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Delivery in an obstetric birth chair: a randomized controlled trial

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Abstract

Objective—To determine whether nulliparae whose second stage of labour is conducted in an obstetric birth chair have a lower incidence of instrumental delivery than those using a conventional delivery bed.
Design—Randomized controlled trial using sealed, opaque envelopes for allocation.
Setting—Delivery ward in a busy teaching hospital.
Patients—1250 nulliparae with a singleton live fetus with cephalic presentation, without epidural anaesthesia, who had achieved full dilatation.
Intervention—Intention to conduct second and third stages of labour in either the Birth-EZ chair or the conventional delivery bed, as randomly allocated.
Main outcome measures—Primary measure: vaginal operative delivery; principal secondary measures: duration of second stage, perineal trauma, blood loss, women's views, and neonatal status.
Results—Delivery in the birth chair did not result in a reduction in operative delivery, overall. However, there was a reduction in vaginal operative delivery for fetal heart rate abnormality. There was no beneficial effect on perineal trauma or puerperal perineal pain. Post-partum haemorrhage was more frequent in the birth chair group.
Conclusions—Delivery in the birth chair does not offer any obvious advantage to women over delivery on a bed.

Women giving birth in institutions in the Western world are commonly expected to adopt recumbent positions for delivery (Shorter 1984). This expectation has come under challenge over the last two decades (Roberts *et al.* 1989). Upright positions, which are common in many cultures, could improve the expulsive phase of labour and thereby reduce the need for operative vaginal delivery and decrease perineal trauma but they could also have disadvantages, such as an increased risk of postpartum haemorrhage (Stewart *et al.* 1989). One way to facilitate an upright position is the use of a birth chair. To assess these possible benefits and hazards we mounted a large randomized trial in which delivery in a commercially available birth chair was compared with delivery on a conventional delivery bed.

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Subjects and methods

The trial was conducted at the Coombe Lying-in Hospital, Dublin between March 1984 and June 1985. Women were eligible for entry to the trial if they were nulliparae with a singleton live fetus with a cephalic presentation. All women who

Table 1. Comparability of trial groups

	Chair (n = 634)		Bed (n = 596)	
Maternal age (years) mean [SD]	24·4	[4·1]	24·3	[4·5]
No. (%) in socio-economic groups 1 to 3	236	(37·1)	176	(29·6)
No. (%) married	518	(81·7)	459	(77·3)
No. (%) induced	109	(17·2)	101	(16·9)
No. (%) accelerated	192	(30·3)	211	(35·4)
No. (%) meconium in amniotic fliud (at first inspection after admission to delivery suite)	51	(8·0)	71	(11·9)
No. (%) oxytocin in labour	294	(46·4)	307	(51·5)
No. (%) electronic fetal heart rate monitoring at any time in labour	136	(21·5)	144	(24·2)
No. (%) fetal blood sample	28	(4·4)	43	(7·2)
No. (%) pethidine	514	(81·3)	495	(83·1)
Length of first stage of labour (h)				
Mean [SD]	5·8	[3·5]	5·9	[3·5]
No. (%) <6	410	(64·7)	378	(63·4)
No. (%) >12	39	(6·2)	41	(6·9)
Birthweight (g)				
Mean [SD]	3396·2	[450]	3404·7	[456]
No. (%) <2500	15	(2·4)	13	(2·2)
Gestational age (completed weeks)				
Mean [SD]	39·7	[1·3]	39·7	[1·3]
No. (%) <37	14	(2·3)	13	(2·2)

had epidural anaesthesia or who were less than 34 weeks pregnant were excluded. This exclusion effectively excluded women with significant pre-eclampsia who were advised to avail themselves of epidural anaesthesia. Formal trial entry was delayed until full dilatation of the cervix was recorded. A numbered, sealed opaque envelope was then opened by the midwife, revealing a random allocation to either a conventional delivery bed or to the obstetric birth chair for the second and third stages of labour. Simple random allocation was generated from a table of random numbers. There was no prognostic stratification.

