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Vaginal delivery of the second twin: a simulation program for residents in obstetrics and gynecology in a type III university maternity hospital

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Abstract

Objective: To implement a vaginal delivery of the second twin simulation program for obstetric and gynecology residents, to reduce maternal-fetal mortality in the management of twin pregnancies in the delivery room.

Design: A prospective education program. The session consisted of a theoretical part, a practical part on a mannequin and an evaluation. The model was designed in a simple and reproducible way. The simulation evaluation was done at several levels according to the validated Kirkpatrick model.

Setting: A tertiary level university maternity hospital.

Participants: Ten obstetric and gynecology residents participated.

Results: The resident's personal feelings about their ability to perform the maneuvers increased significantly after participation in the simulation session. Their technical skills in performing the maneuvers were assessed in a second step. The majority of the participants considered the model realistic and the session useful. All agreed that the simulation was an essential part of their learning process.

Conclusion: A simulated vaginal delivery of the second twin session allows residents to be safely trained in these obstetrical maneuvers, which can be difficult to teach and perform.

Keywords: twin pregnancy; twin vaginal delivery; simulation; Simulation-based training; resident; breech extraction

Competencies: Patient Care; Medical knowledge; Systems-based practice

Introduction

Twin pregnancies are an obstetrical situation more and more frequent in developed countries. There has been an increase of more than 80% since the 1970s due to the rise maternal age and the extensive recourse to medically assisted procreation techniques. In 2016, twin pregnancies represented 3.6% of births in France and 3.3% in the United States [1][2].

Different studies have shown the absence of differences relating to neonatal morbidity and mortality regardless of the mode of birth: vaginal or planned cesarean delivery in selected patients. The multi-center randomized study "Twin Birth Study" conducted in the United States was the first to show that planned cesarean sections did not reduce the risk of neonatal morbidity and mortality compared with vaginal delivery in fetuses over 32 weeks of gestation with a cephalic presentation of the first twin [3]. This was recently confirmed in France by the prospective cohort study JUMODA (JUmeaux MODE d'Accouchement) conducted in 176 maternities in France from February 2014 to March 2015 [4]. This non-randomized study concluded that planned caesarean sections in this context are associated with higher neonatal morbidity and mortality.

However, active management of the second twin is recommended in France instead of a delayed delivery [5][6]. The main objective of this active management is to reduce the time between the two births. Indeed, a long birth interval between the first and second twin is associated, for the second twin, with a decrease in arterial pH [7], an increased risk of emergency caesarean section [8] and a higher neonatal morbidity and mortality [9].

These guidelines involve performing specific obstetrical maneuvers on the second twin according to the fetal presentation [5]: internal podalic version and then breech extraction in the case of transverse or even in high and mobile cephalic presentation, large breech

extraction in the case of breech presentation. Guidelines suggest proceeding the maneuvers with interrupted amniotic membranes.

Despite those recommendations, the elective cesarean section rate for twin pregnancies has continued to rise, from 54% in 1995 to 75% in 2008 in the United States [10], and reached a rate of 45% in 2010 in France [11].

Twin vaginal delivery remains a high-risk obstetrical situation that obstetricians are wary of. Forty-six percent of obstetricians surveyed in the United States reported being uncomfortable with the practice [12]. Add to this, exposure of young obstetricians with the situation remains a rare event during their residency, restricting training opportunities. A study conducted in 2014 by the Association des Gynécologues Obstétriciens en Formation (AGOF) revealed that French residents usually observed and performed between one and five internal podalic version/ breech extraction for the vaginal delivery of the second twin during their entire residency [13].

In obstetrics, as in other medical or surgical specialties, simulation is widely used and accepted as a way of learning [14]. It has now become unanimously acknowledged for the training of medical practitioners and their continuing professional development [15] and seems to be appreciated by physicians [16]. In many obstetrical emergencies, the rapidity and competence of health professionals are necessary for maternal-fetal health. These situations are consequently prone to simulation. Several studies have already demonstrated the utility of simulation training in obstetrics for the management of breech presentation delivery [17], shoulder dystocia [18],[19] post-partum hemorrhage [20], eclampsia [21] and even for improved teamwork in delivery room [22]·[23].

For twin vaginal delivery, some teams have already set up simulation programs with beneficial results on the knowledge and skills of practitioners, both senior and junior [24][25][26].

