

## Pushing techniques in the second stage of labour

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### Pushing techniques in the second stage of labour

It is routine to require women to 'take a deep breath in, hold it and push' in the second stage of labour, but there is no scientific evidence to support this practice. In a randomized controlled trial of spontaneous ( $n = 15$ ) versus directed ( $n = 17$ ) pushing in the second stage, no adverse effects of spontaneous pushing on the woman or baby were found. There was a negative correlation between the length of the second stage and the venous cord blood pH at delivery in the directed pushing group, suggesting that a long second stage was disadvantageous to the fetus when the woman was using a directed pushing technique. No such association was found in the spontaneous pushing group, despite the fact that the women in this group had a significantly longer mean second stage.

## INTRODUCTION

'Take a deep breath, hold it and push' is the instruction given by midwives and obstetricians to women in the second stage of labour in the English-speaking Western world (Beischer & Mackay 1986, Bethea 1973, Moore 1983, Myles 1985). This management of the woman in the second stage has been practised since at least the beginning of this century (Galabin 1904) but there is no scientific basis for it (Thomson 1988, 1990).

Despite assurances in textbooks that the expulsive urge in the second stage is involuntary (e.g. Myles 1964, Sweet 1984), it is claimed that women have to use their voluntary powers as well (e.g. Towler & Butler-Manuel 1973, Sweet 1984). In order to use these voluntary powers, the woman is required to 'take a deep breath, hold it for as long as possible and push down' (e.g. Myles 1964, Reeder *et al.* 1980). The woman is also told to push as though she was opening her bowels (e.g. Garland & Perkes 1959, Beischer & Mackay 1986).

When anyone 'takes a deep breath and holds it' a Valsalva manoeuvre is instituted (Bell *et al.* 1980, Fishman

1986). As the breath is taken and held, the intra-thoracic pressure is increased and the return of the blood from the lower limbs is impaired. There is an initial increase followed by a marked decrease in blood pressure which does not return to within normal limits until after the breath has been released. It is known that a decrease in blood pressure in labour is disadvantageous to the fetus. Bassell *et al.* (1980) and Knauth & Haloburdo (1986) found that the use of the 'breath-holding-pushing' technique during the second stage of labour results in aorto-caval compression and a reduction in the rate of the utero-placental blood flow, and thus compromises the fetus. Caldeyro-Barcia *et al.* (1981) found that when a pushing effort was sustained for 9 to 15 seconds, there were significant decelerations in the fetal heart rate.

When comparing directed pushing (as described above) with spontaneous pushing in primiparae, Beynon (1957) showed a reduction in the instrumental delivery rate from 12% to 6% and in the proportion of women requiring perineal repair from 60% to 40%. However, the study has methodological flaws in that it was not a randomized controlled trial and the sizes of the sample groups are very different.

### **Aim of study**

The aim of the pilot study reported here was, firstly, to assess whether spontaneous pushing activity in the second stage of labour increases its duration, the incidence of instrumental delivery, the incidence of perineal trauma or the need for resuscitation of the baby at birth when compared with a directed pushing technique. Secondly, does a spontaneous pushing activity in the second stage of labour increase women's dissatisfaction with the second stage?

### **METHODS**

The study design was a randomized controlled trial to compare a spontaneous pushing technique with the directed pushing method that has become custom and practice. Data were collected on variables so that the comparability of the two groups could be assessed, as well as the outcome of the treatment method. Three previous randomized controlled trials where midwives have been administering treatment have had problems in ensuring reliability of group allocation (Drayton & Rees 1989, Gardossi 1988, Romney & Gordon 1981). In order to ensure reliability of group allocation, AMT was present for all the second stages.

#### **Inclusion criteria**

In order to exclude possible confounding variables, the inclusion criteria were: willing to take part; aged 18 or over; primiparous; singleton pregnancy; > 37 weeks gestation; cephalic presentation; no epidural analgesia; no maternal condition (obstetric or medical) which would affect the management of the second stage; no fetal condition which would affect the management of the second stage.

