

# Labour induction in postdate pregnancy: when to start – at week 40 or 41 of gestation?

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**Introduction.** Post-term delivery is associated with significantly increased risks of perinatal and maternal complications. The aim of the study was to compare maternal and neonatal complications in two groups: women who delivered at 41 completed weeks (study group) and women who delivered at 40 completed weeks (control group).

**Materials and methods.** This is a retrospective case-control study which included all pregnant women who delivered in the Vilnius City University Hospital (VCUH) from January 1, 2007 to December 31, 2007. Patients were eligible for inclusion in our study if they delivered a live birth beyond 41 weeks of gestation during the study period in the VCUH (n = 182). Using the week of gestation as the primary predictor variable, we examined its association with the following outcomes: mode of delivery, expectant management or labour induction, labour induction method, delivery time, perineal laceration, postpartum hemorrhage, meconium-stained amniotic fluid, oligohydramnios, umbilical artery pH, neonatal morbidity, duration of hospitalisation. From all the women who delivered from 40 completed weeks to 40 weeks + 6 days (n = 193) in the same study period, every tenth woman was selected for the control group.

**Results.** The pregnancy protracts frequently for nulliparous women without reference to mother's age. Labour induction in them more frequently occurs at 41 completed weeks than in the control group (39.6% vs 14.5%,  $p < 0.05$ ; OR 0.37), and the main way of induction in prolonged pregnancies is vaginal prostaglandins. The mother and her newborn at 41 completed weeks tend to have a higher risk of oligohydramnios (10.4% vs 5.2%,  $p < 0.05$ ; OR 0.5), umbilical cord rotation around the baby's neck (57% vs 43%,  $p < 0.05$ ; OR 0.7), meconium-stained amniotic fluid (27.4% vs 16.6%,  $p < 0.05$ ; OR 0.6), vacuum extraction rate (7.7% vs 3.1%,  $p < 0.05$ ; OR 0.4), newborn acidosis (45.5% vs 33.2%,  $p < 0.05$ ; OR 0.73). When meconium-stained amniotic fluid is diagnosed at 41 completed weeks, the delivery should be monitored more intensively because of a higher risk of newborn acidosis after the labour. The mode of delivery, delivery duration, mother's injuries, postpartum hemorrhage and complications, also Apgar scores show no significant differences in these groups.

**Conclusion.** When delivery occurs at 41 completed weeks, the results are worse as compared to those of the delivery at 40 completed weeks. Therefore, it is reasonable to induce labour at 40 completed weeks and beyond of gestation. This suggestion requires large prospective studies and a very precise gestation time estimation for all pregnant women before recommending labour induction at 40 completed weeks.

**Key words:** gestational age, post-term pregnancy, caesarean delivery, labour induction, expectant management, meconium-stained amniotic fluid

## BACKGROUND

According to the World Health Organisation, the definition of post-term pregnancy is the pregnancy that has extended to or beyond 42 weeks (294 days) of gestation (1). Approximately 5

to 10 percent continue to at least 42 weeks' gestation (2). When a pregnancy continues beyond term, the risks of babies dying inside the womb or in the immediate newborn period increase (3). The most frequent cause of an apparently prolonged gestation is an error in dating (4, 5). Post-term pregnancies are associated with numerous adverse outcomes. Maternal risks include emergent caesarean delivery, vacuum extraction or forceps delivery, cephalopelvic disproportion, cervical rup-

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ture, perineal lacerations, dystocia, large fetus, fetal death, postpartum hemorrhage. Neonatal risks are asphyxia, aspiration, admission to intensive care after birth, bone fracture, peripheral nerve paralysis and others (2, 6–8). Women with post-term gestations, who have unfavourable cervixes, can either undergo labour induction or be managed expectantly (4, 9, 10). A policy of labour induction after 41 completed weeks or later, compared to awaiting spontaneous labour for at least one week (42 completed weeks), is associated with fewer perinatal deaths and meconium aspiration syndrome, without an increased risk of caesarean section (A) (9, 11).

