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ORIGINAL ARTICLE

Corticosteroids and Duration of Medical Induction for Mid-Trimester Abortion

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Abstract

Background: **Abortion is defined as the termination of pregnancy before fetal viability, regardless of the method used. It has been shown that using misoprostol alone to medically end an abortion in the second trimester is successful.**

Aim and objectives: **The purpose of the research was to assess the effect of intramuscular dexamethasone on the length of induced second trimester abortion in pregnant women between the ages of 16 and 24 weeks of gestation.**

Patient and methods: **This research was conducted in the Obstetrics and Gynecology Department of Qena General Hospital and Qus Central Hospital from January 2020 to May 2021. A total of 200 pregnant women consented to participate in this research, and they were selected from the emergency wards. All women considered for this study were in the second trimester at gestational age from 16 to 24 weeks and were planned for medical induction of abortion. These inclusion and exclusion criteria were used to recruit women.**

Result: **Most of the cases (94.5 and 98%) in misoprostol only and misoprostol + dexamethasone groups, respectively, were satisfied, and there was significant statistical difference between groups regarding satisfaction.**

Conclusion: **The administration of dexamethasone intramuscularly (12 mg every 24 h) with the medical induction of abortion by misoprostol (200 μg intravaginally every 4 h) appears to be effective regarding shortening the induction-abortion interval (duration between the initiation of induction and expulsion of fetus), reducing the overall misoprostol dosage, and decreasing the duration of the hospitalization. Its cost-effectiveness and availability are apparent benefits.**

Keywords: Abortion, Corticosteroids, Induction, Mid-trimester

1. Introduction

Abortion is defined as the termination of pregnancy (TOP) before fetal viability, regardless of the method used. It is widely accepted that viability is attained between 23 and 24 weeks of gestation.[1]

The second trimester, sometimes known as the mid-trimester, lasts from weeks 13−28 of gestation and is separated into two parts: the early week, lasting from weeks 13−20, and the late week, lasting from weeks 20−28.[2]

Two-thirds of serious abortion-related complications result from second trimester abortions, which account for 10−15% of all induced abortions performed globally.[3]

During pregnancy, prostaglandins (PGs) are crucial in controlling uterine contractility.[4]

In addition to being suited for delivery through noninvasive ways, PG analogs also exhibit a sustained activity owing to their relative resistance to the first quick inactivation in the circulation. Although Prostaglandin E (PGE) analogs are favored owing to their selective selectivity for the myometrium and lack of gastrointestinal disorders, Placental Growth Factor (PGF) analogs are also often used for TOP.[5]

It has been shown that using misoprostol alone to medically end an abortion in the second trimester is successful. Misoprostol-only methods feature greater dosage requirements, more frequent adverse effects, and lengthier abortion times.[6]

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Like other steroids, glucocorticoids have a lipophilic nature that makes it easy for them to bind to intracellular receptors.[7]

Through promotion of surfactant development in the fetal lung and PG synthesis in human intrauterine tissues, respectively, they are implicated in both the maturation of the fetal lung and parturition.[8]

The placental trophoblast secretes corticotrophin-releasing hormone (CRH), which increases exponentially as pregnancy progresses and may act as a regulator of human parturition.[9]

It has been shown that CRH stimulates the production of estrogens in the placenta while inhibiting the generation of progesterone. In addition, placental CRH is released into the fetal circulation, where it directly activates the fetal adrenal gland's fetal zone to produce dehydroepiandrosterone sulfate.[4]

The fetal zone, the primary site of dehydroepiandrosterone sulfate production, the substrate for placental estrogen synthesis, is what distinguishes the fetal adrenal gland from other adrenal glands.[10]

Additionally, glucocorticoids stimulate the placenta's synthesis of CRH and the fetal membrane's synthesis of PGs. As a result, glucocorticoids are crucial for human reproduction.[4]

By downregulating or upregulating the expression of prostaglandin dehydrogenase (PGDH), cortisol increases the generation of PGs in the fetal membranes, which in turn, increase the activity of 11β-HSD1, resulting in more cortisol production with further stimulation of PG output.[11] This series of actions, which were started by glucocorticoids, could be crucial for the positive feed-forward processes of work.

The study aimed to evaluate the effect of intramuscular dexamethasone on the duration of induced second trimesteric abortion in pregnant women at gestational age from 16 to 24 weeks.

