SUMMARY

Comparative Analysis of Labor Induction Methods in Selected Pregnancy Complications

Introduction:

Labor induction is defined as the stimulation of mechanisms leading to the onset of labor before its spontaneous initiation. The aim of labor induction is to achieve vaginal delivery by initiating uterine contractions. The justification for performing this procedure should be the reduction of perinatal mortality and morbidity of the fetus and newborn, as well as the minimization of maternal complications. Due to the increasing rate of labor inductions, it is important to determine the most effective method associated with the lowest risk of complications.

Aim of the Study:

1. To assess the relationship between pregnancy risk factors and the choice of labor induction method.
2. To analyze the impact of cervical preparation before induction on the method of delivery.
3. To evaluate the relationship between the method of labor induction and the frequency of operative deliveries.
4. To investigate the relationship between the method of labor induction and the indications for cesarean section.
5. To determine indications for cesarean section depending on the reasons for labor induction.
6. To analyze the impact of the method of labor induction on the duration of labor.
7. To assess the influence of the method of labor induction on perinatal complications.
8. To analyze the impact of the method of labor induction on complications in the early neonatal period.

Material and Methods:

The study included 604 patients who underwent labor induction between 2008 and 2016 at the 2nd Department and Clinic of Obstetrics and Gynecology of the Medical University of Warsaw at the Princess Anna Mazowiecka Clinical Hospital.

Study Design:

The study consisted of a retrospective analysis of the relationship between pregnancy risk factors and the choice of induction method, the effect of cervical preparation on the mode of delivery, and the association between induction method and the frequency of operative

deliveries. The study also aimed to examine the relationship between the method of labor induction and the indications for cesarean section, as well as to determine the indications for cesarean section depending on the reasons for labor induction. Additionally, the influence of the induction method on the duration of labor, perinatal complications, and complications in the early neonatal period was analyzed.

Inclusion Criteria:

The study included patients with: singleton pregnancy, a live fetus, gestational age ≥36 weeks, intact fetal membranes, complete medical data necessary for analysis, a cervical canal culture collected upon hospital admission.

Exclusion Criteria:

The following patients were excluded: pregnancies with fetal presentation other than cephalic, multiple pregnancies, indications for planned cesarean delivery, spontaneous uterine contractions present at admission, abnormal placental location, prenatally diagnosed fetal anatomical or genetic anomalies, patients who did not consent to the induction procedure.

Endpoints:

The endpoints included: choice of labor induction method, mode of delivery, frequency of operative deliveries, indications for cesarean section, duration of labor, perinatal complications, complications in the early neonatal period.

Results:

The analysis was performed among three groups of patients:

- **Group 1** – patients in whom labor induction was performed using intravenous oxytocin infusion
- **Group 2** – patients in whom labor induction was initiated with a Foley catheter followed by intravenous oxytocin infusion the next day
- **Group 3** – patients in whom prostaglandin gel was used for labor induction

In the group of patients induced with oxytocin, primiparous women constituted only 38.7% vs 56.8% vs 52.2% in the other groups. Primiparous women were significantly less often induced using oxytocin infusion. No statistically significant differences were found in the proportion of patients with a previous cesarean section between the groups (8.5% vs 9.8% vs 7.9%, p=0.78). No differences were observed between the groups regarding the gestational age at which induction was performed or the indications for induction. In all groups, induction was most frequently performed at 39 or 40 weeks of gestation, and the most common indications were abnormal CTG findings and maternal diseases such as gestational diabetes (GDM) and hypertension. No significant differences were found between the groups in the number of

patients with: fetal growth restriction (FGR) (p=0.30), gestational hypertension (p=0.58),pregestational diabetes mellitus (PGDM) (p=0.56), cholestasis (p=0.33).

Uterine hyperstimulation (tetanic uterine contractions) occurred only in patients induced with prostaglandin gel.

A significantly lower rate of cesarean delivery was observed in the oxytocin induction group (9.5% vs 26.7% vs 20.2%, p=0.0002).

No differences were found between the groups in the use of epidural analgesia during labor or in the incidence of perinatal complications such as: soft tissue injuries of the birth canal, postpartum hemorrhage, uterine rupture, postpartum anemia, anaphylactic shock.

A significant difference was observed in the time from the start of induction to delivery. The longest time was observed in the Foley catheter group. Due to the technique of this method, the time between catheter placement and initiation of oxytocin infusion contributed to this difference.

