

# Examination of the Association of Meconium-Stained Amniotic Fluid with Postpartum Infection and Fever After C-Section

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## Abstract

**Background:** Pelvic infections are among the most prevalent and serious postpartum complications. Over the past several decades, these infections, along with preeclampsia and hemorrhage, have constituted the triad of death among mothers. The presence of meconium in the amniotic fluid has been considered as one of the risk factors for postpartum infections. This study aimed to investigate the association of meconium-stained amniotic fluid with postpartum infection and fever.

**Methods:** This prospective cohort study included 200 singleton term pregnant women, referred for childbirth to Imam Khomeini and Razi hospitals of Ahvaz in 2014. The women were assigned to two groups, ie, subjects with meconium-stained amniotic fluid (exposure group) and subjects with clear amniotic fluid (control group). The participants in the two groups were identical in terms of maternal age, gestational age, parity, and duration of ruptured membranes. Pregnant women who had underlying medical problems were excluded from the study. Both groups received intravenous ampicillin half an hour before the surgery until 48 hours after the surgery, based on the protocol introduced by the hospital for women planning cesarean section. The two groups were compared regarding post-C. Section infection. The exposure group consisted of 100 subjects with meconium-stained amniotic fluid, while the control group included 100 subjects with clear amniotic fluid. The participants were observed for maternal prognosis, based on postpartum infections.

**Results:** Both groups underwent C-section. In the exposure and control groups, 14 (14%) and 12 (12%) women had fever after C-section, respectively. Moreover, 6 (6%) and 3 (3%) women in the exposure and control groups had post-C. section wound infections, respectively.

**Conclusions:** No significant difference was found in post-C. Section fever and wound infection between the two groups, which might be related to the duration of intravenous antibiotic administration. To examine the effects of intravenous antibiotics, further studies should be conducted. In both groups, the highest incidence of fever was observed among women younger than 20 years; this result was statistically significant.

**Keywords:** Meconium, Puerperal Infection, Postpartum Fever

## 1. Background

Postpartum infections (also known as puerperal infections), involving the decidua or endometrium, can affect other layers of the uterine, such as myometrium. These infections are characterized by a fever higher than 38°C, which occurs during the first 10 days after giving birth (except the first 24 hours) and persists for at least 2 days (1). They are microbial infections (2) and originate from Gram-positive or Gram-negative bacteria and anaerobes. Factors such as *Chlamydia* and *Neisseria gonorrhoeae* rarely lead to an infection immediately after delivery; in fact, *Chlamydia* usually appears as a delayed infection (3, 4).

Cesarean section (C-section) is a risk factor for the occurrence of postpartum infections. The incidence of infection after C-section is nearly 30% among women not receiv-

ing antibiotic prophylaxis (5); however, use of antibiotics reduces the incidence rate by half. Prolonged labor, prolonged rupture of membranes, frequent vaginal examinations, and presence of meconium in the amniotic fluid are among other risk factors for the incidence of postpartum fever. Besides, poor economic condition, preterm labor, assisted delivery, HIV infection, and Group B streptococcus infections seem to contribute to postpartum fever (6-8).

Meconium passage into the amniotic fluid occurs in about 2% - 9% of pregnancies (9). Its incidence varies depending on the gestational age and starts to increase since about the 31<sup>st</sup> week of pregnancy. A higher prevalence has been reported among black people, especially those inhabiting Southeast Asia (16.8%) (10). Several theories have been proposed in relation to the passage of meconium, and a

number of studies have examined the associated fetal, maternal, and neonatal complications. Although meconium is sterile, it can underlie chemical stimulation and inflammation, followed by infection in the mother and fetus (11-13). Meconium provides a suitable culture medium for bacterial growth, especially *Escherichia coli*. With this background, the present study aimed to examine the association of meconium passage with the incidence of puerperal infections after C-section.

The prevalence of meconium passage in term pregnancies is 7% - 22%. A number of theories have been proposed about meconium passage, and various studies have investigated the neonatal complications of meconium aspiration. On the other hand, several studies have examined the relationship between meconium-stained amniotic fluid and maternal puerperal infections. This study showed that meconium may change the ratio of phosphorus to zinc in the amniotic fluid, thereby weakening the antibactericidal system and increasing the likelihood of uterine infections (4).

Unlike normal vaginal delivery, the incidence rates of metritis and febrile complications are high after C-section. The meconium passage is one of the causes of C-section and can increase the risk of maternal infection and fever. The presence of meconium in the amniotic fluid is regarded as one of the risk factors for infection in the postpartum period. In the current study, the association between postpartum fever and meconium passage was studied in Imam Khomeini and Razi hospitals of Ahvaz, Iran.

