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ORIGINAL ARTICLE

The effect of uterine fundal pressure on the duration of the second stage of labor: A randomized controlled trial

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Abstract

Objective. To determine the effect of uterine fundal pressure on shortening the second stage of labor and on the fetal outcome. *Design*. Randomized controlled trial. *Setting*. Teaching and research hospital. *Sample*. One hundred ninety-seven women between 37 and 42 gestational weeks with singleton cephalic presentation admitted to the delivery unit. *Methods*. Random allocation into groups with or without manual fundal pressure during the second stage of labor. *Main outcome measures*. The primary outcome measure was the duration of the second stage of labor. Secondary outcome measures were umbilical artery pH, HCO_3^-, base excess, pO_2, pCO_2 values and the rate of instrumental delivery, severe maternal morbidity/mortality, neonatal trauma, admission to neonatal intensive care unit, and neonatal death. *Results*. There were no significant differences in the mean duration of the second stage of labor and secondary outcome measures except for mean pO_2 which was lower and mean pCO_2 which was higher in the fundal pressure group. Nevertheless, the values still remained within normal ranges and there were no neonates with an Apgar score <7 in either of the groups. *Conclusion*. Application of fundal pressure on a delivering woman was ineffective in shortening the second stage of labor.

Key words: *Uterine fundal pressure, Kristeller maneuver, second stage of labor, neonatal outcome, umbilical cord blood gas analysis*

Introduction

Fundal pressure during the second stage of a vaginal delivery is a controversial maneuver. Also known as the 'Kristeller maneuver', it is the application of manual pressure on the uppermost part of the uterus towards the birth canal in an attempt to shorten the second stage of labor (1). Although it is not known whether fundal pressure is of benefit during the second stage of labor, it is frequently used (2). The most common clinical indications are fetal distress, failure to progress in the second stage of labor and/or maternal exhaustion or medical conditions when prolonged pushing is contraindicated, such as maternal heart disease (1,3).

The use of fundal pressure varies and seems to be routine practice during delivery in low and middle income countries, while used in the second stage of labor at 84% of the obstetric services in the USA, in only 11% of cases this was documented in the patient's charts, which may reflect the controversial nature of this maneuver (1,4). There seems to be no evidence that fundal pressure is an efficacious and safe technique to shorten the second stage. No data could be found on a MEDLINE search with the keywords of 'second stage of labor, uterine fundal pressure, Kristeller maneuver'. Although several anecdotal reports suggest that it is associated with maternal–fetal complications, such as uterine rupture, amniotic fluid embolism, maternal anal sphincter lacerations, fetal fractures, brain damage, and spinal cord injuries, such information may not be published for medico-legal reasons (5–10). Such untoward effects of fundal pressure could possibly be explained by excessive forces generated during its

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use together with the Valsalva maneuver. Fundal pressure together with the Valsalva maneuver applied during the uterine contraction increased the intrauterine pressure by 86% over baseline (11).

We evaluated if the use of fundal pressure is effective in shortening the second stage of labor and examined the related neonatal and maternal outcomes.

Material and methods

Informed written consent was obtained from all participating women and the study was approved by the local ethics committee, but the study was not pre-registered in a clinical trial registry. All participants were between 37 and 42 weeks gestation with singleton cephalic presentation and none had any medical or obstetrical problems. Neither epidural nor combined spinal–epidural analgesia was used. All women remained alert and responsive throughout their labor. Sample size calculation was performed to avoid type II error. Prior to the study, a lowest meaningful reduction of ≥ 5 minutes in the duration of second stage was agreed upon and 63 women in each group was calculated as providing 80% power to demonstrate that difference when the level of significance was set to 5%. At our institute, the annual number of deliveries is around 3,100 with a 30% cesarean section rate and the average number of vaginal deliveries per month is 175–200. Since some dropouts and denials to participate in the study were expected, we decided to include all of the consecutive women with uncomplicated vaginal deliveries during a one-month period as study subjects and the randomization was done for an expected number of 200 vaginal deliveries. Out of a total of 283 deliveries, 75 were excluded before the second stage by cesarean section, three were postterm pregnancies, seven were preeclamptic and one was a diabetic mother. The remaining 197 women all accepted to participate and were randomly allocated to two groups: intervention ($n = 94$) and control ($n = 103$) by using a computer-generated random number chart (SPSS Version 11.0 for Windows, Inc., Chicago) before the study. In all 200 consecutive patients, numbers were written on envelopes, while the allocation data were entered on separate papers that were put into the numbered envelopes which were then sealed. When the woman was admitted to the delivery ward and met the inclusion criteria, she signed the informed consent form and was given her participation number. When the woman had reached the second stage, the envelope with the participation number on its cover was opened to reveal the randomization and the obstetrician was informed whether fundal pressure was to be applied or not.

