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Skill retention at 6 versus 12 months after simulation training in singleton vaginal breech delivery: a randomised controlled study

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Introduction: Current evidence suggests that annual simulation training is adequate to maintain skills for management of vaginal breech delivery. This study aimed to investigate whether skill levels declined at 6 months and further declined at 12 months after training.
Methods: In this randomised single-blinded study, 12 obstetricians and 42 midwives were assigned at random to attend a 1-hour training session (lecture and simulation on singleton vaginal breech delivery) conducted at month 0 (control group) and at month 6 (intervention group). Their skill score was assessed before training (pre-test), immediately after training (at-test), and 12 months after training (post-test).
Results: Compared with the pre-test score, skill scores increased immediately after the simulation training (at-test) in the intervention group (7.98 vs 15.03, p<0.001) and in the control group (6.86 vs 14.92, p<0.001). Compared with the at-test score, skill scores decreased 6 months after the training (post-test) in the intervention group (15.03 vs 9.57, p<0.001) and 12 months after the training in the control group (14.92 vs 9.74, p<0.001). However, post-test skill scores were better than pre-test skill scores. The two groups were comparable in terms of the decline in skill score from at-test to post-test (-5.49 vs -4.90, p=0.606).
Conclusions: Simulation training results in short-term and long-term improvements in vaginal birth delivery skills. However, skill scores degrade over time and ongoing training at a minimum of 12-month interval is suggested for obstetricians and midwives.

Keywords: Breech presentation; Obstetrics; Simulation training

Introduction

Breech presentation occurs in 3% to 4% of all term deliveries and more commonly in premature deliveries. Perinatal mortality and morbidity is significantly higher in planned vaginal breech delivery than planned Caesarean sections[1], but the optimal mode of delivery remains controversial, especially when Caesarean section causes a significant mortality and morbidity risk to the mother[2,3]. Clinicians may encounter unavoidable vaginal breech delivery cases such as vaginal delivery upon maternal request, preterm delivery, multiple pregnancies, breech presentation when labour is well advanced, and risk of Caesarean section outweighs that of vaginal breech delivery.

Since the Term Breech Trial in 2000, the incidence of vaginal breech delivery has declined[4-8]. There are concerns that unless vaginal breech delivery is routinely practiced, skill transfer to young doctors and midwives will not be efficient and may affect patient safety[4,6]. Simulation training enables training in a safe and non-clinical environment without any risk to patients. Low- and high-fidelity training models and simulators have been shown effective to improve the technical performance of medical staff[9-11]. Simulation training improves resident performance in the management of vaginal breech delivery[12,13]. Nonetheless, knowledge and skills decline over time, and regular educational activities should be carried out to reinforce knowledge and skills[14].

The Clinical Negligence Scheme of Trust suggests annual training to maintain emergency obstetrics skills such as vaginal breech delivery[15]. We hypothesise that skills start to decline as early as 6 months after training and decline further by 12 months. This study aimed to evaluate the level of skill retention at 6 and 12 months after simulation training and to determine the optimal frequency of training required to maintain effective vaginal breech delivery skills.

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Methods

This randomised controlled single-blind study was approved by the Kowloon Central / Kowloon East research and ethics committee, Hospital Authority, Hong Kong (KC/KE-14-0081/ER-2). Oral informed consent was obtained from each participant. All obstetricians and midwives from the Department of Obstetrics and Gynaecology at Queen Elizabeth Hospital who had received simulation training at least 12 months earlier were invited to participate in simulation training for singleton vaginal breech delivery between August 2014 and September 2015. These participants had been included in our previous study on shoulder dystocia[16]. Those who had vaginal breech delivery training within the last 12 months were excluded.

Using an online research randomiser (http://www.randomizer.org/), obstetricians and midwives were each randomised to the intervention or control group to receive simulation training on singleton vaginal breech delivery at 6 months or 0 month later, respectively. Their skills were evaluated one week before training (pre-test), immediately after training (at-test), and 6 months (for intervention group) or 12 months (for control group) after training (re-test) [Figure 1]. Participants were unaware of the need for evaluation. Both groups were retested without prior notification to reduce bias. Those who failed to attend for re-testing were excluded from analysis. The obstetrician who assessed the outcome was not blinded to group assignment.