## 2. Methods

This prospective cohort study included 200 singleton term pregnant women, referred for childbirth to Imam Khomeini and Razi hospitals of Ahvaz in 2014. After obtaining consent forms, 100 subjects with meconium-stained amniotic fluid were recruited as the exposure group, while 100 pregnant women with clear amniotic fluid were considered as the control group; all the participants were candidates for C-section. Women assigned to the 2 groups were identical in terms of maternal age, gestational age, parity, time of membrane rupture, and onset of labor pain.

The exclusion criteria were as follows: 1) rupture of membranes for more than 6 hours; 2) underlying medical conditions such as infection, diabetes, obesity, severe anemia, and/or diseases weakening the immune system; 3) C-section due to the arrest of labor; and 4) C-section continuing for more than 1 hour. In all cases, the abdominal skin surface was prepped with povidone iodine (Betadine® solution) scrub for 5 minutes, and duration of all surgeries was less than 1 hour.

The follow-ups were carried out by a specific team. All the participants were examined and monitored since day 3 after C-section (referred to the hospital to remove the stitches) for a period of 10 days to identify any symptoms of fever or wound infection. All the mothers received intravenous ampicillin half an hour before the surgery until 48 hours after the surgery; both groups underwent emergency C-section. In the current study, a fever greater than or equal to 38°C, which was detected during the first 10 days following childbirth (except the first 24 hours) and lasted for at least 48 hours, was considered as postpartum fever. The final results and maternal prognosis were studied in both groups.

For statistical analysis, we used SPSS version 22.0 (SPSS Inc, Chicago, IL, USA). Continuous variables were expressed as mean  $\pm$  SD and categorical variables as number (percentage). Normal distribution of the variables was verified by Kolmogorov-Smirnov test. We used Chi square and independent sample t-test for inter-group comparisons.  $P < 0.05$  was considered statistically significant.

## 3. Results

A total of 200 pregnant women, who were candidates for C-section, were recruited in the present study. Overall, 100 women were assigned to the meconium-stained amniotic fluid group (exposure group), and 100 women were allocated to the clear amniotic fluid group (control group). The data obtained from the groups were analyzed and compared, using Chi square test. The results indicated that 14% of mothers in the exposure group and 12% of mothers in the control group had fever. Based on the Chi square test results, the difference was not statistically significant (12% vs. 14%,  $P = 0.34$ ).

In this study, the mean age (25.2 years) of mothers in the 2 groups was similar (Table 1). The mean gestational age was 39 weeks and 3 days in the exposure group and 38 weeks and 5 days in the control group. Also, the mean maternal weight was 70.53 and 72.14 kg in the exposure and control groups, respectively. The mean length of hospital stay in the exposure and control groups was 3 and 3.2 days, respectively. Onset of the active phase of labor before C-section was reported in 41 (41%) women in the exposure group and 48 (48%) women in the control group. The type of antibiotics and duration of use were similar in the groups.

A total of 99 (99%) women in the exposure group and 97 (97%) women in the control group underwent C-section for less than 1 hour after the rupture of membranes. Based on the results, 1 (1%) subject in the exposure group and 2 (2%) subjects in the control group had rupture of membranes for 1 to 6 hours (1% vs. 2%;  $P = 0.43$ ). According to the Chi

**Table 1.** Comparison of Variables Under Study in the Groups, (N = 100)<sup>a</sup>

Variables	Exposure Group	Control Group	P Value
Maternal age, y <sup>b</sup>	25.2 ± 7.4	25.2 ± 8	0.50
Gestational age at delivery, weeks <sup>b</sup>	39W+3D ± 15D	38W+5D ± 15D	0.40
Maternal weight, kg <sup>b</sup>	70.53 ± 18.9	72.14 ± 21.5	0.29
Onset of the active phase before C-section <sup>c</sup>	41 (41)	48 (48)	0.16
Rupture of membranes < 6 h <sup>c</sup>	99 (99)	97 (97)	0.16

<sup>a</sup>The mean value of each variable is presented.

<sup>b</sup>Value are expressed as mean ± SD.

<sup>c</sup>Values are expressed as No. (%).

square test results, the difference was not statistically significant. In addition, 6 (6%) subjects in the exposure group and 3 (3%) subjects in the control group had symptoms of wound infection; however, the difference was not statistically significant ( $P = 0.15$ ) (Table 2).

