Simulation Based Approach to Improve Competencies in Respiratory Emergencies amongst Interns

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Abstract:
Background
Medical education is rapidly evolving field with paradigm shift from informative to competency based skills. Simulation has been accepted as an ethical tool, but not been incorporated into medical curriculum. We assessed the ability of residents during internship to manage respiratory emergencies and evaluated simulation as education and assessment tool.
Method:
A prospective study was done with forty three residents during the internship period, which had completed emergency medicine postings. They were assessed in clinical knowledge by questionnaire and clinical skills were assessed by checklist scores in three common respiratory emergencies. The knowledge gained after the workshop was reassessed with post tests questionnaire. We evaluated student feedback with questionnaire responses.
Results
43 interns were included in the study. All of them had completed emergency medicine postings, during internship. Checklist scoring was done for five core competencies :sub competencies were scored and validated with subject experts.[cut off > 75%]There was remarkable difference in pre and post test scores with a mean which was statistically significant. Only 66.6% demonstrated skills in clinical knowledge with lowest scores (25%) in problem based learning. Core competencies which needed to be strengthened by practice and reinforcement were identified. Students felt that such training need to be extended for other medical emergencies and they wanted such training to be integrated in their curriculum.
Conclusion:
Simulation based workshop is effective tool to teach respiratory emergencies and should be incorporated in medical curriculum as an education and assessment tool.

Keywords: Simulation based clinical training, Respiratory emergencies, Assessment tool

1. Introduction

Medical education is rapidly evolving field with paradigm shift from informative to competency based skills. An important outcome of medical undergraduate training is that at the end of training, they should be able to manage range of clinical emergencies.

Much evidence exists in previous studies that clinical skills may be taught poorly and students may not be able to handle demands of training during internship (1). Clinical knowledge is gained through reading, lectures, tutorials, seminars and bedside clinics. Even though clinical simulation has been accepted as an ethical tool, it has not been incorporated into medical curriculum (2-4). Simulation based workshops are effective and should be incorporated into medical curriculum which will help for assessment of competencies as well in medical education.

Simulation is well established for training people during aviation, military, industry and rapidly being transferred to medicine. Simulation has been most prominent innovation in last 15 yrs. Globally and in India numerous medical institutions have incorporated simulation based learning in various disciplines and specialities both as an education and assessment tool. The AAMC (Association of American medical colleges) working jointly with society of simulation in health care and American Association of college of nursing developed survey to understand role of simulation in medical schools for assessment and education (5). In Australia simulation based education has been restricted to local health institutions.(6) Our Study was similar to study done in TIANJIN, China by Fei Han et al in which they introduced new course of simulation based training before the internship for four weeks.

In our study we assessed core and sub competencies amongst interns during their internship using check list scoring during a simulation based exercise in three respiratory emergencies. Clinical knowledge was compared with pre and post test questionnaire. Internal and external construct validity were done with subject experts. On data analysis, those sub competencies were identified which needed to be strengthened with reinforcement and practiced. In this study, we utilized simulation based clinical training (SBCT) for education, training and as an assessment tool.

2. Methodology

Institutional Ethics committee approval was obtained for this project. Retrospective analysis of emergency records was done over a period of two years to prioritize most common respiratory emergencies. Needs survey questionnaire from interns was taken to identify need for such training. A prospective study with convenient sampling was conducted for interns during residency period. Over nine month period, 113 students who had completed emergency medicine and medicine postings during internship were scheduled to attend two hour simulation based workshop spaced at monthly interval in three respiratory emergencies. Every month eight – ten residents attended this workshop. They worked in team of three – four for each of three emergency scenarios.

We used Laerdal SIM man 3G full body computerized manikin, integrated with monitoring devices, airway and resuscitation equipment. The manikin is capable of simulating speech and clinical signs including pulse, chest movement, breath sounds (Normal & Abnormal) heart sounds, bowel sounds, eyeball movements, cyanosis and stridor. The model will generate ECG, blood pressure, pulse oximetry and capnography trace. Airway interventions, fluid and drug administration, cardio version and defibrillations are possible. Students were taken for manikin tour to familiarize themselves with the simulator and monitoring systems

Pretest Questionnaire was designed to test for clinical knowledge related to management of three respiratory emergencies, which was answered by all interns. Students underwent an initial period of familiarization with manikin. In the workshop, students worked in teams in three respiratory emergency scenarios, followed by answering post test questionnaire. Scenarios focused on respiratory emergencies like acute exacerbation of Bronchial asthma, COPD with respiratory failure and pneumothorax. Checklist scoring was done for core competencies like clinical knowledge, problem based learning, system based approach, team work and intercommunication skills. in which further sub competencies were classified and validated by subject experts.

