RESEARCH

23(98), July - August, 2019

ISSN 2321–7359 EISSN 2321–7367

Medical Science

An investigation into the relationship between amniotic fluid sludge in the second trimester of pregnancy and preterm labor

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Article History
Received: 28 March 2019
Accepted: 17 May 2019
Published: July - August 2019

Citation
Fatemeh Mastari Farahani, Maryam Shokrpour, Alireza Kamali, Fatemeh Safi. An investigation into the relationship between amniotic fluid sludge in the second trimester of pregnancy and preterm labor. *Medical Science*, 2019, 23(98), 470-477

ABSTRACT

Introduction: Amniotic fluid sludge is an additional ultrasound indicator for preterm labor. Amniotic fluid sludge refers to dense particles near the inner cervical spine. Amniotic fluid 'sludge' is defined as the presence of dense aggregates of particulate matter in close proximity to the internal cervix. It is of clinical significance in asymptomatic patients at high risk for spontaneous delivery, and in patients with preterm labor and intact membranes. Sub-chorionic hematoma is another ultrasound finding that is associated with

a higher incidence of threatened miscarriage and preterm delivery. Given the ultrasound imaging features, it is similar to the gallbladder sludge. This study aimed to investigate the relationship between amniotic fluid sludge in the second trimester of pregnancy and preterm labor. *Materials and Methods:* This cross-sectional, analytical study was carried out on pregnant women with amniotic fluid sludge referring to the radiology clinic. Pregnant women underwent ultrasound and examined if they had amniotic fluid sludge. Accordingly, 347 people were selected. Firstly, characteristics such as age, location, education level, occupation, number of pregnancies, labor, and abortion were completed by a specialized radiologist. The amniotic fluid sludge was investigated within 14-18 weeks, 20-24 weeks and 24-28 weeks. The cervical length was measured at 20-24 weeks and the duration and method of labor were recorded. Finally, the data were analyzed using SPSS (version 20). *Results:* There was no relationship between preterm labor and the observation of sludge in the second trimester (P = 0.951). There was a relationship between the number of pregnancies and the number of deliveries and the observation of sludge in the second trimester (P = 0.0001). There was a positive relationship between the number of pregnancies and the observation of sludge in the second trimester (r = 0.293). There was a positive relationship between the number of births and the observation of sludge in the second trimester (r = 0.247). *Conclusion:* There was no relationship between preterm labor and amniotic fluid sludge in the second trimester. Further studies are required in this regard.

Keywords: Preterm Labor, Amniotic Fluid Sludge, Second Trimester of Pregnancy

1. INTRODUCTION

Preterm labor is defined as giving birth in less than 37 weeks (Moore, 2002; Khadije Rezaie-Keikhaie et al. 2018). Preterm labor can be spontaneous (50%). It may occur due to membrane rupture (30%) or due to intervention by health care staff (20%). This incidence is reportedly up to 5%-8% in developed and developing countries (Fuchs, 2015). Premature birth is still a major health problem worldwide, leading to 75% of infant deaths. Preterm labor not only causes financial and emotional crises, it can also lead to permanent disability (Berghella, 2009). Around 15 million children were born in 2010 before 37th week of pregnancy worldwide, accounting for 11% of births. About 85% of children born before 37th week of pregnancy are born in the 32nd-36th week of pregnancy, while 10% of children are born in the 28th-31st week of pregnancy. Several factors are associated with the risk of preterm labor, including maternal (social and demographic, psychological and genetic factors), paternal and environmental factors (Hatanaka, 2016). The sonographic finding of dense aggregates of particulate matter in the amniotic fluid close to the internal cervix, known as amniotic fluid (AF) 'sludge', is associated with impending preterm delivery, microbial invasion of the amniotic cavity (MIAC), and histologic chorioamnionitis in patients with spontaneous preterm labor and intact membranes. Similar observations were recently reported among patients with a history of preterm delivery or threatened preterm labor.

