Placental location after Caesarean section



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Objective: Since the presence of placenta accreta is more common in the pregnancies preceded by Caesarean section (CS), and that in the majority of placenta accreta cases invasion of the anterior uterine wall is found, the assumption is evoked that CS scars are predilection sites for implantation and further development of the placenta.

Methods: Medical records of 1018 women with CS were reviewed retrospectively. Placental location was identified from preoperative ultrasonography reports and categorized as anterior and non-anterior (posterior, fundal, or lateral). The frequency of certain placental location was calculated depending on the number of previous CSs and the interval between two CSs. Birth weights of the newborn and placenta, blood loss and number of abortions were correlated depending on placental location. All data were statistically analyzed.

Results: The mean maternal age was 31.5 ± 5.2 years. There was no significant difference in distribution of placental location depending on the number of CS. Number of abortions, blood loss and birth weight were significantly different depending on the placental location and number of CSs (p=0.037; p=0.023; p=0.01). Anterior placenta was more frequent when the interval between two CSs was shorter than 3 years (p<0.05).

Conclusions: The healing process after CS seems to extend well beyond into postpartum, and the inflammatory process allows placental implantation in the anterior wall of the uterus. After it is completed (3-years after CS according to our results), the section area becomes unsuitable for implantation. Further investigation is needed to understand the role of surgical closure technique and genetic makeup on the healing process.

Keywords: placenta, Caesarean section, scar

A placenta helye a császármetszés után

Célkitűzés: Mivel a placenta accreta gyakrabban fordul elő korábban már császármetszéssel szült nők körében, és a placenta accreta esetek többségében az elülső méhfal érintett, így valószínűsíthető, hogy a császármetszés hege a placenta beágyazódásának és fejlődésének helye lesz.

Módszerek: 1018 nőbeteg orvosi dokumentációját tekintettük át retrospektív módon. A placenta helyzetét ultrahangvizsgálattal állapítottuk meg a beavatkozás előtt: elülső és nem elülső helyzetű (hátulsó, méhfenéki vagy oldalsó). A placenta várható elhelyezkedését a korábbi császármetszések száma és a legutóbbi beavatkozás óta eltelt idő alapján határoztuk meg. Összefüggést kerestünk az újszülött és a placenta súlya, a vérveszteség és az abortuszok száma között. Minden adatot statisztikai analízissel elemeztünk.

Eredmények: Az anyák átlagéletkora 31,5±5,2 év volt. Nem találtunk szignifikáns különbséget a placenta elhelyezkedése és a korábbi császármetszések száma között. Szignifikáns különbséget találtunk azonban az abortuszok száma, a vérveszteség és a születési súly között a placenta elhelyezkedésétől és a korábbi császármetszések számától függően (p=0,037; p=0,023; p=0,01). Az elülső placentálódás gyakoribb volt, ha a két császármetszés között kevesebb, mint 3 év telt el (p<0,05).

Következtetések: A császármetszés utáni gyógyulási folyamat elhúzódhat a postpartum időszakon túlra is. A gyulladásos folyamat lehetővé teszi a placenta beágyazódását a méh elülső falába. Ezek után (eredményeink alapján 3 évvel a császármetszés elvégzése után) a terület már nem alkalmas a beágyazódásra. Azonban további vizsgálatok szükségesek annak meghatározására, hogy milyen hatással van a gyógyulási folyamatra a műtéti sebzárás és a beteg genetikai háttere.

Kulcsszavak: placenta, császármetszés, heg

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Introduction

Caesarean section (CS) is one of the most common surgical operations the rate of which is rising steadily. At the Clinic of Gynecology and Obstetrics in Novi Sad, the CS rate has almost tripled in the past twenty years, and today it makes up 32% of all deliveries. The rise is commonly attributed to the increasing number of conditions that lead to CS, such as maternal obesity, gestational diabetes, or multiple gestations as well as Caesarean delivery on demand. However, the previous Caesarean section appears to be the only indication in 26% of the patients in Novi Sad.

