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The Effectiveness of Interactive Clinical Case Study Simulation (ICCSS) as a Teaching –Learning Tool in Cardiopulmonary Resuscitation

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Abstract:
Introduction: *Teaching in medicine should focus on enabling students to acquire knowledge and skill which translates in to best clinical outcomes. Class room based teachings or group discussions don't impart principles of team work, coordination or decision making which is prudent in an emergency situation. Introduction of technology based teaching like simulation is the need of the hour in medical curriculum.*
Methodology: *A total of 21 medical students trained in basic life support underwent an algorithm based class room lecture on shockable rhythm following which they were randomly divided in to 2 groups, 10 students were allocated to Non-simulation and 11 in HPS (Simulation) group. Non Simulation group had one 'hands-on session' based on conventional CPR mannequin for one clinical case scenario based on shockable rhythm. HPS group underwent one 'inter-active clinical case scenario' simulation (ICCSS) using human patient simulator for the same scenario based on shockable rhythm. A 21 point OSCE developed based on AHA guidelines was used to test each group.. Each student was scored based on the number of successfully completed procedures.*
Results: *Data was expressed as Mean+SD or mode. Chi square test or Mann whitney U test was used to compare data and student t test was used to compare quantitative data. P values less than 0.05 was taken to be significant. In the HPS group 95% of the core skills were met when compared to 62% in non simulation group. There was significant difference in performance of practical steps and steps that required team effort. The HPS group was found to be better coordinated.*
Keywords: *Human patient Simulation, Medical students*

I. Introduction

Teaching and learning is highly variable and depends on individual needs, method used, learning style and facilities available. Teaching in medicine should focus on enabling students to acquire knowledge and skill which translates in to best clinical outcomes (1). With increase in patient load, effective teaching requires considerable time, energy and innovation. Majority of teaching in medical colleges are class room based or small group discussions (2). These methods don't impart principles of team work, coordination or decision making which is prudent in an emergency situation. There is increase in emphasis on active learning with participation in place of older passive styles of teaching (2). Introduction of technology based teaching in medical curriculum is a welcome change which can provide for improved patient outcome. For a long time teaching in medicine has been from patients which at some level can be considered unethical. Medical field has always been subject to criticisms for the style of teaching involving patient. It has always been regarded as field of experimentation. With increase in awareness about patient safety and need to provide quality care shift is towards use of simulation for teaching. Simulation has been widely used in the fields of aerospace, military and aviation industry. This method creates a safe learning environment and useful where real patient experience might be limited. It has been shown to be effective in increasing user confidence, communication and allows for practice till becoming competent (3).

In the field of medicine simulation has been shown to improve patient outcome in laparoscopic surgeries, airway management, decrease blood stream related catheter infection and trauma resuscitation (4). Simulation has been increasingly used in the training of healthcare providers and has gained worldwide acceptance for the training of advanced cardiac life support (ACLS).4 The American Heart Association (AHA) has used simulation to train responders to cardiovascular emergencies for over 50 years(3) Advanced cardiac life support (ACLS) consists of set of interventions and protocols to be followed to enable a health care provider to respond and treat in event of a cardiac arrest or other emergencies (5). Advanced cardiac life support (ACLS) certification is a knowledge and performance skill set attained by healthcare providers who may encounter situations requiring advanced medical and nursing attention. The skill set involves advanced knowledge of airway management and cardiac rhythm treatment and management. However in the present scenario, medical curriculum doesn't make ACLS certification compulsory for passing undergraduate medical school. This has led

to gross lack of knowledge, competence and confidence among medical college students to handle emergencies (6). Hence the requirement to include teaching of basic life support and advanced life support at undergraduate level cannot be overemphasized. The ACLS course uses a mix of lecture and case scenarios to promote transfer of knowledge. This structure is amenable to high-fidelity simulation, but the effectiveness of high-fidelity simulation in ACLS knowledge and skill attainment has not been well documented in the literature (7). The aim of this study was to ascertain the effectiveness of interactive clinical case study simulation as a Teaching-Learning tool for management of shockable rhythm in cardiac arrest among medical students.

