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Original Research Article

Impact of multidisciplinary team simulation-based training of residents to improve the outcome of operative vaginal deliveries and obstetric emergencies

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ABSTRACT

Background: Obstetric emergencies such as eclampsia, atonic postpartum hemorrhage and maternal collapse, use of vacuum or forceps for operative vaginal deliveries are high pressure situations where residents don't feel very confident due to lack of practice. Use of high-fidelity simulation to improve the skill-set and confidence level was the main objective of this study.
Methods: This study was done in the D. Y. Patil University simulation lab over a period of 1 month. 42 postgraduate junior residents of the Department of Obstetrics and Gynaecology were included in the study. A pre and post workshop questionnaire on the subject and a confidence questionnaire were used to assess the residents. Three case-based scenarios were constructed on the high-fidelity simulator for the residents in the workshop followed by a debriefing of each case.
Results: The improvement in the knowledge and confidence for managing postpartum hemorrhage and eclampsia was from a mean value of 3.5±1.0 (2-6) and 4.7±1.0 (3-6) respectively in the pretest and a mean value of 8.2±0.8 (7-9) and 8.5±1.1 (6-10) respectively in the post test. The response time to postpartum hemorrhage and setup of eclampsia kit also had statistically significant p value of less than 0.0001.
Conclusions: Practice of obstetric emergencies, improving team building, communication and techniques of operative vaginal deliveries are all within the confines of a simulation laboratory. They are helpful in improving the proficiency of the junior residents and would eventually improve maternal and fetal outcomes.

Keywords: Eclampsia, Post-partum haemorrhage, Simulation, Lucina

INTRODUCTION

Obstetric emergencies are life threatening medical disorders that occur during the process of delivery or labour.[1] The most commonly encountered obstetric emergencies in institutional practice in India are severe preeclampsia, eclampsia and atonic postpartum haemorrhage leading to maternal collapse. Even a small error or a lapse in judgement and decision making during the process of any complicated delivery can alter its course and lead to disastrous results for both, the mother and the baby.

Operative vaginal delivery includes vacuum delivery and forceps application, both of which are used in high pressure situations where it is imminent to cut-short the second stage of labour. Correct technique for application, decision making process to initiate the use of instrument in

delivery and understanding of anatomy is where most residents don't feel confident due to lack of practice in a safe environment.

The purpose of this study was to improve the decision making, communication skills and techniques of the post-graduate junior residents in the department of obstetrics and gynaecology and reinforce the set protocols for any complication arising in the labour room, all within the confines of a safe simulation environment.

Aim and objectives

Aim

Aim of the study was to assess the improvement in the junior residents of the department of the obstetrics and gynaecology in managing obstetric emergencies using a high-fidelity simulation device.

Objectives

Objectives of the study were: to assess the current depth of knowledge of the junior residents in the department of obstetrics and gynaecology regarding operative vaginal delivery and obstetric emergencies; and to evaluate the improvement in the skill-set, confidence level and communication skills in high pressure situations of obstetric emergencies using pre and post-workshop questionnaires.

METHODS

This study was conducted at D. Y. Patil Simulation Laboratory. The duration of the study was for 1 month (October 2024 to November 2024).

Sample size

42 post-graduate junior residents posted in department of obstetrics and gynaecology, D. Y. Patil Hospital, Navi Mumbai were a part of the study.

Inclusion criteria

All post-graduate junior residents of obstetrics and gynaecology department of D. Y. Patil Hospital, Navi Mumbai signing the informed consent form were included in the study.

Exclusion criteria

Any post-graduate junior resident not giving consent for the study were excluded.

Methodology

After obtaining approval from the Institutional Ethics Committee the study was conducted. Three workshops of 6-8 hours each were conducted in a span of 1 month for the junior residents of the department of obstetrics and gynaecology. Each workshop had the following 5 steps: a pre-workshop questionnaire regarding the subject and a confidence questionnaire regarding their skill-set based on the instrument proposed by Scholz et al were given to all the post-graduate junior residents; a general orientation of the simulation laboratory and the high-fidelity simulation device-Lucina; simulation of case-based scenarios for the residents to master procedural techniques, improve decision making skills and enhance interdisciplinary communication; post case de-briefing; and a post workshop questionnaire and a confidence questionnaire to assess the difference in their confidence levels to manage obstetric emergencies and operative vaginal deliveries were given.[2]

The results were calculated using the T-test: two samples assuming equal variances.

