Experimental
&
Clinical Article

Obstetrics; *Maternal-Fetal Medicine and Perinatology*

Obstetric Simulation Training to Breech Delivery, Shoulder Dystocia, Forceps, and Vacuum Experience

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ABSTRACT

OBJECTIVES: This study aimed to create a simulation model in shoulder dystocia, breech delivery, and vacuum forceps applications, and to show the effect of education on the knowledge-skill level of the individuals involved.

STUDY DESIGN: This prospective cohort research was conducted among assistant doctors and midwives. The course was held in the simulation center by creating 4 different scenarios. The steps of each maneuver were determined separately. Performance was evaluated on a five-point Likert-type scale between 1-5 points before and after training. A higher score was considered higher proficiency in the subject.

RESULTS: Of the participants in the study, 51.4% (n=19) of 37 were doctors. The post-training scores obtained from each step of the shoulder dystocia maneuvers, breech birth maneuver, forceps application, and vacuum application were statistically significantly higher than the pre-training scores (p<0.001). The change in the post-training skill scores of the physicians was significantly higher than that of the midwives (p<0.001). Post-training, 67.9% of the participants thought that the simulation training was a great help in transforming their theoretical knowledge into practice.

CONCLUSION: Breech delivery, shoulder dystocia, forceps, and vacuum applications are difficult subjects to education in obstetrics. In these pieces of training, simulation should be used as a training method in obstetric education and integrated into the curriculum. We believe that giving and disseminating an effective and accessible simulation protocol to healthcare professionals can reduce birth complications.

Keywords: Breech delivery, Education, Forceps, Shoulder dystocia, Simulation, Vacuum

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Introduction

Obstetrics is one of many health specialties focused on reducing medical errors and adverse events. Obstetric complications, malpractice, and their consequences cause high compensation payments. Shoulder dystocia complicates 2% of all vaginal deliveries and can cause significant long-term complications, including permanent brachial plexus injury, clavicle fracture, hypoxic brain injury, and neonatal death (1,2). Therefore, managing shoulder dystocia is a critical skill that must be taught during specialization training. Medical simulation is a relatively new field and has been well suited for emergencies such as shoulder dystocia (3).

It was determined that 15% of all deliveries are vaginal operative delivery (4). Forceps, and to a lesser extent, the vacuum application, are used for vaginal operative delivery (5). Although the vacuum application may seem more practical, it requires training and attention to prevent maternal and infant harm (6). Simulation training enables these skills to be learned since there is no risk for the patient or fetus (3).

Delays in diagnosis and therapeutic intervention, a lack of information, miscommunication, and poor teamwork lead to adverse events (4). It was stated that simulation methodologies, which are increasingly used in the world and aim at student-centered education, arise from an ethical obligation in order not to harm the patient, and it was also emphasized that

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simulation fills the gap between theory and practice, and acts as a bridge (5). Although procedural simulation in obstetrics and gynecology dates back to the 9th century, simulation-based team training was not reported until the late 1990s (6-8). The Joint Commission on Accreditation of Healthcare Organizations recommends the use of simulation for the preparation of health personnel for high-risk events, such as shoulder dystocia, emergency cesarean delivery, maternal hemorrhage, and neonatal resuscitation, and to improve team performance based on the Sentinel (adverse) event analysis results (2004–2012). Using educational methods and techniques together, planning sufficient time, and having sufficient trainers are recommended to integrate these programs into simulation-based education (4).

Before starting the study, the basic training needs, approaches, and environments of the assistants and midwives who received obstetric training were determined. The contributing factors to adverse obstetric outcomes experienced in operative deliveries, such as shoulder dystocia, breech delivery, and forceps application, were defined as a lack of experience, poor teamwork, and miscommunication. It was aimed to develop knowledge, skills, and abilities in these areas. A course based on experiential learning theory and simulation was considered a very suitable model (9). A direct experience would allow them to correct existing habits, and become informed, think about, and apply their learned skills. Various scenarios and simulations in emergencies in obstetrics have been described in previous studies (10). Therefore, this study aimed to create a simulation model in shoulder dystocia, breech delivery, and vacuum forceps applications, and to show the effect of education on the knowledge-skill level of the individuals involved.