The rates of labour induction are increasing. Whether elective induction of labour improves outcomes or simply leads to greater complications is debated in the scientific literature. Randomized, controlled trials suggest that elective induction of labour at 41 weeks of gestation and beyond is associated with a decreased risk for cesarean delivery and meconium-stained amniotic fluid (12). There were no recent studies of elective induction of labour at less than 41 weeks of gestation. Among women with less than 41 weeks of gestation, there were trials which reported no difference in the risk of cesarean delivery among women who were induced as compared to expectant management. When the data were stratified by country, the odds of caesarean delivery were higher in women who were expectantly managed compared to elective induction of labour in studies conducted outside the USA (13).

Elective labour induction after 41 completed weeks is the main reason for post-term pregnant women hospitalization in VCUH. The evidence-based local medicine protocols suggest inducing labour at and after 41 completed weeks in low-risk pregnancies (11).

The evidence regarding elective induction of labour prior to 41 weeks of gestation is insufficient to draw any conclusion.

## OBJECTIVE

To compare maternal and neonatal complications in two groups: women who delivered at 41 completed weeks (study group, SG) and women who delivered at 40 completed weeks (up to 40 weeks + 6 days, control group, CG).

## METHODS

This is a retrospective case-control study which includes all pregnant women who delivered in the VCUH from January 1, 2007 to December 31, 2007. Patients were eligible for inclusion in this study if they delivered a live birth at or beyond 41 weeks of gestation during the study period in the VCUH. Maternal demographic data, maternal and neonatal medical records and diagnoses were obtained by utilizing labour histories.

The gestational age was determined on the last menstrual period (having in mind menstrual cycle duration). If the

menstrual cycle was irregular, the gestational age was determined by first ultrasonography in the first trimester by CRL and GS measurements and in the second trimester by BPD measurement.

In order to obtain relatively low-risk pregnancies, exclusion criteria included chronic hypertension, preeclampsia, pre-existing or gestational diabetes, *placenta praevia*, multiple gestation, non-vertex presentation, and fetal anomalies. Using the week of gestation as the primary predictor variable, we examined its association with the following outcomes: mode of delivery, expectant management or labour induction, labour induction method, delivery time, perineal laceration, postpartum hemorrhage, meconium-stained amniotic fluid, oligohydramnios, umbilical artery pH (Table 1), neonatal morbidity, the average time of in-hospital stay. The further exclusion criteria were patients with a prior caesarean and caesarean delivery prior to the onset of labour. The study group included 182 women who delivered at 41 completed weeks and later up to 42 completed weeks.

Table 1. Umbilical artery pH standards by Zalar and Quilligan (1979) (14)

Norm	>7.25
Preacidosis	7.20–7.24
Light acidosis	7.19–7.15
Moderate acidosis	7.14–7.10
Increasing acidosis	7.09–7.00
Deep acidosis	<6.99

From all the women who delivered from 40 completed weeks to 40 weeks + 6 days ( $n = 193$ ) in the same study period, every tenth woman was selected for the control group.

The data were collected employing MS Windows XP Excel 2007. Statistical analyses were performed using the statistical programmes SPSS for Windows (version 15.0). The distribution of data was checked using the Kolmogorov–Smirnov test. Differences of parametric data were tested using the independent sample t-test. All nominal variables were evaluated using the chi-square-test, and the p values less than 0.05 were considered statistically significant.

## RESULTS AND DISCUSSION

In 2007, the VCUH registered 3331 deliveries, of them 182 (5%) were at 41 completed weeks. There were no stillbirths in this group; 1930 women had labour from 40 weeks to 40 weeks + 6 days, and every tenth woman from this group was selected to the control group. The control group included 193 women.

There was no age difference between the groups (SG –  $27.03 \pm 4.84$  years, CG –  $27.74 \pm 5.08$  years,  $p = 0.9$ ; OR 0.94).

Nulliparous women delivered more frequently after 41 completed weeks as compared to the control group (SG – 126 cases, 69%; CG – 104 cases, 54%;  $p < 0.05$ ; OR 1.5).

