International Journal of Gynecology and Obstetrics (2005) **89**, 263–267

International Journal of
GYNECOLOGY
& OBSTETRICS

www.elsevier.com/locate/ijgo

CLINICAL ARTICLE

Intravaginal misoprostol versus Foley catheter for cervical ripening and induction of labor

B.B. Afolabi*, O.L. Oyeneyin, O.K. Ogedengbe

Department of Obstetrics and Gynecology, Lagos University Teaching Hospital, Lagos, Nigeria

Received 21 October 2004; received in revised form 24 February 2005; accepted 24 February 2005

KEYWORDS
Misoprostol;
Intravaginal;
Foley catheter;
Induction of labor;
Cervical ripening

Abstract

Objective: To compare the efficacy and safety of 100 μg of intravaginal misoprostol with intracervical Foley catheter for cervical ripening and induction of labor.
Method: One hundred women being induced in the Lagos University Teaching Hospital, Nigeria, were randomized to receive a single 100 μg dose of misoprostol intravaginally or intracervical insertion of Foley catheter. Data analyses were by the Student's *t*-test and chi-square test.
Result: Misoprostol was more effective in terms of induction to delivery interval (11.84 ± 5.43 versus 20.03 ± 4.68 h, $P<0.05$), change in Bishop score, and number delivered within 24 h, in patients with a one-time successful induction. Uterine hyperactivity and rupture were more frequent in the misoprostol group.
Conclusion: A single 100 μg dose of intravaginal misoprostol is more efficacious than intracervical insertion of Foley catheter for cervical ripening and induction of labor. Further studies using lower doses are needed to determine the safest dose.

1. Introduction

Induction of labor is a common procedure in pregnancy. Its incidence varies widely from about 3–20%, being lower in developing countries [1]. Indications vary also but most obstetricians use it for prolonged pregnancy as it has been shown to reduce perinatal mortality when used after 41 weeks gestation [2]. Forewater amniotomy and oxytocin titration are the most common established methods of induction of labor. In patients with an unripe cervix, cervical ripening is attempted first mainly by the use of prostaglandins or by mechanical methods such as an intracervical balloon catheter like the Foley catheter.

* Corresponding author. Fax: +234 1 2635039.
E-mail address: bosedeafolabi2003@yahoo.com (B.B. Afolabi).

0020-7292/$ - see front matter
doi:10.1016/j.ijgo.2005.02.010

In Nigeria, intracervical Foley catheter insertion is the most commonly used method for cervical ripening as it is relatively cheap, easily available and effective [3]. However, the insertion procedure is uncomfortable for the women. Prostaglandin E2 vaginal preparations are easier to insert, also effective and more comfortable for the women, but are expensive, difficult to store and not readily available in our environment. Misoprostol, a prostaglandin E1 analogue, approved for the management of peptic ulcer disease, has uterotonic and cervical ripening actions. It is used frequently in obstetrics and gynecology for cervical ripening before termination of pregnancy, before induction, and also in the management of postpartum hemorrhage. It also has the advantage of being cheap, a 200-μg tablet being about 3 times cheaper than a size 18 Foley catheter in our environment, and stable at room temperature. These latter characteristics qualify it for use in a resource poor country like Nigeria. There have however been reports of uterine hyperstimulation, a known complication of prostaglandins, with misoprostol, especially at higher doses [4]. Single 100-μg intravaginal doses of misoprostol have been used in previous studies with favorable outcomes [5—7]. This study was thus carried out to compare the efficacy and safety of misoprostol with Foley catheter, for cervical ripening and subsequent induction of labor.

2. Materials and methods

This study was conducted in the Labor ward of the Department of Obstetrics and Gynecology, Lagos University Teaching Hospital (LUTH), Idi-Araba, Lagos, between November 2002 and August 2003.