RESULTS

The mean score of the residents in the pre-test was in the range of 3-8 which improved to 6-10 in the post-test. The p value for this test was less than 0.0001 which was statistically significant (Table 1).

Table 1: Theoretical knowledge about operative vaginal delivery.

Variable	Pre-test	Post-test	P value
Knowledge about operative vaginal delivery	5.2±1.0 (3-8)	8.2±0.9 (6-10)	<0.0001

The mean score in the pretest was 3.1 with the standard deviation of 1.2 (range 0-5) which improved to 7.2 with the standard deviation of 1.0 (range 6-9) in the post-test. The p value was less than 0.0001 which was statistically significant (Table 2).

Table 2: Improvement in confidence for operative vaginal delivery.

Variable	Pre-test	Post-test	P value
Improvement in confidence for operative vaginal delivery	3.1±1.2 (0-5)	7.2±1.0 (6-9)	<0.0001

The residents' theoretical knowledge of post-partum hemorrhage was tested which gave a mean value of 6.4 with the standard deviation of 1 (range 4-8) in the pretest and increased to 8.7 with the standard deviation of 0.8 (range 7-10) in the post-test. The p value for this test was less than 0.0001 which was statistically significant. The next component tested was identification of PPH which had mean pretest value of 5.3 with a standard deviation of 1.1 (range 4-7). The mean post-test value was 8.3 with a standard deviation of 0.7 (range 7-9). This too was

statistically significant with a p value of less than 0.0001 (Table 3).

Table 3: Theoretical knowledge and identification of PPH.

Variables	Pre-test	Post-test	P value
Knowledge about PPH	6.4±1.0 (4-8)	8.7±0.8 (7-10)	<0.0001
Identification of PPH	5.3±1.1 (4-7)	8.3±0.7 (7-9)	<0.0001

The pre-test confidence of the residents in management of post-partum hemorrhage and in team building and communication skills was 3.5 and 3.8 respectively which increased to 8.2 and 8 respectively in the post-test. The p value in assessing both the parameters was less than 0.0001.

The response time of the residents to the treatment of PPH was calculated which showed a drastic reduction from 59.7 seconds with the standard deviation of 9.3 (range 48-75) to 30.2 seconds with the standard deviation of 8.1 (range 20-40). The p value was less than 0.0001 which was statistically significant (Table 4).

Table 4: Improvement in confidence for managing PPH and the response time to PPH.

Variables	Pre-test	Post-test	P value
Confidence in management of PPH	3.5±1.0 (2-6)	8.2±0.8 (7-9)	<0.0001
Confidence in team building and communication skills	3.8±0.8 (2-5)	8.0±0.7 (7-9)	<0.0001
Response time to treatment of PPH	59.7±9.3 (48-75)	30.2±8.1 (20-40)	<0.0001

The theoretical knowledge of the residents in the pre-test had a mean value of 6.1 with the standard deviation of 0.9 (range 5-8) which improved to 7.8 with a standard deviation of 1.0 (range 5-9) in the post-test. The p value for this test was less than 0.0001.

The residents were tested regarding their knowledge of the drugs and instruments required in the eclampsia kit as well as the time required for the setup of eclampsia kit. The p value for both the tests was less than 0.0001, which was statistically significant (Table 5).

The confidence of the residents in managing eclampsia improved from a mean value of 4.7 with the standard deviation of 1.0 (range 3-6) to 8.5 with a standard deviation of 1.1 (range 6-10). The p value for this test was less than 0.0001 which was statistically significant. Similarly, the confidence in team building and communication skills also showed a steep improvement with a p value of less than 0.0001 (Table 6).

Table 5: Theoretical knowledge and setup of eclampsia kit.

Variables	Pre-test	Post-test	P value
Knowledge about severe PE and eclampsia	6.1±0.9 (5-8)	7.8±1.0 (5-9)	<0.0001
Setup of eclampsia kit			
Knowledge of drugs and instruments needed	5.7±1.0 (4-8)	8.1±0.7 (7-9)	<0.0001
Time required for setup	92.2±3.9 (88-98)	47.1±8.8 (33-60)	<0.0001

Table 6: Confidence in management of eclampsia and team skills.

