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Comparative analysis of preinduction cervical ripening and induction of labour in a Polish and German hospital*

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ABSTRACT

Introduction: The aim of preinduction is to accelerate cervical ripening, which results in a reduction in the number of cesarean deliveries and unsuccessful inductions, and shortens the hospitalization time for both women and infants. Induction of labour is an obstetric procedure which involves the stimulation of contractions prior to the spontaneous onset of labour.

Materials and methods: The research was conducted retrospectively and involved the analysis of medical records of 80 pregnant women staying in the Clinic of Obstetrics and Gynecology in the city of Szczecin, Poland, and 117 pregnant women hospitalized in the Clinic of Obstetrics and Gynecology in the town of Schwedt/Oder, Germany.

Results: The most common indications for preinduction cervical ripening and induction of labour in the Polish and German hospitals were oligohydramnios, macrosomia, suspected placental insufficiency, pregnancy between 41 + 0 and 41 + 6 weeks of gestation, intrauterine growth restriction and premature rupture of the membranes. The main indications for preinduction cervical ripening and induction of labour included premature rupture of the membranes (Polish hospital) and pregnancy between 41 + 0 and 41 + 6 weeks of pregnancy (German hospital).

In the German hospital, there were more cases of preinduction and induction resulting in vaginal delivery – 85.47%, whereas in the Polish hospital the percentage was lower at 68.75%. The number of cesarean deliveries was substantially higher in the Polish hospital (31.25%) than in the German hospital (14.53%).

In the Polish hospital, the average duration from the moment of applying a method to the onset of regular contractions was 113 min shorter than in the German hospital. The average duration of vaginal delivery for women in the German hospital, totalled 236 min, which was 42 min shorter than for women at the Polish hospital. The largest percentage of scores on the Apgar scale at the first, third and fifth min after birth was within the normal range and indicated good health conditions of infants with scores ranging from 8–10 points in both hospitals. Significantly more infants in the German hospital received pH from the umbilical cord within the limits of the norm which marks the welfare of neonates (7.20–7.45). The average change in the evaluation of the cervix marked in the Bishop score was higher in the German hospital, making 3.2 points, compared to 0.7 points in the Polish hospital. The duration of hospitalisation in the Polish hospital was shorter than that in the German hospital (3.4 days, with a median of 3 days). The number of days of preinduction and induction was shorter in Poland (1.2 day). The levels of haemoglobin were comparable in the case of the patients from both hospitals.

Among the postpartum complications, cervical rupture and episiotomy were significantly more common in the Polish hospital, while second-degree rupture of the perineum in the German hospital.

Keywords: preinduction cervical ripening; induction of labour; Poland; Germany.

INTRODUCTION

Preinduction cervical ripening aims to accelerate the maturation of the cervix by loosening its structure. Pharmacological methods of pre-induction include prostaglandins, which are formed through enzymatic oxidation of arachidonic acid from cell membranes.

Polyunsaturated fatty acids consist of a cyclopentane ring and 2 side chains with a total of 20 carbon atoms. They induce contraction of the uterine muscle by releasing calcium ions from the reticulum of the endoplasmic membrane and increasing the flow of calcium into the cell. Prostaglandins E1 (PGE1) and E2 are commonly used for preinduction cervical ripening [1, 2, 3, 4, 5, 6].

According to the recommendation of The Polish Society of Gynaecologists and Obstetricians, contraindications to the use of prostaglandins include previous operations on the uterine muscle, cephalopelvic disproportion, previous operative deliveries, 6 or more previous deliveries, non-cephalic positions, signs of fetal hypoxia, allergy to prostaglandins, bronchial asthma, glaucoma, increased intracranial pressure, placenta praevia and unexplained vaginal bleeding [7]. Misoprostol (Cytotec) is a synthetic form of PGE1 that is commonly used to treat peptic ulcers. However, it has not yet been approved for pre-induction and induction of labour. Despite this, American College of Obstetricians and Gynecologists recommends the use of misoprostol as an effective and safe agent for pre-induction

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and induction of labour, and it is applied by obstetricians in many countries worldwide [3, 5, 8, 9, 10, 11, 12, 13].