Patients who attended the antenatal clinic of the above institution requiring cervical ripening (i.e. Bishop score$<$5 using the original Bishop criteria [8]) and induction of labor were eligible for this study if they had a live singleton fetus with cephalic presentation at term, intact membranes with no evidence of labor and no contraindication to a vaginal delivery. Exclusion criteria included a previous uterine scar and a known allergy to prostaglandin preparations.

Eligible patients were then assigned to treatment groups by opening an opaque, sealed envelope that contained the results of computer-generated random numbers, to receive either a single dose of 100 μg misoprostol (Cytotec, Searle, USA) or extra-amniotic Foley catheter. An initial cervical status assessment was done at onset using the Bishop score [8]. In the misoprostol group, half of a scored 200 μg tablet was placed in the posterior fornix of the vagina. In the Foley catheter group, a size 18 Foley Catheter (Agary Pharmaceutical, China) was inserted through the cervix into the extra-amniotic space under aseptic conditions and the bulb was inflated with 30 cm^3 of sterile water. The catheter was taped under gentle traction to the inner aspect of the woman's thigh. Maternal vital signs were periodically measured and charted in the partograph whilst the fetal heart rate was measured with the Pinard's stethoscope every 15 min during and after contractions and also charted. If not yet delivered or in active labor within 12 h, the women had a repeat vaginal examination to assess any changes in Bishop score and the findings were recorded.

Those with a favorable Bishop score (i.e. $>$7) then proceeded to have synchronous forewater amniotomy and incremental intravenous oxytocin titration. Those with an unfavorable score (i.e. $<$ 6) 12 h after initial insertion in both groups were noted, reassessed and offered the standard treatment of a Foley catheter insertion.

Data recorded included age, parity, relevant past and present history, gestational age at induction, indication(s) for induction, induction-delivery interval (i.e. interval between time of insertion and time of delivery), cervical status at onset and at 12 h of insertion, maximum dose of oxytocin used, mode of delivery, presence of uterine tachysystole (i.e. more than 5 uterine contractions in 10 min for two 10-min intervals) and or hypertonus (i.e. uterine contractions lasting more than or equal to 2 min), hyperstimulation (tachysystole in the presence of a non-reassuring fetal heart rate abnormality), non-reassuring fetal heart rate abnormalities [i.e. persistent fetal tachycardia ($>$ 150 beats/min), fetal bradycardia ($<$ 110 beats/min) and/or late decelerations (fetal bradycardia occurring after the peak of a contraction)], other maternal side effects (e.g. nausea and vomiting), perinatal outcome (i.e. Apgar score, need for neonatal unit admission). For this study, failed induction was taken as any induction terminating as an emergency cesarean section. Cervical dystocia was failure of progressive cervical dilatation in active labor despite strong regular uterine contractions in the absence of overt signs of disproportion. One time successful induction referred to women who progressed to vaginal delivery after a single insertion of misoprostol or Foley catheter. Precipitate labor was defined as labor lasting less than 3 h.

The primary outcome measure was the induction-delivery interval. The study was designed to

detect an 8-h difference in induction delivery interval between the two treatments, as seen in a similar study [9]. For detection of this difference with a level of significance of 0.05 and a power of 0.8, 34 patients were required in each group. Continuous data were reported as mean ± standard standard deviation (SD). The Student's *t*-test was used to analyze continuous data whilst the chi-square test and Fisher's exact test were used for the nonparametric data. $P<0.05$ was considered statistically significant.

3. Results

A total of 1211 deliveries took place during the study period out of which 138 were induced. This gave an induction rate of 11.4%. One hundred women met the inclusion criteria and were randomized to receive either 100 μg misoprostol intravaginally or intracervical insertion of Foley catheter. There were 50 women in each group.

The women's baseline characteristics of age, parity and gestational age at delivery were similar in both groups. The indications for induction of labor were also not significantly different between the groups. The mean initial Bishop score for the misoprostol group was 4.28 ± 1.54 and that for the Foley catheter group was 3.90 ± 1.27. The difference was not statistically significant.

