Enhancing Obstetric Emergency Management Through Simulation-Based Training: A Focus on Shoulder Dystocia

Amélioration de la gestion des urgences obstétricales grâce à la formation par simulation: Focus sur la dystocie des épaules

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Abstract

Introduction: Modern obstetrics faces the challenge of effectively training practitioners for the management of rare but critical obstetric emergencies, such as shoulder dystocia. Simulation has become an essential educational tool, allowing healthcare professionals in initial and continuing education to practice in a controlled environment, thereby promoting learning without risk to patients.
Aim: This article explores the effectiveness of simulation in improving practical skills and team management during obstetric emergencies.
Methods: A structured training program was implemented for 14 first-year obstetrics-gynecology residents, consisting of three monthly simulation sessions using both high-fidelity (SimMOM) and low-fidelity mannequins for shoulder dystocia management, supervised by a specialized 5-member team and followed by structured three-phase debriefings.
Results: Our study demonstrates a significant improvement in the management of shoulder dystocia following simulation training, with positive impacts on clinical outcomes and maternal-fetal safety. Despite its advantages, obstetric simulation presents challenges such as financial costs and the need for adequate expertise among trainers.
Conclusion: Simulation offers a promising solution to enhance clinical skills and interprofessional coordination in obstetrics, thereby contributing to better quality of care and the reduction of preventable complications.

Key words: Simulation training, shoulder dystocia, safety patient

Résumé

Introduction: L'obstétrique moderne est confrontée au défi de former efficacement les praticiens à la gestion d'urgences obstétricales rares mais critiques, telles que la dystocie des épaules. La simulation est devenue un outil pédagogique essentiel, permettant aux professionnels de santé en formation initiale et continue de s'exercer dans un environnement contrôlé, favorisant ainsi l'apprentissage sans risque pour les patients.
Objectif: Cet article explore l'efficacité de la simulation dans l'amélioration des compétences pratiques et de la gestion de l'équipe pendant les urgences obstétricales.
Méthodes: Nous avons mis en place un programme structuré de formation pour 14 résidents de première année en obstétrique-gynécologie, comprenant trois sessions de simulation à un mois d'intervalle, combinant mannequins haute-fidélité (SimMOM) et basse-fidélité pour la gestion de la dystocie des épaules, avec des sessions supervisées par une équipe spécialisée de 5 membres et suivies de débriefings structurés en trois phases
Résultats: Notre étude démontre une amélioration significative de la prise en charge de la dystocie de l'épaule suite à la formation par simulation, avec des impacts positifs sur les résultats cliniques et la sécurité materno-fœtale. Malgré ses avantages, la simulation obstétrique présente des défis tels que les coûts financiers et la nécessité d'une expertise adéquate chez les formateurs.
Conclusion: La simulation offre une solution prometteuse pour améliorer les compétences cliniques et la coordination interprofessionnelle en obstétrique, contribuant ainsi à une meilleure qualité des soins et à la réduction des complications évitables.

Mots clés: Formation par simulation, dystocie des épaules, sécurité des patients

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Introduction

Healthcare simulation refers to "the use of equipment (such as a mannequin or procedural simulator), virtual reality, or a standardized patient to replicate healthcare situations or environments, to teach diagnostic and therapeutic procedures, and to allow the repetition of processes, clinical situations, or decision-making by a healthcare professional or team" [1].
It aims to improve patient safety by enabling healthcare professionals to practice before performing procedures on real patients while developing procedural and technical skills. In obstetrics, simulation is particularly valuable for handling critical and rare emergencies, such as shoulder dystocia, a potentially life-threatening complication for both the mother and fetus. This learning method offers a valuable opportunity to practice and master the obstetric maneuvers required in these critical cases, thereby reducing the risks of neonatal and maternal morbidity. This approach includes not only the acquisition of knowledge and technical skills but also the development of relational skills essential for effective communication between the care team members and with the patients.
The objective of this study was to evaluate the effectiveness of simulation in improving the performance of the obstetric team in managing shoulder dystocia, as well as the participants' satisfaction with this innovative teaching method.

