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Influence of gestational diabetes mellitus on outcomes of preinduced labour with dinoprostone vaginal insert

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ABSTRACT

Objectives: The aim of this study was to evaluate the effectiveness of labour preinduction using a dinoprostone vaginal insert in patients with gestational diabetes mellitus versus patients undergoing labour induction for other causes. The second aim of the study was to compare perinatal outcomes in both groups.

Material and methods: The study has a retrospective character, conducted in 2019–2021 in a tertiary reference hospital. The following endpoints were assumed for the analysis: natural childbirth, birth occurring within 12 hours of dinoprostone administration and neonatal outcomes. Furthermore, indications of a caesarean section were analysed.

Results: The percentage of natural childbirths was similar in both groups. Furthermore, in both groups, over 80% of patients gave birth within less than 12 hours following dinoprostone administration. Neonatal outcomes (body weight, Apgar score) did not differ statistically. Analysing indications for a caesarean section, failure in the progress of labour was an indication in 39.5% of cases in the control group, 29.4% of cases in gestational diabetes mellitus (GDM), and 50% of cases in diabetes mellitus (DM). The risk of foetal asphyxia was an indication in 55.8% of cases in the control group, 35.3% of cases in GDM and 50% of cases in DM. Ineffective labour induction — no induction of the contractile function was an indication for a C-section in 4.7% of cases in the control group and 35.3% of cases in GDM; no cases were noted in DM ($p = 0.024$).

Conclusions: The study demonstrated that patients undergoing labour induction due to GDM using a dinoprostone vaginal insert did not differ in terms of labour duration, oxytocin administration compared to patients undergoing labour induction for other causes. Furthermore, the same rate of caesarean sections was found in the study group; however, these groups differ in terms of indications, including risk of foetal asphyxia (35.3% vs 55.8%), failure in the progress of labour (29.4% vs 39.5%), and no active labour (1.8% vs 1.5%). The neonatal Apgar score at 1.5 and 10 minutes after birth was similar in both groups.

Key words: dinoprostone, induction of labor, gestational diabetes mellitus, GDM, cesarean delivery

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INTRODUCTION

Diabetes mellitus (DM) is a set of metabolic disorders manifested by increased serum glucose levels. This condition may result in complications during pregnancy and puerperium. The frequency of different forms of hyperglycaemia during pregnancy reaches 14%, of which gestational pregnancy (GDM) represents nearly 95% [1]. This condition is understood as a diagnosis of glucose tolerance disorders during pregnancy for the first time in the patient life and their intensification to a level typical in pregnant women. The incidence of gestational diabetes in the European population is about 5% (3–8% in Poland) [2].

Labour induction is performed to reduce the percentage of perinatal complications and perinatal mortality and morbidity in patients with pregnancy complications and post-term pregnancy. The most critical complication to avoid is intrauterine foetal death. Labour induction is an artificial stimulation of mechanisms leading to labour before the spontaneous uterine contractile function. The current recommendations of the Polish Society of Gynecologists and Obstetricians specify indications and contraindications to labour induction. In the case of GDM, labour induction should be considered after the completion of pregnancy week (PW) 39. In the case of pregnancy complicated by

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gestational diabetes, labour induction should be considered after PW 38 [3]. Various methods are used for labour preinduction and subsequent induction. The use of prostaglandin vaginal insert for labour preinduction/induction is indicated in patients with an unprepared cervix. Currently, risk factors for labour induction failure are sought.

The aim of this study was to evaluate the effectiveness of labour preinduction using a dinoprostone vaginal insert in patients with gestational diabetes mellitus versus patients undergoing labour induction for other causes. The second aim of the study was to compare perinatal outcomes in both groups.