Material and Method

This prospective cohort study and course were carried out in a single center, between January 2021 and May 2021, among assistant doctors and midwives working in the Obstetrics and Gynecology Department of a university hospital. The study was carried out in a single center and with the participation of the staff working in the center at the time, it was conducted. There are a total of 50 (doctor and midwife) employees working in our department. Two participants were in rotation and 6 of them did not accept to participate in the study. Of the participants in the study, 51.4% (n=19) of 37 people are assistant doctors and 48.6% (n=24) are midwives. The participants were informed about the study, and their written consent was obtained according to the principles of the Helsinki Declaration. The course was held in the simulation center of our university hospital. The steps of each maneuver were determined individually. Performance was evaluated as 1-5 points on a five-point Likert-type scale. A higher score was considered higher proficiency in the subject.

Planning the course

1. Determining the obstetric conditions to be simulated (shoulder dystocia, breech delivery, and vacuum forceps experience).
2. Providing the necessary realism to simulate the birth process and clinical setting.
3. Knowledge and skill assessment pre and post-training.
4. Training with theory and simulation.
5. Each trainee performs all scenarios in the simulator.
6. Implementation of feedback testing.

Course: The trainees attended the simulation exercises without prior notice about the type of simulation to be performed. Socio-demographic information was collected, including gender, age, job title, and total years of practicing obstetrics and gynecology (including residency). The scenarios included participants interacting with each other (in groups of 3 obstetrics assistants, and 2 midwives), a patient manikin and a role-playing senior gynecology and obstetrics member (JEH), an obstetrician who was not role-playing in the scenario but prepared for the scenarios with 10 h of training (SC).

Scenario 1 (shoulder dystocia): Participants were given a brief introduction to the simulation study and instructed to treat the experience as an actual situation and proceed as a real patient. A 35-year-old multiparous patient at an advanced maternal age with an abnormal 1-h glucose tolerance test and normal 3-h glucose tolerance test, who had been pushing for about 90 min, was defined. It was explained to the trainees that they could use the delivery table, tools (instruments, clamps, scissors, and 2 sets of forceps), gloves, and all necessary equipment in the delivery room. When the patient entered the room, the nurse told the assistant that the patient was pushing well, and then the fetal head was delivered in the occiput anterior position. The shoulder was restrained by holding the baby tightly while he was born. Before the theoretical briefing, the knowledge and skill levels of the participants were questioned based on the predetermined maneuver steps, and they were written in the inquiry and evaluation form by a trained obstetrician (SC) and scored from 1 to 5. After 20 min of theoretical training, the steps of the maneuver (call for help, emptying the bladder, stopping the patient from straining, episiotomy application, Mc Roberts Maneuver, suprapubic pressure, Rubin Maneuver, Woods Maneuver, Reverse Woods Maneuver, Delivery of the Back Shoulder, and Gaskin Maneuver) were explained practically in the simulator by a senior obstetrician (JEH). The senior obstetrician (JEH) used video material, a doll, and a pelvis model in the training sessions (Figure 1). Each participant was asked to perform the scenario, and the observer-trained obstetrician gave a score from 1 to 5 on the questionnaire and evaluation form.