The gestational age significantly affects the neonatal mortality rate and complications. Treatment has an important role in determining the outcome of a child in adulthood. By asking the patient and taking into account his or her childbirth history, especially the history of preterm labor; it would be possible to identify the population at risk of premature birth. This risk is associated with the number of preterm labors and is highest for those who have recently had a history of preterm labor (Kindinger, 2017). In developed countries such as America, the preterm labor rate has increased over the past 20 years, which can be attributed to the prevalence of multiple pregnancies, midwifery interventions, diagnosis of preterm labor and increased use of ultrasound (Cunningham, 2015). Cervical length (<25 mm) within 20-24 weeks was associated with a high risk of preterm labor (Sentilhes, 2017 and Boyer, 2014).

Amniotic fluid sludge is defined as the presence of suspended particles in amniotic fluid in the vicinity of the cervix. Although its prevalence is known to be associated with the risk of preterm labor, reports show a strong association between the sludge and the microbial invasion of amniotic cavity (Spiegelman, 2016). However, amniotic fluid sludge is also known to be asymptomatic during pregnancy and its prevalence seems to increase with increasing gestational age. Recent evidence suggests the benefits of amniotic fluid sludge as an indicator for preterm labor (Paules, 2016). Given the ultrasound imaging features, it is similar to the gallbladder sludge. This study aimed to investigate the relationship between amniotic fluid sludge in the second trimester of pregnancy and preterm labor (Kusanovic, 2007).

Fuchs et al. (2015) argued that amniotic fluid is not a risk factor for preterm labor (Fuchs, 2015). Adanir et al. (2017) reported that the prevalence of amniotic fluid sludge was% 19.6, while the preterm labor rate before the 37th week of pregnancy was 66.7% in patients with amniotic fluid sludge. According to Adanir et al. (2017), the preterm labor rate before the 37th week of pregnancy was

27% in patients without amniotic fluid sludge. The preterm labor was higher in patients with amniotic fluid sludge (Adanir, 2017). Given the above mentioned issues, we aimed to investigate the amniotic fluid as an independent risk factor for preterm labor.

2. MATERIALS AND METHODS

This cross-sectional, analytical study was carried out on pregnant women with amniotic fluid sludge referring to the radiology clinic. The pregnant women referred to the ultrasound clinic for routine nursing care during 14 to 28 weeks of pregnancy based on LMP. Those with amniotic fluid sludge were included in the study.

Inclusion criteria

Age of 18-40 years; 14 to 28 weeks of pregnancy based on LMP; the presence of amniotic fluid sludge; singleton pregnancy; secondary infertility; having no history of abortion.

Exclusion criteria

Unwillingness to participate in the study; chromosomal or structural abnormalities; multiple pregnancies; history of preterm labor.

In this study, the patients were investigated after obtaining informed consent and inclusion criteria. Accordingly, 347 people were selected. Firstly, characteristics such as age, location, education level, occupation, number of pregnancies, labor, and abortion were completed by a specialized radiologist. The amniotic fluid sludge was investigated within 14-18 weeks, 20-24 weeks and 24-28 weeks. The cervical length was measured at 20-24 weeks and the duration and method of labor were recorded. Finally, the data were analyzed using SPSS (version 20). Pregnant women were examined weekly by phone call. Finally, the relationship between preterm labor and amniotic fluid sludge was investigated in case of having a labor before 37 weeks.

Ethical committee approval code

This thesis was accepted on March 22, 2017 with code IR.ARAKMU.REC.1396.61 by ethical committee of Arak University of Medical Sciences, Arak, Iran.

3. RESULTS

This cross-sectional, analytical study was carried out on pregnant women with amniotic fluid sludge referring to the radiology clinic. A total of 347 people participated in the study, with a minimum age of 20 years and a maximum age of 40 years. The mean age of patients was 30.93 ± 4.35 years.

In terms of education, 24 were undergraduate (6.9%), 24 had diplomas (6.9%), 51 had associate degree (14.7%), 145 had bachelor's degrees (41.8%), 97 had master's degrees (28%) and 6 had PhD degrees (1.7%) (Figure 1).