MATERIAL AND METHODS

Study group and control group

The study has a retrospective character. The analysis covered patients who underwent labour induction with dinoprostone at the University Hospital Department of Obstetrics and Perinatology (UH) in Kraków in 2019–2021. The Department is an institution of the tertiary referral level, with an average annual number of births is 2,100. The study group consisted of patients undergoing induction for GDM and DM. The control group consisted of patients undergoing labour induction for other reasons. Inclusion criteria: age > 18 years old, pregnancy duration > PW 37, a single pregnancy, an unprepared cervix (Bishop score < 6 points), longitudinal cephalic presentation, foetal membranes intact, labour induction with dinoprostone. Exclusion criteria: condition post-caesarean section, placenta previa, prostaglandins hypersensitivity, contraindications to the use of prostaglandins. The study received consent from the Ethics Committee No. 1072.6120.291.2021.

Maternal and foetal data

During the study, data on age, body mass index (BMI), body weight increase, the number of labours, pregnancy age, indications of labour induction and Apgar score.

Endpoints

The following endpoints were assumed for the analysis: natural childbirth, birth occurring within 12 hours of dinoprostone administration and neonatal outcomes.

Furthermore, indications of a caesarean section were analysed. The need to use the Foley catheter (FC), oxytocin, or misoprostol to continue labour preinduction/induction was also analysed. Other endpoints for analysis included uterine hyperstimulation and administration of epidural during labour.

Labour induction

Our facility uses the following regime for labour preinduction and subsequent induction. For an unprepared cervix (Bishop score < 6 points), a dinoprostone vaginal insert is used. After 24 hours (when the 1st labour stage does not occur and the cervical dilation is < 3 cm), mechanical methods for labour induction are used, namely, Foley catheter, with filling of 60–120 mL for 24 hours. The intravenous oxytocin infusion is initiated when the balloon falls out and there is no contractile function or is removed after 24 hours.

Statistical analysis

The results were analysed using statistical methods and compared with the control group. The analysis was conducted using R package version 3.6.1 (Core Team, Vienna, Austria). Descriptive statistics are presented as means, standard deviations, medians, and interquartile ranges. Independence chi-square tests were used to verify relations between category variables. The two-way p value = 0.05 was assumed as a level of significance for all comparisons.

RESULTS

A total of 6,300 childbirths took place in 2019–2021 at the Clinical Department of Obstetrics and Perinatology, UH, of which 3,400 were by caesarean section. In the analysed period, 300 pregnant women were qualified for labour induction, of whom 198 met the inclusion criteria and were included in the analysis. Indications for labour induction included diabetes mellitus in 64 cases (32%) (57 — GDM, 7 — DM), and other indications in 134 patients [pregnancy duration > 41 weeks — 33%, hypertension — 22%, gestational cholestasis — 1%, foetal growth restriction (FGR) — 4%, and other].

Table 1 presents the characteristics of the study and control groups. Patients with diabetes were subjected to labour induction earlier. This results from current recommendations. Furthermore, pregnant women from the GDM group had higher BMI (overweight) than patients in the control group and DM. GDM patients also had lower body weight increases during pregnancy. According to WHO recommendations, the weight gain should be 7 to 11.5 kg in overweight patients and 11.5 to 16 kg in patients with a normal BMI [4]. Following those recommendations, patients had normal body weight gain during pregnancy. The groups did not differ in terms of other parameters (Tab. 1).

A percentage of natural childbirths was similar in both groups. Furthermore, in both groups, over 80% of patients gave birth within less than 12 hours following dinoprostone administration. Neonatal outcomes (body weight, Apgar score) did not differ statistically (Tab. 1).

Analysing indications for a caesarean section, failure in progress of labour was an indication in 39.5% of cases in the control group, 29.4% of cases in GDM, and 50% of cases in DM. The risk of foetal asphyxia was an indication in 55.8% of cases in the control group, 35.3% of cases in GDM and 50%

Table 1. Comparison of the group induced due to diabetes versus the group induced due to other causes