To avoid potential bias from emotional and psychological factors, women were not invited to participate where conception had been achieved in-vitro, where the baby was to be adopted or where a 'care order' was to be taken out on the baby after delivery.

As the use of an epidural for analgesia was an exclusion criterion, women were not recruited into the study until the cervical os was known to be at least 6 cm dilated. This was to prevent women being recruited into the study early in labour and then being withdrawn when an epidural was used. It was felt that this might have implied censorship of the woman for using epidural analgesia.

#### **Conduct of the study**

When the second stage was diagnosed, the midwife caring for the woman was given a sealed piece of paper which contained the group allocation and the instructions. The instructions for the subjects in the experimental group

were that the woman was to be encouraged only in spontaneous pushing activity. The women in the control group were to be told to 'take a deep breath, hold it and push for as long as possible'. Should the push run out before the contraction ceased, the woman was to repeat the exercise.

For both groups the following instructions were given to the midwife:

If delivery is not imminent in 90 minutes please adopt whatever clinical management you and the woman think fit. If you are concerned about maternal and/or fetal well-being at any time please discontinue the trial and institute normal clinical management for that situation.

If the woman requested, the trial could be discontinued at any time without detriment to her treatment.

Cord blood was taken, immediately after the cord was clamped and cut, to measure blood gas levels and acid base status. Active management of the third stage of labour was carried out following all the deliveries. After delivery the women were asked to complete a 10 cm visual analogue scale (VAS) for five questions on their views of the second stage of labour.

Data were coded and put onto the Amdhal computer. Analysis was performed using SPSSX. For continuous data Students' *t*-test was used where the data were normally distributed. Pooled variance estimate was used when the variance was equal, separate variance estimate when the variance was unequal. When the data were not normally distributed the Mann-Whitney U-test was used. Chi-squared test was used to assess the difference between proportions. The Spearman rank correlation was used to assess the relationship between variables. Confidence intervals of the difference between means were calculated at the 95% level.

#### **Reliability of group allocation**

None of the midwives caring for women in the experimental (spontaneous pushing) group asked the women to 'take a deep breath, etc.' However, after delivery two midwives spontaneously said that they felt that if A.M.T. had not been present they might have been tempted to resort to the directed pushing instructions.

In the control group one midwife, on diagnosing the second stage of labour, told the woman that she did not want her (the woman) to push for an hour as the baby's head was high and the wrong way round. At the end of the hour the midwife followed the group instructions correctly. Although the midwives gave the instructions to the remaining women in the control group in a variety of ways, all of them gave the correct instructions.

**Table 1** Comparability of experimental and control groups

|   | Experimental group<br>( <i>n</i> = 15) | Control group<br>( <i>n</i> = 17) | Test statistic     | Degrees of freedom | <i>P</i> |
|---|--|-----------------------------------|--------------------|--------------------|----------|
| Age (years)                                   |  |                                   |                    |                    |          |
| Mean (SD)                                     | 21.5 (4.2)                             | 23.6 (3.9)                        | <i>t</i> = -1.53   | 30                 | 0.137    |
| Range   | 18-30                                  | 18-30                             |                    |                    |          |
| Ethnic origin ( <i>n</i> ) (Caucasian)        | 12                                     | 14                                | $\chi^2 = 0.029$   | 1                  | 0.8649   |
| Place of own birth ( <i>n</i> ) (UK)          | 13                                     | 15                                | $\chi^2 = 0.0179$  | 1                  | 0.8935   |
| Pre-delivery Hb (g/dl)                        |  |                                   |                    |                    |          |
| Mean (SD)                                     | 11.3 (0.774)                           | 11.3 (0.695)                      | <i>t</i> = -0.22   | 30                 | 0.826    |
| Range   | 10-12.5                                | 10.5-13.3                         |                    |                    |          |
| Gestational age (weeks)                       |  |                                   |                    |                    |          |
| Mean (SD)                                     | 39.9 (1.2)                             | 39.8 (0.8)                        | <i>z</i> = -0.2596 |                    | 0.7952   |
| Range   | 38-42                                  | 38-41                             |                    |                    |          |
| Onset of 1st stage of labour<br>(spontaneous) | 13                                     | 12                                | $\chi^2 = 1.2054$  | 1                  | 0.5032   |
| Duration of first stage of labour (hours)     |  |                                   |                    |                    |          |
| Mean (SD)                                     | 12.32 (5.13)                           | 7.88 (2.622)                      | <i>t</i> = 3.02    | 30                 | 0.0053   |
| Range   | 4.72-19.25                             | 3.62-12.5                         |                    |                    |          |
| Use of entonox (yes)                          | 10                                     | 8                                 | $\chi^2 = 1.2449$  | 1                  | 0.448    |
| Use of pethidine (yes)                        | 11                                     | 7                                 | $\chi^2 = 3.3483$  | 1                  | 0.0673   |
| Diagnosis of 2nd stage at VE ( <i>n</i> )     | 9                                      | 10                                | $\chi^2 = 0.0511$  | 1                  | 0.816    |
| Sex of baby (girls)                           | 6                                      | 8                                 | $\chi^2 = 1.9919$  | 1                  | 0.9333   |
| Baby birthweight (g)                          |  |                                   |                    |                    |          |
| Mean (SD)                                     | 3428 (311)                             | 3382 (458)                        | <i>t</i> = 0.33    | 30                 | 0.747    |
| Range   | 2940-4040                              | 2720-4530                         |                    |                    |          |