Methods

We implemented a structured training program consisting of three simulation sessions, spaced one month apart. The training took place at the "Cesim" simulation center of the Faculty of Medicine of Monastir during the 2021-2022 academic year. Fourteen first-year residents in obstetrics and gynecology were randomly selected to participate in the study.
The simulations utilized a high-fidelity mannequin, "SimMOM," positioned on a delivery table to replicate shoulder dystocia scenarios. This setup allowed for the adjustment of maternal hemodynamic parameters and simulated fetal descent management. Cameras were installed in the simulation room to record the sessions, which facilitated post-simulation debriefing in a dedicated room.
The supervisory team consisted of five specialized members, each with specific roles, including mannequin operator, technical assistant, facilitator midwife, medical support (simulated anesthesiologist or neonatologist), and evaluator.
In addition to the high-fidelity simulation using the "SimMOM" mannequin, participants also received practical training on low-fidelity mannequins. This supplementary training aimed to reinforce essential concepts and provide hands-on experience in a less complex environment, complementing the high-fidelity simulation.
Each simulation session followed a standardized protocol, beginning with a preparatory phase in which participants were briefed on the scenario and assigned specific roles. Following each simulation, a structured debriefing took place in three phases: descriptive, analytical, and synthetic, aimed at optimizing learning outcomes.
Data entry and statistical analysis were conducted using Microsoft Office Excel 2019 and IBM SPSS. Frequencies and numbers were calculated for categorical variables. Participant satisfaction was assessed using a 4-point Likert scale (Strongly Disagree, Disagree, Agree, Strongly Agree). This scale was intentionally chosen to eliminate a neutral midpoint, thereby encouraging participants to provide more definitive feedback and facilitating clearer interpretation of satisfaction levels.

Results

The results of this study evaluating the practical performance of participants in high-fidelity obstetric simulation scenarios reveal several key aspects of both performance and learner satisfaction.

Practical Evaluation of Participants in the High-Fidelity Mannequin Scenario

Six residents were enrolled in the study with two learners for each simulation session using the "SimMom" mannequin. The remaining participants practiced various maneuvers on low-fidelity mannequins after completing the debriefing and theoretical review.
All participants successfully diagnosed shoulder dystocia and called for assistance, including a neonatologist, within one minute of the dystocia. However, no one documented the time of head release, and two performed inappropriate maneuvers, such as pulling on the fetus's head and applying fundal pressure.
The execution of key tasks varied among participants. All correctly performed the McRoberts maneuver with suprapubic pressure. Two residents successfully executed the Jacquemier maneuver, while in two other cases, shoulder release required the intervention of a facilitator acting as a midwife. In some cases, an instructor acting as a senior physician had to intervene to complete the delivery. None of the participants measured the head-to-shoulder release interval (Figure 1).

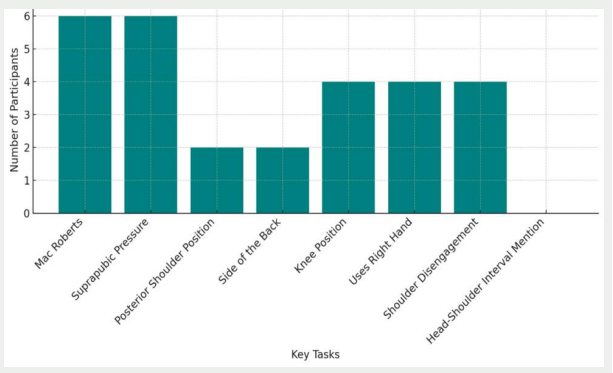

Figure 1. Validation of main tasks

After delivery, none of the participants communicated with the patient to explain the maneuvers performed or discuss potential neonatal complications. Regarding the delivery reports written at the end of the scenario, all included the date and time of delivery, the list of personnel involved, the newborn's weight, the Apgar score, and the initial examination. However, only four residents mentioned the type of dystocia, the position of the back, and the timeline of the maneuvers and no one calculated the head-to-shoulder release interval.