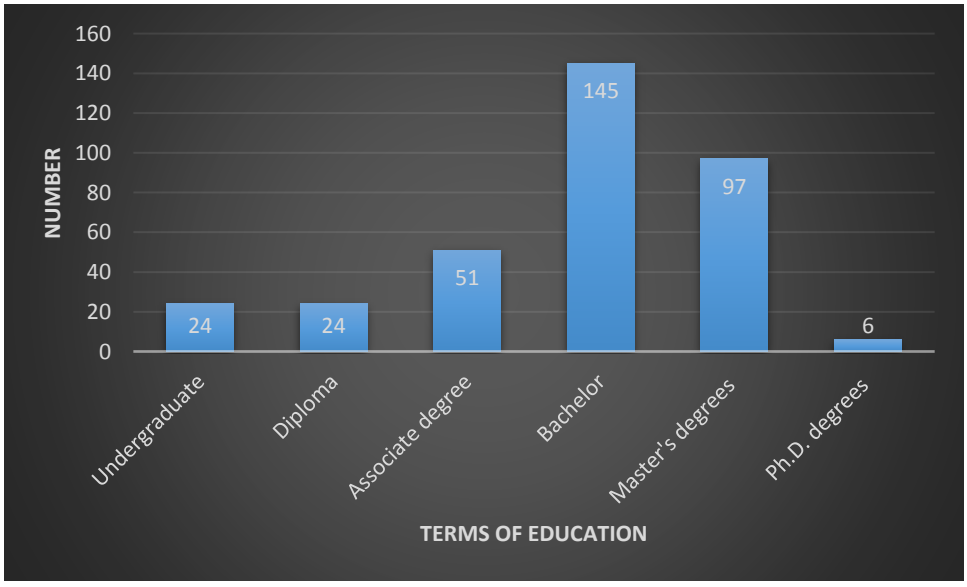

Figure 1 Frequency of pregnant women's education

According to the results, 337 (97.1%) had no preterm labor. Meanwhile, 172 (49.6%) were housewives. 166 (47.8%) experienced the first pregnancy. 163 (47%) had normal labor. The mean cervical length was 36.15 ± 4.153. There was no relationship between preterm labor and the sludge in the second trimester (P = 0.951). There was no relationship between cervical length and the sludge in the second trimester (P = 0.341). There was a positive relationship between the number of pregnancies and the sludge in the second trimester (P = 0.0001). The increase in the number of pregnancies was associated with amniotic fluid sludge in the later weeks (r = 0.293)

There was a positive relationship between the number of deliveries and the amniotic fluid sludge in the second trimester (P = 0.0001). The increase in the number of deliveries was associated with the amniotic fluid sludge in later weeks (r = 0.247). There was a positive relationship between the age of pregnant women and the amniotic fluid sludge in the second trimester (P = 0.0001). The increase in the age of pregnant women was associated with the amniotic fluid sludge in later weeks (r = 0.304) (Tables 1-7) (Figure 2).