There was no evidence of a statistically significant difference in the risk of caesarean section (vaginal births: SG – 151 cases, 83%; CG – 160 cases, 83%; caesarean section: SG – 31 cases, 17%; CG – 33 cases, 17%;  $p = 0.9$ ; OR 1.0) for women who delivered at 41 completed weeks or at 40 weeks to 40 weeks + 6 days, respectively. Nevertheless, after labour induction caesarean sections were more frequent in the group of 41 completed weeks (SG – 16 cases, 22%; CG – 3 cases, 10%;  $p < 0.05$ ; OR 2.3).

As expected, labour induction was more frequent at 41 completed weeks ( $n = 72$ , 39.6%;  $p < 0.05$ ; OR 0.37), and the main technique for induction in this group was vaginal prostaglandins (Misoprostolum 25 µg) each 6 hours ( $n = 46$ , 64%;  $p < 0.05$ ; OR 0.08).

In the period from 40 weeks to 40 weeks + 6 days of gestation ( $n = 28$ , 14.5%;  $p < 0.05$ ; OR 0.37), the main way of labour induction was amniotomy and intravenous oxytocin infusion ( $n = 24$ , 86%;  $p < 0.05$ ; OR 0.42) with a favourable cervix (Bishop's score more than 4).

Delivery time was lightly shorter when labour occurred at 40 weeks to 40 weeks + 6 days, but there was no statistically significant difference between the groups ( $p = 0.5$ , OR 0.89) (Fig. 1).

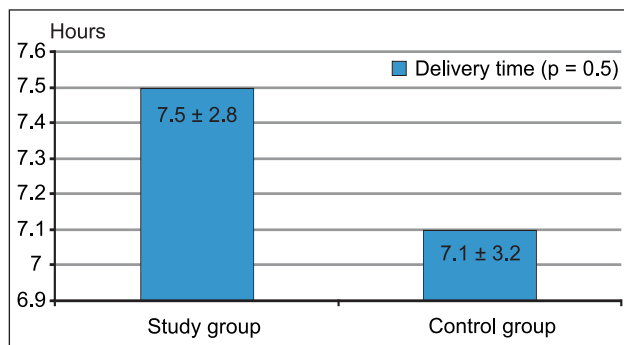


Fig. 1. The mean delivery time

There was a higher risk of instrumental delivery when labour occurred at 41 completed weeks. The vacuum extraction rate was 7.7% ( $n = 14$ ;  $p < 0.05$ ; OR 0.4) in SG and 3.1% ( $n = 6$ ;  $p < 0.05$ ; OR 0.4) in CG. Forceps were not used in either of the groups.

Postpartum hemorrhage was more frequent in the study group (SG:  $n = 16$ , 8.8%; CG:  $n = 13$ , 6.7%;  $p = 0.2$ ; OR 1.3), but there was no statistically significant difference between the groups.

Much to our surprise, the results of complications after delivery were unexpected (fever, haemotransfusion). With no significant difference, more complications appeared after delivery at 40 weeks to 40 weeks + 6 days of gestation (Fig. 2).

The rate of perineum lacerations was the same in both groups (splits: in SG –  $n = 28$ , 15%; in CG –  $n = 31$ , 16%;  $p = 0.8$ ; OR 1.04; snips: in SG –  $n = 72$ , 40%; in CG –  $n = 70$ , 36%;  $p = 0.5$ ; OR 0.92). There were no major maternal perineal traumas.