At Nantes University Hospital, a type III maternity hospital, residents are already aware of simulation thanks to occasional seminars proposed [27]. Our project was to set up a second twin vaginal delivery simulation program aimed at residents, and to evaluate their technical ability to perform the maneuvers and their anxiety about the situation.

Materials and methods:

In September 2021, two simulation training sessions were organized for obstetrics and gynecology residents at Nantes University Hospital regardless of their year of internship. The program focused only on the technical procedure of the second twin delivery, we admitted the physiological delivery of the first twin and focused only on the procedural technique. It could be the first step of a future clinical situation simulation program, in which the technical skill will not be an obstacle of the global management of this obstetrical situation.

We used a 39 cm, 430 g plastic fetus model and a human-sized maternal pelvis mannequin (Simulaid®) (Figures 1 and 2). The fetus was introduced in a latex endo-vaginal ultrasound probe cover. Ambient temperature water was added inside. A fine knot was tied at the cephalic pole of the fetus to make the device watertight and not to interfere with the contact between the breech and the limbs. The whole device could then be placed in the maternal pelvis model (Figure 3).

Residents were split into groups of 5. The simulation sessions were conducted in a labor room of the Nantes University Hospital maternity. The instructor team consisted of two people: an instructor responsible for the correct course of the session and an external evaluator in order to evaluate the participants during their maneuvers performance.

The session was conducted according to the following sequence: "briefing", theoretical part, simulation exercise and the "debriefing".

The session lasted 90 minutes and opened with a "briefing". The briefing was around 10 minutes: the residents visited the delivery room and the equipment available was presented. The session timetable was explained as well as the duration. Key values such as benevolence, and rules of simulation in medical pedagogy were reminded.

~~The instructor team consisted of two people: an instructor responsible for the correct course of the session and an external evaluator in order to evaluate the participants during their maneuvers performance.~~

Then the theoretical part followed. A ten-slide presentation was projected concerning the epidemiology of twin pregnancies, recommendations regarding their vaginal delivery, and the obstetrical maneuvers were explained: internal podalic version and breech extraction, including iconographies. A 3-minute video about the maneuver procedure was viewed.

Following the viewing, residents took turns one by one for the simulation exercise. The session included two rounds per person: a breech extraction and an internal podalic version followed by a breech extraction.

The pelvic model was positioned on the delivery table on a liquid collection bag. A delivery table was set up with a delivery kit consisting of scissors, clamps, an amniotic membrane hook, and sterile compresses. While the participant dressed in a surgical gown and sterile gloves, the fetus was placed in the maternal pelvis, blind to him/her. The resident would

start with a clinical examination, in order to first diagnose the fetal presentation and then to perform the maneuver. The amniotic rupture was left to the operator appreciation if they had to break it artificially.

During the performance, participants could express their diagnosis and their feelings about the sensations, but could not be helped by the instructor. Indeed, in a real clinical situation only the operator is aware of the perceptions. Each resident was evaluated by the external evaluator for the procedure performance, according to a predefined evaluation table. Immediately after the maneuver, the participant expressed his feelings and difficulties. At the end of the session two questionnaires were distributed: a self-assessment questionnaire and a satisfaction questionnaire (Appendix 1). When the participants completed both questionnaires, instructors processed to the “debriefing”. It was a fifteen minutes talk with all participants and instructors. First each participant could express their global feeling, their difficulties, and comment the points of the session to improve, then the instructors discussed about the different stages of the manoeuvres and debrief anonymously the positive points and the main errors they observed. At the end they expressed their global feedback about the session.

The simulation program was evaluated at several levels according to Kirkpatrick's validated model [28]. The first level was evaluated through a satisfaction questionnaire: participants were asked to rate the degree of realism and the usefulness of the session including the relevance of the theoretical part, as well as their overall satisfaction, from 0 to 10. They could also express themselves freely through open comments (Appendix 1).

The second evaluation level of the program was assessed during the practical part of the simulation by the external evaluator. Each participant was evaluated on a scale of 1 to 9 for each technical step of the maneuver.

The quantitative variables were compared by a Mann-Whitney test.

Results

Ten obstetric and gynecology residents participated in the program. The majority were women (90%) aged from 24 to 29 years old. Three were from the first year of residency, four from the second, two from the third and one in the fourth year.

The organization of the sessions was easily managed, with an hour and a half required per session. The sessions took place at the end of the day after the residents' shift in groups of 5.