Misoprostol, as a PGE1 analog, induces uterine contractions by selectively binding to the EP-2/EP-3 receptors of the myometrium [2, 3, 4, 13, 14, 15, 16, 17, 18]. Cytotec is metabolized in the liver and can be administered orally, vaginally, rectally or intrauterine. Prostaglandin E1 is available as an oral tablet (25 μg, 50 μg, 100 μg or 200 μg) or a vaginal insert (Misodel 200 μg). Cytotec causes contractions of the uterus, relaxes the muscles of the trachea and bronchi, and reduces the secretion of hydrochloric acid and pepsin in the stomach. A rectal dose of 800 μg is considered a first-line treatment for uterine bleeding and abnormal uterine muscle contractility after childbirth, in the absence of oxytocin and ergot preparations. In patients with an unprepared cervix and indications for delivery, Cytotec is recommended as a drug for pre-induction and labour induction after the 36th week of pregnancy. For cervical ripening, oral misoprostol should be initiated with a test dose of 25 μg, and the dose should not be repeated more often than every 3–6 h. The maximum dose that a pregnant woman can take within 24 h is 200 μg [3, 4, 8, 10, 11, 12, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29].

Fetal heart rate and uterine function should be regularly monitored after the administration of misoprostol. Possible side effects of using Cytotec include: abdominal pain, diarrhoea, bloating, nausea, pruritus, fever and headache [1, 2, 3, 15].

Induction of labour is an obstetric procedure involving the induction of uterine contractions before they start spontaneously [19, 20, 30, 31, 32, 33, 34]. Oxytocin administration is one of the most common methods used for labour induction, which should be used with caution. The intensity, duration and frequency of contractions should be observed, and continuous monitoring of fetal heart rate is necessary [35, 36].

Oxytocin is produced by the hypothalamus and is then transported to the posterior lobe of the pituitary gland, where it is stored. It is a cyclic, 9-amino acid peptide that induces uterine contractions [22, 37]. Synthetic oxytocin (Pitocin, Syntocinon) administered in labour induction works in the same way as endogenous oxytocin produced during spontaneous labour, but the patient's pain reaction and sensitivity to its effects may vary [7, 8].

By means of inhibitory mechanisms, oxytocin neurons are kept at rest during pregnancy, while the production of this peptide is constantly stimulated. At the right moment, when labour is about to begin, the mechanisms that inhibit the action of oxytocin are unlocked. Therefore, sensitivity to oxytocin varies with the duration of pregnancy. The highest susceptibility of the body to its effects is noted from the 34th week of pregnancy [8, 16, 38].

Labour induction methods carry the risk of obstetric complications. When using oxytocin, these include overstimulation of the uterine muscle, which may cause uterine rupture and fetal hypoxia. This is due to the fact that endogenous oxytocin is secreted during labour in a pulsating manner, and its amount varies depending on the stages of labour. Synthetic oxytocin administered in a continuous infusion prolongs the duration of contractions, increases their occurrence and shortens the breaks between them. Administration of synthetic oxytocin to a woman giving birth may cause disturbances in the bonding between mother and child [38]. The application of oxytocin disrupts the activity of endorphins secreted physiologically during contractions, so the pain sensations during childbirth are stronger [7, 36, 38]. Oxytocin, which is structurally similar to vasopressin, may also have antidiuretic effects. Therefore, if a patient receives high doses of this peptide during labour, hypotonic hyperhydration, known as water intoxication, may occur. To prevent this complication, an oxytocin infusion in a higher concentration should be used, and additionally, crystalloids should be administered [8].

The main goal of this paper was to evaluate the effectiveness of preinduction and induction of labour in a Polish and German hospital.

MATERIALS AND METHODS

The research was conducted retrospectively and involved the analysis of medical records of 80 pregnant women staying in the Clinic of Obstetrics and Gynecology in the city of Szczecin, Poland, and 117 pregnant women hospitalized in the Clinic of Obstetrics and Gynecology in the town of Schwedt/Oder, Germany.

The research concerned the group of pregnant women with postdate pregnancies, calculated according to the Naegele's rule and confirmed by the first trimester ultrasound examinations. These women also had unfavourable cervix, with less than 6 points on the Bishop score. Moreover, pregnant patients with a low biophysical profile and incorrect record of cardiotocography or comorbidities were also included, as these factors determined their classification in the study group.