Twenty-nine women in the misoprostol group and twenty-eight in the Foley catheter group had a one-time successful cervical ripening and induction process i.e. they progressed to vaginal delivery following a single insertion of misoprostol or Foley catheter (Table 1). Three women in the misoprostol group and 6 in the Foley catheter group had to have repeated insertions of Foley catheter before progressing to vaginal delivery. All (100%) the patients in the misoprostol group with a one-time successful induction achieved vaginal delivery within 24 h compared to 82% in the Foley catheter group. The mean values of the induction-delivery interval (IDI) showed a significantly shorter interval in the misoprostol group (11.84 ± 5.43 h) compared with the Foley catheter group (20.03 ± 4.68 h). Fewer women in the misoprostol group required intrapartum oxytocin augmentation compared with those in the Foley catheter group. The difference was statistically significant.

Table 2 shows mean values of improvement in Bishop scores by method and parity, in patients who had a one-time successful induction. Both nulliparous and multiparous women in the misoprostol group had significantly higher values than the Foley catheter group.

As shown in Table 3, there was no significant difference in intrapartum complications between the two groups. Fifty-four percent of patients in the misoprostol group had complications compared with 36% of the Foley catheter group. Uterine tachysystole and hyperstimulation were observed only in patients in the misoprostol group (14%).

The two cases of uterine rupture in the misoprostol group were both diagnosed during cesarean section. The first was a 39-year-old multiparous woman (3 previous deliveries), induced for impaired glucose tolerance at term, who developed persistent fetal tachycardia about 7 h post-insertion, in the absence of uterine hyperactivity. During surgery she was noticed to have a mildly hemorrhaging 2cm rupture at the uterine fundus. She was delivered of a neonate with Apgar scores 5 and 7 in the first and fifth minutes, respectively.

The second was a 32-year-old nulliparous woman induced for prolonged pregnancy who failed to progress in labor secondary to cephalopelvic disproportion. She developed hyperstimulation syndrome about 11 h post-insertion. Cesarean section performed 4 h later revealed a 4-cm partial thickness rupture in the posterior wall of the lower uterine segment. She was delivered of a neonate with Apgar scores 6 and 8 in the first and fifth minutes, respectively.

The cesarean section rates (inductions terminating in an emergency cesarean section) were 36% and 32% for the misoprostol and Foley catheter groups respectively. This difference was not statistically significant.

Table 1 Labor characteristics in patients with a one-time successful induction

Characteristics	Misoprostol $N=29$	Foley Catheter $N=28$	Significance	95% C.I.
IDI (mean (h) ± S.D.)	11.84 ± 5.43	20.03 ± 4.68	$P<0.05$	5.40, 10.98
Birth weight (mean (kg) ± S.D.)	3.45 ± 0.41	3.41 ± 0.66	$P>0.05$	−0.25, 0.33
1st minute Apgar Score (mean ± S.D)	8.17 ± 1.56	9.93 ± 1.72	$P>0.05$	−4.62, 8.15
Percentage delivered within 24 h	100.0	82.1	$P<0.05$	
Percentage of Oxytocin use	24.1	82.1	$P<0.05$	

IDI = Induction-Delivery Interval; SD = Standard deviation; kg = kilograms; mIU/min = milli international unit/minute; C.I. = Confidence interval.

Table 2 Change in bishop score by method and parity in patients with a one-time successful induction

Parity	Misoprostol $N=29$	Foley Catheter $N=28$	Significance	95% C.I.
Nulliparae	$N=13$ $\bar{x}=6.6\pm1.7$	$N=13$ $\bar{x}=4.4\pm1.93$	$P<0.05$	0.71, 3.69
Multiparae	$N=16$ $\bar{x}=6.6\pm2.50$	$N=15$ $\bar{x}=3.9\pm1.62$	$P<0.05$	1.17, 4.23

$\bar{x}$=Mean change in score ± Standard deviation; C.I.=Confidence Interval; N=number in group.