Figure 1: *Shoulder dystocia*

Figure 2: *Breech birth and maneuvers*

Scenario 2 (Breech birth and maneuvers): The trainee has presented the frank, complete, and incomplete breech presentations one by one. Participants were given a standard case scenario and a breech birth to perform with simulation. The trainees were instructed to use the appropriate maneuvers and the necessary tools to perform the delivery. According to the scenario given to the trainee, a model with a 26-year-old gravida 5, para 3, breech presentation, and fetal hips visible in the introitus was prepared in the delivery triage room. On examination, a patient with an estimated fetal weight of 3200 g, who had previously delivered a baby of the largest 3600 g, who had never had a cesarean, was presented. The knowledge and skill levels of the participants were questioned before the theoretical briefing, and the questionnaire and evaluation form was given a score from 1 to 5 by a trained obstetrician (SC). After 20 min of theoretical training, practical training on maneuver steps (Pınard's maneuver, delivery of the feet, Loveset maneuver, Burns Marshall method, Praque Maneuver, Mariceau-Smellie-Veit Maneuver, Forceps to after coming head (piper forceps)) was given by a senior obstetrician (JEH). All of the participants repeated all of the maneuvers on the simulator (Figure 2). The questionnaire and assessment form was graded from 1 to 5 by the observing obstetrician (SC).

Scenario 3 (Vacuum application): According to the scenario given to the trainee, in the delivery triage room, the sagittal suture was in the anteroposterior diameter, the dilation was 10 cm, the effacement was 90%, the fetal head was in the perineum, the estimated fetal weight was 3200 g, and the fetal heart rate was 120/min. The second phase was prolonged. In the case of a decision to apply the vacuum, the knowledge and skill levels of the participants were questioned before the theoretical briefing. The trained obstetrician (SÇ) scored from 1 to 5 on the inquiry and evaluation form. After theoretical training consisting of a 20-min PowerPoint presentation, the vacuum was applied to the baby's sagittal suture to the flexion point, 3 cm away from the posterior fontanelle, by a senior obstetrician. After the birth of the baby's head, the vacuum bell was separated from the fetal head. All of the participants repeated the vacuum application on the model (Figure 3). The observing obstetrician (SC) graded the questioning and assessment form from 1 to 5.

Figure 3: *Vacuum application*

Scenario4 (Forceps application): This scenario was created as the fetal head +1 level of the patient with dilatation of 10 cm, effacement at 100%, sagittal suture anteroposterior diameter of the maternal pelvis, and an estimated fetal weight of 3100 g. The trainee was informed that the fetal heart rate fell to 95/min and that he/she had attended the delivery where a cesarean section was infeasible. When it was decided to apply forceps, the trained observer obstetrician (SC) questioned the knowledge and skill levels of the participants before the theoretical briefing and graded the questionnaire and evaluation form (form 4) with a score of 1 to 5. After 20 min of theoretical training, a senior obstetrician applied Simpson forceps on a doll and pelvis model. All of the participants repeated the forceps application on the model (Figure 4). The observing obstetrician (SC) graded the questioning and assessment form from 1 to 5.

Figure 4: *Forceps application*

Course Feedback: Post-course feedback evaluation was carried out via e-mail. The questions included the reality of the simulator skills, their contribution to clinical skills, thinking that he/she would make fewer mistakes during real clinical applications, and having a positive effect on anxiety before the application (Form 5). Feedback was evaluated (5: excellent, 1: very bad) with a scoring system from 1 to 5. 28 of 37 participants completed the post-course feedback.

Statistical Analysis

In the study, all data were evaluated using IBM SPSS Statistics 20.0 (Armonk, NY, USA). Average and standard deviation values of the numerical data were calculated. Normal distribution and skewness and kurtosis values were evaluated using the Kolmogorov–Smirnov test and Shapiro–Wilk test. The categorical and numerical data in non-parametric distribution were compared with appropriate statistical analyses such as the Kruskal–Wallis test in groups of two. The relationship between pre- and post-training data was evaluated with the Wilcoxon signed rank test. $p<0.05$ was considered statistically significant.

Results

Of the participants in the study, 51.4% (n=19) of 37 were doctors and 48.6% (n=18) were midwives. The average duration of employment for the midwives was 6.78±5.82 (1.5-20) years, and the average duration of employment for the resident doctors was 25.11±12.08 (4-44) months.