2. Patients and methods

From January 2020 to May 2021, this research was conducted in the Obstetrics and Gynecology Department of Qena General Hospital and Qus Central Hospital. A total of 200 pregnant women in all agreed to take part in this research, and they were selected from the emergency wards. All women considered for this study were in the second trimester at gestational age from 16 to 24 weeks, who were planned for medical induction of abortion. Following are the inclusion and exclusion criteria for recruiting women.

2.1. Inclusion criteria

The study includes pregnant women presenting with intrauterine fetal demise at gestations between 16 and 24 weeks and planned to undergo medical induction of abortion and singleton fetus.

2.2. Exclusion criteria

Women who are actively aborting, women with congenital malformed uterus, women with previously scarred uterus or low lying placenta, women with multiple pregnancy, women with any contraindication to steroid therapy such as severe hypertension or uncontrolled diabetes mellitus, and women with kidney diseases with pregnancy.

Informed consent was taken from all women.

We have at first 200 pregnant women at gestational age of 16–24 weeks: 10 women were excluded from randomization because they asked to be discharged from the hospital before completing the treatment.

A total of 190 women met the inclusion and exclusion criteria and were subjected to the randomization and divided into two groups: group 1 (misoprostol only): women who received 3 ml of distilled water administered intramuscularly every 24 h for a maximum of two doses with the onset of medical induction of abortion with misoprostol, and group 2 (misoprostol + dexamethasone) women received dexamethasone at a dose of 12 mg intramuscular injection every 24 h for a maximum of two doses with onset of the medical induction with misoprostol.

All recruited women received misoprostol for medical induction of abortion at a vaginal dose of 200 μg every 4 h, for a maximum of five doses per day (according to the FIGO guidelines 2017).

A total of 190 concealed envelopes were used. Each envelope contained two syringes. Half of the envelopes included two syringes, with each one containing 12 mg dexamethasone for intramuscular injection, and the other half included two syringes, with each one containing 3 ml of distilled water for intramuscular injection.

The two syringes in all envelopes were numbered from 1 to 2 to be used sequentially.

The study was double blinded (neither the patient nor the researcher knew about the type of allocation). No change in allocation of treatment was allowed. If mothers requested a different treatment, they were withdrawn from the study (with the intension to treat all randomized participants and all participants were analyzed as randomized).

A total of 92 women were allocated to treatment 1 and 98 women to treatment 2.

2.2.1. Study methodology

A detailed history and thorough physical examination of all participants were carried out, and every patient was subjected to the following.

(1) Complete history, including age, parity, gestational age, and previous abortions, including number of second trimester miscarriages, systemic disorders, and contraindication of steroids.
(2) Gestational age calculation using Negele's rule (adding 1 year and 7 days to the Last Menstrual Period (LMP) and substrate 3 months) or depending on first trimester scan.
(3) General examination including BMI, heart rate, and blood pressure (weight in kg/height in m^2) normal weight (20–25), overweight (25–30), obese (30–35), markedly obese (35–40), and morbidly obese (>40).
(4) Hemoglobin percentage before the procedure and not less than 6 h after the procedure.
(5) An ultrasound was done for all participants to confirm diagnosis and the gestational age.
(6) Local examination of the cervix to exclude women in active abortion.
(7) Determination of duration of induction-abortion interval in hours, total does of misoprostol and number of second cycle of misoprostol, number of dexamethasone doses, adverse effects of the drug, length of hospital stay, and need for blood transfusion.

2.3. Statistical analysis of the data

With the aid of the IBM SPSS software package, version 20.0, data were fed into the computer and evaluated (IBM Corp., Armonk, New York, USA). Number and percentage were employed to describe qualitative data. Range (minimum and maximum), mean, SD, median, and interquartile range were used to characterize quantitative data. At the 5% level, significance of the findings was determined. The employed tests were χ^2 test to compare several groups for categorical variables and Monte-Carlo correction when more than 20% of the cells have an anticipated count that is less than 5. Student *t* test was used to compare two examined groups for quantitative variables that are typically distributed.

3. Results

This study was conducted on 190 patients who were divided into two groups: 92 patients in group 1 and 98 patients in group 2, as presented in Table 1.

Group 1 included 39 (43%) patients more than or equal to 30 years, 32 (34%) from 25 to less than 30 years, and 21 (23%) less than 25 years. Their age ranged from 22.0 to 35.0 years, with mean ± SD of 28.50 ± 4.11 years. Most cases [63 (68.5%)] were

Table 1. Comparison of the two study groups based on demographic characteristics.