Participants attended a 60-minute lecture plus simulation training with multiple visual aids to explain the risk factors and complications of vaginal breech delivery. Manoeuvres for successful vaginal breech delivery were demonstrated. Participants then practiced the manoeuvres with the mannequin under supervision. Participant's skill to deliver a vaginal breech was tested using a birth simulator that included a mannequin pelvis and a mannequin baby. A scenario was simulated that a parous woman was admitted to the labour ward with a term singleton baby presented in extended breech position and in active labour. The cervix was fully dilated with the fetal sacrum at S+2 level (2 cm below the ischial spine of mother). Involuntary active pushing was ongoing and vaginal breech delivery was imminent and unavoidable. A 16-item marking scheme was used to score the participant's skills in all steps required for the vaginal breech delivery (Figure 2), based on courses of Advanced Life Support in Obstetrics[17] and Practical Obstetrics Multi-Professional Training[18]. Each item comprised both verbal and demonstrative components. No

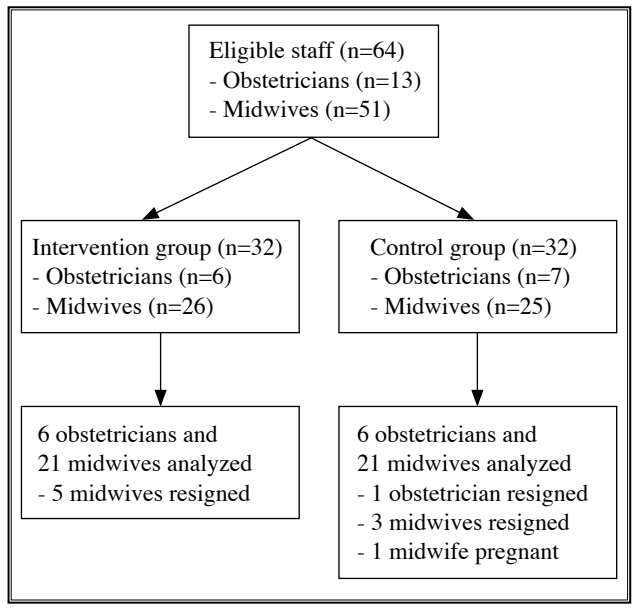

Figure 1. Flow diagram of participants

score was awarded when the participant failed to mention any of the required content. Half score was awarded when the answer was partially completed or when failure to demonstrate the correct manoeuvre despite correct verbal answer of the manoeuvre. The time required to complete the scenario was also assessed. Delivery of the mannequin baby was deemed successful when all the required steps were taken, with the use of the Mauriceau-Smellie-Veit or Burns-Marshall manoeuvre. Delivery of trapped fetal head was also discussed, including the use of forceps, cervical incision, and/or Caesarean section. The test was timed and automatically stopped at 500 s (30 s for each item and 20 s for scenario briefing). Testing, timing, and documenting the results were performed by a single independent obstetrician to prevent inter-observer bias.

Outcomes (score and time to complete the scenario) were compared between (1) pre-test and at-test, (2) at-test and post-test, and (3) pre-test and post-test. ANOVA, paired *t* test, and independent *t* test were used as appropriate. A p value of <0.05 was considered statistically significant. Subgroup analyses of obstetricians and midwives were also performed. In a similar study that investigated short- and long-term knowledge retention after a one-day simulation training for uncommon obstetrics emergencies (excluding vaginal breech delivery), the standard deviation for score in obstetrics emergency training was 6.6.[9] Assuming that skill scores at 6 months would be 5% higher than those at 12 months after simulating training, with one-sided difference and a power of 0.8, the minimal samples size was calculated to be 23 per arm.

Adequate staffing	
Senior midwife, senior obstetrician	
Neonatologist standby at delivery	
Inform anaesthetist	
Inform theatre staff for stand-by at delivery	
Preparation	
Continuous fetal heart monitoring	
Intravenous access, type, and screen	
Instrumental birth pack with forceps	
Procedures	
Delay active pushing until the breech is distending introitus (anus delivering)	
'Hands off' approach	
Avoid traction	
Pressure on non-bony prominences only	
Use correct manoeuvres for assisted breech delivery	
Back anterior and delivery of legs	
Lovset for delivery of arms	
Mauriceau-Smellie-Viet or Burns Marshall	
Forceps	
Work with assistant during Mauriceau-Smellie-Veit / forceps delivery	
Problem-solving skills	
Delay in descent of breech: avoid augmentation; book caesarean section	
Delivery of Nuchal arms	
Management of entrapped head	
Total score (1 mark each out of 16):	
Total delivery time (minutes):	