The analysis presented below was carried out in 2 stages. The first stage involved collecting data from the medical record of women classified in the study group based on an auctorial data form. The second stage of the research involved statistical analysis based on the conducted study. The readiness of the cervix was determined by the Bishop score decided. Neonatal results were evaluated using the Apgar Score System, as well as pH value, cBase in the gasometric test and acid-base balance of the cord blood. Haemoglobin levels in women were measured through venous blood tests during the first day after labour.

RESULTS

The most frequently used method of preinduction cervical ripening and induction of labour among the examined patients in the Polish hospital was oxytocin, with 40.6% (n = 80) of pregnant women receiving it. In the German hospital, the most frequently used method of preinduction cervical ripening (59.4%, n = 117) and induction of labour was misoprostol, which contains PGE1 – Table 1.

TABLE 1. Mode of preinduction or induction of labour

Mode of preinduction or induction of labour	Poland (n = 154)	Germany (n = 150)	p-value
Oxytocin	80 (40.60%)	18 (12.00%)	**<0.001**
Misoprostol oral	0 (0.00%)	117 (59.40%)	

n – count
bold p-values indicate a statistical significance <0.05; p-value: Pearson χ^2 test

The majority of patients in the Polish hospital were in their first pregnancy (61.25%), compared to 36.75% in the German hospital. In the Polish hospital, primiparous women were the most numerous group (61.25%), while in the German hospital, women who had given birth once or more (61.54%). Ninety percent of women in the Polish hospital were at the gestational age between 37 + 0 and 40 + 6 weeks, compared to 73.50% in the German hospital. In the German hospital, a greater percentage of women (23.93%) were at a gestational age between 41 + 0 and 41 + 6 weeks compared to the patients in the Polish hospital (6.25%); 21.25% of Polish patients were diagnosed with hypothyroidism, compared to 0% in the German hospital – Table 2.

Significantly more frequently (p = 0.001) pregnancy between 41 + 0–41 + 6 weeks was the reason for induction of labour in German patients (24.79%) than in Polish patients (6.25%). Another significant difference observed between Polish and German patients was the frequency of occurrence of premature rupture of membranes (PROM). It was more common among women in Poland (40.00%) than in the German hospital (18.80%, p = 0.001). Intrauterine growth restriction was recorded as an indication for pre-induction or induction of labour in Polish patients (1.25%, n = 1) and German patients (8.55%). Oligohydramnios was an indication in the case of Polish patients (23.75%) and German patients (13.68%). A certain number of pregnant women in Poland (16.25%) and the German hospital (22.22%) were qualified for pre-induction or induction of labour due to fetal macrosomia. Another indication was the suspicion of placental insufficiency, which was documented in the case of Polish patients (11.25%) and German patients (21.37%). Pregnancy-induced hypertonia was an indication in Polish patients (3.75%), and pregnancy over 42 + 0 weeks in 1 German patient 0.85% (n = 1). Polyhydramnios and tachycardia were documented in 2.50% of Polish patients. Gestational cholestasis or suspected thrombosis were not indications for either Polish or German patients – Table 3.

In the German hospital (85.47%), more pre-induced and induced pregnancies ended in a vaginal birth compared to the Polish hospital (68.75%, p = 0.004). The rate of caesarean sections was higher in the Polish hospital – 31.35% than in the German hospital – 14.53%. Among women who had given birth at least once, a larger proportion in the German hospital (98.61%) had a vaginal birth than in the Polish hospital (83.87%, p = 0.012). The percentage of primiparous achieving a vaginal birth was 59.18% in the Polish hospital and 64.44% in the German hospital.

In the Polish hospital, the average duration from the administration of oxytocin to the onset of regular contractions was 113 min shorter than in the German hospital, where misoprostol

TABLE 2. Demographic parameters / Demographic data and baseline characteristics

Parameter	Poland (n = 80)	Germany (n = 117)	p-value
Maternal age (years) M ±SD	28.01 ±5.2	28.46 ±5.5	0.638
Gestational age (days) M ±SD	275 ±8.7	278 ±9.0	0.033
Gravidity			
1	49 (61.25%)	43 (36.75%)	**0.001**
2	22 (27.50%)	33 (28.21%)	
>3	9 (11.25%)	41 (35.04%)	
Parity			
0	49 (61.25%)	45 (38.46%)	**0.001**
>1	31 (38.75%)	72 (61.54%)	
Coexisting diseases			
Gestational hypertension	7 (8.75%)	3 (2.56%)	0.106
Gestational diabetes	11 (13.75%)	19 (16.24%)	0.632
Cholestasis of pregnancy	2 (2.50%)	3 (2.56%)	0.664
Hypothyroidism	17 (21.25%)	0 (0.00%)	**<0.001**