Fundal pressure was applied manually with one of the provider's forearms pressed on the uppermost part of the uterus at a 30–45° angle to the maternal spine in the direction of the pelvis. Fundal pressure was applied by obstetricians concomitant with each uterine contraction when the cervix was fully dilated and the woman felt a spontaneous urge to push down, until delivery of the fetal head. Vaginal examinations were done every 30 minutes when the cervix reached 8 cm dilatation. If the woman felt a strong urge to push down, the examination was performed earlier. By increasing the frequency of vaginal examinations, we tried to estimate the most approximate point of the start of the second stage. Additionally, we tried to control for other confounders affecting the duration of second stage such as use of uterotonics. Oxytocin for induction or augmentation purposes was used during the first stage of labor in 13/94 patients in the study and in 18/103 patients in the control group. When the women reached full dilatation and a spontaneous urge to push (start of the second stage), the oxytocin infusion was stopped.

The second stage was defined as the time (in minutes) between the cervix being fully dilated together with the spontaneous urge to push and to expulsion of the fetus. Umbilical artery blood was sampled immediately following delivery. A 10–20 cm segment of umbilical cord was clamped with two clamps near the neonate and two near the placenta. The cord was cut between the two proximal and two distal clamps. Blood was drawn from the umbilical artery closest to the clamp on the neonatal side into a 1–2 ml heparinized syringe. The needle was capped and the sample immediately transported to the laboratory to be analyzed (Bayer™ RapidLab 865 full-automatic co-oxymetry blood gas analyzer, Bayer, Germany).

Duration of the second stage was the primary outcome measure. Umbilical artery pH, HCO_3^-, base excess, pO_2 and pCO_2 values, Apgar scores after five minutes, the rate of spontaneous vaginal delivery, instrumental delivery, soft tissue damage (perineal, vaginal, anal sphincter), severe maternal morbidity/mortality, neonatal trauma (fractures, hematoma), admission to neonatal intensive care unit and neonatal death were secondary outcome measures. For the data analysis, the SPSS 11.0 (SPSS Inc., Chicago, IL, USA) statistical package was used. Comparisons of the variables between the control and the study groups were performed by the student *t*- and Pearson chi-squared tests. Measurements were considered significantly different at a

p-value of <0.05 and 95% confidence limits were used for the difference between two means to indicate the variability the difference would have in other samples.

Results

Body mass index and birthweight were not different between the intervention and control groups, but women in the study group were 2.3 years younger and there were fewer nulliparous women in the intervention group than in the control group (Table I). One woman each in the groups had to be delivered by cesarean section due to failure to progress in the second stage, and one in the intervention group had to be delivered by vacuum extraction due to fetal distress, leaving 194 women for analysis by intention-to-treat for the primary outcome. Umbilical cord blood gas analysis could be performed in only 179 women due to inadequate sample collection in nine and blood clotting in six samples. Data from the 197 women and neonates was analyzed for the remaining secondary outcome measures. The details of the allocation, randomization, and intention-to-treat analysis are shown in Figure 1.

The difference between the mean duration of second stage was not significant between the intervention and control groups (Table I). There was no difference in the rate of oxytocin use between the groups ($p=0.48$). Since the groups were not homogenous in terms of parity, we compared the mean duration of the second stage separately in the nulliparous and multiparous women. There was no difference between the mean duration of the second stage among the intervention and control groups in the nulliparous and multiparous women (Table II).

There was no difference in the mean umbilical artery pH, HCO_3^- and the base excess between the two groups (Table II), but the mean pO_2 was lower whereas the mean pCO_2 was higher in the intervention group compared to the control group (Table II). No neonates had an Apgar score of <7. There was no difference between the rate of spontaneous vaginal delivery, severe maternal morbidity/mortality, neonatal trauma, admission to neonatal intensive care unit, and neonatal death among the two groups.

Table I. Comparison of demographic characteristics.

	Control group ($n=103$)	Study group ($n=94$)	*p*-Value*
Age (yr)	26.68 ± 5.69	24.41 ± 5.33	0.007
BMI** (kg/m^2)	27.49 ± 4.32	27.17 ± 4.32	0.63
Birthweight (g)	3241 ± 436	3308 ± 438	0.31
Nulliparity (%)	54% (56/103)	36% (34/94)	0.009

Data are presented as mean $\pm$ SD.
*Unpaired student *t*-test and Pearson chi-square test.
**BMI: Body mass index.

Discussion

The present study may be the first randomized trial to evaluate the effect of manual fundal pressure on the duration of the second stage of labor. Our results do not support the general belief in and almost routine practice of fundal pressure as being effective in shortening the second stage of labor. However, our study has some limitations. The mean duration of the second stage in both groups was shorter than the median time usually reported but the mean duration of labor, including the second stage, is highly variable and can be explained by ethnic, genetic, and cultural backgrounds of the study populations (12,13). It is furthermore difficult to define the start of the second stage. In order to overcome this, we examined the women frequently after 8 cm dilatation. The commencement of spontaneous pushing is also not easy to define. These factors might explain the shorter duration of the second stage in our study population. On the other hand, epidural or combined spinal–epidural analgesia was not used for any of the participants. We cannot determine if in a different clinical setting with epidural use, fundal pressure might have an effect on the duration of the second stage. The only other similarly designed randomized study addressed the effect of fundal pressure in nulliparous women with an epidural (14). The authors used an inflatable obstetric belt (not manual pressure) to increase intraabdominal pressure during bearing down efforts in the second stage of labor, but no significant difference in the duration of the second stage was noted. In one other observational study of 34 deliveries, Cosner et al. (3) reported an even longer second stage of labor and a higher incidence of third- and fourth-degree perineal lacerations in women who had fundal pressure applied, compared with those who delivered spontaneously.