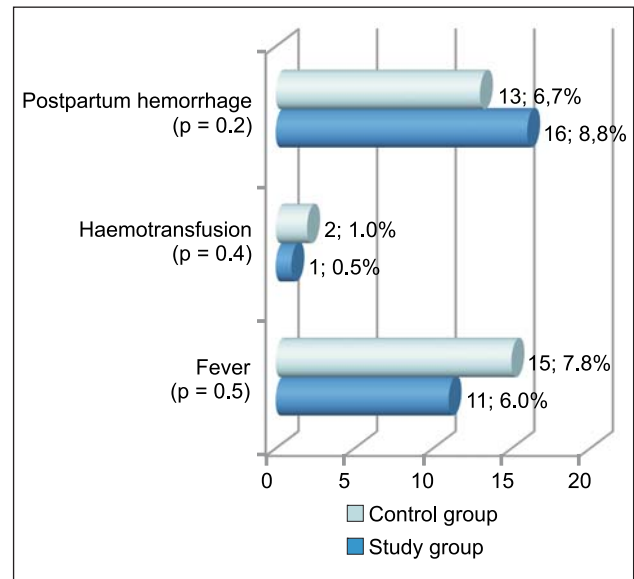


Fig. 2. Complications after delivery

Newborn singularity and outcomes were searched in detail in both trial groups.

There were more female newborns in the study group (SG:  $n = 100$ , 55%; CG:  $n = 96$ , 50%;  $p = 0.5$ ; OR 0.91) than male newborns (SG:  $n = 82$ , 45%; CG:  $n = 97$ , 50%;  $p = 0.5$ ; OR 0.89), but with no significant difference.

When labour occurred at 41 completed weeks, there was a higher risk of newborn paratrophy (SG:  $n = 42$ , 23.1%; CG:  $n = 38$ , 19.7%;  $p = 0.5$ ; OR 0.85), but a lower risk of newborn hypotrophy than at 40 weeks to 40 weeks + 6 days (SG:  $n = 6$ , 3.3%; CG:  $n = 16$ , 8.3%;  $p < 0.05$ ; OR 0.39). The mean newborn weight in the study group was  $3683 \pm 412$  g and in the control group  $3610 \pm 446$  g ( $p = 0.9$ ; OR 1.08).

The newborns from the study group were 0.5 cm higher than in the control group, their other measurements were also bigger, but the difference was not statistically significant (Fig. 3).

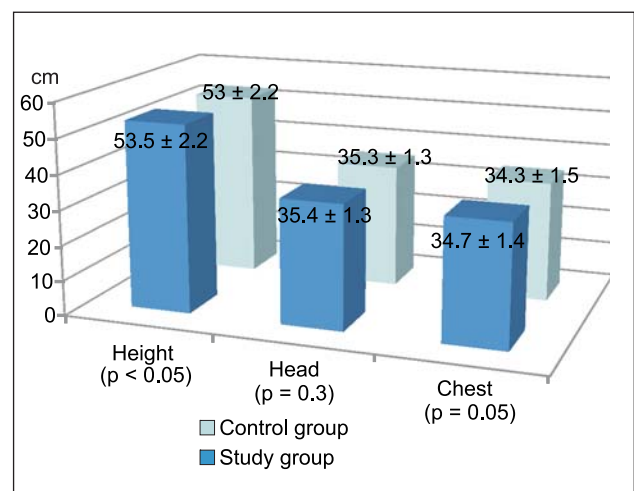


Fig. 3. Newborn body measurements

We analysed the factors that could influence the worse newborn outcomes, such as umbilical cord rotation around the baby’s neck, amniotic fluid index (AFI), meconium presence in amniotic fluid, Apgar score after labour.

Umbilical cord rotation around newborn’s neck was more frequent in the study group (SG: n = 66, 57%; CG: n = 49, 43%; p = 0.05; OR 0.7). Is this the reason for late delivery, or conversely – is it the result of prolonged pregnancy? We found no answer to this question.

AFI were also different in the groups. There was a statistically significant risk of oligohydramnios in the SG (AFI < 5) (SG: n = 19, 10.4%; CG: n = 10, 5.1%; p < 0.05; OR 0.5), but polyhydramnios (AFI > 20) was less frequent in the control group (SG: n = 4, 4.8%; CG: n = 12, 6.7%; p = 0.6; OR 0.3). Meconium in amniotic fluid was found statistically significantly more frequently when labour occurred at 41 completed weeks of gestation (SG: n = 50, 27.4%; CG: n = 32, 16.6%; p < 0.05; OR 0.6).