Ethical approval for the trial was given by the hospital research committee. Women were informed about the trial during pregnancy. They were told that the birth chair was new to the hospital and that they might be asked to participate in a trial to assess it. Those who attended antenatal classes were shown the chair during a visit to the labour ward. Formal trial entry was delayed until vaginal delivery was confidently expected to occur and consent was sought to a particular type of delivery once random allocation was known. Once told of their random allocation, those who declined to be delivered as randomly assigned were delivered as they requested, but all analyses are based on the groups as randomly allocated.

Apart from adherence, as far as possible, to the randomly allocated policy for delivery, caregivers were free to manage the second and third stages of labour in whatever ways they felt to be appropriate. Women delivered on the bed were free to use recumbent or semi-recumbent positions in either the dorsal or left lateral position, depending on the preferences of both midwife and woman, and the position that the woman found most comfortable for pushing. For women using the Birth-EZ chair for the second and third stages of labour, the midwife conducting the delivery was free to adjust the height and angle of the chair according to her preference and that of the women.

The primary hypothesis tested in the trial was that the use of a birth chair would reduce the rate of vaginal operative delivery from the then current rate in the hospital for nulliparae of 16·6%, to 11%. A total sample size of 1300 women was planned to achieve an 80% chance of detecting a reduction of this magnitude at the 5% level of statistical significance. Other maternal outcomes considered were duration of

Table 2. Actual place of delivery

	Chair ($n = 634$)		Bed ($n = 596$)	
	No.	(%)	No.	(%)
Actual place of delivery				
Chair	413	(65)	20	(3)
Bed	221	(35)	576	(97)
Reasons for place of delivery not as randomized				
Chair unavailable	72	(11)	0	(0)
Woman refused	92	(14)	8	(1)
Doctor refused	5	(1)	0	(0)
Mother too sedated	8	(1)	0	(0)
Fetal distress	4	(1)	0	(0)
Other	29	(5)	7	(1)
Not known	11	(2)	5	(1)

the second stage of labour, occurrence of perineal trauma and of manual removal of the placenta, blood loss after delivery, and the haemoglobin value 3 or 4 days after delivery. Neonatal effects were assessed in terms of 1 and 5-min Apgar scores, endotracheal intubation and admission to the special care nursery. During the first 8 months of the trial, an attempt was made to interview consecutive women who took part in the trial. Of the 686 women delivered over this period 331 were allocated to the chair and 355 to the bed. Completed interviews were obtained from 552 women (80%), 263 and 289 in the two groups respectively.

Statistical analysis used *t*-tests for differences in the means for continuous data, and odds ratios with 95% confidence intervals (CI) for categorical data. A multivariate analysis was used to adjust for imbalances between the trial groups. There were no interim analyses.

Results

A total of 1250 women participated in the trial.

