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Internal podalic version of second twin: Improving feet identification using a simulation model

David Desseauve [a,*], Caroline Daelemans [b], Alexandre Farin [c], Imane Ben M'Bareck Jauvion [d,e], Pierre-François Ceccaldi [d,e], for the Prise en charge des Accouchements à Risque eT des Urgences Maternelles PARTUM teaching program

[a] Women-Mother-Child Department, Lausanne University Hospital (CHUV), Lausanne, Switzerland
[b] Women-Mother-Child Department, Geneva University Hospitals (HUG), Geneva, Switzerland
[c] Obstetric Unit, Riviera-Chablais Hospital, Rennaz, Switzerland
[d] Department of Simulation, Université de Paris, Paris, France
[e] Obstetrics and Gynecology Service, Assistance Publique – Hôpitaux de Paris, Hôpital Beaujon, Clichy La Garenne, France

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ABSTRACT

Background: Podalic version and breech extraction require high obstetrical expertise. Identifying fetal extremities is the first crucial step for trainees. When this skill is not polished enough, it increases the inter-twin delivery interval and can even jeopardize the whole manoeuver.

Material and methods: We present a model for simulating and training this specific skill, with obstetrical mannequin, and 3D printed hands and feet. Five feet and five hands (five rights and five lefts of each one) were printed in 3D after initial ultrasound acquisition of a near term fetus. Each foot and hand, was individually set in a condom filled with 100 cc of water and closed with a knot. A Sophie's Mum Birth Simulator Version 4.0 de MODEL-med was placed on the edge of the table. Each hand and foot was inserted into the pelvic mannequin. An evaluation of the students' skills using this model was performed. A significant reduction of the global mean to extract the first foot and all the feet was noticed at three month of interval.

Conclusion: This model is an option to train and assess a crucial skill for version and breech extraction.

Introduction

With the primary goal to reduce the rate of primary cesarean delivery, the 21th century's obstetricians face what can be named, "the twin delivery dilemma ". On one hand recent guidelines like the one from the American College of Obstetrics and Gynecology (ACOG) state that it is a reasonable option to offer vaginal delivery for diamniotic non-vertex presenting twins when a skilled obstetrician is available [1]. On the other hand, the obstetrical skills in internal podalic version, breech extraction, and operative vaginal deliveries for twin delivery tend to disappear due to ongoing debates about the better route of delivery for twins, singleton breech fetuses, or the safety of assisted delivery [2]. There is consistent data supporting active management of the second twin delivery: the reduction of the inter-twin delivery interval could improve neonatal outcomes [3]. Even in the case of cephalic/cephalic twin presentations, 20% of vertex presenting second twins will change presentation spontaneously after the first twin is delivered requiring obstetrical maneuvers [4]. According to Alexander et al., 8.9 % of caesarean section on second twins had been performed after a failed operative vaginal delivery [5].

The data needed to understand and improve medical practices for the delivery of twins include patient selection, regular practice of technical procedures (obstetrical skills), non-technical coordination during their performance, and of course fetal characteristics (presentation, gestational age). All of this influences the deliveries between the two fetuses. Some technical skills such as internal version are as feasible by the normal delivery route or during caesarean section.

It is now admitted that skilled obstetricians are too few to train the next generation with a real companionship during their training period on labor ward [6]. It is therefore wishful thinking to believe that the reduction of primary cesarean delivery in women with twins, could be reached in the present situation whatever the country. Furthermore the

* Corresponding author.
E-mail address: david.desseauve@chuv.ch (D. Desseauve).

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safety motto which spreads widely in medical education "Never the first time on a patient" challenges now senior obstetricians to find new solutions to teach on labor ward.

It is possible today, with the widespread use of simulation and 3D printing in medicine, to design educational projects in order to learn performing skills considered uncommon [7]. The simulation model presented by Cornette et al., realistically mimics the Podalic Version and Breech Extraction (PVBE) of second twin [8]. Thanks to this model all the steps of PVBE can be trained. Nevertheless we hypothesize that identifying fetal extremities is the first crucial and challenging step for trainees. This first step requires digital dexterity and sensitivity to identify the correct fetal limb extremity. When this skill is not polished enough, it increases the inter-twin delivery interval and can even jeopardize the whole manoeuver. We present here a simulation model that realistically mimics sensations obstetricians experience during the first step of PVBE (identification of fetal limbs extremities). A video describes the model in detail, (Video 1)). An evaluation of the students' skills using this model was performed during a European teaching program (PARTUM).

Methods

We have developed and experimented this model during the PARTUM European teaching program (https://www.ulb.be/fr/programme/fc-532) which aims to improve obstetrical skills using simulation and a 'Guide on the Side', rather than a 'Sage on the Stage', teaching philosophy.

Before the exercise, we have taught the principles of PVBE (indication, objectives, and methods) and each student has practiced once on the model described by Cornette et al. Before the exercise, the landmarks for recognition of fetal feet and hands had been pointed out to the candidate. All candidates (N = 18) were obstetricians (residents, seniors registrars or consultants).

Five feet and five hands (five rights and five lefts of each one) were printed in 3D after initial ultrasound acquisition of a near term fetus (Fig. 1). Two different materials have been used for 3D printing (Blue PolyFlex TPU95 2.85 mm, Black PLA Neofil3D 2.85 mm) on Ultimaker 2+ printer (Ultimaker, Utrecht, Netherlands), to provide different renitences and a haptic sensitive feedback. Each foot and hand, was individually set in a condom filled with 100 cc of water and closed with a knot. A Sophie's Mum Birth Simulator Version 4.0 de MODEL-med was placed on the edge of the table. Each hand and foot was inserted into the pelvic mannequin.