Demographic data	Group 1 ($n = 92$) [n (%)]	Group 2 ($n = 98$) [n (%)]	Test of significance	P
Age (years)				
<25	21 (23.0)	23 (23.46)		
25–<30	32 (34.0)	37 (37.75)	$\chi^2 = 0.189$	0.910
≥30	39 (43.0)	38 (38.77)		
Minimum–maximum	22.0–35.0	22.0–35.0		
Mean ± SD	27.50 ± 3.91	27.90 ± 3.81	$t = 1.071$	0.286
Median (IQR)	28.50 (25.0–32.0)	28.0 (25.0–31.0)		
BMI (kg/m^2)				
Normal (18.5–24.9)	4 (4.3)	7 (7.14)		
Overweight (25–29.9)	63 (68.5)	69 (70.4)	$\chi^2 = 4.320$	0.115
Obese (≥30)	25 (27.2)	22 (22.44)		
Minimum–maximum	22.70–34.0	24.50–32.0		
Mean ± SD	29.19 ± 2.91	28.09 ± 2.06	$t = 0.340$	0.734
Median (IQR)	28.10 (26.45–30.10)	28.10 (26.40–29.60)		
Residence				
Rural	43 (46.73)	37 (37.75)	$\chi^2 = 1.648$	0.199
Urban	49 (53.26)	61 (62.24)		

χ^2, χ^2 test; IQR, interquartile range; *t*, Student *t* test.
P: *p* value for analyzing the groups under study.
Group 1: women who only receive misoprostol for induction of abortion.
Group 2: women who receive dexamethasone at a dose of 12-mg intramuscular injection.
Statistically substantial at *p* value less than or equal to 0.05.

overweight (BMI 25–29.9 kg/m^2), 25 (27.2%) were obese (BMI ≥30 kg/m^2), and four (4.3%) were normal (BMI 18.5–24.9 kg/m^2). Their BMI ranged from 24.7 to 32 kg/m^2, with mean ± SD of 29.19 ± 2.91 kg/m^2.

Group 2 included 38 (38.77%) more than or equal to 30 years, 37 (37.75%) from 25 to less than 30 years, and 23 (23.46%) less than 25 years. Their age ranged from 22.0 to 35.0 years with mean ± SD of 27.90 ± 3.81 years. Most cases [69 (70.4%)] were overweight (BMI 25–29.9 kg/m^2), 22 (22.44%) was obese (BMI ≥30 kg/m^2), and seven (7.14%) were normal (BMI 18.5–24.9 kg/m^2). Their BMI ranged from 24.5 to 32 kg/m^2 with mean ± SD of 28.09 ± 2.06 kg/m^2.

Comparison of the obstetric histories of the two study groups is presented in Table 2. Most cases in the two groups had no previous abortions (93.4 and 91.8% in groups 1 and 2, respectively). Their gestational age ranged from 16.0 to 24.0 years, with mean ± SD of 20.01 ± 2.59 years.

Regarding parity, prior abortions, and gestational age, there was no statistically substantial variation between the groups (Table 3).

There was no statistically significant difference between groups regarding the type of abortion,

Table 2. Comparison of the obstetric histories of the two study groups.

Obstetric history	Group 1 (n = 92) [n (%)]	Group 2 (n = 98) [n (%)]	Test of significance	P
Parity				
Parous	45 (48.9)	42 (42.85)	$\chi^2 = 0.502$	0.478
Nulliparous	47 (51.1)	56 (57.14)		
Previous abortion				
No	86 (93.4)	90 (91.8)	$\chi^2 = 0.064$	0.800
Yes	6 (6.6)	8 (8.2)		
Gestational age				
Minimum–maximum	16.0–24.0	16.0–24.0		
Mean ± SD	20.01 ± 2.59	19.94 ± 2.48	$t = 0.195$	0.846
Median (IQR)	20.0 (17.50–22.0)	20.0 (18.0–22.0)		

χ^2, χ^2 test; IQR, interquartile range; t, Student t test.
Group 1: women who only receive misoprostol for induction of abortion.
Group 2: women who receive dexamethasone at a dose of 12-mg intramuscular injection.
Statistically significant at p value less than or equal to 0.05.

Table 3. Comparison of the two study groups in terms of the results.