Our study population was not randomized in terms of parity. There were more nulliparous women in the intervention group than in the control group. This bias emerged from the nature of randomization. The effort to allocate variables to be equally distributed in each group might have a detrimental effect on the randomization. Unless the sample size reaches to thousands, one should not expect to see all variables to be located in each group in the same amounts. In our randomized trial, it is natural that some variables may have distributed heterogeneously and the question is whether this difference in these

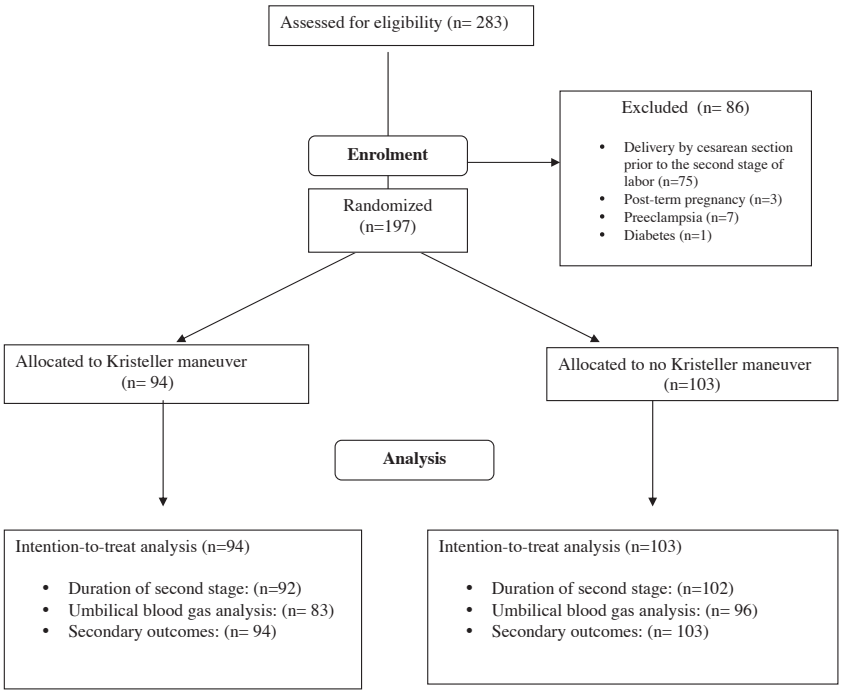

Figure 1. Flow of study participants (number of patients are shown in parentheses).

variables has any effect on the outcomes. The answer can be achieved by adjustment for heterogeneous variables. Consequently, subgroup analysis did not reveal a difference related to the parity, but there were only a total of 90 nulliparous and 107 multiparous women in our study which were insufficient for the level of required 80% power.

Neonatal outcome was good in both groups with no cord blood pH lower than 7.2 and mean HCO_3^- and the base excess values were also within the normal ranges. Therefore, the use of fundal pressure does not seem to have an adverse effect on the short-term neonatal outcome as reported before (11,14). This study is the first to evaluate the relation between fundal pressure and umbilical blood gas analysis. A lower mean pO_2 and higher mean pCO_2 might be caused by umbilical cord compression or functional alterations in the placental intervillous space increasing risk of fetal hypoxemia and asphyxia, but intrauterine pressure increase related to the use of fundal pressure was not measured and may have been different between the doctors (15). These aspects need further study with simultaneous measurement of intrauterine pressure.

As a conclusion, uterine fundal pressure seems not to shorten the second stage of labor appreciably, but

Table II. Comparison of the outcome measures.

	Control group ($n=103$)	Study group ($n=94$)	p-Value*	95% Confidence interval of the difference
Duration of the second stage of labor (minute)	17.4±10.9	16.6±9.4	0.617	−2.236 to 3.756
Duration of the second stage of labor in nulliparous (minute)	23.1±12.2	18.6±9.5	0.08	−0.534 to 9.55
Duration of the second stage of labor in multiparous (minute)	14.5±9.1	13.9±8.5	0.617	−2.827 to 4.007
UA** pH	7.30±0.15	7.27±0.12	0.139	−0.009 to 0.075
UA HCO_3^- (mEq/L)	23.55±3.92	24.01±2.99	0.378	−1.495 to 0.570
UA base excess (mEq/L)	−2.69±6.11	−2.76±4.34	0.931	−1.504 to 1.643
UA pO_2 (mmHg)	22.15±11.24	17.19±7.35	0.001	2.165 to 8.008
UA pCO_2 (mmHg)	47.24±11.24	53.20±12.62	0.000	−9.323 to −2.962
Episiotomy	51 (49.5%)	56 (59.5%)	0.178	

Data are presented as mean±SD.
*Unpaired student t-test and Pearson chi-square test.
**UA: Umbilical artery.

appears innocuous as far as maternal and fetal short-term effects indicate.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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