However, not all of the women followed the instructions. Two women did not take a deep breath and used open and closed glottis pushing and two women did take a deep breath in but then used little short sharp pushes instead of long sustained ones. For the purpose of analysis these women have been retained in the original groupings (Armitage & Berry 1987).

Permission to undertake the study was given by the Division of Obstetrics and Gynaecology and the District Health Authority Research Ethics Committee.

## RESULTS

Thirty-two women were recruited into the study. Using a table of random numbers, 15 were allocated to the experimental group and 17 to the control group.

### Comparability of groups

The age range in both groups was 18-30 years, with a mean of 21.5 in the experimental group, and 23.6 in the

**Table 2** Pethidine score between the two groups

| Pethidine score | Experimental group<br>( <i>n</i> = 15) | Control group<br>( <i>n</i> = 17) |
|-----------------|--|-----------------------------------|
| 0               | 4                                      | 11                                |
| 1.5             | —                                      | 1                                 |
| 2               | 7                                      | 4                                 |
| 3               | 3                                      | —                                 |
| 5               | 1                                      | 1                                 |

*z* = -1.7967, *P* = 0.0724, CI = -0.7 to -0.06.

control group (Table 1). There was no difference in the proportion of those who were Caucasian or in those who had been born in the United Kingdom. The mean length of gestation was 39.9 weeks in the experimental group and 39.8 in the control group, with respective ranges of 38-42 and 38-41.

**Table 3** Outcomes of variables in the experimental and control groups

|   | Experimental group<br>(n = 15) | Control group<br>(n = 17) | Test statistic    | Degrees of freedom | P      | 95% Confidence intervals |
|---|--------------------------------|---------------------------|-------------------|--------------------|--------|--------------------------|
| Duration of second stage (min)                        |                                |                           |                   |                    |        |                          |
| Mean (SD)   | 121.4 (58.4)                   | 58 (42)                   | $t = 3.455$       | 30                 | 0.002  | 26.5–99.5                |
| Range   | 23–227                         | 19–146                    |                   |                    |        |                          |
| Mode of delivery (n) (normal)                         |                                |                           |                   |                    |        |                          |
|   | 12                             | 15                        | $\chi^2 = 0.0232$ | 1                  | 0.8788 | –0.3–0.2                 |
| Estimated blood loss (ml)                             |                                |                           |                   |                    |        |                          |
| Mean (SD)   | 252 (169)                      | 250 (184)                 |                   |                    |        |                          |
| Range   | 50–700                         | 50–800                    | $z = -0.3049$     |                    | 0.7605 | –126.4–130               |
| Perineal trauma: need for repair                      |                                |                           |                   |                    |        |                          |
|   | 11                             | 10                        | $\chi^2 = 0.2396$ | 1                  | 0.6305 | –1–0.8                   |
| Condition of baby at delivery: need for resuscitation |                                |                           |                   |                    |        |                          |
|   | 5                              | 6                         | $\chi^2 = 0.0657$ | 1                  | 0.7936 | –0.3–0.5                 |

