Original Research

8 am versus 8 pm labour induction with dinoprostone vaginal tablets in term pregnancies with unfavourable cervices—a randomised controlled trial

Aizura Syafinaz Ahmad Adlan[1,*], Vikneswaran Virasamy[1], Doris Ng Sin-Wen[2], Noor Azmi Mat Adenan[1]

[1] *Department of Obstetrics and Gynaecology, Faculty of Medicine, University of Malaya, 50603 Kuala Lumpur, Malaysia*

[2] *Department of Obstetrics and Gynaecology, University Malaya Medical Centre, 59100 Kuala Lumpur, Malaysia*

*Correspondence: syafinaz@ummc.edu.my (Aizura Syafinaz Ahmad Adlan)

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Background: To evaluate the feasibility of timing delivery of induction of labour cases to occur during office hours and reduce night time delivery. *Methods*: Patients scheduled for induction of labour were randomized to 8 am or 8 pm insertion of dinoprostone vaginal tablets. The main outcome measure was time of delivery between 8 am to 5 pm. The secondary outcome measures were mode of delivery and its indications, neonatal outcomes, maternal satisfaction and labour room staff satisfaction. *Results*: 164 patients were recruited with 78 patients randomized to the 8 am group and 86 patients randomized to the 8 pm group. There was no significant difference in timing of delivery between both groups, with delivery between 8 am to 5 pm for the 8 am group being 35.9% and for the 8 pm group being 44.2% (P = 0.339). For the secondary outcome measures, there was no significant difference found between mode of delivery (vaginal, instrumental or Caesarean section), neonatal Apgar score and cord blood pH, nor maternal satisfaction score based on the Likert scale. However there was a statistically significant difference (P = 0.001) for labour ward staff satisfaction based on the Likert scale, favouring the 8 pm induction timing. *Conclusion*: 8 am versus 8 pm timing for induction of labour has no significant difference to the timing of delivery during office hours, but the 8 pm induction of labour group has significantly greater labour ward staff satisfaction.

Keywords

Induction of labour; Randomized trial; Timing of delivery; Staff satisfaction

1. Introduction

Induction of labour is defined as an intervention designed to artificially initiate uterine contractions leading to progressive dilatation and effacement of the cervix, and birth of the baby. It is a common obstetric procedure that may affect up to 25% of pregnant women and indicated when the mother or fetus will benefit from a higher probability of a healthy outcome from an earlier delivery than prolonging the pregnancy [1]. The methods used during induction of labour range from pharmacological agents, mechanical devices and complementary alternative methods such as breast stimulation and castor oil [2]. If the cervix is not favourable (Bishop score $\leq$ 6) prior to induction of labour, cervical ripening agents such as prostaglandins are commonly used [3].

Traditionally, induction of labour are commenced from the morning, or may be potentially delayed if the labour room is busy. Some mothers may progress well and deliver during the daytime between 8 am to 5 pm, however some may deliver in the late evening to the early hours of the morning the next day [4]. Several studies have been done in an attempt to predict and calculate the timing of delivery for induction of labour cases [4–9]. However, due to the diversity of induction methods employed, varying results were reported [4–9]. The timing of delivery of induction of labour cases is of great interest. It is believed to benefit healthcare personnel in terms of a more even workload distribution as well as minimize staff fatigue [10–12]. It has also been shown to affect maternal and fetal outcomes [13, 14].

In the Malaysian setting and in many other countries, the labour room is looked after by the doctors on call after 5 pm until the next day, with each on call shift lasting 24 to 33 hours [15, 16]. Whilst fatigue is well established to affect performance in general, it has not been proven that health care staff exhaustion causes harm to patients clinically [17]. Nevertheless, health care personnel fatigue remains a concern with regard to potential for errors in patient's care [18]. Furthermore, in the Malaysian context, there are fewer doctors looking after these patients after 5 pm compared to office hours from 8 am to 5 pm, where the full complement of staff and consultants are in hospital and there is greater supervision of the doctors on duty [19].