**Table 2.** The Statistical Analysis of Postpartum Complications in the Groups<sup>a</sup>

Complications	Exposure Group	Control Group	P Value
Postpartum wound infection	6 (6)	3 (3)	0.15
Postpartum fever	14 (14)	12 (12)	0.34
Admission > 3 days	1 (1)	0	0.16

<sup>a</sup>Values are expressed as No. (%).

In the exposure group, 78% of the participants had thick meconium, while 22% had diluted meconium. The incidence rates of wound infection and fever were compared between the two groups. The obtained results showed no significant difference in terms of the incidence of fever ( $P = 0.812$ ). In both groups, the highest incidence of fever was observed among mothers younger than 20 years ( $P = 0.836$ ). Based on the Chi-square test results, this finding was statistically significant.

Overall, 26 women had postpartum fever in the two groups (Table 3). Among these women, 14 belonged to the exposure group, 2 of whom had urinary tract infections (UTIs), 1 had deep vein thrombosis (DVT), 3 had wound infections, and 8 were diagnosed with endometritis. On the other hand, in the control group, 2 women had UTI, 3 had wound infections, and 7 were diagnosed with endometritis; all these women were treated with proper antibiotics. Considering the incidence of endometritis, the difference between the 2 groups was not statistically significant ( $P = 0.07$ ).

#### 4. Discussion

Chorioamnionitis and fever are among the complications of C-section. Various factors seem to contribute to the occurrence of these complications. The presence of meconium in the amniotic fluid can be considered as one of these factors. Bacterial growth increases in the presence of meconium in the endometrium, which may be due to the rise of growth factors and decreased bacteriostatic performance. In a previous study, the incidence of fever after normal vaginal delivery and C-section was reported about 2% - 3% and 5% - 20%, respectively (14).

A study conducted by Florman et al. revealed that meconium can promote the growth of bacteria in vitro (15). In fact, meconium can act as an activator of polymorphonuclear and cytokine systems in vitro and affect the neutrophil phagocytic activity (16). In another study carried out by Nsu et al., the results demonstrated that in the presence of meconium in the amniotic fluid, the level of response to tocolyse decreased and the prevalence of chorioamnionitis increased. However, according to the results of the current study, no significant association was found between meconium-stained amniotic fluid and the prevalence of chorioamnionitis.

In the present study, in order to evaluate meconium as an independent factor, mothers who were identical in terms of age and time of delivery were analyzed. The rupture of membranes in the two groups did not persist for more than 6 hours. Considering the prevalence of infection, postpartum fever, and wound infection, no significant difference was found between the two groups ( $N = 12, 12\%$  vs.  $N = 14, 14\%$ ); this finding is not consistent with the results reported in other studies.

A study conducted by Rahimi Sharbaf et al. on a group of women with C-section indicated that the incidence rates of wound infection and fever were higher in the experimental group (meconium-stained amniotic fluid), compared to the control group (17). This discrepancy may be

**Table 3.** The Statistical Analysis of the Causes of Fever in the Groups

Postpartum fever	DVT	UTI	Wound Infection	Chorioamnionitis	Endometritis
Exposure group, (N = 14)	1	2	3	0	8
Control group, (N = 12)	0	2	3	0	7

due to the fact that women in the present study received antibiotics for 48 hours and that high-risk groups, prone to infection, were eliminated. A study carried out by Jazayeri et al. showed that the prevalence of postpartum infection was higher in the meconium group, compared to the control group; however, there was no significant difference in terms of the prevalence of chorioamnionitis (8).

In the present study, 14 (14%) women in the meconium group had fever, 2 of whom had UTI, 1 had DVT, 3 had wound infections, and 8 were diagnosed with endometritis. In contrast, 12 (12%) women in the control group had fever, 2 of whom had UTI, 3 had wound infections, and 7 were diagnosed with endometritis. In the present study, a significant relationship was found between age below 20 years and the incidence of postpartum infection. This relationship has been also noted in some previous studies (18-21).

#### 4.1. Conclusion

No significant association was found between post-C. Section fever and wound infection in the two groups, which might be related to the duration of intravenous antibiotic administration. Overall, further studies should be conducted to evaluate the effects of antibiotics on the prevention of postpartum infection in the presence of meconium. In both groups, the highest incidence of fever was observed among women younger than 20 years ( $P = 0.836$ ); this result was statistically significant. Further studies with more precise inclusion and exclusion criteria and elimination of confounding variables are needed to gather more accurate results.

#### Footnote

**Conflicts of interest:** The authors declare no conflicts of interest.

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