The material needed was the same as used during practical exercises in the delivery room.

The latex probe covers were those used in all departments of the maternity ward.

Half of the participants (5/10) had already received theoretical training concerning the obstetrical maneuvers to be carried out on the second twin: 3 during their clinical rotations, 1 during a University Diploma and 1 during a national meeting.

All residents had already experienced a twin pregnancy delivery with internal version and breech extraction by caesarean section and half had previously performed at least one, the other half never (Table 1). All except one resident from first-year had observed at least one internal version and breech extraction on twin vaginal delivery. Half had observed more than 5 with the senior obstetrician performing maneuvers. Six out of ten had already performed

between 1 to 5 times with supervision, the others never, and none had trained already more than 5 times.

Residents evaluation carried out by the evaluator trainer is presented in Table 2.

Residents were asked to evaluate their technical skills self-confidence in performing the maneuvers and their anxiety towards the situation before and after the simulation session.

We noticed a significant increase in the perception of technical abilities (4.5/10 vs. 2.5/10 in median, $p=0.02$). Anxiety did not significantly decrease (5.5 vs. 7.0, $p=0.22$).

Then they evaluated the simulation device, sequence and the program's impact on future professional practice. More than the majority, 60%, rated the realism of the simulation model as 7/10. 90% of participants evaluated the utility as being at least 8/10, as well as the relevance of the theoretical part of the session. All participants estimated their overall satisfaction at or above 8/10. 30% considered the impact intermediate (6-7/10), the rest considered the impact stronger ($\geq 8/10$).

Seventy percent of the participants declared having already undergone obstetric simulation programs on the following topics: physiological delivery, breech delivery, maternal cardiac arrest, shoulder dystocia and instrumental extraction. The global residents' feeling was positive, they were unanimous concerning the importance of the simulation training sessions. All said "yes" when asked if they would like to participate in one again and felt that a simulation training session on the management of the second twin vaginal delivery should be an integral part of an obstetrician-gynecologist background.

Discussion

Obstetrics lends well to simulation because of the urgent situations and the medico-legal issues that this specialty represents. Simulation in obstetrics has been developed since the first half of the 18th century [29]. "The Machine" imagined by Mrs du Coudray consisted of a model made of wool and canvas representing a pelvis and a newborn baby, to train junior midwives [30]. In the United States, the Association of American Medical Colleges (AAMC) recommended in 1898 the use of the Budin-Pinard phantom [31]. Since that time, many obstetric simulation models have been developed [32], including high-fidelity and augmented reality simulation models [33].

Our study showed that the organization of a simulation program for the vaginal delivery of the second twin was easily achievable at the Nantes University Hospital, with low cost and in a reproducible manner. The residents benefited immediately in terms of confidence in their technical skills. Our study while certainly not powerful enough to show an effect on the anxiety felt, the effect on individual benefit was noticed. All the residents found this teaching to be useful and are requesting the perpetuation of this simulation program in order to not have to perform first time technical procedures on a patient.

Our program tried to conform to good practice of simulation. The sequence: "briefing" - situation - "debriefing" was carried out correctly. We note the importance of debriefing and evaluation. Indeed, evaluation is one of the key points of a simulation session: *"Evaluation in education is the systematic analysis of the quality of teaching and learning"*, Mac Dougall, 2010. ~~Kirkpatrick's model, introduced in 1967 suggests an evaluation on 4 levels. It's the most frequently used evaluating model in simulation. Level 1 is self-assessed and concerns the degree of participants' satisfaction. It was evaluated in our study by a questionnaire (Appendix 2). Level 2 is used to assess the technical knowledge and performance of participants. It's the evaluation by an external observer during the practical part of the~~

~~course. A second session would be necessary to evaluate the progress of the residents on their objective technical skills and to evaluate their progression between two sessions. In addition, further studies would be needed to evaluate levels 3 and 4 of Kirkpatrick's model. Level 3 concerns the impact on professional practice change, and level 4 assesses the clinical impact with the benefit to the patient.~~

Our survey also has some limitations. First, a small sample of residents, only ten, was represented and the group was heterogeneous: residents from the 1st to the 4th year of residency were represented with different level of experience according to their stage of residency over six year in total. Our model can be improved: the water put into the amniotic sac was not at 37°, the model was of moderate fidelity compared to some high fidelity models found in other studies [34]. However, the participants still considered the model to be realistic and to provide close to reality tactile sensations. The equipment required for our simulation device can be found in any maternity hospital, which facilitates the reproduction of this session for the training of a wide range of practitioners.