II. Methodology

The study was initiated after obtaining ethical clearance from the institutional ethical committee. All students were explained about the study protocol and consent was taken for participation in the study. A total of 21 medical students trained in basic life support were included in the study. All students underwent an algorithm based class room lecture on shockable rhythm. Following which they were randomly divided in to 2 groups, Non- simulation group and HPS (Simulation group). A total of 10 students were allocated to simulation and 11 in HPS group. Non Simulation group had one hands-on session based on conventional CPR mannequin for one clinical case scenario based on shockable rhythm. HPS group underwent one inter-active clinical case scenario simulation (ICCSS) using human patient simulator for the same scenario based on shockable rhythm. A 21 point OSCE developed based on AHA guidelines was used to test each group. The 21 point OSCE consists of steps that need to be performed for resuscitation during a cardiac arrest which is shockable (figure 1). All the students were assessed by the same examiner to maintain uniformity. 1 point was awarded for correct response and performance of step. Each student was scored based on the number of successfully completed procedures out of the possible correct steps. All students were briefed and corrected for the mistakes observed during OSCE after assessment.

III. Results

All result was tabulated and SPSS version 21 was used to do statistical analysis. Data was expressed as Mean+SD or mode. Chi square test or Mann whitney U test was used to compare data and student t test was used to compare quantitative data. P values less than 0.05 was taken to be significant. Baseline characteristics of both the groups were comparable and there was no significant difference between both the groups (Table 1). Mean score was comparatively higher in HPS group in comparison to non simulation group (Table 2).In the HPS group 95% of the core skills were met when compared to 62% in non simulation group. There was significant difference in performance of practical steps and steps that required team effort. The HPS group was found to be better coordinated. There was significant difference in the steps given in table (Table 3, Graph 1).

Figures and Tables

Table 1: Demographic profile of students in the group

Sex	**10 (male) 1 (female)**	**9 (male) 1 (female)**
Age	**19 (years)**	**19.5 (years)**
Semester	**8**	**8**

Table 2 : Mean score of both the groups

Non Simulation	**12.91+3.048***
HPS	**20.060+0.561***

*** p<0.05 student t test**

Table 3: OSCE steps difference between both groups

Step	HPS (%)	Non Simulation (%)	P value
3	**63.64**	**10**	**0.017***
4	**54.55**	**0**	**0.023***
6	**72.73**	**20**	**0.007***
13	**90.91**	**30**	**0.001***
15	**90.91**	**10**	**0.000***
18	**81.82**	**10**	**0.000***