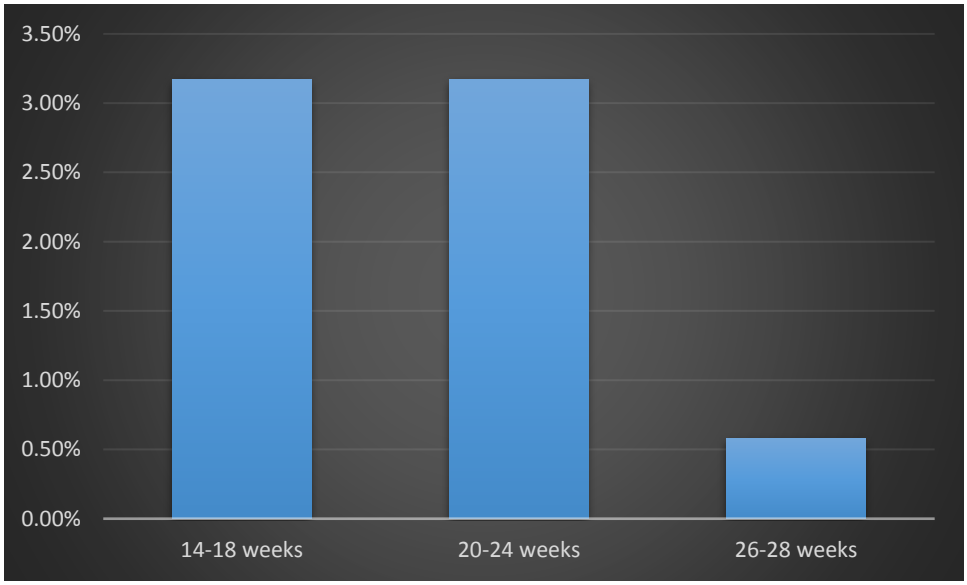

Figure 2 The relationship between amniotic fluid sludge and preterm labor

Table 1 Frequency and percentage of qualitative variables in the study

Qualitative variables		Number (%)
Residence	City	308 (88.8)
	Village	39 (11.2)
Job	Clerk	156 (45)
	Housewife	172 (49.6)
	Freelancer	19 (5.5)
The number of pregnancies	1st pregnancy	166 (47.8)
	2nd pregnancy	132 (38)
	3rd pregnancy	30 (8.6)
	4th pregnancy	14 (4)
	5th pregnancy	5 (1.4)
The type of delivery	Caesarean section	163 (47)
	Natural	184 (53)
Preterm delivery	Yes	10 (2.9)
	No	337 (97.1)

Table 2 Mean and standard deviation of cervical length

Quantitative variable	Mean and standard deviation
cervical length	36.4 ± 155.153

Table 3 The relationship between amniotic fluid sludge and preterm labor

Preterm labor	14-18 weeks Number (%)	20-24 weeks Number (%)	26-28 weeks Number (%)	p-value
Yes	4 (3.17)	4 (3.17)	2 (0.576)	0.951
No	126 (36.31)	129 (37.17)	82 (23.62)	

Table 4 The relationship between amniotic fluid sludge and cervical length

Variable	14-18 weeks Mean and standard deviation	20-24 weeks Mean and standard deviation	26-28 weeks Mean and standard deviation	p-value
cervical length	35.3±96.090	36.5±9.367	36.3±54.319	0.595

Table 5 The relationship between amniotic fluid sludge and pregnancy

The number of pregnancies	14-18 weeks Number (%)	20-24 weeks Number (%)	26-28 weeks Number (%)	p-value
1st pregnancy	85 (24.49)	61 (17.57)	20 (5.76)	0.0001
2nd pregnancy	38 (10.95)	44 (12.68)	50 (14.40)	
3rd pregnancy	5 (1.44)	22 (6.34)	13 (3.74)	
4th pregnancy	1 (0.288)	4 (3.17)	9 (2.59)	
5th pregnancy	1 (0.288)	2 (0.576)	2 (0.576)	

Table 6 The relationship between amniotic fluid sludge and the number of deliveries

The number of deliveries	14-18 weeks Number (%)	20-24 weeks Number (%)	26-28 weeks	p-value
No deliveries	2 (0.576)	5 (1.44)	0 (0)	0.0001
1st delivery	96 (27.96)	75 (21.61)	38 (10.95)	
2nd delivery	27 (7.780)	39 (11.23)	33 (9.51)	
3rd delivery	3 (0.864)	13 (3.74)	6 (1.72)	
4th delivery	2 (0.576)	1 (0.288)	7 (2.01)	

Table 7 The relationship between amniotic fluid sludge and the age of pregnant women

Qualitative variable	14-18 weeks Mean and standard deviation	20-24 weeks Mean and standard deviation	26-28 weeks Mean and standard deviation	p-value
Age	28.4±85.53	32.4±23.04	32.4±11.10	0.0001

Figure 3 and 4 show transvaginal ultrasound image showing the presence of dense aggregates of particulate matter (amniotic fluid 'sludge') in the proximity of the internal cervical os in second trimester of pregnancy.