The umbilical artery pH analysis after delivery is performed to all newborns in the VCUH. It is one of indicators which shows how long fetus hypoxia and the newborn’s metabolic disorders continue. When the pH is less than 7.25, acidosis is determined (Table 1). We found an evidence of the statistically significant risk of acidosis (pH < 7.25) in newborns who were born at 41 completed weeks. There were more cases of light and increasing acidosis but less of moderate acidosis in the study group (Fig. 4).

We compared the results and found a correlation between meconium-stained amniotic fluid and acidosis in the groups. The risk of acidosis is higher in a newborn when meconium in its amniotic fluid is found at 41 week and later (p < 0.05; OR 0.33; RR 0.92) (Fig. 5).

The final estimation of newborn wellbeing is the Apgar score. There was no evidence of a statistically significant dif-

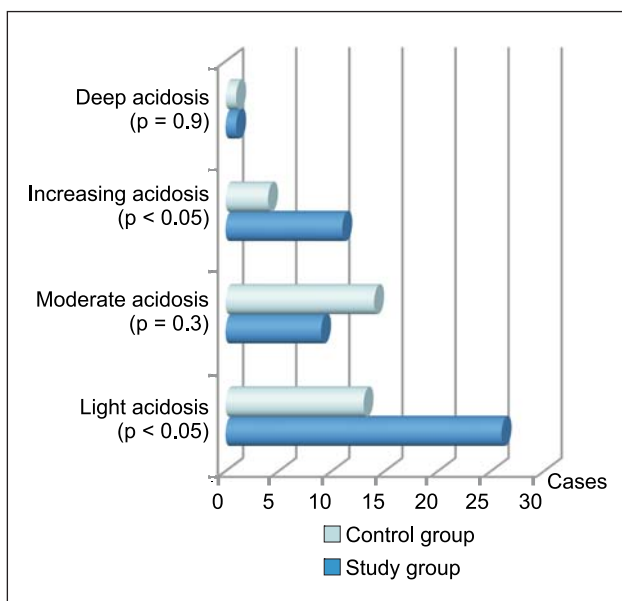


Fig. 4. Cases of acidosis in SG and CG

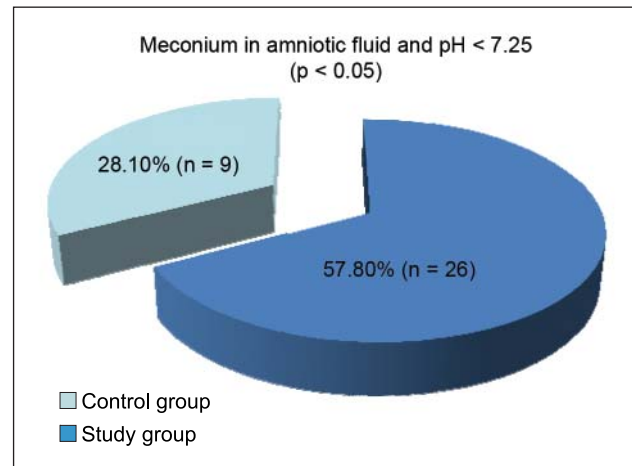


Fig. 5. Correlation between meconium-stained amniotic fluid and umbilical artery pH

ference in the risk of a low Apgar score in either of the groups after the 1st minute (SG: 9 ± 0.97; CG: 9.1 ± 0.95; p = 0.9; OR 1.05) or after the 5th minute (SG: 9.8 ± 0.7; CG: 9.8 ± 0.58; p = 0.9; OR 1.0).

No statistically significant difference was found in the groups as regards the structure of perinatal morbidity (Table 2).