***P< 0.05 chi square test**

Graph 1: OSCE steps performed by both the groups

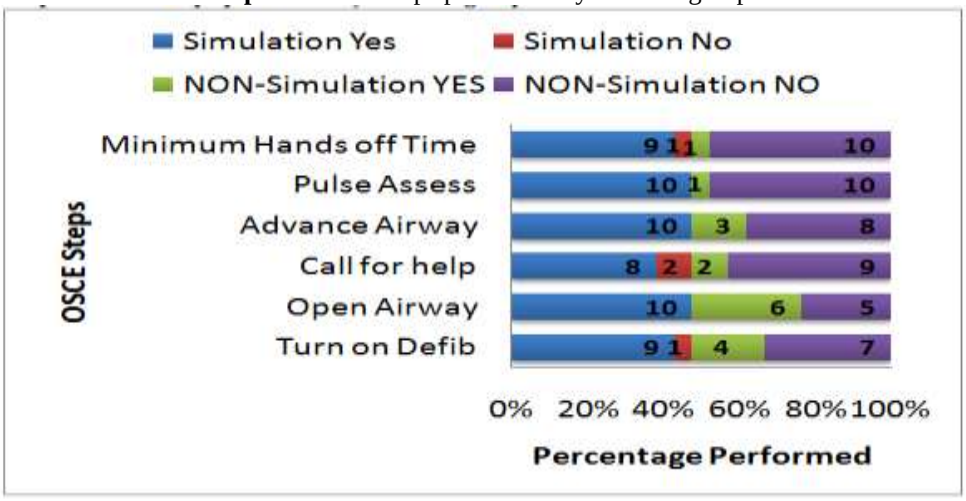

Figure 1: OSCE Steps

1. Assemble Equipment
2. Check Responsiveness
3. Turn on defibrillator
4. Open Airway
5. Check for Pulse
6. Call For help
7. Chest Compressions
8. Placement of Defib pad L
9. Placement of Defib pad R
10. Analyse Rhythm
11. Resume CPR
12. Shock
13. Advance airway
14. Adrenaline dose
15. Pulse assessment
16. Amiodarone for refractory VF
17. Switch of candidates
18. Minimum Handoff time
19. Safety during shock
20. Effective Chest Compression
21. Adequate Ventilation

IV. Discussion

This study compared the utility of human patient simulation as a teaching learning tool for management of shockable rhythm in cardiac arrest among medical students. The students in HPS group had higher rate of completion of all the steps in the OSCE. These findings were similar to previous studies by Gonzalez et al (8) which showed superiority of using high fidelity stimulation for teaching ACLS. However study by Han et al showed that ACLS simulation teaching for residents did not translate to improved patient outcome (4). Difference in results can be attributed to the difference in methodology used, control, population size and method used to assess performance.

High fidelity stimulation provides for an enhanced learning process by integrating audio, visual, and tactile and communication. This makes for better coordination, minimizes errors and ensures better adherence of protocol (9). This is supported by findings of the present study which showed better coordination. There was significant difference in performance of those steps which determines the efficiency of resuscitation between both the groups. Students in the HPS group were less likely to forget critical steps like call for help, turning on of defibrillator and minimum hands off time during CPR.

Usual ACLS teaching uses videos followed by hand on training on mannequin for teaching and use of multiple choice questions and scenario based assessments. There is immense pressure and anxiety on the student to perform and this might lead to poor performance. Our study utilized lecture based teaching using PowerPoint followed by simulation. This was aimed to increase retention and provide time for orientation. Each teaching method has different effects on learning and retention. Medical simulation is proposed to enhance learning and retention by allowing participants to transform the learning environment from a passive and structured approach to a hands-on experience (10). It provides opportunity for active participation, discussion, reflection and debriefing without interfering with patient treatment. A debriefing was done after each assessment individually.

This was important to improve performance and allow for self reflection. Simulation has been shown to improve user interaction, retention and decrease anxiety(4). This will ultimately translate to better patient outcome. Static simulators have been used extensively in ACLS teaching which is amendable to change. Use of high fidelity simulation will give a feed back and a real time experience which is important in resuscitation (9, 11, 12). Shockable rhythm algorithm requires performance of shock early in protocol. High fidelity simulation will enable clinical and behavioral learning required for this process along with coordination. It will also provide an opportunity to identify mistake, placement and effectiveness of shock delivery which are critical for successful resuscitation (9, 11,12).

In our country, use of simulation as a teaching learning tool is still at infancy with the increased cost, manpower and training required for operation. This is the first study to demonstrate its potential to improve learning and performance.

However there were several limitations to this study, first the population size was not very large to account for individual differences. Second, a pre and post test was not conducted to compare the difference. Third, a non intervention arm was not present. Fourth, only shockable rhythm was taught and tested. Lastly actual translation to better patient outcome was not tested. Further study utilizing the full ACLS protocol in a larger population is warranted to ascertain the superiority of simulation.

V. Conclusion

Human patient simulation is an effective teaching learning tool for shockable rhythms of cardiac arrest among medical college students. It enhances performances, improves coordination and ensures better adherence to protocol.

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