Outcome	Group 1 (n = 92) [n (%)]	Group 2 (n = 98) [n (%)]	Test of significance	P
Rime till abortion (h)				
Minimum–maximum	12.0–36.0	11.0–29.0		
Mean ± SD	23.74 ± 6.85	19.38 ± 5.65	$t = 4.912$*	<0.001*
Median (IQR)	24.0 (18.0–29.50)	20.0 (14.0–24.0)		
Misoprostol dose (μg)				
Minimum–maximum	800.0–1800.0	600.0–1400.0		
Mean ± SD	1166.0 ± 272.7	986.0 ± 211.3	$t = 5.217$*	<0.001*
Median (IQR)	1000.0 (1000.0–1400.0)	1000.0 (800.0–1000.0)		
Dexamethasone dose (mg)				
Minimum–maximum	–	12.0–24.0		
Mean ± SD	–	15.12 ± 5.29	–	–
Median (IQR)	–	12.0 (12.0–24.0)		
Type of abortion				
Incomplete	10 (10.87)	5 (5.1)	$\chi^2 = 2.446$	0.118
Complete	82 (89.1)	93 (94.9)		
Oxytocin augmentation				
Required	32 (34.78)	19 (19.4)	$\chi^2 = 8.515$*	0.004*
Not required	60 (65.2)	79 (80.6)		
Hemoglobin variations (g/dl)				
Minimum–maximum	0.50–1.10	0.50–1.10		
Mean ± SD	0.84 ± 0.19	0.85 ± 0.19	$t = 0.446$	0.656
Median (IQR)	0.90 (0.70–1.0)	0.90 (0.70–1.0)		

χ^2, χ^2 test; IQR, interquartile range.
Group 1: women who only receive misoprostol for induction of abortion.
Group 2: women who receive dexamethasone at a dose of 12-mg intramuscular injection.

Table 4. Comparison of the two study groups in terms of their adverse effects.

Adverse effects	Group 1 ($n = 92$) [n (%)]	Group 2 ($n = 98$) [n (%)]	χ^2	P
Nausea	3 (3.2)	1 (1.0)	1.846	$^{FE}P = 0.369$
Vomiting	9 (9.7)	5 (5.1)	1.607	0.205
Diarrhea	3 (3.2)	0	3.046	$^{FE}P = 0.246$
Fever	2 (2.1)	1 (1.0)	2.749	$^{FE}P = 0.212$
Headache	0 (0.0)	1 (1.0)	1.005	$^{FE}P = 1.000$
Hyperglycemia	2 (2.1)	2 (2.0)	0.000	$^{FE}P = 1.000$

Group 1: women who only receive misoprostol for induction of abortion.
Group 2: women who receive dexamethasone at a dose of 12-mg intramuscular injection.

Table 5. Comparison of satisfaction levels between the two study groups.

Satisfaction	Group 1 ($n = 92$) [n (%)]	Group 2 ($n = 98$) [n (%)]	χ^2	P
Satisfied	87 (94.5)	96 (98.0)	0.421	0.516
Dissatisfied	5 (5.4)	2 (2.0)		

Group 1: women who only receive misoprostol for induction of abortion.
Group 2: women who receive dexamethasone at a dose of 12-mg intramuscular injection.

Table 6. Comparison of the two study groups in terms of length of hospital stay.

Hospital stay	Group 1 ($n = 92$) [n (%)]	Group 2 ($n = 98$) [n (%)]	χ^2	P
48 h	80 (86.9)	93 (94.8)	0.569	0.001
More than 48 h	12 (13.0)	5 (5.1)		

Group 1: women who only receive misoprostol for induction of abortion.
Group 2: women who receive dexamethasone at a dose of 12-mg intramuscular injection.

hemoglobin distinction (g/dl), or even oxytocin augmentation. There was a statistically significant difference between groups regarding the time until abortion (h) and misoprostol dose (μg) (Table 4).

Adverse effect was more common in group 1, with no statistically significant difference between the two groups (Table 5).

Most cases (94.5 and 98% in groups 1 and 2, respectively) were satisfied.

There was a statistically significant difference between groups regarding satisfaction (Table 6).

There was a statistically significant difference between groups regarding hospital stay.