M – median; SD – standard deviation; n – count
bold p-values indicate a statistical significance <0.05; p-value: Pearson χ^2 test

TABLE 3. Indications for preinduction or induction of labour

Indications	Poland (n = 80)	Germany (n = 117)	p-value
Premature rupture of membranes	32 (40.00%)	22 (18.80%)	**0.001**
Fetal macrosomia	13 (16.25%)	26 (22.22%)	0.301
Intrauterine growth restriction	1 (1.25%)	10 (8.55%)	0.060
Pregnancy-induced hypertonia	3 (3.75%)	0 (0.00%)	0.129
Oligohydramnios	19 (23.75%)	26 (13.68%)	0.069
Suspicion of placental insufficiency	9 (11.25%)	25 (21.37%)	0.065
Polyhydramnios	2 (2.50%)	0 (0.00%)	0.319
Fetal tachycardia	2 (2.50%)	0 (0.00%)	0.319
Postterm pregnancy (<41 weeks and 0 days–41 weeks and 6 days)	5 (6.25%)	29 (24.79%)	**0.001**
Postterm pregnancy (<42 weeks and 0 days)	0 (0.00%)	1 (0.85%)	0.848

n – count
bold p-values indicate a statistical significance <0.05; p-value: Pearson χ^2 test

TABLE 4. Efficiency outcomes

Outcome parameter	Poland (n = 80)	Germany (n = 117)	p-value
Vaginal delivery	55 (68.75%)	100 (85.47%)	**0.004**
nulliparous	29 (59.18%)	29 (64.44%)	0.600
parous	26 (83.87%)	71 (98.61%)	**0.012**
Cesarean section	25 (31.25%)	17 (14.53%)	**0.004**
nulliparous	20 (40.82%)	16 (35.56%)	0.600
parous	5 (16.13%)	1 (1.39%)	**0.012**
Time from induction to an onset of active labour (minutes) M ±SD	93 ±146.2	206 ±195.9	**<0.001**
Duration of the first stage of labour (minutes) M ±SD	264 ±143.9	226 ±195.9	**0.008**
Duration of the second stage of labour (minutes) M ±SD	29 ±27.8	31 ±36.5	0.347
Duration of the third stage of labour (minutes) M ±SD	6 ±3.4	11 ±7.7	**<0.001**
Duration of labour (minutes) M ±SD	278 ±122.4	236 ±153.8	**0.003**
Maternal haemoglobin level after birth (mmol/L) M ±SD	6.5 ±0.7	6.7 ±0.7	**0.038**
Change of Bishop score from induction to an onset of active labour (M ±SD)	0.7 ±1.7	3.2 ±2.5	**<0.001**
Time of preinduction and induction of labour (days) M ±SD	1.2 ±0.6	1.5 ±0.8	**0.001**
Time of hospitalization (days) M ±SD	3.4 ±1.5	4.4 ±1.3	**<0.001**

M – median; SD – standard deviation; n – count
bold p-values indicate a statistical significance <0.05; p-value: Pearson χ^2 test

TABLE 5. Indications for cesarean delivery

Indications	Poland (n = 80)	Germany (n = 117)	p-value
Lack of progression	15 (60.00%)	5 (29.41%)	0.102
Dystocia of cervix	0 (0.00%)	1 (5.88%)	0.844
Abnormal cephalic presentation	0 (0.00%)	2 (11.76%)	0.898
High longitudinal position	2 (8.00%)	1 (5.88%)	0.647
Nonreassuring fetal status	1 (4.00%)	9 (52.94%)	**0.001**
Eclampsia / Severe pre-eclampsia	1 (4.00%)	0 (0.00%)	0.844
Foetal distress	1 (4.00%)	8 (47.06%)	0.798

n – count
bold p-values indicate a statistical significance <0.05; p-value: Pearson χ^2 test