There were no significant differences in the first minute Apgar scores between the two groups (Table 1). In addition, there were no significant differences in the rates of neonatal resuscitation and admission into the neonatal unit.

4. Discussion

Intravaginal misoprostol was found to be more effective than extra-amniotic Foley catheter in terms of induction-delivery interval, proportion of vaginal deliveries within 24 h and mean change in Bishop score for women with a first time successful induction. Also, fewer numbers of women with one-time successful inductions in the misoprostol group (24%) required oxytocin augmentation compared with those in the Foley catheter group (82%).

Studies comparing intravaginal misoprostol with other prostaglandins have shown it to be more effective for induction of labor, both using 100 μg [5] and a lower dose of 50 μg [10,11]. A systematic review comparing intravaginal misoprostol with conventional intravaginal prostaglandins showed misoprostol to be more effective for cervical ripening and induction of labor [12]. In the few trials comparing intravaginal misoprostol with extra-amniotic Foley catheter, however, no difference was found between Foley catheter and misoprostol for cervical ripening or induction of labor [13,14]. This could be because lower repeated doses of misoprostol were used in those trials compared with this study which used a single 100-μg dose. Another reason for the difference could be because induction-delivery intervals were compared in the one-time successful inductions in this study. This was done because women with an unfavorable Bishop score after their initial treatment subsequently had the standard treatment of Foley catheter. Thus the induction delivery interval could be extremely prolonged and even more so if they ended up with a cesarean section. As the Pinard's stethoscope is used for intrapartum fetal monitoring in our centre, extreme caution is employed when carrying out induction, hence the use of a single dose of misoprostol in this study.

Uterine hyperactivity is a major concern with the use of misoprostol. Gottschall et al. [5] reported a combined rate of uterine tachysystole and hyperstimulation of 18.6% in their series. In this study a combined rate of 14% was observed in the misoprostol group (Table 3). Kramer et al. [15] reported a disturbing rate of 70% in their misoprostol group. However, in that study multiple insertions of 100 μg intravaginal misoprostol were used. There are several reports of uterine rupture associated with misoprostol use although trials large enough to assess such a rare event may not be feasible. In this study, the two cases of uterine rupture occurred in the misoprostol group. Although the difference in incidence of uterine rupture and other intrapartum complications were not statistically significant, the fact that they were all higher in the misoprostol group calls to question the safety of the single 100-μg dose of misoprostol. The American College of Obstetricians and Gynecologists recommends a maximum dose of 50 μg every 6 h for cervical ripening and induction of labor [16]. A trial with sufficient power to measure safety outcomes, using

Table 3 Intrapartum complications

Complications	Misoprostol $N=50$ (%)	Foley Catheter $N=50$ (%)	P-value	Significance
Tachysystole	4 (8)	0	0.059[a]	NS
Hyperstimulation Syndrome	3 (6)	0	0.121[a]	NS
Fetal heart rate Abnormalities	9 (18)	11 (22)	0.803[b]	NS
Uterine Rupture	2 (4)	0	0.247[a]	NS
Genital laceration	3 (6)	1 (2)	0.309[a]	NS
Precipitate labor	1 (2)	0	0.500[a]	NS

[a] Fisher's exact test.
[b] Yates correction test.

lower doses of misoprostol such as a single 50 μg dose, may help clarify these issues.

There were no significant differences in perinatal outcome between the two groups. The latter supports the relative safety of intravaginal misoprostol as regards perinatal outcome as previously documented in other studies [5,15,17]. The cesarean section rate and their indications were also not statistically different between the two groups and were similar to that of previous trials [5,15,17].

Intravaginal misoprostol appears to be a more effective alternative to intracervical Foley catheter for pre-induction cervical ripening and induction of labor in our environment. Studies with more power and lower misoprostol doses need to be conducted in order to achieve an adequate balance between optimum efficacy and safety.