A significantly higher incidence of postpartum infections was observed in the prostaglandin gel group (4.4% vs 1.5% vs 0%, p=0.05).

Operative vaginal deliveries (using vacuum extraction) and cesarean sections occurred significantly more often in patients with an unfavorable cervix (≤6 points on the Bishop score) (70.4% vs 29.6%, p=0.001; 80.7% vs 19.3%, p=0.001). The rate of cesarean sections performed due to threatened intrauterine fetal asphyxia was: 9.0% in the oxytocin group, 17.3% in the Foley catheter group,15.8% in the prostaglandin gel group (p=0.04). Cesarean sections due to failure to progress in labor were most common in the Foley catheter group compared with the prostaglandin gel and oxytocin groups (8.9% vs 0.5% vs 0%, p=0.04). Among patients delivered by cesarean section: threatened fetal asphyxia was significantly more often the indication in the oxytocin induction group, failure to progress was significantly more common in the Foley catheter group, failed induction was significantly more frequent in the prostaglandin gel group.

A significantly higher rate of cesarean sections due to threatened fetal asphyxia was observed in patients with an unfavorable cervix according to the Bishop score compared with those with a favorable cervix (16.9% vs 8.9%, p=0.008).

A significant difference was also observed in: low Apgar score (4.4% vs 1.0% vs 2.1%), perinatal hypoxia (5.4% vs 2.9% vs 0.5%, p=0.015). These outcomes were more frequent in neonates whose mothers were induced with prostaglandin gel compared with Foley catheter or oxytocin induction. Clavicle fractures were significantly more common in neonates delivered by operative vaginal delivery (vacuum extraction) compared with those delivered

spontaneously (11.1% vs 1.5%, $p<0.05$). Perinatal hypoxia occurred significantly more often in infants delivered by cesarean section compared with those born via spontaneous or operative vaginal delivery (10.5% vs 0.9% vs 7.4%, $p=0.000005$). Hyperbilirubinemia in the first days after birth was significantly more frequent in neonates of mothers with: hypertension (25.5% vs 17.1%, $p=0.03$), pregestational diabetes (5.9% vs 1.3%, $p=0.004$). Signs of perinatal hypoxia were significantly more common in neonates of mothers with PGDM (11.1% vs 2.0%, $p=0.01$). Intrauterine infection significantly more often complicated deliveries in women with PGDM (16.6% vs 2.0%, $p=0.001$).

The highest infection rate was observed in the prostaglandin gel induction group compared with oxytocin and Foley catheter groups (8.4% vs 2.5% vs 3.4%, $p=0.0125$). When Escherichia coli was cultured from the cervical canal, the infection rate increased from 4.3% to 14.3% ($p=0.016$).

The shortest duration of the first stage of labor occurred in the prostaglandin gel group compared with oxytocin and Foley catheter groups (4.1 h vs 5.0 h vs 6.3 h, $p<0.00005$).
The shortest average duration of the second stage of labor was also observed in the prostaglandin gel group (0.37 h vs 0.49 h vs 0.50 h, $p=0.0014$). The use of epidural analgesia significantly prolonged the average duration of the second stage of labor (0.34 h vs 0.59 h, $p<0.00005$).

Conclusions

1. Pregnancy risk factors do not influence the choice of induction method.
2. Lower cervical readiness for labor at the start of induction is associated with a higher rate of cesarean delivery.
3. Operative vaginal deliveries occur significantly more often in women induced with intravenous oxytocin, whereas cesarean sections are more common in women undergoing preinduction with a Foley catheter.
4. Among women induced with intravenous oxytocin, cesarean section was most often required due to threatened intrauterine fetal asphyxia; in the Foley catheter group, more often due to failure to progress in labor; and in the prostaglandin gel group, more frequently due to failed induction.
5. Threatened intrauterine fetal asphyxia is the most common indication for cesarean section among patients induced due to fetal growth restriction and/or hypertension, while failure to progress in labor is the main indication among women induced due to pregestational diabetes.

6. The duration of both the first and second stages of labor is longest in women induced with a Foley catheter.
7. Induction of labor with prostaglandin gel is associated with a higher incidence of postpartum infections.
8. Perinatal hypoxia occurs more frequently in neonates of mothers induced with prostaglandin gel.