was administered. A longer average duration of the dilatation stage was observed in the Polish hospital, amounting to 264 min. However, the longer average duration of the second and third stages was recorded in the German hospital, amounting to 31 and 11 min, respectively. The average duration of labour in patients in the German hospital was shorter and amounted to 236 min. Significantly lower (p = 0.038) average postpartum haemoglobin value was observed in Polish patients (6.5 mmol/L) than in German patients (6.7 mmol/L). The average change of evaluation of the cervix marked on the Bishop score was higher in the German hospital and it was 3.2 points whereas in the Polish hospital it was 0.7 points. The average number of days on which pre-induction and labour induction methods were used was shorter in the Polish hospital (1.2 days) than in the German hospital (1.5 days). The maximum number of days on which patients in the Polish hospital underwent pre-induction and labour induction methods was 4, while in the German hospital it was 6 days. In the Polish hospital, the duration of hospitalization was shorter, averaging 3.4 days, with a median of 3 – Table 4.

Remarkably more frequently (p = 0.001), the risk of fetal asphyxia occurred in the German hospital – 52.94% – compared to the Polish hospital – 4.00%. Among Polish patients who underwent cesarean section (31.25%), despite the attempt to deliver vaginally with pre-induction and induction of labour, the most common indication was lack of progress of labour – 60.00%. Other indications for caesarean section documented in the records of expectant mothers in the Polish hospital included high longitudinal position, risk of fetal asphyxia, eclampsia and life-threatening conditions for the fetus. In 14.53% of German patients, the most common indications for cesarean delivery were the threat of fetal asphyxia (52.94%) and the risk of fetal death (47.06%) – Table 5.

Apgar scores at the first, third and fifth min in both compared hospitals were within the normal range, corresponding to the good condition of the newborns after delivery (8–10 points). The average Apgar score at the first min of life was 9.1 points in the Polish hospital and 8.7 points in the German hospital. At the third min of life it was 9.5 in the Polish hospital and 9.7 in the German hospital, while at the fifth min it was 9.8 and 9.9, respectively.

The highest percentage of pH value from umbilical cord blood after delivery, both in the Polish hospital (75.00%) and in the German hospital (91.45%) in patients who received misoprostol, was within the normal range (7.20–7.45). Significantly more newborns in the German hospital (96.58% vs. 82.50%) had cBase results from the umbilical cord blood in gasometric test within the normal range (p = 0.001). In the Polish hospital, a higher percentage of newborns (6.25%) had a cBase value below 10 than in the German hospital (2.56%) – Table 6.

TABLE 6. Neonatal outcomes

Parameter	Poland (n = 80)	Germany (n = 117)	p-value
Apgar score at the 1 min (M ±SD)	9.1 ±1.3	8.7 ±0.8	**0.001**
0–3	1 (1.25%)	0 (0.00%)	
4–7	4 (5.00%)	11 (9.40%)	0.256
8–10	75 (93.75%)	106 (90.60%)	
Apgar score at the 3 min (M ±SD)	9.5 ±1.0	9.7 ±0.6	0.260
0–3	1 (1.25%)	0 (0.00%)	
4–7	2 (2.50%)	1 (0.85%)	0.309
8–10	77 (96.25%)	116 (99.15%)	
Apgar score at the 5 min (M ±SD)	9.8 ±0.7	9.9 ±0.2	**0.017**
0–3	0 (0.00%)	0 (0.00%)	
4–7	1 (1.25%)	0 (0.00%)	0.479
8–10	79 (98.75%)	117 (100.00%)	
pH (M ±SD)	7.28 ±0.1	7.30 ±0.1	0.358
<7.20	17 (21.25%)	7 (5.98%)	
7.20–7.45	60 (75.00%)	107 (91.45%)	**0.004**
>7.45	3 (3.75%)	3 (2.56%)	
cBase			
<-10	5 (6.25%)	3 (2.56%)	
-10–2	66 (82.50%)	113 (96.58%)	**0.001**
+2	9 (11.25%)	1 (0.85%)	

n – count
bold p-values indicate a statistical significance <0.05; p-value: Pearson χ^2 test

In the Polish hospital, second-degree rupture of the perineum was not recorded among the examined patients, while in the German hospital it affected 13.68% of patients. Episiotomy was performed significantly more often (p = 0.001) in the Polish hospital (35.00%) than in the German hospital (10.26%). A statistically remarkable difference (p = 0.007) was detected while comparing the incidence of cervical rupture in the Polish hospital and the German hospital. Cervical rupture was documented in 10.00% of Polish patients and 0.85% (n = 1) of German patients.