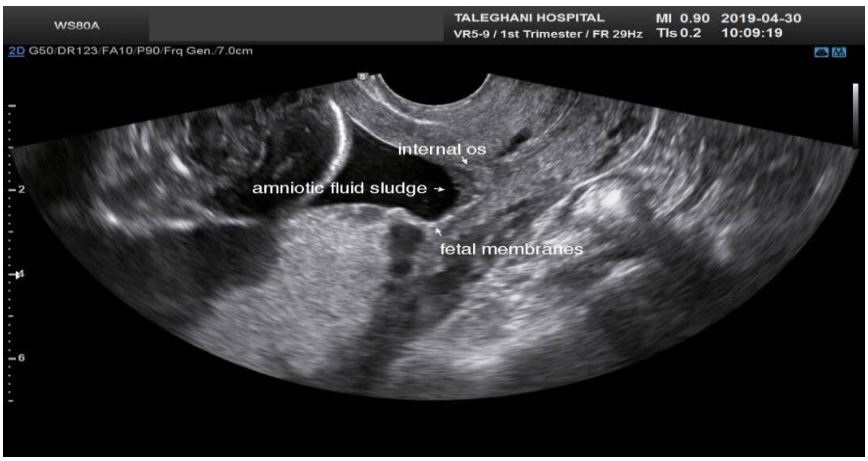

Figure 3 Transvaginal ultrasound image showing the presence of dense aggregates of particulate matter (amniotic fluid 'sludge')

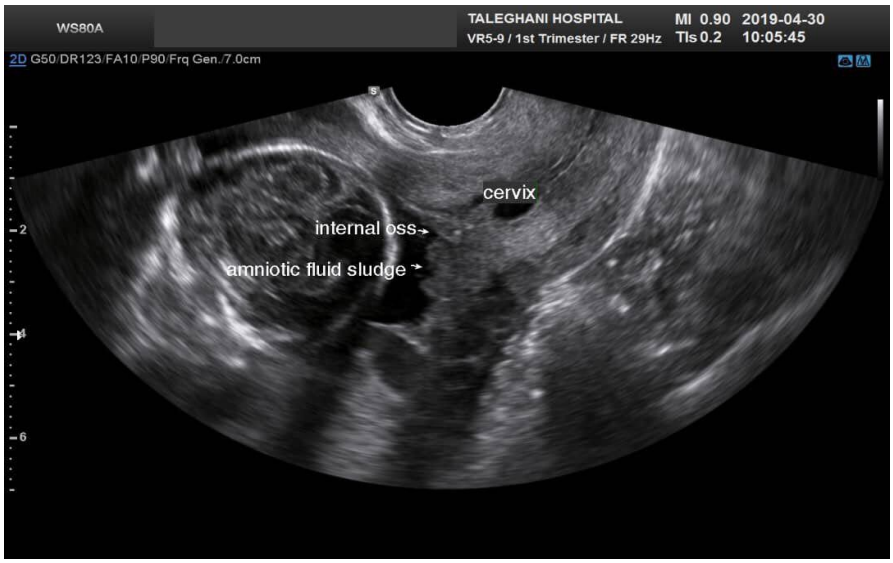

Figure 4 Proximity of the internal cervical os in second trimester of pregnancy

4. DISCUSSION

There was no relationship between preterm labor and the amniotic fluid sludge in the second trimester (P = 0.951). There was a positive relationship between the number of pregnancies and the amniotic fluid sludge in the second trimester (P = 0.0001). The increase in the number of pregnancies was associated with amniotic fluid sludge in the later weeks (r = 0.293) .There was a positive relationship between the number of deliveries and the amniotic fluid sludge in the second trimester (P = 0.0001). The increase in the number of deliveries was associated with the amniotic fluid sludge in later weeks (r = 0.247). There was a positive relationship between the age of pregnant women and the amniotic fluid sludge in the second trimester (P = 0.0001). The increase in the age of pregnant women was associated with the amniotic fluid sludge in later weeks (r = 0.304).