Table 3. Maternal and neonatal outcomes of labour and delivery

	Chair ($n = 634$)		Bed ($n = 596$)		Odds ratio	95% CI
No. (%) delivery by						
Senior midwife	74	(11·7)	22	(3·7)		
Pupil midwife	450	(71·0)	418	(70·1)		
Doctor	86	(13·6)	96	(16·1)		
Medical student	24	(3·8)	60	(10·1)		
No. (%) vaginal operative delivery	80	(12·6)	89	(14·9)	0·82	0·59, 1·13
No. (%) reasons for operative delivery						
Failure to advance	48	(7·6)	44	(7·4)	1·02	0·61, 1·56
Fetal heart rate abnormalities	19	(3·0)	36	(6·0)	0·49	0·28, 0·84
Other	13	(2·1)	9	(1·5)	1·36	0·59, 3·16
State of perineum. No. (%)						
Intact	133	(21·0)	111	(18·6)	1·16	0·88, 1·53
Tear (no suture)	26	(4·1)	20	(3·4)	1·23	0·68, 2·22
Tear (and suture)	96	(15·2)	62	(10·4)	1·53	1·09, 2·13
Episiotomy	329	(51·9)	350	(58·7)	0·76	0·61, 0·95
Episiotomy and tear	50	(7·9)	53	(8·9)	0·88	0·59, 1·31
Mean [SD] length of 2nd stage (min)	31·7	[19·2]	31·2	[18·8]		
Mean [SD] length of 3rd stage (min)	8·2	[10·5]	8·2	[11·1]		
No. (%) manual removal of placenta	18	(2·8)	10	(1·7)	1·68	0·79, 3·55
No. (%) blood loss >500 ml	32	(5·1)	22	(3·7)	1·37	0·80, 2·37
Haemoglobin 3rd/4th postnatal day						
Mean [SD]	12·5	[1·6]	12·7	[1·6]		
No. (%) <11 g/dl	72	(11·6)	49	(8·3)	1·42	0·98, 2·07
No. (%) postpartum blood transfusion	12	(1·9)	7	(1·2)	1·60	0·64, 3·95
Neonatal outcome. No. (%)						
1-min Apgar ≤5	7	(1·1)	6	(1·0)	1·09	0·37, 3·26
5-min Apgar ≤7	1	(0·2)	4	(0·7)	0·28	0·05, 1·62
Intubated	2	(0·3)	3	(0·5)	0·63	0·11, 3·63
Admitted to special care nursery	23	(3·6)	27	(4·5)	0·79	0·45, 1·39

Table 4. Results of mothers' answers to the questionnaire

	Chair (n = 263) No. (%)	Bed (n = 289) No. (%)
More comfortable second stage versus first	160 (61)	174 (60)
Same	30 (11)	30 (10)
Less	71 (27)	79 (27)
Don't know	2 (1)	6 (2)
Could move freely	175 (67)	195 (67)
Too restricted	79 (30)	88 (30)
Don't know	9 (3)	6 (2)
Felt in control	190 (72)	209 (76)
Felt out of control	73 (28)	80 (28)
Overall a pleasant experience	17 (6)	31 (11)
Not too unpleasant	135 (51)	131 (45)
Rather unpleasant	64 (24)	69 (24)
Very unpleasant	47 (18)	58 (20)
No perineal pain when interviewed	158 (60)	176 (61)
Mild	44 (17)	44 (15)
Moderate	45 (17)	55 (19)
Severe	16 (6)	14 (5)

There were 20 post-randomization withdrawals, of whom 7 had been allocated to the chair and 13 to the bed; 5 (2, 3) ineligible women were randomized in error and 15 (5, 10) envelopes were lost or destroyed. Our analysis is based on the remaining 1230 women, of whom 634 were allocated to the birth chair and 596 to the conventional delivery bed. The difference in the number of women in the two groups reflects the use of simple random allocation, without balancing procedures such as blocking.

Maternal characteristics of the two groups are summarized in Table 1, which indicates that the two groups were similar in a number of important respects. These characteristics apply mainly to the comparability of the two groups at trial entry, but it is possible that some of the interventions described, such as oxytocin acceleration or electronic monitoring were initiated after random allocation.

Most of the women were delivered according to their allocation, 65% of the chair group, and 97% of the bed group (Table 2). In both groups, the main reason for discrepancies was refusal by the women. In addition, a birth chair was not available for about 10% of women so allocated, either because of a short second stage or because the delivery room containing the birth chair was already occupied.

Table 3 describes the conduct and outcome of delivery for the two trial groups. Because senior midwives found it difficult to supervise medical students performing deliveries in the birth chair, delivery by medical students was largely restricted to the conventional bed group and this was reflected in the larger numbers of deliveries by senior midwives in the birth chair group. The unusually low frequency of adverse neonatal outcomes may reflect the effect of the exclusion criteria on screening out women with more complicated labours.