Variable	Diabetes			p value
	No, n = 134	Yes 2-GDM, n = 57	Yes 3-DM, n = 7	
	q2 (q1–q3)	q2 (q1–q3)	q2 (q1–q3)	
Pregnancy	1.00 (1.00–2.00)	2.00 (1.00–2.00)	1.00 (1.00–1.00)	0.065
Childbirth	30.00 (27.00–34.00)	31.00 (28.00–34.00)	27.00 (25.00–34.00)	0.332
Apgar 1′	10.00 (10.00–10.00)	10.00 (10.00–10.00)	10.00 (9.00–10.00)	0.041
Apgar 5′	10.00 (10.00–10.00)	10.00 (10.00–10.00)	10.00 (10.00–10.00)	0.426
Apgar 10′	10.00 (10.00–10.00)	10.00 (10.00–10.00)	10.00 (10.00–10.00)	0.466
GA (days)	281.50 (274.00–287.00)	273.00 (271.00–277.00)	273.00 (264.50–274.50)	0.000
BMI before pregnancy	23.51 (21.45–25.50)	25.26 (21.63–28.04)	22.86 (22.36–24.68)	0.089
BMI before labour	29.12 (26.95–31.58)	28.66 (25.74–31.91)	29.03 (27.68–30.08)	0.784
Weight increase	16.00 (11.00–19.00)	11.00 (7.75–14.00)	14.00 (12.50–15.50)	0.000

DM — diabetes mellitus; GDM — gestational diabetes mellitus; BMI — body mass index

Table 2. Comparison of obstetrics outcomes in a group of patients induced due to diabetes and other causes

Variable	Category	No	Yes 2-GDM	Yes 3-DM	p value
		n (%)	n (%)	n (%)	
Childbirth	0	43 (32.1)	19 (33.3)	4 (57.1)	0.391
	1	91 (67.9)	38 (66.7)	3 (42.9)	
Labour duration (hours)	0	111 (82.8)	47 (82.5)	5 (71.4)	0.742
	1	23 (17.2)	10 (17.5)	2 (28.6)	
Foley catheter	0	99 (73.9)	39 (68.4)	4 (57.1)	0.510
	1	35 (26.1)	18 (31.6)	3 (42.9)	
Oxytocin	0	19 (18.4)	12 (26.1)	1 (16.7)	0.551
	1	84 (81.6)	34 (73.9)	5 (83.3)	
Epidural	0	88 (65.7)	37 (64.9)	5 (71.4)	0.943
	1	46 (34.3)	20 (35.1)	2 (28.6)	
Hyperstimulation	0	133 (99.3)	56 (98.2)	6 (85.7)	0.017
	1	1 (0.7)	1 (1.8)	1 (14.3)	
Misodel	0	128 (95.5)	56 (98.2)	7 (100.0)	0.567
	1	6 (4.5)	1 (1.8)	0 (0.0)	
No active labour	0	132 (98.5)	56 (98.2)	6 (85.7)	0.063
	1	2 (1.5)	1 (1.8)	1 (14.3)	
Indications for a caesarean section	1	17 (39.5)	5 (29.4)	2 (50.0)	0.024
	2	24 (55.8)	6 (35.3)	2 (50.0)	
	3	2 (4.7)	6 (35.3)	0 (0.0)	

Indications for a caesarean section: 1 — labour not progressing; 2 — the risk of foetal asphyxia; 3 — other; DM — diabetes mellitus; GDM — gestational diabetes mellitus

of cases in DM. Ineffective labour induction - no induction of the contractile function was an indication for a C-section in 4.7% of cases in the control group and 35.3% of cases in GDM; no cases were noted in DM (p = 0.024).

In the GDM group, CF insertion was required more frequently (31.6% cases vs 26.1% in the control group); however, the results were not statistically significant. Oxytocin (81.6% vs 73.9%) and misoprostol formulations (4.5% vs 1.8%) were used more frequently in the control group. These results also did not reach statistical significance. The rate of failures to reach active labour despite using all methods for labour preinduction and induction was similar in both groups.

In both groups, about 35% of patients received epidural. The hyperstimulation rate was similar (0.7% vs 1.8%). The detailed results are shown in Table 2.