The comparison of the pre-and post-training shoulder dystocia maneuver step scores of the participants is given in table I. The post-training scores obtained from each step of the shoulder dystocia maneuvers were statistically significantly higher than the pre-training scores ($p<0.001$). The comparison of the pre-and post-training breech birth maneuver step scores of the participants is given in table II. The scores obtained from each step of the breech delivery maneuvers post-training were statistically significantly higher than the pre-training scores ($p<0.001$). The comparison of the pre-and post-training forceps application step scores of the participants is given in table III. The scores obtained from each step of the forceps applications post-training were statistically significantly higher than the pre-training scores ($p<0.001$). The comparison of the pre and post-training vacuum application step scores of the participants is given in table IV. The scores obtained from each step of the vacuum applications post-training were statistically significantly higher than the pre-training scores ($p<0.001$).

The post-training forceps use skill scores of the doctors (17.84±2.292) were significantly higher than the pre-training scores (5.11±0.459) ($p<0.001$). The post-training forceps use skill scores of the midwives (10.83±0.924) were significantly higher than the pre-training scores (5.00±0.000) ($p<0.001$). While the pre-training forceps usage skill scores of the doctors and midwives were similar ($p=0.337$), the change in the post-training skill scores of the doctors was significantly higher than the change scores of the midwives ($p<0.001$) (Table V).

The change in the skill scores of the physicians in shoulder dystocia maneuvers, breech delivery maneuvers, and vacuum application after training was significantly higher than that of midwives ($p<0.001$) (Table V). Post-training, 67.9% of the participants thought that the simulation training was a great help in transforming their theoretical knowledge into practice.

Table I: *Comparison of the pre-and post-training shoulder dystocia skill scores of the participants.*

	Pre-training	Post-training	*p*
Ability to recognize shoulder dystocia	4.03 ± 1.11	4.54 ± 0.65	<0.001
Ability to request a call for help	1.38 ± 0.89	3.65 ± 1.25	<0.001
Performs McRobert's maneuver.	2.51 ± 1.28	3.95 ± 0.81	<0.001
Applies supapubic pressure	1.89 ± 1.41	3.92 ± 0.82	<0.001
Applies gentle downward pull	1.86 ± 1.29	3.41 ± 0.92	<0.001
Performs an episiotomy	1.73 ± 1.09	3.46 ± 1.19	<0.001
Rubin's or Wood (rotation maneuvers)	1.11 ± 0.31	3.49 ± 1.12	<0.001
Attempting to deliver the posterior arm	1.49 ± 1.04	3.41 ± 1.18	<0.001
Performs the fracture of the clavicle	1.05 ± 0.32	2.43 ± 1.14	<0.001
Repeats the first 4 maneuvers	1.00 ± 0.0	2.32 ± 1.18	<0.001
Performs symphysiotomy	1.08 ± 0.49	2.84 ± 1.16	<0.001
Performs Zavanelli maneuver	1.22 ± 0.63	2.84 ± 1.34	<0.001
Collects blood for cord gases	1.0 ± 0.0	2.41 ± 1.32	<0.001
Records her/his actions.	1.0 ± 0.0	2.59 ± 1.49	<0.001

**Wilcoxon signed rank*

Table II: *Comparison of the pre-and post-training breech birth skill scores of the participants.*

