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Original Research Article

Impact of timely obstetric simulation on vaginal breech delivery management

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ABSTRACT

Background: The management of breech presentations represents a significant challenge in obstetrics, necessitating advanced skills for optimal clinical outcomes. Simulation-based training has emerged as a promising approach to enhance the proficiency of healthcare professionals in assisted vaginal breech deliveries, potentially improving neonatal outcomes.
Methods: This research study was conducted at Rafic Hariri University Hospital, Beirut, to evaluate the impact of simulation-based training on the management of breech presentations. Using Robson's classification, a comparative analysis was performed on the outcomes of breech deliveries before and after the implementation of this training. The focus was primarily on assisted vaginal deliveries within the R6 (all nulliparous women with a single breech baby, cesarean section) and R7 (all multiparous women with a single breech baby, cesarean section) groups.
Results: Post-training, there was a notable increase in the rate of assisted vaginal deliveries in the R6 category, indicating the effectiveness of the simulation-based training. However, the rate of assisted vaginal deliveries within the R7 group showed no significant change. Additionally, the positive impact of the training demonstrated a time-sensitive decline, underscoring the necessity for ongoing practice and reinforcement of skills.
Conclusions: Simulation-based training offers substantial benefits in managing breech presentations, particularly evident in the increased rate of assisted vaginal deliveries among nulliparous women (R6). However, the absence of change in the multiparous women (R7) group and the time-sensitive reduction in training effectiveness highlight the critical need for continuous skill development and reinforcement.

Keywords: Assisted vaginal delivery, Breech presentation, Neonatal outcomes, Obstetrics, PROMPT, Simulation-based training

INTRODUCTION

Breech presentations, where fetuses' orient feet or buttocks first instead of the standard head-down position, emerge in about 3 to 4% of pregnancies post the 37-week mark.[1] These unconventional fetal positions can amplify childbirth-associated risks, encompassing complications like cord prolapse, head entrapment, asphyxia hypoxia, and cerebral haemorrhage.[2] Factors such as Polyhydramnios, bicornuate uterus, and placental conditions like placenta praevia are potential culprits for breech presentations.[3] Other determinants include multiparity, premature births, specific fetal anomalies, increased fetal mortality, and a truncated umbilical cord.[4]

Given these challenges, specialized training programs have become indispensable. The in-time obstetric simulation training, for instance, offers case-based

learning to hone critical teamwork skills, leadership acumen, communication prowess, and heightened situational awareness.[5] A notable outcome of this program is its tangible enhancement of healthcare professionals' capabilities, especially when tackling obstetric emergencies like vaginal breech deliveries. Post-training evaluations have illuminated marked improvements in teamwork, manifesting particularly in the management of cord prolapse scenarios.[6]

For structured monitoring and categorization, the World Health Organization (WHO) in 2015 vouched for the Robson classification system, a globally accepted tool.[7] According to this classification, Group 6 consists of first-time mothers with a singleton fetus in breech, while Group 7 includes women with prior birthing experiences but currently with a singleton fetus in breech.[8]

Simulation training has etched a significant footprint in modern obstetrics, especially in facilitating breech-assisted vaginal deliveries. These programs, proliferating globally, have heralded positive transformations in delivery outcomes.[9]

A notable adoption of this training methodology is evident at Rafic Hariri University Hospital in Beirut, which stands alone in Lebanon's healthcare landscape for its comprehensive integration of the trainers program for maternity staff and its reliance on the Robson classification.[10]

With this backdrop, our study aimed to assess the effectiveness of the in-time obstetric simulation training, primarily at the Rafic Hariri University Hospital. By contrasting outcomes before and after the training intervention, we aspire to quantify its influence on breech delivery management and related neonatal results.

METHODS

Study type and setting

This case-management study was carried out at Rafic Hariri University Hospital, a tertiary care facility in Beirut, Lebanon. The study period spanned from June 2018 to June 2019.

Inclusion criteria

Inclusion criteria for the study were pregnancies of 37 weeks or more, hospital birth, a verified live fetus, and a NICU fetus, focusing on singleton pregnancies.

Exclusion criteria

Exclusion criteria included preterm deliveries (under 37 weeks gestation), out-of-hospital births, fetal deaths in utero identified before delivery, lethal fetal abnormalities identified antenatally, and cases with incomplete medical records.

