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EDUCATION AND TRAINING

Effect of high-fidelity shoulder dystocia simulation on emergency obstetric skills and crew resource management skills among residents

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ABSTRACT

Objective: To determine the effect of a simulation training program for residents in obstetrics and gynecology in terms of technical and nontechnical skills for the management of shoulder dystocia. *Methods:* A prospective study was performed at a center in Italy in April–May 2015. Thirty-two obstetrics and gynecology residents were divided into two groups. Residents in the control group were immediately exposed to an emergency shoulder dystocia scenario, whereas those in the simulation group completed a 2-hour training session with the simulator before being exposed to the scenario. After 8 weeks, the residents were again exposed to the shoulder dystocia scenario and reassessed. Participants were scored on their demonstration of technical and nontechnical skills. *Results:* In the first set of scenarios, the mean score was higher in the simulation group than the control group in terms of both technical skills ($P=0.008$) and nontechnical skills ($P<0.001$). This difference was retained after 8 weeks. *Conclusion:* High-fidelity simulation programs could be used for the training of residents in obstetrics and gynecology to diagnose and manage obstetric emergencies such as shoulder dystocia.

1. Introduction

Shoulder dystocia is one of the most feared obstetric complications. Its diagnosis and management are difficult, and the condition is associated with a high incidence of neonatal morbidity and mortality [1]. Shoulder dystocia occurs in 0.2%–3% of all deliveries [2], and there are no medical history or diagnostic tools that predict its occurrence [3–5]. The obstetric risk factors that have been associated with shoulder dystocia—e.g. advanced maternal age, previous high birth weight, and previous operative delivery [6,7]—are controversial. For instance, the birth weight is less than 4000 g [8] in 40%–60% of newborns with shoulder dystocia. Therefore, most known risk factors have a low predictive value [9].

In view of the uncommon occurrence of shoulder dystocia [10] and the significant technical skills required to treat this condition, most obstetricians are not well prepared to deal with this emergency. The effective management of shoulder dystocia requires swift collaboration between the lead physician and the rest of the obstetrics team [11]. This can only be achieved through the development of a multidisciplinary team that works together toward a common aim. The Confidential Enquiry into Stillbirths and Deaths in Infancy report [12] showed that 50% of all maternal deaths and 75% of all intrapartum fetal deaths can be avoided by optimal obstetric management, supporting the concept that teamwork is essential for the successful treatment of shoulder dystocia.

High-fidelity simulation training applied to obstetrics is an effective tool to enable operators not only to overcome the technical challenges of this emergency, but also to practice and develop the team leadership skills that are needed to effectively cooperate with other healthcare professionals in the delivery room [13,14]. The aim of the present study was to determine the impact of a simulation training program in shoulder dystocia on the ability of obstetrics and gynecology residents to manage these emergencies, to develop and apply correct treatment algorithms, and to communicate effectively with the obstetrics team.

2. Materials and methods

The present prospective study was undertaken between April 1 and May 30, 2015. It included the 32 obstetrics and gynecology residents in years 2–5 of their education at the University of Pisa in Pisa, Italy. Previous studies [15] have shown that individuals react differently when they know they are being assessed, so the decision was taken not to inform residents that they were participating in a study—including that their simulation performances would be video-

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recorded and analyzed—until data collection had finished. At that point, all included residents gave their consent for the use of their data for research purposes. No sensitive or personal data were used, and results were used only for research purposes and not for the evaluation of residents. For these reasons, we did not believe ethics committee approval was necessary.

The sequence of study procedures is shown in Fig. 1. Before randomization, all residents completed an anonymous self-assessment questionnaire to evaluate theoretical knowledge about the management and treatment of shoulder dystocia. The questionnaire contained seven questions, meaning that the maximum possible score was 7. The questions assessed the residents' knowledge, such as whether they knew the correct sequence to follow to resolve shoulder dystocia or which arm to use for Jacquemier maneuver.

On April 1, 2015, residents were randomized into two groups (16 per group), on the basis of the alphabetical order of surnames. Residents assigned to the control group immediately participated in a series of simulation scenarios. Those assigned to the other group—the simulation group—were not exposed to the simulation scenarios until the following day, after they had completed a 2-hour training session with a simulator that allowed the completion of maneuvers.

Each series of simulations included several separate scenarios residents. In addition to shoulder dystocia, simulations of normal delivery, breech presentation, and postpartum hemorrhage were completed; participants did not know which scenario they were to face in advance.