Our primary hypothesis that women allocated to the chair would be less likely to have an instrumental vaginal delivery, was not sustained. Although there were somewhat fewer operative deliveries in the group allocated to the birth chair (a difference which reflected fewer forceps deliveries prompted primarily by fetal heart rate abnormalities), this difference was not statistically significant. One woman, allocated to the bed, required caesarean section for fetal distress in the second stage of labour.

There was little difference in the overall rate of perineal trauma. In the birth chair group a lower episiotomy rate was offset by more perineal tears. Use of the birth chair had no detectable effect on the lengths of the second or third stages of labour.

Manual removal of the placenta, postpartum haemorrhage, low maternal haemoglobin and postpartum blood transfusion were all more common in the birth chair group, but none of these differences was statistically significant at the 5% level.

Neonatal outcomes appeared to be similar in the two groups (Table 3); but these 'poor' outcomes were uncommon in both groups and this is reflected in the wide confidence intervals surrounding the point estimates of the differences between the two groups.

Analysis of the mothers' answers to the questionnaires revealed striking similarities between the two groups with respect to the women's feelings of comfort during the second stage, their ability to move freely during the second stage, and the sense of being in control during the second stage (Table 4). There was no difference in the women's overall assessment of the experience of childbirth, with about 20% of women in each arm of the trial describing the birth of their babies as a 'highly unpleasant experience'.

Table 5. Effect of birth chair during second stage of labour on instrumental vaginal delivery

Study	Chair	Bed	Odds ratios and 95% CI: Numerical	Graphical: 0·1	0·5	1	2
Present study (1991)	80/634	89/596	0·82 (0·59–1·14)				
Stewart *et al.* (1989)	13/157	7/147	1·77 (0·72–4·38)				
Turner *et al.* (1986)	37/318	38/318	0·97 (0·60–1·57)				
Hemminki *et al.* (1986)	17/88	8/82	2·27 (0·98–5·29)				
Stewart *et al.* (1983)	10/94	12/90	0·78 (0·32–1·88)				
Liddell *et al.* (1985)	11/27	7/21	1·38 (0·42–4·37)				
Marttila *et al.* (1983)	2/50	6/50	0·34 (0·08–1·44)				
Chen *et al.* (1987)	2/73	8/43	0·14 (0·04–0·52)				
Typical odds ratio			0·91 (0·72–1·14)				

Similarly, whether or not a woman had been allocated to be delivered in the chair or the bed did not influence the amount of perineal pain experienced in the puerperium (Table 4).

Discussion

This trial aimed to clarify the place of the birth chair for vaginal delivery in nulliparous women. The trial was confined to nulliparae, as with a vaginal operative delivery rate in parous women of only 4%, a very large trial would be required to show a reduction in this outcome. The birth chair we used is commercially available within Britain and Ireland and is similar in many respects to alternative designs of birth chair.

The concept of using gravity to aid expulsive efforts in the second stage of labour is appealing, and as there is evidence that ambulation in the first stage of labour improves progress (Roberts 1989) there is reason to expect that delivery in the birth chair might be associated with a reduced rate of instrumental delivery. We facilitated the chances of demonstrating a useful reduction in instrumental delivery by recruiting a sufficiently large number of women to the trial and by confining the trial to nulliparae who have a higher rate of instrumental delivery than multiparae. Previously reported trials have been

Table 6. Vaginal operative delivery stratified by presence of meconium or fetal blood sample (FBS) at trial

	All		Meconium or FBS		No meconium or FBS	
	Chair (n = 634)	Bed (n = 596)	Chair (n = 65)	Bed (n = 86)	Chair (n = 569)	Bed (n = 510)
No. (%) vaginal operative delivery	80 (12·6)	89 (14·9)	15 (23·1)	16 (18·6)	65 (11·5)	73 (14·3)
No. (%) reasons for operative delivery						
Failure to advance	48 (7·6)	44 (7·4)	7 (10·9)	4 (4·7)	41 (7·2)	40 (7·9)
FHR abnormalities	19 (3·0)	36 (6·0)	2 (3·1)	10 (11·6)	17 (3·1)	26 (5·1)