	Pre-training	Post-training	*p*
Ability to recognize breech birth	3.30 ± 1.28	4.19 ± 0.84	<0.001
Ability to request a call for help	1.08 ± 0.27	3.78 ± 1.00	<0.001
Waiting for the birth of the feet	1.57 ± 1.21	3.62 ± 0.95	<0.001
Inviting mother to push	1.27 ± 0.38	3.73 ± 1.17	<0.001
Birth of the Shoulders (Lovset maneuver)	1.59 ± 1.21	3.65 ± 0.85	<0.001
Give birth to the back shoulder	1.27 ± 0.80	3.49 ± 0.93	<0.001
Birth of the fetal head (with Mariceu-Weith-Smellie)	1.38 ± 0.98	3.68 ± 0.88	<0.001
Birth of the fetal head (with Modified Prague Maneuver)	1.11 ± 0.51	3.62 ± 1.01	<0.001
Delivery of the fetal head (with forceps application to the head from behind)	1.00 ± 0.0	3.03 ± 1.01	<0.001
Birth of the fetal head (with Burns-Marshal-Method)	1.16 ± 0.60	3.68 ± 1.00	<0.001

**Wilcoxon signed rank*

Table III: *Comparison of the pre-and post-training forceps application skill scores of the participants.*

	Pre-training	Post-training	*p*
Deciding to apply forceps	1.00 ± 0.0	2.86 ± 1.00	<0.001
Emptying the bladder	1.00 ± 0.00	2.24 ± 1.03	<0.001
Determination of fetal head position	1.05 ± 0.32	3.05 ± 1.02	<0.001
Forceps extraction and delivery of the baby	1.00 ± 0.01	3.08 ± 1.18	<0.001
Removing the forceps blades	1.00 ± 0.01	3.19 ± 1.17	<0.001

**Wilcoxon signed rank*

Table IV: *Comparison of the pre-and post-training vacuum application skill scores of the participants.*

	Pre-training	Post-training	*p*
Determining the vacuum application level	1.46 ± 0.86	3.38 ± 1.03	<0.001
Determining the baby's head position	1.54 ± 0.96	3.24 ± 1.14	<0.001
Positioning the vacuum application bell	1.73 ± 1.14	3.38 ± 1.21	<0.001
Checking the surrounding tissues post-vacuum bell application	1.14 ± 0.95	3.27 ± 1.12	<0.001
Removing the baby by vacuum extraction	1.59 ± 1.14	3.43 ± 1.32	<0.001
Post-vacuum baby disengagement	1.59 ± 1.14	3.54 ± 1.14	<0.001

**Wilcoxon signed rank*

Table V: *Comparison of the difficult birth maneuver skill scores of the doctors and midwives*

	Doctor	Midwife	*p*
Ability to use forceps			
Pre-training	5.11 ± 0.45	5.00 ± 0.01	0.337
Post-training	17.84 ± 2.29	10.83 ± 0.924	<0.001
Mean change	12.74 ± 2.33	5.83 ± 0.924	<0.001
Breech birth skill			
Pre-training	17.79 ± 5.08	11.50 ± 0.78	<0.001
Post-training	43.26 ± 2.40	29.28 ± 3.73	<0.001
Mean change	25.47 ± 5.37	17.78 ± 3.65	<0.001
Shoulder dystocia skill			
Pre-training	26.53 ± 4.64	17.94 ± 2.71	0.005
Post-training	53.53 ± 7.47	36.50 ± 5.64	<0.001
Mean change	27.00 ± 10.94	18.56 ± 4.59	0.005
Vacuum delivery skill			
Pre-training	12.47 ± 6.02	6.00 ± 0.01	<0.001
Post-training	25.79 ± 2.67	14.39 ± 2.20	<0.001
Mean change	13.32 ± 5.72	8.39 ± 2.20	0.002