Timing of delivery has also been associated with poorer neonatal outcomes in several large studies, with increases in the odds of neonatal mortality by up to 16% [20, 21]. Similarly, Gijsen *et al.* [22] reported increased risk of an adverse perinatal outcome indicated by lower Apgar scores, increased neonatal intensive care unit admission and higher mortality rates if the delivery occurred during off-hours on evenings and nights compared to similar daytime deliveries. In order to minimize this, it is prudent to optimize our labour ward management to improve outcomes for mothers and their babies, in addition to improving working conditions for our healthcare staff [19, 23].

Prior to beginning this trial, there was no study comparing morning and night time induction of labour in the Malaysian population. Various studies have been conducted in order to determine the best method of induction of labour [24–26]. Dinoprostone PGE2 vaginal tablet is one of the most commonly available prostaglandin in all major hospitals in Malaysia and is chosen in this study for that reason [27]. In addition, dinoprostone PGE2 vaginal tablets are suitable both as a ripening and an induction agent, as our study population are women with unfavourable cervices. Whilst the trial results may vary depending on the obstetric population and the staffing of labour room, the results of this trial will provide information directly relevant to clinical practice.

2. Materials and methods

This prospective, randomized controlled trial was conducted in a tertiary university teaching hospital in Kuala Lumpur from June 2016 until December 2016. The trial was registered with Malaysia's National Medical Research Register (identifier NMRR-16-262-2946 accessible at https://www.nmrr.gov.my/) and received ethics approval from University Malaya Medical Centre Medical Ethics Committee.

We hypothesized that commencing induction of labour at night at 8 pm with 3 mg dinoprostone PGE2 vaginal tablets reduced the risk of night time deliveries, and our primary outcome was timing of delivery between 8 am to 5 pm. We used the standard 8 am induction of labour as our control arm. For our secondary outcomes, we assessed if labour outcomes were improved by recording the mode of delivery as well as the indication of operative delivery, should it become necessary. Neonatal outcomes were assessed by documentation of the umbilical cord pH, the fetal Apgar score and admission into Special Care Nursery (SCN). The Likert scale was used to assess both maternal and labour room staff satisfaction of the induction process. The patient was asked to rate the statement "I am satisfied with the birth process which includes time of admission, induction of labour, time of delivery and also the post delivery period" on a scale of 1 (strongly disagree), 2 (disagree), 3 (undecided), 4 (agree), and 5 (strongly agree). The staff in charge of the induction process was asked to rate the statement "I am satisfied with the time of induction, time of delivery and overall birth process" on the scale of 1 (strongly disagree) to 5 (strongly agree) as above.

Women who were seen in our antenatal clinic and required induction of labour were identified and invited to participate in the study. The inclusion criteria were term ($\geq$ 37 weeks), singleton pregnancy in a cephalic presentation, with a normal fetal cardiotocography and a Bishop score of $\leq$ 6 on recruitment. Patients who had previous uterine surgery, history of pre-eclampsia, complicated gestational diabetes, intrauterine fetal death, fetus with known anomalies and women with known prostaglandin allergy were excluded from this trial.

Women who gave written consent to participate in the trial were sequentially given a numbered, opaque, sealed envelope containing the randomized allocation to treatment arms. The block randomization was generated by a computer random number generator in blocks of 4 or 8. Due to the nature of the intervention, it is impossible to blind the treating clinician or the patient. The study investigator was blinded to the patient's allocation. The treating clinician arranged for admission and asked the patient to come to the labour room at 7 am or 7 pm on the day of induction, depending on the allocation of the treatment arm. Demographic data such as patient's age, ethnicity, parity, BMI, indication for induction of labour and Bishop's score were recorded in case record forms.

Induction of labour was performed in the labour room by the doctor on duty by insertion of 3 mg dinoprostone tablets vaginally into the posterior fornix. Standard obstetric practice for induction of labour were applied to all parturients. Labour ward staff and postpartum patients were required to complete a questionnaire assessing their overall satisfaction with the labour process. The questionnaire answers were scored on the Likert scale. Following delivery, the time of delivery, labour and neonatal outcomes were retrieved from the patient's clinical notes.

Table 1. Sociodemographic Data.