Table 2. Perinatal morbidity in SG and CG (p = 0.27)

	Study group	Control group
General morbidity	50	41
Perinatal hypoxia	6	5
Perinatal infection	8	5
Cephalhematoma	12	8
Fracture of clavícula	1	5
Hyperbilirubinemia	11	8
Meconium aspiration syndrome	1	0
Postmaturity syndrome	3	0
Other diseases	8	7

We checked the average time of in-hospital stay after delivery. Women who delivered at 41 completed weeks stayed longer (SG: 3 ± 1.473 days) than those who delivered from 40 weeks to 40 weeks + 6 days (CG: 2 ± 0.086 days), but the difference was not statistically significant (p = 0.4; OR 0.47).

According to Nicholson, in the low-risk group optimal time of delivery was calculated to be 37 weeks + 1 day to 41 weeks + 0 day (15). In the study of Caughey, among the low-risk women who delivered at 37 completed weeks or beyond, the rates of primary caesarean delivery, operative vaginal delivery, third or fourth degree perineal lacerations and chorioamnionitis increased at 40 weeks of gestation (p < 0.001) and the rate of postpartum hemorrhage increased at 41 weeks of gestation (p < 0.001) (16). Our study is in concordance with these statements – we found a higher risk of oligohydramnios, umbilical cord rotation around the baby’s

neck, meconium presence in amniotic fluid, vacuum extraction rate, newborn acidosis at 41 weeks of gestation and beyond.

The main complication of labor induction after 40 complete weeks of gestation is emergent caesarean delivery due to labour dystocia or fetal distress. This pattern is debated in scientific literature. Recent studies show that the medical staff education and the development and enforcement of induction guidelines contributed to a decrease in inappropriate inductions, a lower caesarean birth rate for electively induced nulliparous (17). Wennerholm's study found that more women randomized to expectant management delivered by caesarean section (18). Our study found that caesarean delivery rate was the same in both groups – at 40 or at 41 complete weeks of pregnancy, but much more often cesarean section was made in the study group after labour induction.

ACOG recommendations (published in 2004) are based on level C evidence; many authorities recommend prompt delivery in a post-term pregnancy patient with a favorable cervix and no other complications (4). In the recent study of Caughey (in 2009), the rates of operative delivery, postpartum hemorrhage, chorioamnionitis, perineal lacerations and endomyometritis all increased beyond 40 weeks of gestation. Management of the pregnancies that progress beyond the estimated date of delivery should include counseling regarding the risks of increasing gestational age (12). We found the same rate of caesarean delivery beyond 40 and beyond 41 week of gestation, and after labour induction caesarean sections were more frequent in the group at 41 completed weeks than at 40 weeks to 40 weeks + 6 days.

Accurate pregnancy dating is important for minimizing the false diagnosis of postterm pregnancy. The gestational age is determined on the basis of the known last menstrual period in women with regular, normal menstrual cycles. It must be combined with findings of the first ultrasound examination. Although recent data have highlighted the accuracy of first trimester ultrasonography, the variation by ultrasonography generally is  $\pm 5$  days to 12 weeks,  $\pm$  days to 20 weeks (4). In our study, we collected these findings from medical data. To obtain more precise results, a large prospective study and a very precise gestation time estimation were needed for all pregnant women before recommending labour induction at 40 completed weeks.

Our suggestion is that labour induction is a more appropriate way for postterm pregnancy management if the pregnancy is 40 completed weeks and the patient has a favorable cervix.

## CONCLUSIONS

1. The pregnancy protracts frequently for nulliparous women without reference to the mother's age.

2. Labour induction occurs more frequently at 41 completed weeks than from 40 weeks to 40 weeks + 6 days of gestation, and the main way of induction in prolonged pregnan-

cies is vaginal prostaglandins (Misoprostolum 25  $\mu$ g every other 6 hours).

3. The caesarean delivery rate was the same in both groups. After labour induction, caesarean sections were more frequent in the group of 41 completed weeks than at a period from 40 weeks to 40 weeks + 6 days.

4. The risk factors such as oligohydramnios, umbilical cord rotation around the baby's neck, meconium presence in amniotic fluid, vacuum extraction rate and newborn acidosis are much higher for the mother and her newborn at 41 completed weeks.

5. After meconium-stained amniotic fluid is diagnosed at 41 completed weeks, the delivery should be monitored more intensively because of a higher risk of newborn acidosis after labour.