Regarding our simulation program evaluation, it allows only two level of the most frequently used evaluating model in simulation: Kirkpatrick's model. This model introduced in 1967 suggests an evaluation on 4 levels. Level 1 is self-assessed and concerns the degree of participants' satisfaction. It was evaluated in our study by a questionnaire (Appendix 2). Level 2 is used to assess the technical knowledge and performance of participants. It's the evaluation by an external observer during the practical part of the course. A second session would be necessary to evaluate the progress of the residents on their objective technical skills and to evaluate their progression between two sessions. In addition, further studies would be needed to evaluate levels 3 and 4 of Kirkpatrick's model. Level 3 concerns the

impact on professional practice change, and level 4 assesses the clinical impact with the benefit to the patient. This might be considered in the future.

Vaginal delivery of twin pregnancy is not a rare event in Hospital university centers, representing 15/1000 pregnancies. In the French JUMODA cohort study including 5915 patients at more than 32 weeks of gestation, 25% of them had a planned caesarean section, 75% an attempted vaginal delivery and of these, 80% delivered vaginally [4]. When French obstetricians were surveyed, more than 90% of them accepted to attempt vaginal delivery when the first twin is in cephalic presentation, regardless of the presentation of the second twin [35]. This is the presentation of 80% of twin pregnancies [36].

However, internal podalic version is an obstetrical maneuver for which the operator acts blindly to his senior who is not in a position to control or correct the procedure, unlike an instrumental extraction for example. This may explain why senior obstetricians are more concerned about letting their residents perform this maneuver. A recent study showed no difference in neonatal morbidity and mortality between the delivery of a second twin of noncephalic presentation by a junior and a senior obstetrician [37]. In this study, senior obstetricians allowed their residents to perform 40% of twin deliveries. The results of this study may encourage practitioners to be more confident in supervising their residents. The implementation of a simulation model and pre-delivery training would further reassure the senior obstetrician. Dedicated sessions for seniors could also maintain their skills and participate to the perpetuation of teaching vaginal twin delivery to future generations of obstetricians.

Conclusion

We implemented a simulation session of vaginal delivery of the second twin in our hospital, which allows residents to practice and gain significant technical skills. Based on the ethical principle of teaching through simulation: "never the first time on a patient", prior participation in this situation could allow a more serene approach in the birth room and perpetuate the teaching of these risky maneuvers which are the same to know in case of caesarean section.

Competing Interests

The authors did not report any potential conflicts of interest with this article.

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Figure 1: Fetus model



Figure 2: Human-sized maternal pelvis mannequin



Figure3: Fetus in the maternal pelvis mannequin



Table 1: Description of resident population (10 residents) and their internal podalic version/breech extraction experience during caesarean and vaginal delivery

Resident	Year of residency	Number of maneuvers performed during C-section	Number of maneuvers performed during vaginal delivery
1	1st	1-5	1-5
2	2nd	1-5	1-5
3	3rd	1-5	1-5
4	2nd	0	1-5
5	1st	0	0
6	4th	0	1-5
7	2nd	1-5	0
8	3rd	0	0
9	1st	0	0
10	2nd	0	1-5

Table 2: Average over 9 obtained by all interns for each stage of the maneuver

Stage	Maneuver	Stage of the maneuver	Average
1	Internal podalic version	Fetal presentation diagnosis	8.2
2		Breech localization	8.4
3		Locating foot with ankle angulation or toe briefs	8.8
4		Anterior foot or both feet grasping	8.3
5		Intact amniotic membranes	7.7
6		Lowering of the foot(s) by gentle traction	7.1
7		Release of the back in anterior	8.8
8	Breech extraction	Traction with slight rotation until the scapulae are visible	8.3
9		Surgical towel to grasp the fetus	6
10		In kneeling position	6
11		Fetus grasping: thumbs placed over the sacrum and fingers over the anterior iliac crests	8.7
12		First 90° rotation of the fetus	8.3
13		Traction in the umbilical-coccytal axis	8
14		Anterior arm delivery	8.1
15		Second 180° rotation in the reverse direction	7.7
16		Second shoulder and arm delivery	8
17		Bracht or Mauriceau maneuver	8.4