Data collection procedure

Data collection involved the use of the electronic maternity database (STORK), specifically designed to log cases of vaginal breech delivery at the hospital. This database captures detailed information on each delivery, including the mode of delivery, clinical indications, employed maneuvers during delivery, Apgar scores at one and five minutes post-delivery, and admissions to the special care nursery (SCN). The accuracy of the data entered into STORK was verified by cross-referencing with hard copy patient notes.

Separate data on the training sessions attended by physicians, including attendance, performance metrics, and feedback, were maintained by the hospital's training department. This information was used to assess the impact of training on delivery outcomes.

Training intervention

Obstetricians were divided into two groups based on their participation in Practical Obstetric Multi-Professional Training (PROMPT). The study compared the methods of breech presentation delivery between these groups using the Robson 10-group classification. Educational workshops incorporating simulated sessions aligned with PROMPT were conducted for attending physicians, who then applied these skills in patient care.

The in-time course

This one-day, case-based simulation training focused on enhancing multidisciplinary teamwork during obstetric emergencies, including vaginal breech delivery. Participants, including obstetric residents, registrars, nursing, and midwifery staff, engaged in emergency simulation scenarios and practical workshops using a PROMPT birthing simulator.

Figure 1: The PROMPT baby manikin and pelvis birthing simulator.

Maneuvers and simulation

Training included hands-on practice of breech vaginal delivery maneuvers on a manikin baby and pelvis, under the guidance of experienced obstetric staff.

The study was conducted adhering to clinical research ethical standards and was approved by the Ethics Committee of Rafic Hariri University Hospital. Though informed consent was not sought from participants due to the study's retrospective and non-invasive nature, all data were anonymized, and participant rights and confidentiality were rigorously upheld.

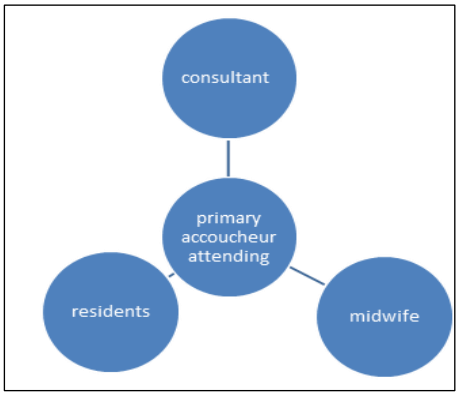

Figure 2: Primary arroucheur attending types.

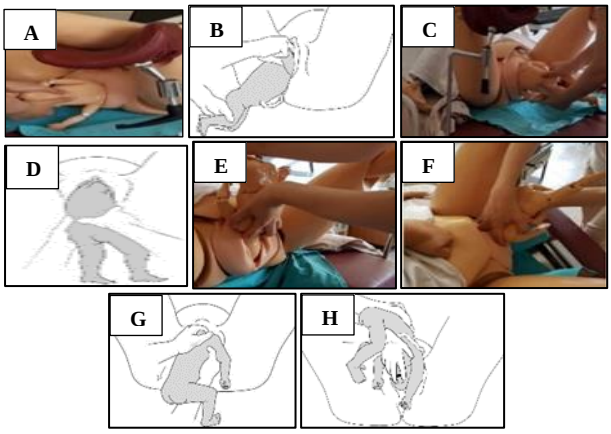

Figure 3: Different maneuvers of breech delivery during simulation. This figure depicts the execution of: (A-F) A Lovset's manoeuvre, which is a common technique for rotating the breech baby during delivery. (G & H) Mauriceau's manoeuvre, another method used to aid in breech deliveries.

Statistical analysis

The study utilized independent t-tests and Chi-square tests to analyze demographic and clinical data, finding no significant differences in maternal age, parity, BMI, and gravida between non-training and training groups. Assisted vaginal deliveries in the R6 group significantly increased post-training ($p<0.05$), demonstrating the training's effectiveness. Logistic regression highlighted prematurity as a key factor in NICU admissions, without significant differences in Apgar scores or NICU admission rates between the groups. Analysis was conducted using SPSS version 25.0, with significance set at $p<0.05$.

RESULTS

Demographic details

From Table 1, maternal age, parity distribution, body mass index (BMI), and gravida did not display significant differences between the non-training and training groups. Mode of delivery and maneuvers at delivery were also compared.

Table 1: Maternal demographic and other characteristics between pre and post-training persons.