6. The inferior results of delivery occurring at 41 completed weeks are due to induced labour at 40 weeks to 40 weeks + 6 days of gestation. However, this suggestion requires larger prospective studies with a very precise gestation time estimation for all pregnant women.

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## KADA GERIAU SUŽADINTI GIMDYMĄ – 40 AR 41-ą NĖŠTUMO SAVAITĘ?

### Santrauka

**Įvadas.** Nėštumui užsitęsęs, labai pablogėja perinatalinės baigtys, daugėja motinos komplikacijų. Tyrimo tikslas – palyginti motinos ir vaisiaus komplikacijas dviejose gimdyvių grupėse: gimdžiusių 41-ą nėštumo savaitę (tiriamoji grupė – TG) ir gimdžiusių 40-ą nėštumo savaitę (kontrolinė grupė – KG).

**Medžiaga ir metodai.** Į šį retrospektyvų atvejo-kontrolės tyrimą buvo įtrauktos visos moterys, gimdžiusios Vilniaus miesto universitetinėje ligoninėje (VMUL) 2007 m. sausio 1 d. – 2007 m. gruodžio 31 dieną. Tyrimui atrinkome atvejus, kai moterys gimdė VMUL 41-ą nėštumo savaitę. Tirtas nėštumo trukmės poveikis šiems veiksniams: gimdymo būdai, nėštumo priežiūros taktikai, gimdymo trukmei, gimdymo takų plyšimams, kraujavimui po gimdymo, mekonijaus atsiradimui vaisiaus vandenyse, oligohidramnionui, virkštelės arterijos pH, naujagimių sergamumui, buvimo ligoninėje trukmei. Kontrolinei grupei buvo atrinkta kas dešimta moteris, tiriamuoju laikotarpiu gimdžiusi nuo 40 iki 40 savaitės +6 dienos (n = 193).

**Rezultatai.** Dažniausiai nėštumas užsitęsia pirmą kartą gimdančioms moterims nepriklausomai nuo jų amžiaus. Gimdymas dažniau sužadinamas 41-ą nėštumo savaitę (TG – 39,6 %; KG – 14,5 %, p < 0,05; OR 0,37); pagrindinis sužadinimo būdas užsitęsęs nėštumui – prostaglandinai į makštį. Moterims, gimdžiusioms po 41 savaitės, dažniau nustatyta: oligohidramnionas (TG – 10,4 %; KG – 5,1 %, p < 0,05; OR 0,5), apie kaklą apsisukusi virkštelė (TG – 57 %; KG – 43 %, p < 0,05; OR 0,7), mekonijus vaisiaus vandenyse (TG – 27,4 %; KG – 16,6 %, p < 0,05; OR 0,6), naujagimių acidozė (TG – 45,5 %; KG – 33,2 %, p < 0,05; OR 0,73). Šioms moterims dažniau atlikta vakuuminė vaisiaus ekstrakcija (TG – 7,7 %; KG – 3,1 %, p < 0,05; OR 0,4). Diagnozavus mekonijų vaisiaus vandenyse 41-ą nėštumo savaitę, gimdymo priežiūra turi būti intensyvesnė, nes padidėja naujagimio acidozės tikimybė. Tariant gimdymo būdą, trukmę, motinos traumatizmą, kraujavimą po gimdymo ir komplikacijas, taip pat įvertinant naujagimį pagal Apgar skalę, statistiškai patikimo skirtumo abiejose grupėse nerasta.

**Išvados.** Perinatalinės išeitys geresnės, kai gimdymas sužadinamas po 40-os nėštumo savaitės. Šiai rekomendacijai pagrįsti reikia platesnio prospektyvinio tyrimo, taip pat būtina tiksliai nustatyti nėštumo laiką.

**Raktažodžiai:** nėštumo laikas, užsitęsęs nėštumas, cezario pjūvio operacija, gimdymo sužadinimas, laukimo taktika, mekonijus vaisiaus vandenyse