**Table 4** Cord venous blood gas values at delivery in the experimental and control groups

|                           | Experimental group<br>(n = 15) | Control group<br>(n = 17) | Test statistic | Degrees of freedom | P      | 95% Confidence intervals |
|---------------------------|--------------------------------|---------------------------|----------------|--------------------|--------|--------------------------|
| pH                        |                                |                           |                |                    |        |                          |
| Mean (SD)                 | 7.28 (0.14)                    | 7.331 (0.02)              | $t = -1.36$    | 30                 | 0.184  | –0.1–0.2                 |
| Range                     | 6.827–7.406                    | 7.130–7.434               |                |                    |        |                          |
| pCO <sub>2</sub> (mmHg)   |                                |                           |                |                    |        |                          |
| Mean (SD)                 | 39.093 (9.247)                 | 37.147 (8.219)            | $t = 0.63$     | 30                 | 0.533  | –4.4–8.2                 |
| Range                     | 18.6–55.1                      | 21.5–57.7                 |                |                    |        |                          |
| pO <sub>2</sub> (mmHg)    |                                |                           |                |                    |        |                          |
| Mean (SD)                 | 28.687 (6.484)                 | 29.994 (6.709)            | $t = 0.56$     | 30                 | 0.58   | –6.1–3.5                 |
| Range                     | 15.9–42.0                      | 15.0–46.5                 |                |                    |        |                          |
| HCO <sub>3</sub> (mmol/l) |                                |                           |                |                    |        |                          |
| Mean (SD)                 | 18.347 (4.348)                 | 19.229 (2.65)             | $t = -0.7$     | 30                 | 0.488  | –3.4–1.7                 |
| Range                     | 8.5–23.0                       | 12.7–23.0                 |                |                    |        |                          |
| Base excess (mmol/l)      |                                |                           |                |                    |        |                          |
| Mean (SD)                 | –7.727 (6.443)                 | –5.594 (2.814)            | $t = 0.932$    | 30                 | 0.6386 | –1.8–5.2                 |
| Range                     | –27.1––1.6                     | –11.1––0.4                |                |                    |        |                          |

The groups were comparable on the following variables: pre-delivery haemoglobin levels, onset of the first stage of labour (spontaneous, accelerated or induced) use of entonox, use of pethidine, use of Fentazin, whether the woman had an intravenous infusion, presence of ketonuria, how the second stage of labour was diagnosed, sex of the baby and baby birthweight (see Table 1).

However, there was a significant ( $P = 0.0053$ ) difference between the groups in the length of the first stage of labour (Table 1). The mean length of the first stage in the experimental group was 12.32 hours, whereas in the control group it was 7.88 hours.

A pethidine score was computed using 50 mg = 1. There was a trend for the women in the experimental group to have

**Table 5** Scores on visual analogue scales of views of the second stage of labour between the experimental and control groups