Figure 2. Marking scheme for management of singleton vaginal breech delivery

Results

A total of 13 obstetricians and 51 midwives were assigned at random to the intervention group (n=6+26) or control group (n=7+25). Five midwives from the intervention group and one obstetrician and four midwives from the control group were resigned or pregnant and hence excluded. Results of six obstetrician and 21 midwives in each group were analysed. The intervention and control groups were comparable in terms of years of working experience (14.05±7.15 vs 14.67±5.21) and the number of participants regularly working in the labour ward (17 vs 19).

Compared with the pre-test score, the at-test score increased and the time required to complete the scenario decreased immediately after the simulation training in the intervention group (7.98 vs 15.03, $p<0.001$; 348.09 vs 176.31 s, $p<0.001$) and the control group (6.86 vs 14.92, $p<0.001$; 369.34 vs 266.69 s, $p=0.003$), respectively (Tables 1 and 2). Compared with the at-test score, the post-test score decreased and the time required to complete the scenario increased 6 months after the training in the intervention group (15.03 vs 9.57, $p<0.001$; 176.31 vs 219.41 s, $p=0.06$) and 12 months after the training in the

Table 1. Skill score and time to complete the scenario before simulation training (pre-test), immediately after simulation training (at-test), and 6 months (for intervention group) or 12 months (for control group) after simulation training (post-test) for singleton vaginal breech delivery

Outcome	Pre-test	At-test	Post-test	P value (paired *t* test)		
				Pre-test vs test	At-test vs post-test	Pre-test vs post-test
Intervention group						
Skill score						
Overall	7.98±3.14	15.03±0.81	9.57±2.24	<0.001	<0.001	0.05
Obstetricians	8.29±5.67	15.43±0.79	11.88±2.47	0.01	0.003	0.029
Midwives	7.90±2.15	14.92±0.80	8.93±1.72	<0.001	<0.001	<0.064
Time, s						
Overall	348.09±105.78	176.31±63.94	219.41±58.74	<0.001	0.06	<0.001
Obstetricians	263.57±84.96	193.57±74.88	210.89±53.99	0.097	0.591	0.099
Midwives	371.76±99.91	171.48±61.39	221.79±60.84	<0.001	0.005	<0.001
Control group						
Skill score						
Overall	6.86±3.57	14.92±1.23	9.74±2.68	<0.001	<0.001	<0.001
Obstetricians	9.67±1.78	15.75±0.42	13.25±1.21	0.001	<0.004	<0.005
Midwives	6.21±3.58	14.73±1.28	8.93±2.23	<0.001	<0.001	0.001
Time, s						
Overall	369.34±130.85	266.69±104.02	213.00±53.97	0.003	0.018	<0.001
Obstetricians	261.00±52.58	307.17±105.37	154.17±42.64	0.444	0.007	0.027
Midwives	394.35±131.19	257.35±103.50	226.58±47.18	<0.001	0.194	<0.001

control group (14.92 vs 9.74, p< 0.001; 266.69 vs 213.00 s, p=0.018), respectively (Tables 1 and 2). Compared with the pre-test score, the post-test score increased and the time required to complete the scenario decreased at 6 months after the training in the intervention group (7.98 vs 9.57, p=0.05; 348.09 vs 219.41 s, p<0.001) and 12 months after the training in the control group (6.85 vs 9.74, p<0.001; 369.34 vs 213.00 s, p<0.001), respectively (Tables 1 and 2).

Both groups were comparable in terms of pre-test score (7.94 vs 6.86, p=0.185), at-test score (15.03 vs 14.92, p=0.677), and post-test score (9.57 vs 9.74, p=0.782). The two groups were comparable in terms of the decline in score from at-test to post-test (-5.49 vs -4.90, p=0.606). However, the change in the time to complete the scenario was longer for the intervention than control group (46.09 vs -50.56 s, p<0.001) [Tables 1 and 2]. Subgroup analyses for obstetricians and midwives showed similar trends.