First-degree rupture of the perineum was diagnosed in 18.75% of patients in the Polish hospital and 27.35% in the German hospital, respectively. Another complication, labia rupture, occurred in 3.75% of Polish patients and 3.42% of German patients. The revision of the uterine cavity in the examined group was performed in 5.00% of Polish patients and only 1 German patient (0.85%). Rupture of the vagina occurred in 3.75% of Polish patients and 5.98% of German patients. Postpartum fever was reported only in 1.71% of German patients. Umbilical cord entanglement was recorded in 1.25% newborns in the Polish hospital and 2.56% in the German hospital. Postpartum anaemia occurred in 42.50% of Polish patients and 30.77 % of German patients – Table 7.

DISCUSSION

In the study by Acharya et al. [39, 40], Sajjad et al. [37], and Fareed et al. [41], the most common indications for pre-induction or induction of labour were pregnancy-induced hypertension and postterm pregnancy. The study by Schmidt et al. dentified postterm pregnancy, PROM, gestational diabetes, and intrauterine growth retardation as the most common indications [42].

In contrast to our own research, Jasim et al. reported that 76.6% of vaginal deliveries were achieved after the use of misoprostol, and 80% after the use of oxytocin. There were no significant differences in the above studies regarding the 2 methods and the type of delivery. The threat of intrauterine fetal hypoxia and lack of progress in labour were the most common indications for caesarean section in that study [16]. Similar to our own research, Abdel-Aal et al. reported a vaginal birth rate of 86% after the use of misoprostol, and 74% after the use of oxytocin. Lack of progress in labour and the risk of fetal death were the most common indications for caesarean section in that study [14]. Bhatu et al. obtained similar results to our own research in their study on induction with misoprostol and oxytocin, with 85.56% and 76% of women giving birth vaginally, respectively. The most common indication for caesarean section was the threat of intrauterine fetal hypoxia – 76.9% after the use of misoprostol and 64.3% after the use of oxytocin [35]. In the study by Sharada et al., the percentage of vaginal deliveries after the use of misoprostol (67.3%) was higher than after the use of oxytocin (62%) [34]. The number of vaginal deliveries in the study by Kashanian et al. on induction with oxytocin (75%) and misoprostol (72.5%) was comparable. The most common indications for caesarean section in that study were lack of progress in labour and the risk of intrauterine fetal hypoxia [43]. According to the research by Sajjad et al. 73.5% and 71.7% of women induced with misoprostol and oxytocin, respectively, delivered vaginally [37].

Mean duration from misoprostol administration to regular uterine contractions in the study by Pourali et al. was longer, amounting to 249 min compared to the use of oxytocin, which took 229 min [44]. Similarly, in our own research, and the study by Kashanian et al., it was observed that the average duration from the administration of misoprostol to the onset of regular uterine contractions was significantly longer (263 min) than when oxytocin was used (70 min) [42]. In the study by Nair et al., the mean duration from administration of misoprostol to delivery was 14 h and 16 min, with 68.95% of women giving birth to their offspring within 24 h from the start of induction with misoprostol [45].

In contrast, Jasim et al. noted that the average amount of time from misoprostol administration to delivery was 11 h 58 min, whereas in the group of pregnant women receiving oxytocin,

TABLE 7. Maternal outcomes / Postpartum complications

Complications	Poland (n = 80)	Germany (n = 117)	p-value
First-degree ruptures of the perineum	15 (18.75%)	32 (27.35%)	0.164
Second-degree ruptures of the perineum	0 (0.00%)	16 (13.68%)	**0.001**
Labia ruptures	3 (3.75%)	4 (3.42%)	0.788
Revision of uterine	4 (5.00%)	1 (0.85%)	0.175
Rupture of the vagina	3 (3.75%)	7 (5.98%)	0.710
Fiber	0 (0.00%)	2 (1.71%)	0.651
Episiotomy	28 (35.00%)	12 (10.26%)	**0.001**
Rupture of the cervix	8 (10.00%)	1 (0.85%)	**0.007**
Umbilical cord entanglement	1 (1.25%)	3 (2.56%)	0.898
Postpartum anemia	34 (42.50%)	36 (30.77%)	0.091