There was no relationship between amniotic fluid sludge and preterm labor. Premature birth is still a major health problem worldwide, leading to 75% of infant deaths. Preterm labor not only causes a financial and emotional crisis but also leads to permanent disability. This study aimed to investigate the risk factors and preventative measures of preterm labor. Our study showed that there was no relationship between amniotic fluid sludge and preterm labor. In fact, amniotic fluid sludge does not affect the incidence of preterm labor. However, most of the studies outlined below stated that preterm labor was associated with the amniotic fluid sludge. Adanir et al., (2017) argued that amniotic fluid sludge was an independent risk factor for the identification of asymptomatic women at risk of preterm labor (Adanir, 2017). Their results are not in good agreement with those of our study which can be attributed to the ethnic differences. Adanir et al., performed transvaginal ultrasound at weeks 20-22, 26-28 and 32-34.

However, in our study, amniotic fluid sludge was investigated with ultrasound at weeks 14-18, 20-24 and 24-28. Hatanaka et al., (2016) conducted a study on the amniotic fluid sludge, introducing it as an independent risk factor for preterm labor. They aimed to examine the clinical prevalence and significance of amniotic fluid sludge among asymptomatic patients at risk of preterm labor ($p = 0.02$) (Hatanaka, 2016). Their results were not in good agreement with those of our study, which can be attributed to the ethnic differences. In a prospective cohort study entitled *The Independent Association of a Short Cervix, Positive Fetal Fibronectin, Amniotic Fluid Sludge, and Cervical Funneling with Spontaneous Preterm Birth in Twin Pregnancies*, Spiegelman et al., (2016) investigated this issue in pregnant women. Accordingly, 635 patients with twin pregnancies underwent ultrasound before the 35th week. Meanwhile, low pregnancy age was not associated with preterm labor. In twin pregnancy, a short cervical length, positive fetal fibronectin and amniotic fluid sludge were independently associated with spontaneous preterm birth (Spiegelman, 2016). Their results were not in good agreement with those of our study, which can be attributed to the ethnic differences. Paules et al., (2016) carried out a study entitled Amniotic fluid sludge as a marker of intra-amniotic infection and histological chorioamnionitis in cervical insufficiency: a report of four cases and literature review. Amniotic fluid sludge is a useful indicator of the chorioamnionitis and preterm labor (Rozenberg, 2017). Their results were not in good agreement with those of our study, which can be attributed to the ethnic differences. In our study, the amniotic fluid was evaluated at weeks 14-18, 20-24 and 24-28. However, Paules et al., (2016) did this at weeks 24-24. Fuchs et al., (2015) conducted a case-control study entitled the impact of amniotic fluid "sludge" on the risk of preterm delivery. This study aimed to examine the effect of amniotic fluid sludge on the risk of preterm labor and describe the effect of treatment with antibiotics in these conditions. The amniotic fluid sludge and treatment with azithromycin were associated with a higher risk of premature infant. However, after adjusting the cervical length and vaginal bleeding in the second trimester, risk factors were not independent. Further studies are needed to evaluate the effect of antibiotics on pregnancy with amniotic fluid sludge (Fuchs, 2015). Their results were not in good agreement with those of our study, which can be attributed to the ethnic differences. Boyer et al., (2014) performed a study entitled clinical significance of amniotic fluid sludge in twin pregnancies with a short cervical length. The amniotic fluid sludge in a twin pregnancy with a short cervical length is a risk factor for preterm delivery and perinatal death (Boyer, 2014). Their results were not in good agreement with those of our study, which can be attributed to the ethnic differences.

5. CONCLUSION

There was no relationship between preterm labor and the sludge in the second trimester. There was no relationship between cervical length and the sludge in the second trimester. There was a positive relationship between the number of pregnancies and the sludge in the second trimester. The increase in the number of pregnancies was associated with amniotic fluid sludge in the later weeks. There was a positive relationship between the number of deliveries and the amniotic fluid sludge in the second trimester. The increase in the number of deliveries was associated with the amniotic fluid sludge in later weeks. There was a positive relationship between the age of pregnant women and the amniotic fluid sludge in the second trimester. The increase in the age of pregnant women was associated with the amniotic fluid sludge in later weeks.