	Training n=46	Non training n=46	p-value
Maternal age	31 (25–36; 20–41)	32 (26–35; 17–42)	0.532
parity	Nullipare 17	Nullipare 20	0.976
	R6 36,96%	R6 43,48%	
	Multipare 29	Multipare 26	
	R7 63,94%	R7 56,52%	
BMI kg /m^2	25.5 (23.3–29.4; 17.7–44.1)	25.4 (23.8–29.8; 18.3–45.9)	0.661
Gravida	3 (2–4; 1–6)	2 (2–4; 1–13)	0.755
Mode of delivery (%)			
Spontaneous vaginal breech	17 (30.4)	18 (31.5)	0.212
Assisted breech	8 (14.3)	6 (26.3)	0.212
Breech extraction	21 (55.4)	22 (41.2)	0.212
Manoeuvres performed at delivery	25 (44.6)	42 (52.5)	0.467
Type of manoeuvres performed at delivery (%)			
Lovsett's	3 (5.4)	9 (11.3)	0.359
Mauriceau-Smellie-Veit	4 (7.1)	9 (11.3)	0.623
Other (i.e. Burns Marshall)	7 (12.5)	8 (10)	0.848
Total, any manoeuvre	25 (44.6)	42 (52.5)	0.467

It is evident that the maternal age did not show a significant difference between the non-training and training groups, with a p-value of 0.532. The age ranged from 17 to 42 years in the non-training group, and from 20 to 41 years in the training group.

The parity distribution between the two groups, when classified according to Robson's classification (R6 and R7), was also not significantly different with a p-value of 0.976. Notably, the percentage of multiparous women in the R7 category was slightly higher post-training.

The body mass index (BMI) showed a minimal difference between the groups, with medians around 25.4 and 25.5 for the non-training and training groups, respectively. The gravida, indicating the number of pregnancies a woman has had, ranged between 1-13 for the non-training group and 1-6 for the training group, without a significant difference (p-value: 0.755).

In terms of the mode of delivery, the percentage of spontaneous vaginal breech, assisted breech, and breech extraction deliveries were comparable between the two groups, with p-values of 0.212 for each.

Regarding the maneuvers performed at delivery, a slight decrease was observed in the training group (44.6%) compared to the non-training group (52.5%). However, when considering the specific types of maneuvers, the numbers were similar between groups.

Table 2: Prevalence of vaginal delivery in breech presentation according to Robson classification and the status of simulation.

Doctors who attend the simulation				Doctors who didn't attend the simulation			
Robson 6		**Robson 7**		**Robson 6**		**Robson 7**	
Cesarean	Vaginal delivery	Cesarean	Vaginal delivery	Cesarean	Vaginal delivery	Cesarean	Vaginal delivery
10	7	23	6	20	0	19	7
Prevalence of assisted vaginal delivery in each group (%)							
7/17=41.1%		6/29=20.7%		0/20=0%		7/26=27%	

Delivery mode and maneuvers

In the comparative analysis of delivery modes and maneuvers between the training and non-training groups, notable differences were observed, particularly in the context of assisted vaginal deliveries and the involvement of senior physicians during the procedures. The study delineated three main breech delivery maneuvers demonstrated during simulation training: Lovset's, Bracht's, and Mauriceau's maneuvers.

Lovset's maneuver is characterized by the rotation of the infant to facilitate the presentation of the anterior shoulder, followed by the application of downward traction to assist the descent of the shoulders along the pubic axis, culminating in the delivery of the anterior arm and shoulder. Bracht's maneuver involves holding the infant by the hips and elevating towards the mother's abdomen following the delivery of the arms, without applying traction, to allow the neck to pivot around the symphysis, with an assistant applying suprapubic pressure to aid in delivering the aftercoming head. Mauriceau's maneuver requires the infant to straddle the birth attendant's forearm, lowering the infant's head (with the occiput anterior) to bring the occiput in contact with the symphysis, and tilting the infant's back upwards toward the mother's abdomen, facilitating a controlled delivery.

These maneuvers, integral to the management of breech deliveries, underscore the significance of specific techniques in enhancing delivery outcomes and ensuring the safety of both the mother and the infant. The presence of senior physicians during these deliveries, especially in the training group, further highlights the importance of expertise and hands-on guidance in executing these complex procedures effectively.

Trends in cesarean delivery post-simulation training

Following the end of the simulation sessions, it was a marked reduction in the rate of cesarean delivery, especially for groups R6 and R7 from July to December 2019. However, a surge was observed between January and June 2020, aligning the rates to those witnessed prior to the simulation training sessions. This trend is illustrated in Figure 4.