**Kruskal–Wallis test*

Discussion

Unexpected emergencies can sometimes occur during labor that can harm both the mother and the baby (11,12) Since obstetric emergencies are rare and challenging to learn in real life, simulation-based medical education has been argued to be an important remedy (13). In such a training program, training and assessment problems should be presented originally. A device or set of conditions should be prepared. The trainee should be expected to respond to the problems as in natural conditions (14). According to the Accreditation Council for Graduate Medical Education, at least 15 operative vaginal deliveries must be performed individually before graduation. Correct cup placement on the fetal head and knowing when to abandon it appear to be critical components of achieving a safe and successful vacuum delivery. The "ease of use" of a vacuum compared to forceps has led to deficiencies in training and an increasing number of complications due to its use (15). The use of forceps is especially limited nowadays. Shoulder dystocia is still among the unpredictable complications in obstetrics, and maternal and neonatal morbidity can be reduced with correct maneuvers. Apply approach and knowledge and the maneuvers are important in breech vaginal delivery training. Other education programs should be provided since it is impossible to reach a sufficient number of operative births in education due to the cesarean section rates. Because simulation-based education can touch every stage of the experiential learning cycle, it is an ideal tool for experiential learning and is suitable for adult learners (16). It was stated in a systematic review compiling the previous studies that simulation training improved obstetric outcomes in operative vaginal deliveries. A decrease was found in neonatal and maternal complications (perineal tear, anal sphincter injury, cervical, vaginal injury, neonatal scalp, and facial injury) in vaginal deliveries post-training (17). There was a significant difference in the evaluation of pre-and post-training skills (simulation and theoretical) in the present study in the operative births. Post-training scores increased significantly in all of the skills. Similarly, Daniels et al. (2010), in their study comparing the didactic and simulation methods for shoulder dystocia and arthrosis scenarios, concluded that the group trained with the simulation method had higher scores and higher success levels (18). The benefit of the course, and the total scores of the doctors, were higher than those of the midwives. It was thought that the reason for this might be related to the length of the undergraduate education period undertaken by doctors. The use of simulation in nursing education and its integration into the curriculum allows students to learn based on experience, increase their knowledge level and self-confidence, and improve their clinical decision-making skills (19). The present study is the first in the literature to include shoulder dystocia management, breech delivery skills, vacuum, and forceps experience, and has a wide scope. The fact that the groups were very compact and consisted of few participants also ensured that the benefit of the trainees was at the maximum level.

Simulation programs should include a standard didactic curriculum added to a solid simulation curriculum, and trainee feedback and development should be documented in the training program (17). The presentations, scenarios, assessments, and evaluation techniques made during the course were standard applications in this study. The post-course feedbacks of the participants about the course were positive. Participants evaluated the simulation applications as excellent and stated that they partially reflected real situations. In addition, the trainees reported that their anxiety decreased and that the training with simulation would positively contribute to their experience and vocational birth skills.

In addition, the presented study proved that very costly robotic systems are not necessary for simulation training, and maneuvers can be learned well with simple pelvic models and babies. We believe that giving and disseminating an effective and accessible simulation protocol on obstetrics to health personnel may reduce birth complications. The use of simulation as an educational method in obstetrics education, and its integration into the curriculum, provide the students with the opportunity to learn based on practice by providing self-confidence and without harming the patient in a safe environment, thus improving their decision-making skills.

There are limited numbers of studies on this subject all over the world. However, no study includes all difficult delivery models (breech shoulder forceps and vacuum applications) together. Simulation studies are generally carried out with a large number of participants and not all participants can practice in simulation. However, in our study, each participant practiced on the simulator. The small number of participants is one of the limitations of the study. The study can be repeated in larger populations and multicenter.

Ethical Approval: The participants were healthcare professionals, and patients and patient data were not used in the study. Post-training was announced, and the study was carried out by obtaining written consent from eligible participants before participating in the study in a single center. The training program was planned to take place during regular working hours, and no extra fee was charged for the course. The evaluation forms of the participants were kept confidential. The trial complied with the current version of the Declaration of Helsinki on biomedical research and with the Act on Processing of Personal Data. Relevant approval from The Regional Ethics Committee (Approval number: 2021-382, 05.02.2021).

Informed Consent: Written and verbal consent was obtained from all participants for the study.

Availability of data and materials: The data supporting this study is available through the corresponding author upon reasonable request. / The datasets and code used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests: No conflict of interest was declared by the authors.

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