Variables	Pre-test	Post-test	P value
Confidence in management of eclampsia	4.7±1.0 (3-6)	8.5±1.1 (6-10)	<0.0001
Confidence in team building and communication skills	4.5±0.8 (3-6)	8.5±0.9 (7-10)	<0.0001

DISCUSSION

Simulation-based training (SBT) has gained significant attention in the field of medical education, particularly in high-risk areas such as obstetrics. The implementation of multidisciplinary team-based simulation for residents in obstetrics is a promising approach to improving patient outcomes during operative vaginal deliveries (OVDs) and obstetric emergencies. This training methodology promotes the development of both technical and non-technical skills, which are essential for managing complex situations in the delivery room.[3]

Improved communication and teamwork

One of the primary advantages of multidisciplinary team-based simulation is the enhancement of communication and teamwork among healthcare providers.[4,5] Our study shows a drastic improvement in the confidence of residents in team building and communication skills while managing PPH with a p value of less than 0.0001. As described in the study by Weiss et al, simulation has exposed students and residents to increased levels of inter-professional communication and care coordination, which have led to an increase in team performance overall.[4] In obstetrics, the successful outcome of high-risk procedures, such as forceps or vacuum-assisted deliveries, often hinges on clear communication between obstetricians, anesthesiologists, nurses, and other supporting staff.[6,7]

Simulation allows residents to engage in simulated scenarios where they can practice coordinating care with different specialists, thus improving their ability to communicate effectively during real-life emergencies.[8-10] By fostering teamwork and reducing hierarchy in a simulated setting, residents can develop a greater understanding of each team member's role, which is crucial during time-sensitive procedures such as operative vaginal deliveries.[11]

In a study done by Minor et al, within the direct simulation group, knowledge and confidence scores significantly improved from pre- to immediately post-training (knowledge score mean difference 9.81 [95% CI 3.23–16.40] with a p value <0.01.[12] Similarly in our study, the theoretical knowledge and the confidence in managing obstetric emergency situations shows a significant improvement with all parameters having a p value of <0.001.

Reduction of stress and increased confidence

Obstetric emergencies can be stressful and overwhelming for residents who are still in the process of acquiring expertise. Simulation provides a safe space where residents can familiarize themselves with high-stakes situations without the added pressure of real-life consequences. By practicing in a simulated setting, residents are able to reduce anxiety and increase their self-confidence. This familiarity and comfort level can significantly improve their performance in real-world emergencies, resulting in better outcomes for both the mother and the infant.[13] The improvement in confidence for management of post-partum hemorrhage and eclampsia, which are the most commonly encountered emergencies in the Indian setting, was significant with a mean value of 3.5±1.0 (2-6) and 4.7±1.0 (3-6) respectively in the pretest and a mean value of 8.2±0.8 (7-9) and 8.5±1.1 (6-10) respectively in the post test.

Similarly, in a study done by Mannella et al, trainees have been shown to increase technical skills (46.27±4.6 with p value <0.0001), the successful application rate (85.71% with p value 0.0161) and to reduce the time to complete the procedure (86.2±29.9 s with p value <0.0001) for operative vaginal deliveries.[14] Hernandez et al also inferred that in the PPH simulated case, the results showed that the health professionals obtained a higher mean score in the post-test than in the pre-test in all of the competencies, thus being statistically significant (p<0.0001).[15]

Challenges and limitations

Despite its benefits, the implementation of multidisciplinary team simulation-based training does face several challenges. The availability of resources and the need for skilled facilitators are key limitations, as the setup of high-quality simulations requires specialized equipment, dedicated space, and personnel. The time commitment required for residents to participate in simulation training may also compete with their clinical responsibilities, which could limit their exposure to such valuable educational experiences.

CONCLUSION

Overall, multidisciplinary team simulation-based training holds significant promise in enhancing the quality of obstetric care, particularly in the areas of operative vaginal deliveries and obstetric emergencies. By improving communication, teamwork, and both technical and non-technical skills, SBT prepares residents to manage complex clinical scenarios more effectively. While challenges remain in terms of resources and time, the benefits of simulation in improving patient safety and outcomes far outweigh these barriers. This study indicates a marked difference in the knowledge and confidence of the junior residents' post-workshop for managing obstetric emergencies with a p value of <0.0001 in all parameters of assessment. With continued support and innovation, this training model could become a cornerstone of obstetric education, ultimately leading to improved clinical outcomes in maternal and neonatal care.

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