|  | Experimental group | Control group | Test statistic     | Degrees of freedom | P      | 95% Confidence intervals |
|--|--------------------|---------------|--------------------|--------------------|--------|--------------------------|
| What was the pushing part of your labour like?   | <i>n</i> = 14      | <i>n</i> = 16 |                    |                    |        |                          |
| Mean (SD)  | 3.814 (4.365)      | 5.669 (3.350) | <i>z</i> = -1.2903 |                    | 0.197  | -4.8-1                   |
| Range  | 0-11.1             | 0.4-9.8       |                    |                    |        |                          |
| To what extent were you actually able to help to make your baby arrive more quickly in labour?                         | <i>n</i> = 14      | <i>n</i> = 17 |                    |                    |        |                          |
| Mean (SD)  | 6.514 (3.737)      | 7.394 (2.235) | <i>t</i> = -0.81   | 29                 | 0.423  | -3-1.3                   |
| Range  | 0-10.5             | 2.4-10.0      |                    |                    |        |                          |
| How satisfied do you feel with the way you coped during the pushing part of your labour?                               | <i>n</i> = 14      | <i>n</i> = 17 |                    |                    |        |                          |
| Mean (SD)  | 7.764 (3.468)      | 6.853 (2.651) | <i>z</i> = -1.6914 |                    | 0.908  | -0.1-1.1                 |
| Range  | 0.0-10.7           | 0.4-10.0      |                    |                    |        |                          |
| What was the delivery of your baby like?   | <i>n</i> = 14      | <i>n</i> = 17 |                    |                    |        |                          |
| Mean (SD)  | 4.507 (4.415)      | 6.453 (2.917) | <i>t</i> = -1.4143 | 29                 | 0.1647 | -4.6-0.8                 |
| Range  | 0.0-10.7           | 2.0-10.0      |                    |                    |        |                          |
| How satisfied do you feel with the care you received from the staff caring for you in the pushing part of your labour? | <i>n</i> = 14      | <i>n</i> = 17 |                    |                    |        |                          |
| Mean (SD)  | 9.55 (0.616)       | 8.682 (2.13)  | <i>z</i> = -1.3039 |                    | 0.1923 | -0.7-1.1                 |
| Range  | 8.0-10.7           | 1.4-10.08     |                    |                    |        |                          |

**Table 6** Spearman rank correlations for total sample (*n* = 32)

Duration of first and second stages

$r = 0.4081$ ,  $P = 0.01$ , CI = 0.13-0.63

Duration of first stage and pethidine scores

$r = 0.5678$ ,  $P = 0.0001$ , CI = 0.33-0.74

Duration of second stage and pethidine scores

$r = 0.3204$ ,  $P = 0.037$ , CI = 0.03-0.56

used pethidine more than the women in the control group but the difference did not quite reach the level of statistical significance, although the confidence intervals appear to support the idea of a difference (Table 2). However, as shown in Table 2, the distribution of values is skewed and

confidence intervals based on the normal distribution are of doubtful value.

### Outcome of treatment

There was no difference in outcome for the type of delivery, perineal trauma rate, estimated maternal blood loss, whether the baby needed resuscitation at delivery (Table 3), cord venous blood gas levels and acid base status (Table 4) between the two groups. However, there was a significant ( $P = 0.002$ ) difference between the groups in the length of the second stage. In the experimental group the mean length of the second stage was 121.4 minutes and, in the control group, it was 58 (Table 3).

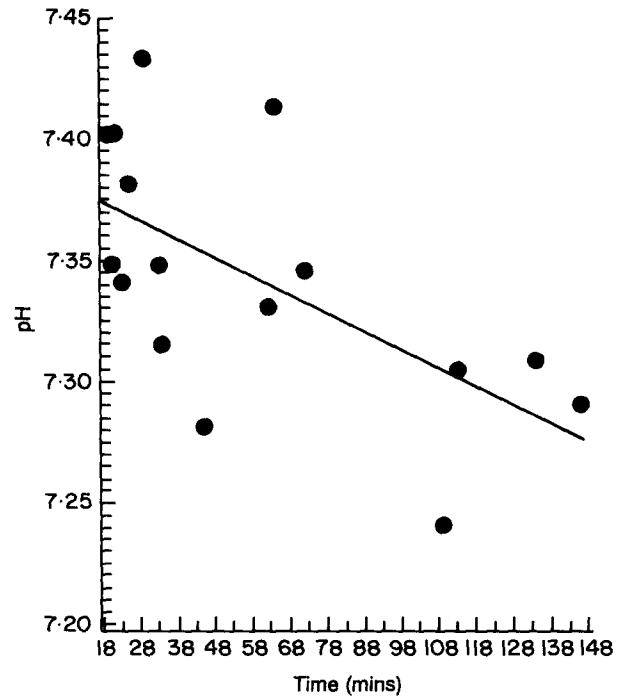
**Table 7** Spearman rank correlation coefficients between the duration of the second stage and the cord venous blood gas values in the experimental and control groups