Characteristics	8 am (n = 78)	8 pm (n = 86)	*P*-value
Age (years)	30.32 ± 4.06	31.23 ± 5.39	0.227
Parity			1.000
Primigravida	44 (56.4)	49 (57.0)	
Multigravida	34 (43.6)	37 (43.0)	
Ethnicity			0.175
Malay	47 (60.3)	43 (50.0)	
Chinese	13 (16.7)	10 (11.6)	
Indian	13 (16.7)	21 (24.4)	
Others	5 (6.4)	12 (14.0)	
BMI (kg/m^2)			0.174
< 25	21 (27.3)	13 (15.3)	
25–29.9	38 (49.3)	49 (57.6)	
$\geq$ 30	18 (23.4)	23 (27.1)	

Data expressed as mean with ± standard deviation and/or number (%).

Statistical analysis

A total of 240 patients (120 in each arm) was required to achieve 80% power to detect a difference at significance level of 0.05. Data was entered into SPSS 19 (SPSS Inc., Chicago, IL, USA). Normally distributed continuous data were analyzed with the Student's *t* test, and the Chi square test was applied for categorical data.

3. Results

A total of 240 pregnant women requiring induction of labour were recruited into this study, but only 164 patients completed the trial successfully. The 76 patients did not complete the trial because 62% delivered prior to induction of

Table 2. Labour Outcome.

Outcome	8 am (n = 78)	8 pm (n = 86)	*P*-value
Time of Delivery			0.339
8 am–5 pm (office hours)	28 (35.9)	38 (44.2)	
5 pm–8 am (after office hours)	50 (64.1)	48 (55.8)	
Time of Delivery			0.408
8 am–12 mn (before midnight)	55 (70.5)	55 (64.0)	
12 mn–8 am (after midnight)	23 (29.5)	31 (36.0)	
Mode of Delivery			0.526
SVD	49 (63.4)	47 (55.3)	
Instrumental	10 (13.0)	12 (14.1)	1.000
Fetal Distress	8 (80)	10 (83.3)	
Prolonged 2nd stage	2 (20)	2 (16.7)	
Caesarean Section	18 (23.4)	26 (30.6)	0.395
Fetal Distress	11 (61.1)	11 (42.3)	
Poor Progress	2 (11.1)	6 (23.1)	
Failed Induction of Labour	5 (27.8)	7 (26.9)	
Pre-eclampsia	0	2 (7.7)	

Data expressed as number (%).

Table 3. Neonatal Outcome.

Outcome	8 am (n = 78)	8 pm (n = 86)	*P*-value
Birth Weight (kg)	3.05 ± 0.41	3.09 ± 0.38	0.412
AS @ 1 min	8.64 ± 1.13	8.66 ± 1.14	0.920
AS @ 5 min	9.91 ± 0.59	9.86 ± 0.71	0.613
AS @ 10 min	10.00 ± 0.00	9.95 ± 0.34	0.226
Cord blood pH	7.30 ± 0.08	7.19 ± 0.70	0.151
Cord blood BE	-4.05 ± 6.70	-3.01 ± 4.46	0.263
SCN Admission			
Yes	2 (2.6)	7 (8.2)	0.175
No	76 (97.4)	79 (91.8)	

Data expressed as mean with ± standard deviation and number (%).

Table 4. Maternal Satisfaction Level.

Level	8 am (n = 78)	8 pm (n = 86)	*P*-value
Strongly Disagree	1 (1.3)	0	
Disagree	9 (11.5)	7 (8.2)	
Undecided	4 (5.1)	14 (16.5)	0.053
Agree	47 (60.3)	38 (44.7)	
Strongly Agree	17 (21.8)	26 (30.6)	

Data expressed as number (%).

Table 5. Delivering Staff Satisfaction Level.

Level	8 am (n = 78)	8 pm (n = 86)	*P*-value
Strongly Disagree	9 (11.5)	1 (1.2)	
Disagree	18 (23.1)	15 (17.6)	
Undecided	6 (7.7)	13 (15.3)	< 0.001
Agree	40 (51.3)	25 (29.4)	
Strongly Agree	5 (6.4)	31 (36.5)	

Data expressed as number (%).

labour, 21% had a Bishop score of > 6, 13% were admitted after the commencement of induction time and 4% had Caesarean section for large-for-gestational age fetus. Of the 164, 78 were randomized to the 8 am group and 86 were in the 8 pm group. There was no significant differences between the populations of the two groups, as seen in Table 1.