Discussion

In most developed countries, in addition to external cephalic version, planned Caesarean section is a mode of delivery for a singleton breech presentation[19]. Expertise in vaginal birth delivery is difficult to acquire, and physicians may not gain enough experience during training. Simulation training in vaginal birth management is therefore important. Nonetheless, no conclusive practice recommendations are available, owing to the heterogeneity of studies[20]. Australia[21] and England[15] recommend annual drills for obstetrics skills including vaginal birth management. Self-assessed confidence and knowledge increase immediately after simulation training, but skills and knowledge levels may decrease as early as 72 hours or 6 weeks after training[13,22]. Annual training has been suggested because knowledge and skills declines as early as 4 months after training, but improvements are retained at both 4 and 12 months compared with the pre-test status[9].

Our study demonstrated that simulation training immediately improved skill levels in vaginal breech delivery, but these skill levels declined with time (at both 6 and 12 months after training). However, the skills level at 6

Table 2. Skill score and time to complete the scenario between intervention and control groups

Outcome	Intervention group	Control group	P value (ANOVA)
Skill score			
Pre-test			
Overall	7.98±3.14	6.86±3.57	0.185
Obstetricians	8.29±5.67	9.67±1.78	0.580
Midwives	7.90±2.15	6.21±3.58	0.048
At-test			
Overall	15.03±0.81	14.92±1.23	0.677
Obstetricians	15.43±0.79	15.75±0.42	0.390
Midwives	14.92±0.80	14.73±1.28	0.532
Post-test			
Overall	9.57±2.24	9.74±2.68	0.782
Obstetricians	11.88±2.47	13.25±1.21	0.244
Midwives	8.93±1.72	8.93±2.23	0.987
Pre-test vs at-test			
Overall	7.02	8.05	0.206
Obstetricians	7.14	5.75	0.540
Midwives	6.98	8.58	0.061
At-test vs post-test			
Overall	-5.49	-4.90	0.606
Obstetricians	-3.55	-0.49	0.282
Midwives	-6.03	-5.79	0.704
Pre-test vs post-test			
Overall	1.59	2.88	0.109
Obstetricians	3.59	3.58	0.994
Midwives	1.03	2.71	0.065
Time, s			
Pre-test			
Overall	348.09±105.78	369.34±130.85	0.478
Obstetricians	263.57±84.96	261.00±52.58	0.950
Midwives	371.76±99.91	394.35±131.19	0.494
At-test			
Overall	176.31±63.94	266.69±104.02	<0.001
Obstetricians	193.57±74.85	307.17±105.37	0.044
Midwives	171.48±61.39	257±103.50	0.494
Post-test			
Overall	219.4±58.74	213.00±53.97	0.651
Obstetricians	210.89±53.99	154.17±42.64	0.062
Midwives	221.79±60.84	226.58±47.18	0.754
Pre-test vs at-test			
Overall	-171.16	-99.84	0.063
Obstetricians	-14.69	46.17	0.103
Midwives	-200.28	-133.54	0.104
At-test vs post-test			
Overall	46.09	-50.56	<0.001
Obstetricians	17.31	-136.33	0.006
Midwives	-54.15	-30.77	0.004
Pre-test vs post-test			
Overall	-128.69	-156.34	0.322
Obstetricians	-52.69	-106.83	0.238
Midwives	-149.97	-167.77	0.567

months was maintained at 12 months. Despite the decline, the skill scores at 12 months remained significantly higher than those at pre-test. The intervention and control groups were comparable in terms doctor-to-midwife ratio, years of experience, and number of staff regularly working in the labour ward setting where exposure to vaginal delivery is more likely. Initial skills on vaginal breech delivery were suboptimal when >12 months had elapsed after last training and hence annual training was validated, as suggested by another study[15].

Our study was limited by the fact that it was carried out in a single centre and with limited number of participants. Data involving larger numbers and multiple obstetric centres is preferable. The assessor of the participants was not blinded to the study aims. Some participants would have encountered real-life vaginal breech delivery and hence updated their knowledge and skills between tests. The time to complete the scenario during training was significantly faster in the control group, suggesting more receptive to the training. This is an incidental finding as the two groups were comparable in terms of work experience or ward settings. Nevertheless, the difference disappeared in the post-training test. Despite efforts to test all participants at the same time, it was unavoidable that participants may have informed others about the unannounced post-training test and this might have resulted in last-minute revision before the test.

Conclusions

Simulation training results in short-term and long-term improvements in vaginal birth delivery skills. However, knowledge and skills degrade over time. Ongoing training at a minimum of 12-month intervals is suggested for obstetricians and midwives.

Declaration

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