Acknowledgments

We need to express our gratitude to the Clinical Research Council of Valiasr Hospital and the Deputy of the Arak Medical University for their assistance.

Financial resources

There are no financial resources.

Conflicts interest

There is no conflicts interest.

REFERENCE

1. Adanir I, Ozyuncu O, Gokmen Karasu A, Onderoglu L. Amniotic fluid "sludge"; prevalence and clinical significance of it in asymptomatic patients at high risk for spontaneous preterm delivery. J Matern Fetal Neonatal Med. 2017; 26:1-6.
2. Berghella V, Baxter J, Hendrix N. Cervical assessment by ultrasound for preventing preterm delivery. Cochrane Database Syst Rev. 2009 Jul 8 ;(3):CD007235.
3. Boyer A, Cameron L, Munoz-Maldonado Y, Bronsteen R, Comstock C, Lee W, et al. Clinical significance of amniotic

fluid sludge in twin pregnancies with a short cervical length. Am J Obstet Gynecol. 2014; 211(5):506.e1-9.

4. Cunningham F, Leveno K, Bloom S, Hauth J, Rouse D, Spong C. Williams's obstetrics. 24, editor. New York: McGraw-Hill; 2015.
5. Fuchs F, Boucoiran I, Picard J, Dube J, Wavrant S, Bujold E, et al. Impact of amniotic fluid "sludge" on the risk of preterm delivery. J Matern Fetal Neonatal Med 2015; 28(10):1176-80.
6. Hatanaka A, Mattar R, Kawanami T, Franca M, Rolo L, Nomura R, et al. Amniotic fluid "sludge" is an independent risk factor for preterm delivery. J Matern Fetal Neonatal Med. 2016; 29(1):120-5.
7. Khadije Rezaie-Keikhaie, Maryam Moshfeghi, Zohreh Kazemi, Leili Rezaie-kahkhaie, Maryam Nakhaemoghadam. Predicting preterm labor based on vaginal PH and cervical length at 22-24 weeks of gestation: A cross-sectional study. Med Sci, 2018, 22(94), 529-532
8. Kindinger L, Bennett P, Lee Y, Marchesi J, Smith A, Cacciatore S, et al. The interaction between vaginal microbiota, cervical length, and vaginal progesterone treatment for preterm birth risk. Microbiome. 2017; 5(1):6.
9. Kusanovic J, Espinoza J, Romero R, Gancalvec L. Clinical significance of the presence of amniotic fluid 'sludge' in asymptomatic patients at high risk for spontaneous preterm delivery. Ultrasound Obstet Gynecol 2007; 30:706-14.
10. Moore ML. Preterm birth: a continuing challenge. J Perinat Educ. 2002; 11(4):37–40.
11. Paules C, Monero E, Gonzales A, Fabre E, Gonzalez de Aguero R, Oros D. Amniotic fluid sludge as a marker of intra-amniotic infection and histological chorioamnionitis in cervical insufficiency: a report of four cases and literature review. J Matern Fetal Neonatal Med. 2016; 29(16):2681-4.
12. Rozenberg P. Universal cervical length screening for singleton pregnancies with no history of preterm delivery, or the inverse of the Pareto principle. BJOG. 2017; 124(7):1038-1045.
13. Sentilhes L, Senta M, Ancel P, Azria E, Benoist G, Blanc J, et al. Prevention of spontaneous preterm birth: Guidelines for clinical practice from the French College of Gynaecologists and Obstetricians (CNGOF). Eur J Obstet Gynecol Reprod Biol. 2017; 210:217-224.
14. Spiegelman J, Booker W, Gupta S, Lam-Rochlin J, Rebarber A, Saltzman D, et al. The Independent Association of a Short Cervix, Positive Fetal Fibronectin, Amniotic Fluid Sludge, and Cervical Funneling with Spontaneous Preterm Birth in Twin Pregnancies. Am J Perinatal. 2016; 33(12):1159-64.