The shoulder dystocia scenario was completed twice in a delivery room containing a standard delivery table with common instruments, clamps, scissors, and forceps. An assistant (G.P.) was present who was acting as the midwife. The SimMom birthing simulator (Laerdal, Gatesville, TX, USA) with an additional automated delivery module was used for the simulation. The automated delivery module (ADM Simmom, Laerdal, code 377-05150) allowed adjustment of the descent of the head and shoulders by a scenario director (P.M., a senior obstetrician experienced in simulation) following a pre-established protocol. The scenario director stayed outside the room and controlled the program through video cameras. The performance of the residents was recorded for research purposes and for subsequent group discussion.

The residents were instructed to treat the simulation as a real-life situation and to use any instruments and gloves accordingly. Before entering the delivery room, each resident was asked to review the clinical history of a 28-year-old multiparous woman in labor, with the fetus in the cephalic position, who had no apparent risk factors for difficult labor. The woman had been pushing for approximately 60 minutes at full cervical dilatation. When the resident entered the room, the assistant acting as the midwife told him/her that the patient was pushing well and that the fetal head had just been delivered in the right occiput anterior position, but the doctor had been called because she (the assistant) had "difficulty with the shoulders."

The resident was expected to diagnose shoulder dystocia, and was then tested for the ability to perform the correct sequence of obstetric maneuvers to solve shoulder dystocia (Box 1), and crew resource management (Box 2). All other actors (senior obstetrician, anesthesiologist, senior midwife, and neonatologist) entered the room at the time of the resident's request. An external and experienced observer monitored the resident's actions from the next room, and the examination was considered complete with execution of the Zavanelli maneuver.

If the resident was unable to perform one of the maneuvers or if one of the maneuvers was performed incorrectly, the simulation was not blocked; the scenario continued through the subsequent steps. The scenario was only stopped when all maneuvers had been performed, when the resident was unable to complete a subsequent maneuver within the shoulder dystocia algorithm, or in the event of a fatal error (incorrect diagnosis or dangerous execution of any of the maneuvers).

The residents were evaluated for their technical skills (ability to perform the maneuvers included in the shoulder dystocia treatment algorithm according to international guidelines) and for their management and communication skills (crew resource management). One point was assigned for each correctly performed maneuver; zero points were assigned if a procedure was not attempted or if it was performed incorrectly. The duration of each maneuver and the duration of the entire procedure were measured.

After 8 weeks, residents repeated the series of different scenarios, including the shoulder dystocia simulation scenario, on which they were reassessed.

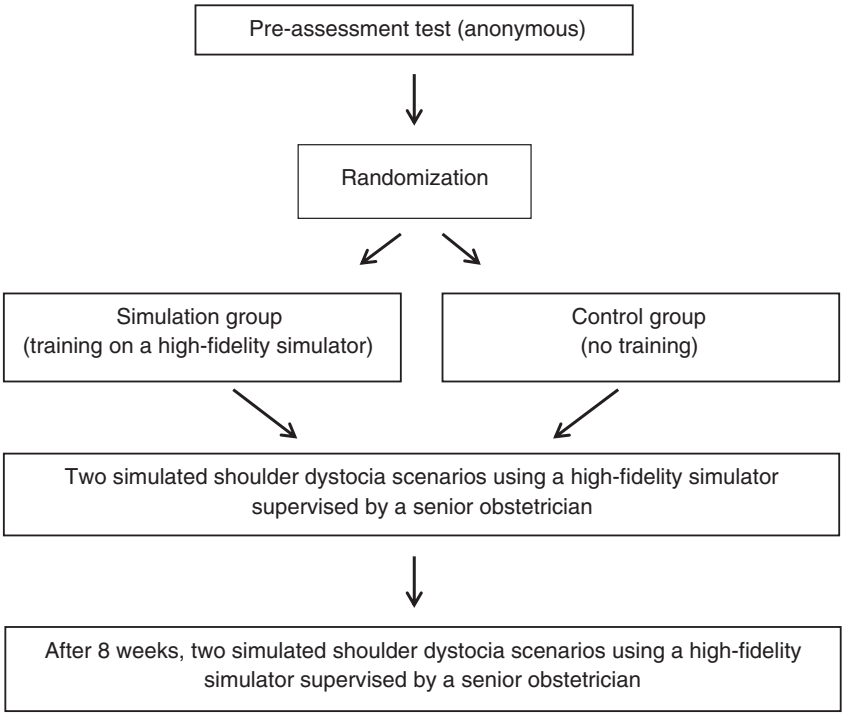

Fig. 1. Experimental design of the study.

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