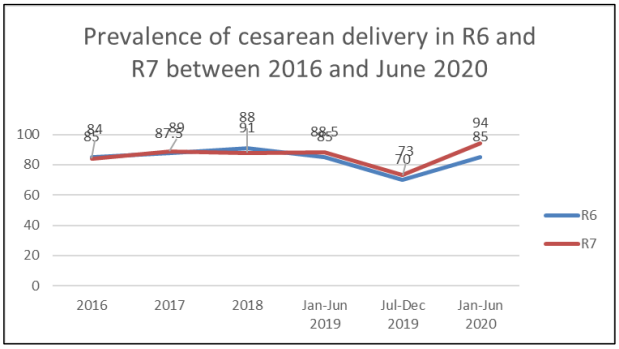

Figure 4: Prevalence of cesarean delivery in R6 and R7 from 2016 to June 2020.

In group R6, no assisted vaginal delivery (VD) attempts were made by obstetricians who did not participate in the

simulation. However, in the simulation group, the prevalence of VD was considerably higher, with 41.1% (7/17) attempts (Table 2). This difference is significant ($p < 0.05$). In the simulation group for category R6, attending obstetricians were more inclined to attempt assisted vaginal deliveries. In situations where VD was not attempted by physicians who had missed the simulation session, a senior physician was typically present.

Neonatal outcomes

Apgar score

Apgar scores of term pregnancies delivered vaginally were analyzed. The influence of prematurity on the Apgar score was also examined.

Factors influencing neonatal intensive care unit (NICU) admissions were studied, with prematurity standing out as a significant contributor. A breakdown of reasons for NICU admissions for both vaginal births and C-sections was provided. Prematurity was a significant factor in neonatal intensive care unit (NICU) admissions, both among natural births and C-sections. For the assisted vaginal birth group, 20% (4/20) of admissions to the NICU were due to prematurity, as all admitted neonates were born between 28 and 33 weeks of gestation. Conversely, no full-term infants delivered vaginally required NICU admission.

Of the C-section patients, 14% (10/72) were admitted to the NICU. Three of these were full-term deliveries (at 39 weeks, 38 weeks, and 38 weeks plus two days). One NICU admission was due to intrauterine growth restriction (IUGR), two were for respiratory distress, and the rest were for prematurity. Tragically, one preterm baby born at 29 weeks plus two days needed intubation and did not survive.

DISCUSSION

Our study, breaking new ground in the Lebanese context, is the first to assess the influence of simulation-based training on the rates of assisted vaginal delivery for breech presentations, according to Robson's classification. Notably, the data suggests that such training boosts the confidence of obstetricians, especially for breech deliveries in the R6 category.

The effectiveness of the Practical Obstetric Multi-Professional Training (PROMPT) has been well-documented. Originally from Bristol, its global influence has led to notable declines in neonatal hypoxic brain damage, shoulder dystocia-related injuries, and emergency caesareans.[11]

Interestingly, while Australia saw improvements in non-technical facets like teamwork after introducing PROMPT, the impact on tangible medical outcomes was less pronounced.[12,13] Recent evaluations of PROMPT focus more on non-technical skills and specific outcomes like Apgar scores at 1 minute instead of traditional measures like the 5-minute Apgar scores or maternal blood loss.[11,13-15]

As per Draycott's 2015 observations, the success of obstetric emergency training can differ based on the nature of data and training environment.[10-13] Factoring in local clinical conditions can amplify the results. A 2018 review reinforced the benefit of simulation-based training in boosting physician performance in obstetrics.[15] Moreover, in 2017, the Royal College of Obstetricians and Gynecologists pinpointed the importance of specific ultrasound findings during labor in foretelling vaginal breech delivery outcomes.[15] Our results echo the CNGOF's 2020 guidelines, which state that experienced obstetricians can minimize neonatal complications for both vaginal and elective cesarean deliveries in term breech pregnancies.[15] Furthermore, our findings align with Hardy et al, emphasizing simulation's pivotal role in enhancing medical practitioners' confidence and expertise.[13]

This study has some limitations. The distinctiveness of our research is its fresh perspective on the Lebanese medical environment, underscoring the potential of simulation-based training. Yet, it's crucial to acknowledge some limitations. Since our study is retrospective and conducted in a single center, the findings might not reflect the entirety of the Lebanese healthcare context.

CONCLUSION

Incorporating obstetric simulation training can dramatically improve the management of vaginal breech deliveries. We noticed a surge in vaginal deliveries among the simulation-trained physicians, especially in the R6 category of the Robson classification. However, these skills appeared to wane over time. To ensure persistent quality and confidence in handling breech vaginal deliveries, we advocate for regular refresher courses and sustained training.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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