For the primary outcome, there was no significant difference in the timing of delivery for both study groups. The majority of patients (> 50%) delivered outside of office hours for both arms of the study, with only 35.9% of the 8 am group and 44.2% of the 8 pm group delivering during the hours of 8 am to 5 pm. There was also no significant difference between the mode of delivery, rate of Caesarean or instrumental delivery, and the indication for said deliveries, as seen in Table 2.

Neonatal outcomes were analysed based on birth weight, Apgar score at 1, 5 and 10 minutes, cord blood pH and base excess (BE) as well as Special Care Nursery (SCN) admission. There was no significant difference for the neonatal outcome between the two study arms, with more than 90% of the newborns being discharged to mother after initial assessment, as demonstrated in Table 3.

Maternal and labour room staff satisfaction were assessed using the Likert scale. The scores were analysed to identify if a preference was found for either timing. There was no significant difference between maternal satisfaction for the induction and labour process, with the 8 am group reporting score of 3.90 versus 3.98 in the 8 pm group ($P = 0.581$). Interestingly, the labour room staff satisfaction reported greater satisfaction in the 8 pm group with a score of 3.82 compared to 3.18 in the 8 am group ($P = 0.001$). The results of our findings are as illustrated in Tables 4,5.

4. Discussion

The primary objective of this trial was to analyse if it was feasible to plan more of our deliveries to occur during office hours and reduce the number of night time delivery for the benefit of the patient, neonate and the labour room staff. Though the time of delivery was not statistically significant between the two arms in terms of *P* value, 44.2% of parturients from the 8 pm group delivered within office hours, compared to 35.9% from the 8 am group. A strong positive finding could have provided the evidence and impetus to change clinical practice, however this was not achieved by this trial. Herein we realise that a larger sample trial may give a significant difference if we could achieve one.

Our secondary outcomes for this study was to improve the conditions for the mother and staff involved in the care of the mother. However, there was no statistically significant difference found in the mode of delivery, neonatal outcome, and in maternal satisfaction. What has come as a surprise was that the labour room staff were most satisfied with the 8 pm induction group, despite there not being any statistical significance in other variables. Our analysis would have

contributed more insights had we obtained more data on the contributory reasons for these preferences. Unfortunately, this data was not captured on the Likert scale.

For the patients, on the basis that there was no difference between the two group outcomes and satisfaction, the choice of time of induction could be offered to them. Some patients may opt for night time induction to be able to plan their admission and also to organize their home or work prior to coming in to the hospital, whichever is more convenient to them.

One of the strengths of our study include its prospective and randomized design. No difference between groups were observed in the baseline characteristics of the patients, making patient bias negligible. Furthermore, the data collection and analysis was done by the investigator who blinded to the patient's allocation, thus reducing the effect of bias.

One of the limitations of our study is that it is a single-blinded study, as it is impossible to blind the patient and the treating doctor to the timing of induction of labour. Secondly, we had an unexpectedly high attrition rate in this study, and there is a likelihood that the outcome of the trial may have a more favourable result statistically if a larger sample size was used. The reason for induction of labour was also not captured and analysed in this study, as we wanted the trial to represent the general population who present for induction of labour, regardless of the cause. It is possible that the indication for induction may have affected the birth timing and outcomes of the study. However, there were no statistically significant different in the baseline demographics of the patients in our trial to suggest so.

5. Conclusions

8 am versus 8 pm timing for induction of labour has no significant difference on the timing of delivery during office hours, mode of delivery, neonatal outcomes and maternal satisfaction. However, the 8 pm induction of labour group has significantly greater labour ward staff satisfaction.

Author contributions

ASAA, VV and NAMA were responsible for the conception and design of the study. All authors were involved in patient recruitment. VV contributed to the data collection and statistical analysis. ASAA and VV contributed to the data analysis and interpretation. All authors contributed to the manuscript preparation and all authors approved the final version of the manuscript.

Ethics approval and consent to participate

The trial was registered with Malaysia's National Medical Research Register (identifier NMRR-16-262-2946 accessible at https://www.nmrr.gov.my/) and received ethics approval from University Malaya Medical Centre Medical Ethics Committee (Grant No.: NMRR-16-262-2946). We have obtained with the informed consent of all participants.

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Conflict of interest

The authors declare no conflict of interest.

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