DISCUSSION

The GDM diagnosis increases the risk of complications during pregnancy and in the perinatal period, including pregnancy-induced hypertension, pre-eclampsia, a caesarean section, foetal macrosomia, shoulder dystocia, neonatal hypoglycaemia, perinatal injury, as well as intrauterine foetal demise and stillbirths [5–7]. Furthermore, the neonatals of mothers with diabetes, regardless of the time of the pregnancy end, are at risk of developing complications affecting their respiratory tracts, such as respiratory distress syndrome (RDS) or Transient Tachypnoe of the Newborn (TTN) [8, 9]. It is generally thought that diabetes diagnosis, accurate glycaemia monitoring and labour induction reduce the risk of the development of complications. In the analysed group, no perinatal death or shoulder dystocia occurred. In the conducted study, the rate of caesarean sections was similar (32.1% in control vs 33.3% in GDM). Recently, an analysis of the PROBAAT study was conducted. It researched risk factors for ending labour induction with a caesarean section. The described predictors included the mother's age, BMI, number of labours, origin, and neonatal body weight [10]. In our study, the groups did not differ for these parameters.

In the case of the correct diabetes control during pregnancy, the patient can safely give birth at the due date [11, 12]. The literature includes contradictory reports concerning perinatal outcomes regarding maternal and neonatal complications in the case of correctly controlled gestational diabetes, depending on the selected management: waiting or induction at the due date. There are reports both on no differences in foetal macrosomia and a percentage of caesarean sections related to the selected management (waiting or labour induction) [13], as well as information on a reduced rate of births of neonates large for gestational age (LGA) and the increased hyperbilirubinemia rate in the group of pregnant women undergoing labour induction, with the increased percentage of shoulder dystocia cases in the case of the waiting approach [14]. Hawkins et al. [15] compared labour duration in patients induced with misoprostol in diabetes and the control group. They found that in the diabetes group, the time to reach active labour was significantly longer. In our study, most patients gave birth within 12 hours of the dinoprostone administration, independently in both groups. According to the recommendations of the Polish Society of Gynecologists and Obstetricians (PTGiP) and guidelines of the American College of Obstetricians and Gynecologists (ACOG), in women with diet controlled GDM and no additional indications, the completion of pregnancy should not be planned before 39 + 0 PW [5, 16]. In the case of insulin-controlled gestational diabetes, ACOG recommends ending pregnancy between PW 39 + 0 and PW 39 + + 6, while the PTGiP guidelines recommend considering active management after the end of PW 39 + 0 [5, 16]. In the case of pre-pregnancy diabetes and gestational diabetes, Polish guidelines recommend ending the pregnancy after the completion of PW 38 [16]. At our centre, under the Polish guidelines, labour induction was conducted after PW 39; therefore, the average pregnancy duration in diabetes patients was 39 weeks.

In women with diabetes, labour is induced mainly to reduce the risk of foetal death after PW 39, which is four times higher in patients with pre-pregnancy diabetes and two times higher in patients with GDM [15]. Such management is recommended before the end of PW 40 in women with GDM, which is difficult to manage, but it can also be considered for a mild course of this disease [17, 18]. In some cases, a decision to induce labour is made to avoid foetal macrosomia and associated risk of difficult labour; however, a consensus has not yet been reached as to an optimum time for this procedure and associated benefits for a mother and a newborn. Nevertheless, based on the latest reports, it is assumed that in women with GDM, labour induction before the end of pregnancy week 40 reduces the risk of foetal asphyxia and a need for a caesarean section [19]. In the conducted analysis, the median for the Apgar score was 10 points and did not differ between groups.