Although CS is performed routinely with rare short term complications that have to be treated surgically (intraabdominal bleeding 0.1% of all CS cases, subfascial hematoma 0.05%, uterine atony 0.5%, and wound dehiscence 0.15%, respectively), CS might have long term consequences and may cause severe adverse outcome for both the mother and the baby in future pregnancies. The most devastating complication is placenta accrete, which leads to profuse postpartum hemorrhage and peripartum hysterectomy. The reported incidence of placenta accreta cases is 3/1000 deliveries; however, the risk exponentially grows with the number of CS in a patient and presence of placenta previa [1]. According to the study of 116 placenta previa cases at the Clinic in Novi Sad, 17 placenta accreta cases were confirmed in histopathology, 82.3% of which invaded the anterior uterine wall [2].

Since the severe placental complications happen at the site of uterine scar in the majority of the cases, and they become more frequent with the higher number of previous CSs, the hypothesis is set that CS scar is the predilection site for implantation and further development of the placenta.

This study aimed to assess whether the anterior placenta is more frequent in patients with iterative Caesarean section. We also tried to evaluate whether certain placental locations influence the characteristics of the placenta, the newborn, or the blood loss.

Materials and methods

This retrospective study was conducted at the Clinic of Gynecology and Obstetrics of the Clinical Center of Vojvodina in Novi Sad, Serbia. The study protocol was approved by the hospital Scientific and Ethics Committees.

Medical records of women delivering by Caesarean section in the period between October 2014 and January 2016 were collected and reviewed. We considered patients with single fetus pregnancy to whom ultrasonography was performed one day preoperatively eligible for the study. The location of the placenta was stated as anterior or nonanterior (posterior, fundal, or lateral), regarding its relation to the uterine scar. Patients were grouped according to the number of Caesarean sections and placental location.

Patients with multiple pregnancies, abnormal placentation, and with incomplete clinical records were excluded. Other data collected from the medical records

were maternal age, weight and height, birth weight and birth length, gravidity, parity, number of abortions, blood loss at delivery, and placental fresh weight.

Data were statistically analyzed by using the SPSS program.

The chi-square test was used to calculate the frequency of certain placental locations depending on the number of previous Caesarean sections and the time passed since the previous CS. The correlation between the placental location and the newborn weight was calculated by using the ANOVA test. The same test was used for correlation between the placental location and the placental fresh weight as well as the placental location and blood loss. Placental fresh weight and newborn weight as well as weight of the mother were correlated by using the Pearson's test.

Results

In the time interval considered, 1018 women met the inclusion criteria and were enrolled in the study. For 511/1018 (50.2%) women, this was the first CS. Overall, 507/1018 (49.8%) women underwent Caesarean section before, 417/1018 (41%) of which had one, 82/1018 (8%) had two, and 8/1018 (0.8%) women had three CSs.

The mean maternal age was 31.5 ± 5.2 years, mean maternal weight was 81.4 ± 14.1 kg, and the mean maternal height was 166.3 ± 9.3 cm.

Concerning the newborn characteristics, 50.1% were female and 49.9% male, mean birth weight was 3294.8 ± 650.8 g, and mean birth length was 49.2 ± 3 cm. The mean gestational age at birth was 38.8 ± 2 weeks. The mean placental fresh weight was 597.5 ± 104 g.

The anterior location of the placenta was less common, with an increasing number of prior CSs, and the fundal placenta showed the same trend (*Figure 1.*). The opposite happened to the posterior placenta, which occurred more frequently. The lateral placenta did not have a regular trend.



Figure 1. Frequency of anterior and non-anterior (posterior, fundal, or lateral) placenta in patients with equal/less than 3 and more than 3 years after the previous Caesarean sections