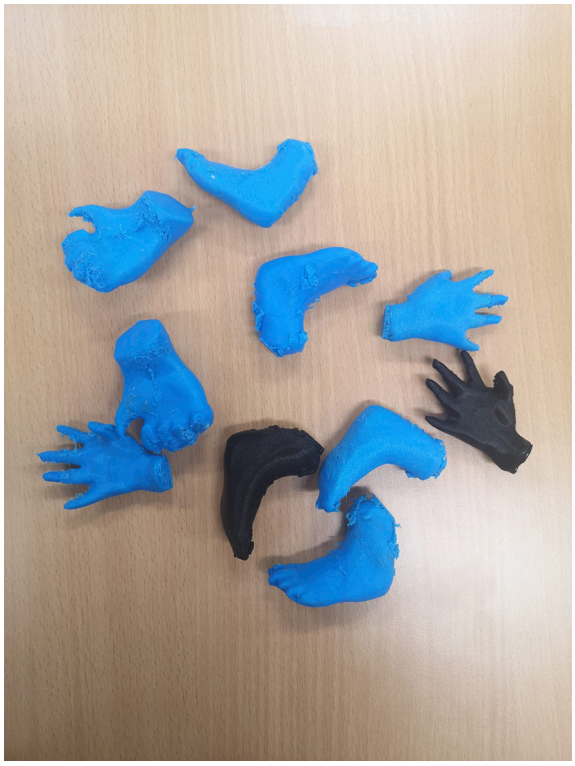

Fig. 1. Example of hands and foot used in simulation model.

Then we asked the candidates (N = 18) to extract all the feet available inside the mannequin. We timed them up to extract the first foot then all five feet. The extraction of one or several hands, or the rupture of the condoms, were also put on record. The same candidates endeavored to do the same exercise during a second session three months later.

The results between two the different sessions were compared using non-parametric tests (Wilcoxon rank signed for mean time, and Friedman test for the numbers of condoms ruptured or hands extracted). Results between the different kind of candidates (junior obstetricians, and senior obstetricians) were also compared.

All candidates gave a written consent to participate to this assessment. In this exploratory pilot study, power calculations were not performed. The significance level was defined as $p < 0.05$. Data analysis and reporting was performed using Stata V16 (Stata Corp, College Station, TX, USA).

Experience/results

The global mean time to extract the first foot was respectively 24.2 ± 10.4 s vs 17.2 ± 9.02 s with a significant difference (p = 0.03) between the two periods. There was non-significant differences for other outcomes (rupture of pouches or hands instead of feet). There was however a significant improvement in the time necessary to extract all feet (124.0 ± 41.2 vs 94.6 ± 41.3p = 0.02) (Table 1).

This exploratory study allows us to draw further hypotheses to evaluate the efficiency of this model to improve skills in the identification of feet and hands. The gain of time is probably not clinically relevant to reduce the inter-twin delivery interval. However this exercise allows the trainees to become aware that this specific time, fetal foot location and extraction, contributes to the overall time of the birth interval between the twins, which in itself influences the neonatal outcome of the second twin. Indeed, the longer above 15 min the inter twins delivery time is, the closer to 7.00 the umbilical cord pH of the second twin will be [9]. Nevertheless speed can be related to familiarity and confidence in the procedure. We observed that in the setting of training, the most important benefit of time measurement is that it provides a significant stress factor for the participants. This is important because stressors imposed on the learner, during simulation-based training, may help support the acquisition of stress management skills that are necessary on the labor ward [10].

Facing the challenge to develop more and more complex and reliable mannequins for several obstetrical situations, we show, in this approach, that we can with an accurate analysis of a complex obstetrical procedure improve one of the crucial gestures.

Table 1
Comparison of performance skills to identify hand and foot using a simulation model dedicated for the first step of PVBE between 2 sessions (3 months of interval).

Study population (N = 18)	*Session 1* *N = 18*	*Session 2* *N = 18*	*p-value*
Exit Time (mean ± SD, sec)			
First foot	24.2 ± 10.4	17.2 ± 9.02	0.03
All five feet	124.0 ± 41.2	94.6 ± 41.3	0.02
Rupture of pouches during the process (median, [min–max])	1 [0;5]	1 [0;3]	0.3
Hands out instead of feet (median, [min–max])	0 [0;1]	1 [0;2]	0.4

This model is not a comprehensive model for the teaching of second twin birth. During internal version, traction on the anterior rather than the posterior leg limits the risk of "confrontation" between the hip and knee and the symphysis. It is possible to distinguish the anterior foot from the posterior one by perception of the thumb position: up or down. The anterior foot is identified when the thumb looks down. It will be possible to train this specific skill with an improved accuracy of 3D printed mannequins like the one designed by Cornette et al. [8]. In the same way, the use of 3D print technology after ultrasound acquisition enables us to customise the simulation model further, for example for the identification of preterm fetal extremities."

Impact of this training in real conditions are lacking in this first exploratory study, but we hope that obstetricians will be more confidents when they will have to do the next PVBE.

Conclusion

The training of uncommon maneuvers in obstetrics could, be possible with means such as 3D printing allowing the development of simple tools for a repeated simulation as close as possible to the real conditions. Other studies are necessary to help acquire the technical skills necessary for safer obstetrical practices.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ejogrb.2022.05.036.

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