Impact of the Simulation Session on Theoretical Knowledge

Participants underwent theoretical assessments before (pre-test) and after (post-test) the simulation session. Before the training, the pre-test results showed that only 12 out of 42 candidates correctly answered the questions regarding the initial tasks during shoulder dystocia.

Nine participants correctly answered the MCQ on the McRoberts maneuver. None of the participants correctly answered the MCQs on the reverse Wood's maneuver and the Jacquemier maneuver. Overall, none of the participants scored above average; 21 candidates (50%) had no correct answers, and 21 candidates (50%) correctly answered 1 out of 5 MCQs.

After the training, twelve participants (28.57%) correctly answered all the post-test questions. Eighty five percent of participants scored above average indicating a significant improvement in the theoretical knowledge acquired (Figure 2).

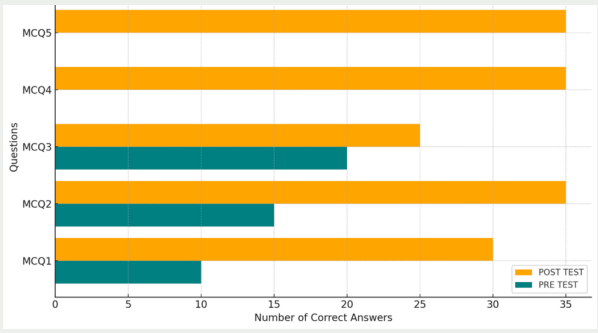

Figure 2. Number of correct answers to pre- and post-test questions

Degree of Participant Satisfaction

Regarding participant satisfaction, the majority expressed high satisfaction with the organization of the simulation session. However, six participants complained about insufficient time allocation between different phases of the simulation session, and three disagreed that the group size was appropriate (Table 1).

Table 1. Degree of participant satisfaction with the organization of the session

Degree of participant satisfaction	Strongly Disagree	Disagree	Agree	Strongly Agree	Total
The duration of the session is suitable for the content	0	0	12	30	42
The distribution of time between different phases was relevant	0	6	9	27	42
The trainers were available	0	0	3	39	42
The group size was adequate	2	1	15	14	42
The general atmosphere was conducive to learning	0	0	4	38	42

All participants considered the session's topic relevant, although two expressed doubts about the ability of simulation to effectively supplement practical training. Thirty-one participants out of 42 found the briefing reassuring, while 4 did not respond to this question. Similarly, 19 participants felt that the explanations were clear, and the briefing time was adequate for everyone. Regarding the elements covered in the briefing, 33 agreed that all the following elements were addressed (the importance of simulation, ethical principles, session objectives, role distribution), while 9 participants did not respond to this question.

Eight residents (19%) disagreed that the time allocated for the simulation itself was adequate. Three thought the debriefing time was insufficient. All six participants involved in the scenario stated that they had the opportunity to reflect on and discuss their performance during the debriefing. Additionally, all participants agreed that the instructor offered constructive feedback and summarized key issues during the debriefing. (Table 2).

Table 2. Degree of participant satisfaction with the conduct of the session

	Strongly Disagree	Disagree	Agree	Strongly agree	Total
The participants' reception by the trainers was caring	0	0	0	42	42
The briefing reassured me	0	0	7	31	38
The explanations were sufficiently clear	0	1	22	19	42
The time allocated to the briefing was appropriate	0	0	0	42	42
During the briefing, all these elements were covered: the interest of the simulation, the ethical principles, the session objectives, the distribution of everyone's roles	0	0	6	27	33
The time allocated to the simulation itself is appropriate	2	6	18	14	40
The time allocated to the debriefing is appropriate	0	3	30	9	42
During the debriefing, the participants were able to express their feelings	0	0	3	39	42
The distribution of speaking time for each was fair	0	6	6	30	42
There was no judgment during the debriefing	1	2	7	32	42
I had the opportunity to reflect and discuss my performance during the debriefing (for those who participated in the role play)	0	0	0	6	6
If necessary, the trainer offered me hints that allowed me to progress in my thinking	0	0	8	34	42
The trainer provided constructive criticism during the debriefing	0	0	13	29	42
The trainer summarized important questions during the debriefing	0	0	13	29	42
During the debriefing, the observation grid was used	0	0	23	19	42