Table 1. Association between the number of previous Caesarean sections and placental location									
				Total					
			Anterior	Posterior	Fundal	Lateral			
		Count	250	228	21	12	511		
		% within CS count	48.9%	44.6%	4.1%	2.3%	100.0%		
	0	% within Placental location	50.6%	48.8%	56.8%	60.0%	50.2%		
		% of Total	24.6%	22.4%	2.1%	1.2%	50.2%		
		Count	203	197	14	3	417		
		% within CS count	48.7%	47.2%	3.4%	0.7%	100.0%		
Number	1	% within Placental location	41.1%	42.2%	37.8%	15.0%	41.0%		
of previous		% of Total	19.9%	19.4%	1.4%	0.3%	41.0%		
Caesarean		Count	35	40	2	5	82		
sections		% within CS count	42.7%	48.8%	2.4%	6.1%	100.0%		
	2	% within Placental location	7.1%	8.6%	5.4%	25.0%	8.1%		
		% of Total	3.4%	3.9%	0.2%	0.5%	8.1%		
		Count	6	2	0	0	8		
		% within CS count	75.0%	25.0%	0.0%	0.0%	100.0%		
	3	% within Placental location	1.2%	0.4%	0.0%	0.0%	0.8%		
		% of Total	0.6%	0.2%	0.0%	0.0%	0.8%		
		Count	494	467	37	20	1018		
		% within CS count	48.5%	45.9%	3.6%	2.0%	100.0%		
Total		% within Placental location	100.0%	100.0%	100.0%	100.0%	100.0%		
		% of Total	48.5%	45.9%	3.6%	2.0%	100.0%		

CS - Caesarean section; % - percentage

However, there was no significant association between the number of previous CSs and placental location (p=0.091). Since the number of women who previously underwent Caesarean 3 times was 8 (0.8%), and it was 0 with fundal and lateral placenta location; we excluded them from the calculation.

Concerning the time interval between the previous Caesarean section and the current delivery, a significant difference in placental location was observed (*Figure 1.*) (p=0.018). When the time from the previous CS was equal

or less than 3 years, the anterior placenta occurred more often (54.1%). Contrary, when this period was more than 3 years, non-anterior placenta was found more frequently (55.9%).

Concerning newborn weight, significant correlation has been found depending on the placental location (*Table 2.*) (p=0.042). When only the anterior placentas were observed, a significant result was obtained. Newborns of mothers from the second CS were heavier than those from the first CS [x(CS1)=3172.6 g; x(CS2)=3389.1 g; p=0,01].

Table 2. Association between newborn weight and placental location										
	Ν	X	SD	Min	Max	F	р			
Anterior	405	3285.531	635.708	550	5030	2 745	0.042			
Posterior	390	3297.513	657.309	770	4780	2.745	0.042			
Fundal	32	3010.937	729.624	1440	4090					
Lateral	19	3045.789	632.722	1580	4290					
Total	846	3275.284	651.368	550	5030					

N – absolute number, X – average value, SD – standard deviation, Min – minimal value, Max – maximal value

The highest average placental fresh weight occurred in the anterior located placenta (620.9 g), and the lowest average placental fresh weight was in fundal placenta (*Table* 3.), (585.2 g). Anterior placenta showed the highest average blood loss (698 mL), and the fundal placenta presented the lowest average blood loss (*Table* 4.), (440 mL), but no significant correlation has been found (p=0.77 and p=0.27, respectively) considering the correlation of placental fresh weight as well as blood loss with placental location.

However, comparing blood loss in anterior placentas between first and second CS, there was significantly less bleeding in the second CS [x(CS1)=655 mL; x(CS2)=503 mL; p=0.023].

Finally, patients with anterior placenta had more abortions before the second CS than before the first CS (p=0.037).

Discussion

In this study, we did not find significant association between the number of previous CSs and the placental location. Nevertheless, some regularity was been detected. The higher the number of the previous CSs, the less common anterior and fundal placentas were. The opposite happened to posterior placenta that occurred more frequently.

There is a body of published papers stating different results. Some of them claim that the presence of CS scar has no impact on placental location [3]. A recent prospective cohort study has found that the CS scar was related to an increased risk of anterior placental implantation [4]. Getting the same results as we did, *Naji et al.* have concluded that women with a previous history of CS are significantly placenta located on the posterior wall of the uterus [5]. A possible explanation may lie in the higher rate of spontaneous abortions when the implantation is at the site of the CS scar, i.e., the anterior site of the uterus [6].

Our study suggests the important role of the time passed from the prior CS concerning the implantation site in the subsequent pregnancy. When the time since the previous CS was equal or less than 3 years, the anterior placenta occurred more often and contrary, when this period was more than 3 years, non-anterior placenta was more often present. Lately, studies have increasingly been focusing on the uterine inflammatory response and its association with a successful implantation. It is well known that the implantation is a physiological inflammatory process characterized by an ingress of leukocytes, production of chemokines, pro-inflammatory cytokines, and other inflammatory mediators [7, 8, 9]. There is a rising interest on the potential factors that may influence this process [10]. There is a body of research confirming that a local endometrial trauma increases the implantation rate by provoking the immune system to generate an inflammatory reaction [11, 12, 13, 14, 15].