References

[1] Orhue AAE. Review of induction of labor. Trop J Obstet Gynaecol 1997;14(1):1–14.

[2] Crowley P. Interventions for preventing or improving the outcome of delivery at or beyond term (Cochrane Review). The cochrane library, issue 4. Chichester, UK: John Wiley & Sons, Ltd; 2003.

[3] Ezimokhai M, Nwabinelli JN. The use of foley's catheter in ripening the unfavorable cervix prior to induction of labor. Br J Obstet Gynaecol 1980;87:281–9.

[4] Hofmeyr GJ, Gulmezoglu AM, Alfirevic Z. Misoprostol for induction of labor: a systematic review. Br J Obstet Gynaecol 1999;106:798–803.

[5] Gottschall DS, Borgida AF, Mihalek JJ, Saver F, Rodis JF. A randomized clinical trial comparing misoprostol with prostaglandin E2 gel for preinduction cervical ripening. Am J Obstet Gynecol 1997;177:1067–70.

[6] Herabutya Y, O-Prasertsawat P, Pokpirom J. A comparison of intravaginal misoprostol and intracervical prostaglandin E_2 gel for ripening of unfavorable cervix and labor induction. J Obstet Gynaecol Res 1997;23:369–74.

[7] Srisomboon J, Piyamongkol W, Aiewsakul P. Comparison of intracervical and intravaginal misoprostol for cervical ripening and labor induction in patients with an unfavourable cervix. J Med Assoc Thail 1997;80:189–94.

[8] Bishop EH. Pelvic scoring for elective induction. Obstet Gynecol 1964;24:266–8.

[9] Sciscione A, McCullough H, Manley J, Shlossman P, Pollock M, Colmorgen GA. Prospective randomized comparison of Foley catheter insertion versus intracervical prostaglandin E_2 gel for preinduction cervical ripening. Am J Obstet Gynecol 1999;180:55–9.

[10] Chuck FJ, Huffaker BJ. Labor induction with intravaginal misoprostol versus intracervical prostaglandin E_2 gel (Prepidil gel): randomized comparison. Am J Obstet Gynecol 1995;173:1137–42.

[11] Danielian P, Porter B, Ferri N, Summers J, Templeton A. Misoprostol for induction of labor at term: a more effective agent than dinoprostone vaginal gel. Br J Obstet Gynaecol 1999 (Aug.);106(8):793–7.

[12] Hofmeyr GJ, Gülmezoglu AM. Vaginal misoprostol for cervical ripening and induction of labor (Cochrane Review). The cochrane library, issue 4. Chichester, UK: John Wiley & Sons, Ltd.; 2003.

[13] Chung JH, Huang WH, Rumney PJ, Garite TJ, Nageotte MP. A prospective randomized controlled trial that compared misoprostol, Foley catheter, and combination misoprostol-Foley catheter for labor induction. Am J Obstet Gynecol 2003;189:1031–5.

[14] Sciscione AC, Nguyen L, Manley J, Pollock M, Maas B, Colmorgen G. A randomized comparison of transcervical Foley catheter to intravaginal misoprostol for preinduction cervical ripening. Obstet Gynecol 2001;97:603–7.

[15] Kramer RL, Gilson GJ, Morrison DS, Martin D, Gonzales JL, Qualls CR. A randomized trial of misoprostol and oxytocin for induction of labor: safety and efficacy. Obstet Gynecol 1997;89:387–91.

[16] American College of Obstetricians and Gynecologists. New U.S. Food and Drug Administration Labeling on Cytotec (Misoprostol) Use and Pregnancy. ACOG Committee Opinion Number 283. Washington, DC: ACOG; 2003.

[17] Mundle WR, Young DC. Vaginal misoprostol for labor: a randomized controlled trial. Obstet Gynecol 1996;88:521–5.