n – count
bold p-values indicate a statistical significance <0.05; p-value: Pearson χ^2 test

it was 8 h and 58 min [16]. A statistically significant difference between the time of administration of a given method and delivery was also observed in the study by Abdel-Aal et al. [14]. The mean duration from oxytocin administration to delivery was 8 h and 2 min, and in the case of misoprostol it was 6 h and 8 min. Moreover, the mean duration of the second stage was shorter with the use of misoprostol than with oxytocin. In the study by Bhatu et al., a significantly shorter duration from induction to delivery was observed in the group of primiparous women comparing misoprostol to oxytocin. The mean time from administration of misoprostol to delivery in the aforementioned group of women was 8 h and 30 min, and with the use of oxytocin it was 10 h and 40 min [35]. Acharya et al. noted that the average duration from the administration of misoprostol to delivery was 17 h and 9 min, and from the administration of oxytocin 16 h and 9 min [39, 40]. In the study by Sharada et al. a similar period of time from induction to delivery was observed, with the use of misoprostol – 19 h and 1 min, and oxytocin – 18 h and 4 min [34].

Unlike our own research, the study by Pourali et al. indicated that the average duration of labour with the use of oxytocin was 600 min, and with the use of misoprostol 480 min. The mean duration of the first stage in that study in oxytocin-induced women was 57 min and 48 min in misoprostol-induced women [44]. In the study by Kashanian et al., the average duration of labour (530 min), the first stage (476 min) and the second stage (46 min) with oxytocin were longer than with misoprostol. In this case, average duration of labour was 474 min, the first stage 421 min and the second stage 42 min. In the study described above, only the average duration of the third stage with oxytocin induction was shorter (9 min) than with misoprostol (11 min) [43].

In the study by Fareed et al., it was observed that the average duration from the application of misoprostol to delivery was 7 h and 21 min, and with the use of oxytocin was 7 h and 53 min [41]. In the study by Jasim et al., no statistically significant differences were observed between the Apgar scores in newborns at first and fifth min of life whose mothers were induced with misoprostol or oxytocin. The mean Apgar score at the first min of life in newborns of mothers receiving misoprostol was 6.6 points and 8.1 points at the fifth min of life. Newborns of mothers induced with oxytocin received 6.4 points at the first min of life, and 8.1 points at the fifth min of life [16]. According to the research by Abdel-Aal et al., the average Apgar score was 8.3 and 8.4, in newborns of mothers induced with oxytocin and misoprostol, respectively [14].

In the research by Pourali et al., the mean change of the Bishop score after using misoprostol was 2.8 points, and after using oxytocin, it was 1.5 points [44].

In the research by Morris et al., among women induced with misoprostol 10%, postpartum complications such as retained placenta and postpartum haemorrhage were documented. One patient, diagnosed with pre-eclampsia, died after delivery as a result of postpartum haemorrhage [12].

According to the research by Nair et al., 9.04% of women had postpartum haemorrhage and 12.67% had sepsis in the postpartum period [45].

The most common postpartum complications in the study by Hokkila et al. were episiotomy and postpartum haemorrhage [17].

CONCLUSIONS

1. The German hospital demonstrated higher effectiveness in achieving natural deliveries compared to the Polish hospital, indicating better outcomes for preinduction cervical ripening and induction methods.
2. The duration of delivery and the first stage of labour were significantly shorter in the German hospital whereas the second and the third stage of labour was shorter in the Polish hospital.
3. The actions taken in the Polish hospital resulted in more efficient induction, with regular contractions achieved in a shorter period of time.
4. The health condition of newborns after birth, as assessed by the Apgar scale, showed no significant differences between the preinduction or induction methods used.
5. The methods of preinduction cervical ripening and induction were found to be safer for infants based on the analysis of acid base balance.
6. The Polish hospital had a higher incidence of cervical rupture and episiotomy, while second-degree perineal ruptures were more frequent in the German hospital.
7. The duration of preinduction cervical ripening, induction, and hospitalisation was shorter in the Polish hospital.
8. The German hospital showed more significant changes in the Bishop scores when comparing the preinduction cervical ripening and induction methods.

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