Table 7. Effect of birth chair during second stage of labour on estimated blood loss ≥500 ml

Study	Chair	Bed	Odds ratios and 95% CI: Numerical	Graphical (0·5 – 1 – 2 – 10)
Present study (1991)	32/634	22/598	1·38 (0·80–2·38)	
Stewart *et al.* (1989)	27/157	7/147	3·48 (1·71–7·10)	
Turner *et al.* (1986)	28/318	19/31	1·51 (0·83–2·74)	
Stewart *et al.* (1983)	12/94	4/90	2·84 (1·02–7·89)	
Typical odds ratio			1·87 (1·34–2·60)	

smaller, and have involved both nulliparous and parous women (Hemminki *et al.* 1986; Turner *et al.* 1986; Stewart *et al.* 1983; Liddell & Fisher 1985; Chan 1963). In our trial, the women recruited were at relatively high risk of sustaining perineal trauma (80%), and of operative delivery (14%).

Overall 14% of women allocated to delivery in the chair asked to be delivered in a conventional bed. The other principal reason for standard management in this group was that labour progressed too quickly to allow transfer to the delivery room with the birth chair. This is consistent with the findings in other trials (e.g., Turner *et al.* 1986). Statistical analyses are, however, based on the groups as allocated (intention-to-treat analysis) and the trial therefore compared a policy of planned delivery in a birth chair with the alternative policy of planned delivery in a conventional delivery bed.

The difference in status of the person performing the delivery reflected the fact that delivery in the birth chair was the newer, experimental policy. Senior midwives were reluctant to supervise medical students if the allocation was to the chair and tended to perform the delivery themselves.

An overview of eight randomized trials (including the one described in the present paper) of upright versus recumbent position in the second stage of labour (Table 5) showed no effect on the rate of instrumental delivery (Spiby 1990). In the Coombe Hospital trial, the results were consistent with those of other trials. However, although operative delivery in general was not reduced, delivery in the chair was associated with a reduced rate of vaginal operative delivery for fetal heart rate abnormalities (odds ratio 0·49, 95% CI 0·28–0·84). The fewer operative deliveries prompted by fetal heart rate abnormalities may be due to chance. Alternatively, it may reflect a beneficial effect of upright posture on fetal acid-base balance or a greater ease in auscultating the fetal heart in supine women. A further possibility is that this difference may be an artefact attributable to the fact that women allocated to be delivered in the bed were already at somewhat higher risk of instrumental delivery at trial entry, as suggested by the increased rate of meconium-stained amniotic fluid and fetal blood sampling in the first stage of labour (Table 1).

A stratified analysis of results was conducted in order to examine more closely the effect of meconium or fetal blood sampling before randomization on the rate of instrumental delivery for fetal heart rate abnormalities in the second stage. Both strata show a lower rate of instrumental vaginal delivery for fetal heart rate abnormalities in women delivered in the chair, but the bulk of the difference in the overall result is attributable to the excess of instrumental deliveries in the high risk group delivered in the bed (Table 6). Multivariate analyses taking into account the potential confounders of marital status, socio-economic group and fetal heart rate monitoring as well as meconium and fetal blood sampling did not have any marked effect on our principal conclusions, the adjusted odds ratios for vaginal operative delivery were 0·82 (95% CI 0·58 to 1·16) and for intact perineum 1·23 (0·91 to 1·64). Adding the accoucheur/se to the model

changes these figures to 0·09 (0·64–1·28) and 1·17 (0·87–1·58), respectively.