The use of a prostaglandin vaginal insert to preinduce/ /induce labour is recommended in patients with an immature cervix to reduce the need for a caesarean section. Factors increasing a chance for effective labour induction using the insert include younger age, white and Asian race, a lower body mass index (BMI), multiparity, older gestational age, a condition post water breaking, and a greater cervical maturity according to Bishop's score [20]. The use of dinoprostone increases the percentage of natural childbirths versus mechanical methods, especially in primigravida women [21]. Other management regimes are also verified when dinoprostone proves to be ineffective. The Re-DINO study analysed the efficacy of the repeated use of the insert [22]. At our centre, we use mechanical methods with the Foley catheter. The rate of FC applications was 31.6% in the diabetes group and 26.1% in the control group ($p = 0.51$). Currently, risk factors for labour induction failure using this method in women with diabetes are sought. It was found that curves of the active labour course in women with and without diabetes have a similar progression when labour is induced with prostaglandins; however, this is subject to the external cervix being dilated to at least 3.7 cm [23]. In our centre, a caesarean section was performed significantly more often because active labour was not reached when compared to the control group. Therefore, a re-assessment of recommendations for the time of labour induction in GDM patients should be considered, considering the risk of neonatal complications versus the risk of caesarean section.

CONCLUSIONS

The study demonstrated that patients undergoing labour induction due to GDM using a dinoprostone vaginal insert did not differ in terms of labour duration, oxytocin administration, epidural administration or hyperstimulation, compared to patients undergoing labour induction for other causes. Furthermore, the same rate of caesarean sections was found in the study group; however, these groups differ in terms of indications, including risk of foetal asphyxia (35.3% vs 55.8%), failure in progress of labour (29.4% vs 39.5%), and no active labour (1.8% vs 1.5%). The neonatal Apgar score at 1.5 and 10 minutes after birth was similar in both groups.

Article informations and declarations

Conflict of interest

The authors declare no conflict of interest.

