5-fundus length (r = 0.304, p <0.05). The distance between the uterine fundus and L5 was also significantly correlated with endometrial thickness, posterior wall of the uterus, promontorium-fundus length and anteroposterior length of the uterus (Tab. 2).

The mean (min–max) endometrial thickness in the vaginal delivery and cesarean section groups was 13.3 (4–25) and 12.4 (4–29) mm, respectively. Three (11.1%) patients in the cesarean section group and two (10%) in the vaginal delivery group had coagulum-like mass which was smaller than 3 cm in (anteroposterior) length in the cervix. None of these patients experienced abnormal vaginal bleeding during the hospitalization or the puerperal phase. Minimal, transient pelvic effusion with a maximum depth of 1cm was observed in the pouch of Douglas in three (11.1%) patients after cesarean section. No fluid was visualized in the abdomen or the pelvis in women who had vaginal delivery. There was a significant correlation between parity and uterine width (r = 0.304, p <0.05) (Tab. 2).

Discussion

In this study, we have described normal abdominal and pelvic USG images 24 hours following cesarean section and vaginal delivery, in the postpartum period. We have observed minimal transient pelvic effusion in three (11.1%) patients who had uneventful cesarean deliveries. Antonelli *et al.*[6] found free-fluid effusion in only two out of 145 women (1.4%) four days following cesarean section, but in another study, no free fluid was observed within 24 hours following uneventful cesarean delivery[7]. We believe that free fluid collection except for minimal fluid accumulation in the pouch of Douglas should be considered as an abnormal finding after delivery.

We have found that the promontorium-fundus length and the fundus-cervix length were significantly greater in patients with vaginal delivery compared to those who had cesarean section. We have found non-significantly greater uterine width and L5-fundus lengths in the vaginal delivery group. A larger uterine size was observed in patients who had vaginal delivery compared to those who had cesarean section. Lousquy *et al.*[8] have also found that uterine length was significantly greater in patients who delivered by vaginal route *vs* cesarean section. They believe that this results from different oxytocin doses (15 *vs* 55 units). In our study, the total doses of oxytocin administered during delivery and early postpartum period were 35 and 45 units, respectively. Uterine measurements were performed at 24 hours after delivery and none of the patients received oxytocin during the last 12 hours. Therefore, our findings could not be attributed to oxytocin usage.

In another study, significantly greater uterine lengths were reported following cesarean section *vs* vaginal delivery (22.5 *vs* 17.3 cm). It has been hypothesized that the uterus contracts more efficiently and stays firmer after vaginal delivery than after cesarean section[9]. We can think that larger uterine dimensions following vaginal delivery might be explained by the labor itself and be a completely normal finding, but it may also be a sign of poorly contractile uterus in symptomatic patients. Therefore, uterine length measurement seems to be an important part of postpartum sonographic evaluation.

In our study, we have found a significant correlation between fundus-cervix and L5- fundus distances ($r = 0.304$, $p < 0.05$). There was also a strong positive correlation between L5-fundus and promontorium-fundus measurements ($r = 0.632$, $p < 0.01$).

The measurement of uterine length from the fundus requires significant pressure on the uterus, which is difficult to perform in patients after cesarean delivery due to the postoperative pain. Measuring the distance between the L5 vertebra and the uterine fundus seems to be more informative and is less painful. In cases where L5-fn measurement is not possible, Pr-fn measurement is also a reasonable option.

On the other hand, no difference in endometrial thickness was found between women who had cesarean section and those after vaginal delivery. The mean endometrial thickness was 13.3 (4–25) mm for vaginal delivery and 12.4 (4–29) mm for cesarean section. We can conclude that homogenous endometrial thickness up to 30 mm at 24 hours after vaginal and cesarean delivery can be accepted as a normal finding in the absence of abnormal bleeding. Moreover, a <30 mm coagulum-like structure in the cervical region may also be a normal finding. We have observed a coagulum-like image smaller than 3 cm in the anteroposterior direction in three (11.1%) patients after cesarean section and two (10%) patients in the vaginal delivery group. It has also been reported that an echogenic material can be present within the uterine cavity in up to 40% of asymptomatic women 48 hours following vaginal delivery[10]. Several authors have described routine ultrasound findings of the uterus following delivery[10–13]. Some reported sonographic findings after vaginal delivery while others after cesarean section. Also, the time-points of sonographic examinations were heterogeneous. Sokol *et al.*[10] performed USG examination within 48 hours following vaginal delivery while other authors reported sonographic findings seven days after vaginal delivery[13]. Since the majority of postpartum hemorrhages occur in the early postpartum period, we have performed ultrasound scans 24 hours following delivery. Sonographic evaluation of the uterus and pelvis may also play a very important role in the management of patients with an unexplained drop in hemoglobin levels after delivery without significant vaginal bleeding. Thus, knowledge on the normal appearance of the uterus following childbirth seems quite important for radiologists and clinicians to avoid misdiagnosis. Most studies on sonographic assessment of postpartum uterus did not provide uterine dimensions. Koskas *et al.*[7] evaluated uterine ultrasonographic findings after uneventful cesarean sections 24 hours following delivery; they measured some uterine dimensions in different planes. In other studies, uterine volumes were obtained, but uterine dimensions were not reported[13]. In our study, we have not only measured the uterine lengths in different planes, but we also reported some additional uterine distances, such as the L5-fundus and promontorium-fundus lengths. Additionally, we compared these results in women who delivered by vaginal and abdominal route.

Conclusion

Our study showed that homogenous endometrial thickness <30 mm may be a normal finding after delivery. Likewise, a coagulum-like mass up to 30 mm in the cervix may also be a normal finding in asymptomatic women. The measurement of L5- fundus distance is a simple and an effective technique to evaluate the size of the uterus. It may be employed instead of a fundus-cervix measurement and other uterine dimensions. Knowledge on the normal sonographic appearance of the postpartum uterus can help clinicians define the pathologic conditions and avoid misdiagnosis and overtreatment.

Conflict of interest

The authors do not report any financial or personal connections with other persons or organizations, which might negatively affect the contents of this publication and claim rights to it.

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