On the other hand, there is little known about the healing of the uterine scar tissue after surgical injury in women, but animal models could give us a guideline. In a mouse model, the site of the uterine scar was active and underwent significant remodeling transformation even at 15 days post-CS (7.5 months in human equivalent). In addition, several biomechanical endpoints differed between strains even 60 days post-CS (2.5 years in human equivalents) [16]. Comparing these observations with ours, after-CS healing process seems to extend well beyond into postpartum, and as a inflammatory process, it allows placental implantation

Table 3. Dependence of placental fresh weight (g) on placental location										
	Ν	Mean	Standard Deviation	Standard Error	95% Confidence Interval for Mean		Min	Max		
					Lower Bound	Upper Bound				
Anterior	453	620.87	274.328	12.889	595.54	646.20	62	6010		
Posterior	416	611.82	89.048	4.366	603.24	620.40	68	1120		
Fundal	29	585.17	78.904	14.652	555.16	615.19	480	790		
Lateral	15	604.67	62.320	16.091	570.15	639.18	510	700		
Total	913	615.35	202.999	6.718	602.16	628.53	62	6010		

Table 4. Dependence of blood loss on placental location											
	Ν	Mean	Standard Deviation	Standard Error	95% Confidence	Min	Max				
					Lower Bound	Upper Bound					
Anterior	95	698.42	782.333	80.266	539.05	857.79	200	7000			
Posterior	78	529.49	252.833	28.628	472.48	586.49	100	1500			
Fundal	5	440.00	240.832	107.703	140.97	739.03	100	700			
Lateral	3	600.00	173.205	100.000	169.73	1030.27	500	800			
Total	181	616.85	596.895	44.367	529.30	704.40	100	7000			

in that area (i.e., in the anterior wall of the uterus). After it is completed (3 years after Caesarean section, according to our results), the section area becomes unsuitable for implantation. The information about the incidence of post CS complications in both groups, with placenta accreta on the first place would be necessary in order to make conclusions crucial for the clinicians. Further investigation is needed to make us understand the role of the surgical closure technique [2] and genetic makeup on the healing process, and the ratio of regeneration and repair in the CS scar.

Our data further showed that fetuses with fundal and lateral placenta had lower weight on delivery compared with those whose placenta was anteriorly or posteriorly located. *Fung et al.* have found that women with fundal and lateral placenta in second trimester had greater risk of the occurrence of small for gestational age fetuses [17]. Similar results have been reported by Kalanithi et al. showing that pregnancies complicated by IUGR are more likely than non-IUGR pregnancies to have lateral placentation [18]. Some other studies have reported no difference in newborn weight [19].

Regarding the dependence of placental fresh weight and blood loss on placental location, our study showed no significant correlation. However, the highest as well as the lowest mean placental fresh weight and blood loss were found at the same placental locations. We found the highest average blood loss in the women with anterior placentation, and this was in accordance with the recent study presenting that when the placenta is located in anterior wall there is more frequent incidence of PPH, of manual removal of placenta and prolonged duration of third stage [20]. The lowest average blood loss was within the fundal placenta. The study about myometrial thickness during human labor has shown significant thickening of the anterior and fundal myometrium during the second stage of labor, and significantly thicker anterior and posterior walls after the completion of the third stage of labor; thus, it may represent the dominant role of certain walls in these two stages of labor [21]. Adding the well-known fact that progesterone from the placenta blocks myometrial contractility primarily at the site of implantation, we could search for explanation of the different amount of blood loss in the wall function and myometrial contractility. A prospective study has showed that the length of the third stage of labor is shorter if the placenta is located at the fundus, which is in accordance with the previous hypothesis [22].

Still, very similar results regarding neonatal birth weight, placental fresh weight and blood loss depending on the placental location may point to a better vascularization of certain uterine walls. Further studies need to be conducted in order to find the answer.

The authors declare no conflicts of interest.

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