REFERENCES

1. Nicolosi BF, Souza RT, Mayrink J, et al. Preterm SAMBA Study Group. Incidence and risk factors for hyperglycemia in pregnancy among nulliparous women: A Brazilian multicenter cohort study. PLoS One. 2020; 15(5): e0232664, doi: 10.1371/journal.pone.0232664, indexed in Pubmed: 32401767.
2. Araszkiewicz A, Bandurska-Stankiewicz E, Borys S, et al. 2021 Guidelines on the management of patients with diabetes. A position of diabetes Poland. Clin Diabetol. 2021; 10(1): 1–113, doi: 10.5603/dk.2021.0001.
3. Bomba-Opoń D, Drews K, Huras H, et al. Polish Gynecological Society Recommendations for Labor Induction. Ginekol Pol. 2017; 88(4): 224–234, doi: 10.5603/GP.a2017.0043, indexed in Pubmed: 28509326.
4. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. World Health Organ Tech Rep Ser. 1995; 854: 1–452, indexed in Pubmed: 8594834.
5. ACOG Practice Bulletin No. 107: Induction of Labor. Obstet Gynecol. 2009; 114(2): 386–397, doi: 10.1097/aog.0b013e3181b48ef5, indexed in Pubmed: 19623003.
6. Rosenstein MG, Cheng YW, Snowden JM, et al. The risk of stillbirth and infant death stratified by gestational age in women with gestational diabetes. Am J Obstet Gynecol. 2012; 206(4): 309.e1–309.e7, doi: 10.1016/j.ajog.2012.01.014, indexed in Pubmed: 22464068.
7. Metzger BE, Lowe LP, Dyer AR, et al. HAPO Study Cooperative Research Group. Hyperglycemia and adverse pregnancy outcomes. N Engl J Med. 2008; 358(19): 1991–2002, doi: 10.1056/NEJMoa0707943, indexed in Pubmed: 18463375.
8. Yildiz Atar H, Baatz JE, Ryan RM. Molecular mechanisms of maternal diabetes effects on fetal and neonatal surfactant. Children (Basel). 2021; 8(4), doi: 10.3390/children8040281, indexed in Pubmed: 33917547.
9. Capobianco G, Gulotta A, Tupponi G, et al. Materno-Fetal and neonatal complications of diabetes in pregnancy: a retrospective study. J Clin Med. 2020; 9(9): 2707, doi: 10.3390/jcm9092707, indexed in Pubmed: 32825775.
10. Quach D, Ten Eikelder M, Jozwiak M, et al. Maternal and fetal characteristics for predicting risk of Cesarean section following induction of labor: pooled analysis of PROBAAT trials. Ultrasound Obstet Gynecol. 2022; 59(1): 83–92, doi: 10.1002/uog.24764, indexed in Pubmed: 34490668.
11. Spong CY, Mercer BM, D'Alton M, et al. Timing of indicated late-preterm and early-term birth. Obstet Gynecol. 2011; 118(2 Pt 1): 323–333, doi: 10.1097/AOG.0b013e3182255999, indexed in Pubmed: 21775849.
12. ACOG committee opinion no. 560: Medically indicated late-preterm and early-term deliveries. Obstet Gynecol. 2013; 121(4): 908–910, doi: 10.1097/01.AOG.0000428648.75548.00, indexed in Pubmed: 23635709.
13. Alberico S, Erenbourg A, Hod M, et al. GINEXMAL Group. Immediate delivery or expectant management in gestational diabetes at term: the GINEXMAL randomised controlled trial. BJOG. 2017; 124(4): 669–677, doi: 10.1111/1471-0528.14389, indexed in Pubmed: 27813240.
14. Lurie S, Insler V, Hagay ZJ. Induction of labor at 38 to 39 weeks of gestation reduces the incidence of shoulder dystocia in gestational diabetic patients class A2. Am J Perinatol. 1996; 13(5): 293–296, doi: 10.1055/s-2007-994344, indexed in Pubmed: 8863948.
15. Hawkins JS, Stephenson M, Powers B, et al. Diabetes mellitus: an independent predictor of duration of prostaglandin labor induction. J Perinatol. 2017; 37(5): 488–491, doi: 10.1038/jp.2016.270, indexed in Pubmed: 28125096.
16. Bomba-Opoń D, Drews K, Huras H, et al. Polish Gynecological Society Recommendations for Labor Induction. Ginekol Pol. 2017; 88(4): 224–234, doi: 10.5603/gp.a2017.0043.
17. American College of Obstetricians and Gynecologists' Committee on Practice Bulletins—Obstetrics. ACOG Practice Bulletin No. 201: Pregestational Diabetes Mellitus. Obstet Gynecol. 2018; 132(6): e228–e248, doi: 10.1097/AOG.0000000000002960, indexed in Pubmed: 30461693.
18. Practice Bulletin No. 137. Obstet Gynecol. 2013; 122(2): 406–416, doi: 10.1097/01.aog.0000433006.09219.f1, indexed in Pubmed: 23969827.
19. Sutton AL, Mele L, Landon MB, et al. Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. Delivery timing and cesarean delivery risk in women with mild gestational diabetes mellitus. Am J Obstet Gynecol. 2014; 211(3): 244.e1–244.e7, doi: 10.1016/j.ajog.2014.03.005, indexed in Pubmed: 24607755.
20. Mbele AM, Makin JD, Pattinson RC. Can the outcome of induction of labour with oral misoprostol be predicted. S Afr Med J. 2007; 97(4): 289–292, indexed in Pubmed: 17446955.
21. Yamaguchi M, Takakura S, Enomoto N, et al. Comparison of perinatal outcomes between controlled-release dinoprostone vaginal delivery system (PROPESS) and metreurynter for cervical ripening in labor induction: A retrospective single-center study in Japan. J Obstet Gynaecol Res. 2021; 47(12): 4256–4262, doi: 10.1111/jog.15036, indexed in Pubmed: 34545652.
22. Coste Mazeau P, Hessas M, Martin R, et al. Is there an interest in repeating the vaginal administration of dinoprostone (Propess®), to promote induction of labor of pregnant women at term? (RE-DINO): study protocol for a randomized controlled trial. Trials. 2020; 21(1): 51, doi: 10.1186/s13063-019-3985-0, indexed in Pubmed: 31915047.
23. Timofeev J, Huang CC, Singh J, et al. Spontaneous labor curves in women with pregnancies complicated by diabetes. J Matern Fetal Neonatal Med. 2012; 25(1): 20–26, doi: 10.3109/14767058.2012.626923, indexed in Pubmed: 21955108.