4. Discussion

Placental CRH increases myometrial contractility, directly stimulating PG synthesis, affecting uterine blood flow, and modulating the synthesis of other peptides thought to be involved in the TOP.[12]

Our study of induction of abortion using intramuscular dexamethasone with vaginal misoprostol compared with vaginal misoprostol alone demonstrated that dexamethasone usage in combination with misoprostol was successful in reducing the time between an induction and an abortion, the length of hospitalization, and the overall dosage of misoprostol.

This double-blinded, randomized, controlled, clinical experiment was conducted in the Obstetrics and Gynecology Departments of Qena General Hospital and Qus Central Hospital from January 2020 to May 2021. A total of 190 pregnant women in all agreed to take part in this research, and they were selected from the emergency wards. All women considered for this study were in the second trimester at gestational age from 16 to 24 weeks, who were planned for medical induction of abortion. They were divided into two groups: group 1 included 92 women who received misoprostol alone and group 2 included 98 women who received misoprostol and dexamethasone.

All recruited women received misoprostol for medical induction of abortion at a vaginal dose of 200 μg every 4 h, for a maximum of five doses per day (according to the FIGO guidelines, 2017).

In this study, both groups were demographically similar regarding maternal age, gestation age, parity, BMI, numbers of previous abortions, and timing of abortion. There was no substantial variation in age (P)=(0.286) gestation age (P)=(0.846), parity

(*P*)=(0.478), BMI (*P*)=(0.734), and induction-abortion interval (h) *P*=(0.001).

The mean age of participating women in the dexamethasone group was 27.9 years old whereas was 27.5 years old in the placebo group.

The mean gestational age in the dexamethasone group was 19.94 weeks, whereas in the placebo group was 20.01 weeks. For the parity on admission, 56 of 98 women in the dexamethasone group, whereas 47 of 92 women in the placebo group were nullipara, and the remaining patients were multipara in both groups. This means that data in both groups were homogenous. If these data showed a big difference in both groups, we would think that the induction-abortion interval may be reduced in the dexamethasone group owing to most women being multigravida, which may have a role in shortening the induction-abortion interval and not due to the effect of dexamethasone on the induction process.

The mean BMI in the dexamethasone group was 28.09, whereas was 29.19 in the placebo group, which means that data in both groups were homogenous.

In the present research, there was a statistically significant difference between the two groups in terms of the induction-abortion interval (the amount of time between the start of induction and the expulsion of the fetus, $p = 0.001$), and the length of hospitalization ($p = 0.001$). Although the placebo group's median induction to abortion interval was 23.74, it was 19.38 h in the dexamethasone group.

In the current research, there was a statistically significant difference between both groups regarding the dose misoprostol used (Table 3) ($p = 0.001$). The mean dose of misoprostol in the dexamethasone group was 986 μg, whereas was 1166 μg in the placebo group. The need for second cycle of misoprostol was more in the dexamethasone group. This means that patients who received dexamethasone with misoprostol in the dexamethasone group got less doses of misoprostol and a small number of patients needed second cycle of induction, so patients in the placebo group got more doses of misoprostol, and also, they were more liable for complications of misoprostol (fever and gastrointestinal upset) and prolonged hospital stay.

Adverse effect was more common among group 1, with no statistically significant difference between the two groups.

Hyperglycemia, which appeared in two women in both group, was borderline hyperglycemia, and the two women had a family history of diabetes mellitus. Therefore, there was no relation between using dexamethasone with its does in the current study and increasing the number of patients with hyperglycemia.

Moreover, we concluded from the current study that use of dexamethasone was not associated with decreasing the amount of blood loss or number of patients who needed surgical evacuation. Complete abortion was seen in 93 patients getting dexamethasone and misoprostol together and in 82 patients getting misoprostol alone, with no discernible difference in these numbers.

This result goes with those of Kashanian *et al*,[13] where 122 nulliparous women with full-term pregnancies and bishop scores of 7 or higher were randomly assigned to obtain a single 8 mg dose of dexamethasone or a placebo 6 h before the start of labor induction. The time between the start of labor induction and the start of the active phase of labor was lower in the dexamethasone group than in the control group. They came to the conclusion that dexamethasone medication reduced the length of labor.

If we compare this study with the current study, it may give us inspiration that to reduce the time between induced abortions in the second trimester and labor, dexamethasone combined with misoprostol is used.