A trained faculty was present during the workshop for checklist scoring of key clinical management tasks and simulated attender to test for communication skills. Faculty offered suggestions and assisted in providing relevant investigation reports. Workshop training consisted of participation in simulations, observations of peers, feedback following simulations and debriefing during which students developed systematic approach to manage acute emergencies. Students gave post test followed by feedback, seeking their view on learning with simulation. Simulation practice process included 10 minutes of briefing, 15 minutes of simulation, 15 minutes of observation of other team performance and 1 hr of debriefing. Students were asked to fill in a post test questionnaire. Feedback on the programme was also collected. Pre and post test results were compared. Mean and standard deviation was calculated with paired T test using the software SPSS 19.0.

3. Results

We compared results by expressing continuous variables in mean and standard deviation and categorical variable in percentage. Between groups comparison was done by paired T test with P value less than 0.05 as statistically significant. Statistical analysis was done in SPSS software version 19.0.

Analysis of the pre and post test questionnaire was done and results compared. There was remarkable difference in mean score in pre test (5.72) compared to post test (7.72) with significant p value of 0.002 (Fig 1).

Graphical Representation of Pre Test and Post Test Scores obtained by Trainees, Mean score with SD displayed with Level of statistical significance expressed as P value.
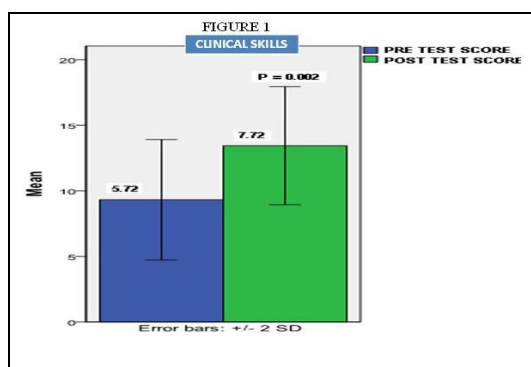
Figure 1: Pre and post test scores during SBCT

Clinical knowledge was tested based on sub competencies like correlation of history with findings and relevance given to comorbidities; 66.6% out of the students were able to demonstrate satisfactory skills. Problem based learning skills were checked based on arriving at a diagnosis, correct medication, asking for relevant investigations and interpretation of the same. This was observed in only 25% of total residents. System based practice regarding team work and knowledge sharing was observed in 50% of total interns. Professionalism reflected by constructive intervention and feedback from peers was observed in 41.6% of interns. Intercommunication skill regarding discussion of management with relatives and communication with senior consultants was observed in only 33.3% cases Qualitative analysis was done for data collected from feedback questionairre Students compared the learning process in simulation workshop with their traditional learning. They listed advantages of such training as given in feedback questionnaire. They considered that such assessment helps to improve upon leadership qualities and also realized importance of working in a team.

CHECK LIST SCORING DURING SBCT

Date: **Interns Batch:**

Team: **(Please Tick Appropriate)**

I. PATIENT CARE (PC)	YES	NO	MARGINAL
PCI → Gathers Information from Patient			
➢ **Focused History Taking**			
➢ H/O Dyspnoea / Wheeze / Cough			
➢ Negative H/O			
➢ H/O Atopy / Allergy			
➢ H/O TB / Recurrent LRTI / Others			
➢ H/O HTN / DM / RA / Others			
➢ Occupational H/O			
➢ Personal H/O - Habits			
➢ Smoking / Others → Pack Yrs			
➢ Treatment H/O			
➢ H/O Previous Hospitalization			
➢ H/O Previous Exacerbations			
➢ H/O Ventilatory Management			
PC2 → Gathers Information from Relatives			
➢ Confirms Patient's History			
➢ Previous Hospitalization			
➢ Re – Confirms Addictions			
➢ Compliance to Treatment			
➢ Details of Follow Up with Physician / G.P			
Pc3 → Translate History to Application			
→ Comforts Patient			
→ Assess ABC			
→ Patients Examination			
II. CLINICAL KNOWELEDGE			
CK1 → Correlate History & Findings			
➢ Considers to Connect Monitor			
→ Checks Vitals			
→ Connects ECG Monitor			
→ Orders ECG			
→ Connects B.P. Monitor			
→ Checks B.P			
➢ Starts IV Access			
➢ Stabilize Patient / O2 as Needed			
➢ Considers NIV			
➢ Considers Advanced Airway			