Possible differences in patient characteristics at trial entry raise the question of whether midwives had broken the randomization code (by, for example, opening more than one envelope at a time) in expectation of vaginal operative delivery that is more conveniently performed in the bed. Telephone or computerized randomization would have helped to guard against such selection biases. The trial protocol might also have been violated by midwives who proceeded with randomization in circumstances which should have acted as reasons for exclusion from the trial, for instance when the chair was unavailable (Table 2). This reflected a lack of enthusiasm for the trial; this was evident among some of the staff who recognized that the trial would end when the target number of women was reached. During the trial it was apparent that such violations were taking place on a sporadic basis. Attempts to reinforce the protocol were hampered by the large numbers of midwives involved, and by the delicate professional relationships which exist between clinical midwives, research staff and obstetricians. Some obstetricians also registered a lack of approval of the birth chair by refusing to comply with the random allocation. The extent and cumulative effect of these violations is probably impossible to estimate reliably, but the possibility that an effect may exist needs to be borne in mind in interpreting the trial results.

In the absence of a reduction in instrumental delivery, use of the birth chair would still benefit women if it was associated with a lower occurrence of perineal trauma. A small reduction in the episiotomy rate was offset by an increased rate of perineal tears, a finding consistent with other randomized trials (Sleep *et al.* 1989). The likely explanation is that the perineum is less accessible during birth chair delivery and episiotomy is more difficult to perform for this reason. The reduced rate of episiotomy was of no apparent benefit to women. There was no difference in the amount of perineal pain reported by women in the two groups (Table 4).

The birth chair policy had no detectable effect on the lengths of the second and third stages of labour. Again, this is consistent with other controlled trials of birth chairs (Sleep *et al.* 1989) and runs counter to suggested benefits for upright postures for delivery.

Available data for postpartum haemorrhage from all relevant controlled trials (including this one) are summarized in Table 7 (Spiby 1990). Taken together, they provide strong evidence that delivery in a birth chair increases the risk of post partum haemorrhage. Measurement of blood loss is potentially biased by knowledge of the trial allocation and by the practice of putting a basin under the birth chair to collect blood. In this trial, however, differences in less subjective measures of blood loss, such as haemoglobin concentration postpartum and the need for blood transfusion during the puerperium, were consistent with the difference in blood loss measured at delivery. One possible explanation is greater blood loss associated with more frequent need for manual removal of the placenta in the birth chair group. Sleep *et al.* (1989) favour the alternative hypothesis that the increased blood loss is due to bleeding from perineal trauma, exacerbated by obstruction to venous return caused by the birth chair. We observed perineal oedema and haemorrhoids in some women who used the birth chair, a finding also reported by Goodlin & Frederick (1983) and Cottrell & Shanahan (1986).

The results of the Coombe Hospital trial differ most dramatically from those of the other relevant trials with respect to women's assessment of the two positions. We were unable to detect any benefit in terms of comfort, sensation of mobility, and feelings of control during the second stage, or in terms of overall satisfaction with the birth experience. We had expected increased maternal satisfaction as previous trials had elicited more frequent positive responses from the group that had used the upright position (Sleep *et al.* 1989). It may be that in previously reported trials, women giving birth to their second baby attributed their easier delivery to using the birth-chair for the first time. Enthusiastic reports in the media of the availability of the birth chair might also be expected to bias the women's outlook.

The absence of any benefit from delivery in the birth chair is disappointing, especially as there are clear benefits associated with upright posture in the first stage of labour. The small increase in blood loss at delivery may further reduce professional enthusiasm for its use. Since the completion of the trial the use of the birth chair in the Coombe Hospital has declined rapidly, and this is mainly due to an increased demand from women for epidural anaesthesia. The episiotomy rate among nulliparae delivered

spontaneously declined from 41% during the trial period to 26% in 1988. In view of the finding by Begley (1987) that the likelihood of a woman giving birth with an intact perineum was most strongly influenced by the identity of her midwife, the preference of the midwife with respect to the conduct of the second stage should not be discounted. Use of the birth chair is, of course, only one means of facilitating upright posture in the second stage.

Alternative postures such as squatting or kneeling have yet to be investigated systematically.

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