These findings disagreed with the results of a retrospective study by Vitner *et al*,[14] which was done on 122 women in a row who had TOP between 13 and 24 weeks and were given 400 μg of vaginal misoprostol every 6 h, up to a total of four treatments. The researchers found that the induction-to-abortion interval was inversely connected with parity and correlated with gestational age, meaning that the delay was shorter with greater parity and shorter with less gestational age. They also found that misoprostol is safe and effective in mid-trimester abortion. We also discovered that in contrast to the present research, both groups' gestational ages and parities were comparable, and that the dexamethasone group's shorter induction-abortion interval was unrelated to either factor.

A study by Allam *et al*[5] was performed on 140 pregnant women for induction of second trimester abortion from June 2018 till December 2019.

A study by Patel *et al*[15] was done on 50 suitable women who were separated into two groups of 25 patients each, one for the case group and the other for the control group, in a study that took place at the Dhiraj General Hospital in Piparia, Waghodia. Women in the case group received 200 mg of mifepristone orally, followed by 200 μg of misoprostol intravaginally after 24 h. This process was repeated every 6 h for a total of five doses. They came to the conclusion that mifepristone plus

misoprostol is now an established, highly successful, and safe therapy for medical treatment compared with administering misoprostol (200 μg) vaginally to women in the control group for a total of five doses for abortion in the second trimester.

In agreement with our results, Vahratian *et al*[16] reported the effect of maternal obesity and overweight on the course of labor. Data from 612 nulliparous women who had full-term pregnancies and took part in the pregnancy and nutrition research from 1995 to 2002 were evaluated. For women of normal weight, overweight women, and obese women, the average duration of labor by each centimeter of cervical dilatation was calculated and used as a marker of labor progression. Their research revealed that, as compared with women of normal weight, both overweight and obese women's median labor times were considerably longer.

In agreement with our results, Kai *et al*[17] reported the effect of a patient's obstetric factors on how long an abortion was induced with gemeprost and osmotic dilatators. Data from 216 women who were hospitalized for second trimester medical abortions between 1996 and 2009, during pregnancies that lasted between 12 and 21 weeks, were examined. The median induction-abortion interval was 294 min in patients with parity more than 3 and 375 min in nonparous patients, according to the research, which found a significant link between parity more than 3 and a shorter induction-abortion period when compared with nonporous individuals. Additionally, a substantial correlation between gestational age more than 16 weeks and longer induction-abortion intervals was found.

This also goes with those of Kashanian *et al*[13] The time between the start of labor induction and the start of the active phase of labor was smaller in the dexamethasone group than in the control group in a double-blind, randomized, controlled trial on 122 nulliparous women with a full-term pregnancy and a bishop score of 7 or higher who were randomly assigned to obtain a single 8 mg of dexamethasone or placebo 6 h before the start of labor induction (3.09 + 1.5 vs. 4.21 h). Dexamethasone patients also had lower second stage of labor times (22.23 + 16.09 vs. 29.01 + 15.32 min; $p = 0.014$). They came to the conclusion that dexamethasone medication reduced the length of labor.

A study by Patel *et al*[15] compared two groups, where 25 women in the study group received 200 mg of mifepristone orally, followed by 200 μg of misoprostol vaginally after 24 h, repeated every 6 h until five doses, and 25 women in the control group received 200 μg of misoprostol vaginally, repeated every 6 h until five doses. The research revealed a substantial variation between the study group and the control group in terms of the success rate and length of hospital stay, with the study group's induction-abortion interval being shorter.

The same research also came to the conclusion that combining mifepristone pretreatment with vaginal misoprostol allowed for pregnancy termination in the second trimester and considerably shortened the time between induction and abortion.

The research also revealed that there was no statistically significant difference between the two groups in terms of preinduction hemoglobin, postinduction hemoglobin, and total estimated blood loss.

Additionally, the analysis revealed no statistically significant difference between the two groups.

5. Conclusion

The administration of dexamethasone intramuscularly (12 mg every 24 h) with the medical induction of abortion by misoprostol (200 μg intravaginally every 4 h) appears to be effective regarding shortening the induction-abortion interval (duration between the initiation of induction and expulsion of fetus), reducing the overall misoprostol dosage, and decreasing the duration of the hospitalization. Its cost-effectiveness and availability are apparent benefits.

Ethical approval

The study was approved by the Research Ethical Committee of Al-Azhar University and the patients were given all the information they need about the trial. An informed written consent was taken from each participant in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Conflict of interest

There are no conflicts of interest.

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Authorship: All authors have a substantial contribution to the article.

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