Discussion

Obstetric simulation emerges as a crucial tool for training and continuous professional development in the management of obstetric emergencies, such as shoulder dystocia. This approach allows healthcare professionals to practice in a safe and controlled environment, thereby improving their technical and non-technical skills, such as communication and the management of multidisciplinary teams. In 2010, in response to alarming rates of often preventable maternal and neonatal mortality, the WHO recommended improving the management of obstetric emergencies through practical training based on simulations [2]. In response to WHO guidelines and the growing demands for patient safety, structured simulation programs like PROMPT and MOSES have been developed to standardize training and improve clinical outcomes. These programs offer systematic, structured, and multidisciplinary management of obstetric emergencies and are now part of the obstetrics and gynecology training curriculum in the United States and the United Kingdom [3].

Current data demonstrate the effectiveness of simulation in managing shoulder dystocia, with studies showing significant improvements in successful delivery rates following training, as well as a reduction in neonatal complications such as brachial plexus injuries. A multicenter randomized controlled trial conducted by Crofts et al. in the UK in 2006 compared the outcomes of training 95 midwives and 45 doctors in the management of shoulder dystocia, either using a high-fidelity mannequin measuring the traction force on the fetus's neck or an actress paired with a traditional low-fidelity mannequin [4]. All training was associated with improved performance: the use of basic maneuvers increased from 114 out of 140 (81.4%) to 125 out of 132 (94.7%) (P = 0.002), successful deliveries from 60 out of 140 (42.9%) to 110 out of 132 (83.3%) (P < 0.001), and effective communication with the patient from 79 out of 139 (56.8%) to 109 out of 132 (82.6%) (P < 0.001), respectively, before and after training.

An ancillary study to the previous one, focusing on the improvement of knowledge in the management of obstetric emergencies through simulation, including shoulder dystocia, revealed a significant increase in knowledge three weeks after the simulation session (level 2 according to the Donald Kirkpatrick evaluation model). Another study conducted by Issenberg SB et al., published in 2005, assessed the patient's perception of safety during shoulder dystocia, the respect and professionalism afforded to her, and the quality of communication within the team. These three parameters significantly improved after the simulation (p < 0.001) (level 3 according to the Donald Kirkpatrick evaluation model) [6].

In 2016, the same team evaluated the ongoing training of obstetric teams through simulation for the management of shoulder dystocia, 12 years after its implementation (one session every 2 months since 2000) [7]. Best practices in the management of shoulder dystocia were significantly more frequently followed over time (46.3% before simulation sessions, 92% at the start of the training period, and 99.8% at the end of the period; p < 0.001). A strong clinical impact was also demonstrated, with a significant reduction in the rate of brachial plexus injuries from 7.4% before simulation training to 2.3% at the beginning and 1.3% at the end of the period (p < 0.01) (level 4 according to the Donald Kirkpatrick evaluation model). The authors report a long-term benefit on clinical practice and neonatal morbidity from the use of simulation in the management of shoulder dystocia. They also report the absence of neonatal brachial plexus extension during the last 12 months of the study across the 562 cases of shoulder dystocia reported.

However, despite its advantages, obstetric simulation faces significant challenges. Trainer training is often insufficient, which can compromise the quality of simulation sessions. Moreover, the high costs in terms of equipment and personnel time remain obstacles to the widespread expansion of these programs. Additionally, the need for high-level evidence on the clinical impact of simulation persists, necessitating more rigorous studies to justify the financial and human investment required [8-10].

Conclusions

While simulation offers considerable potential for improving the management of obstetric emergencies, its effective deployment requires ongoing commitment to trainer training, rigorous evaluation of its clinical effects, and careful management of financial and human resources. These efforts are essential to ensure high-quality obstetric care and maximum safety for patients and their newborns.

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