|                        | Experimental group<br>(n = 15) | Control group<br>(n = 17) |
|------------------------|--------------------------------|---------------------------|
| <b>pH</b>              |                                |                           |
| r                      | -0.3128                        | -0.596                    |
| P                      | 0.128                          | 0.006                     |
| CI                     | -0.66-0.15                     | -0.81--0.24               |
| <b>pCO<sub>2</sub></b> |                                |                           |
| r                      | 0.1143                         | 0.3961                    |
| P                      | 0.343                          | 0.058                     |
| CI                     | -0.34-0.53                     | -0.02-0.7                 |
| <b>pO<sub>2</sub></b>  |                                |                           |
| r                      | -0.3                           | -0.3951                   |
| P                      | 0.139                          | 0.058                     |
| CI                     | -0.66-0.16                     | -0.7-0.02                 |
| <b>HCO<sub>3</sub></b> |                                |                           |
| r                      | -0.0322                        | 0.0245                    |
| P                      | 0.455                          | 0.463                     |
| CI                     | -0.47-0.42                     | -0.39-0.44                |
| <b>BE</b>              |                                |                           |
| r                      | 0.1448                         | 0.3141                    |
| P                      | 0.303                          | 0.11                      |
| CI                     | -0.32-0.55                     | -0.12-0.64                |

When indicating their views on the five questions about the second stage of labour on the VAS, not all women responded to all the questions and in responding some women made their cross beyond the 10 cm mark. There was no significant difference in the scores recorded by the women in the two groups (Table 5).

Using a Spearman rank correlation for the total sample (32) there was a significant positive correlation between the length of the first stage of labour and the length of the second stage (Table 6). A Spearman rank correlation of the pethidine scores for the total sample with the lengths of both the first and second stages showed a significant positive correlation for both (Table 6). This showed that there was a relationship between a long first stage and a long second stage and a relationship between increasing amounts of pethidine and a longer first and second stage.

A Spearman rank correlation between the length of the second stage and the cord venous blood gases showed a significant ( $P=0.006$ ) negative correlation between the length of the second stage and the pH in the control (directed pushing) group (Table 7). Thus, in the control group a longer second stage was associated with a



**Figure 1** Venous cord blood pH by length of the second stage of labour in the control group.

reduction in the pH of the venous cord blood (Figure 1). No such correlation existed in the experimental group despite the fact that the women in this group had a significantly longer mean second stage.

## DISCUSSION

The study reported here is a pilot study of a randomized controlled trial comparing directed with spontaneous pushing in the second stage of labour. The advantage of this study is that reliability of group allocation was achieved for all second stages.

The spontaneous pushing technique was not found to be dangerous to mother and/or baby. Wood *et al.* (1973) and Piquard *et al.* (1989) found that prolongation of the second stage of labour adversely affected cord blood values at delivery. However, in both studies the women were delivered supine, a position known to be disadvantageous to the fetus (Carpenter 1977, Humphrey *et al.* 1973, Humphrey *et al.* 1974). Although the pH values in this study remained within the normal range, it would appear that a prolonged second stage was only disadvantageous to the fetus if the mother was using a directed pushing technique.

There was no difference between the two groups on the women's views of the second stage. It is interesting that

some of the women scored their views of the second stage beyond the 10 cm mark on the VAS. After a similar finding when investigating pain in labour, Niven (1986) suggested that the VAS may lack the sensitivity to allow labouring women to express the extent of their feelings.

Although the mean duration of the second stage in the experimental group was twice that of the second stage in the control group, the mean duration of the first stage was longer in the experimental group. There was a positive correlation between the duration of the first and second stages. There was also a positive correlation between the amount of pethidine used and the duration of both the first and second stages.

Therefore, it is suggested that in this study the increase in the duration of the second stage in the experimental group (spontaneous pushing) cannot necessarily be attributed to the effect of the pushing technique. Further research, using a much larger sample, is needed to assess whether a spontaneous pushing technique can reduce the proportion of women requiring instrumental delivery as suggested by Beynon (1957).

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