		YES	NO	MARGINAL
CK2 →Comorbidities				
➢	Considers Impact of Comorbidities on Present Situation			
➢	Stabilize Comorbidities			
➢	Seeks Expert Help			
CK3 →				
➢	Identifies Cardiac Arrest			
➢	Starts CPR			
➢	Identifies Shockable Rhythm			
➢	Identifies Non Shockable Rhythm			
➢	Delivers High Quality CPR			
➢	Delivers Defibrillation Appropriately			
III.	**SYSTEM BASED PRACTICE**	**YES**	**NO**	**MARGINAL**
SBP 1 →				
➢	Work Effectively with Peer Discussion			
➢	Divides Responsibilities amongst team members			
➢	Knowledge Sharing			
➢	Knowing One's Limitation			
SBP 2 →				
➢	Recognize need for emergency medications equipment / its importance			
➢	Closed Loop Communication			
➢	Clear Messages			
➢	Clear Roles & Responsibilities			
IV.	**PROBLEM BASED LEARNING (PBL)**			
PBL →1				
➢	Considers Probable Diagnosis			
➢	Medication Given: → Correct Medication			
	→ Considers Loading Dose			
	→ Correct Dosage			
	→ Correct Frequency			
➢	Mode of Delivery (Neb/IV/IM/Oral)			
➢	Considers Adrenaline			
➢	Consider Antiarrythmics			
PBL →2				
➢	Asks for Investigations Reports			
➢	Interpret Investigations Reports			
➢	Modifies Treatment			
PBL →3				
➢	Awaits Responses			
➢	Reevaluation & Summarizing			
➢	Revises D.D			
➢	Consider Reversible Causes			
V.	**PROFESSIONALISM (PR)**			
PR →1:				
➢	Closed Loop Communication			
➢	Constructive Intervention			
➢	Takes Feedback from Peers			
PR →2				
➢	Mutual Respect			
➢	Considers Treatment Options			
➢	Discuss with Relatives / Severity of problems			
PR →3				
➢	Need to Shift to ICU			
➢	SOS Explains Need of Intubation			
➢	Integrity / Ethical Behaviour			
VI.	**INTERCOMMUNICATION SKILLS (ICS)**			
ICS →1				
➢	D / W Team members regards Tt			
➢	Seeks Expert Advice			
➢	Informs Relatives			
ICS →2				
➢	Communicates with experts / Senior consultant			
➢	Cost of Care			
➢	Patients Condition			
➢	Explains need for further ICU care / Cath Lab			

Table 1: Check list scoring devised for SBCT

4. Discussion

Simulation based clinical training can be utilized as an education and assessment tool. Our study was similar to study done in TIANJIN, China where in they introduced new course of simulation based training before the internship for four weeks and found

improvement in ability of medical students to apply the knowledge, solve practical problems, professional competence, critical thinking skills (7). Similar studies were conducted to improve clinical competencies in nursing students at Seoul Kor by H Kung Hur and Young Sook Roh (8).

Small et al in 1999 conducted a study with main objective of detailed specification of tools and technique used in high fidelity simulation, to share results of emergency medicine simulation workshop, introducing multiple three patient scenarios and to focus on team work applications(9).Earlier studies had given feedback regards learning new skills in safe environment(6). In our study 96% rated the simulator exercise "Excellent" and 100% suggested that this exercise should be made a mandatory part of the curriculum, 90% participants wanted this training to extend for other medical and cardiac emergencies. Our students showed significant increase (about 20%) in knowledge level after simulation based training (SBCT) and preferred use of simulation compared to traditional teaching which is consistent with earlier studies (10).

Manual and computerized checklist scoring helped us to identify the drawbacks in core competencies & certain sub competencies in which students lacked confidence like decision making, team work, leadership qualities and patient communication. Morgan et al in 2001 used the manual checklist to score the anesthesia skills in medical undergraduates (11). Bowlet et al in 2003 demonstrated reliability and construct validity of simulation based assessment using highly specified checklist to score acute care skills (12).

Our study compared clinical knowledge with questionnaire and core competencies with checklist scoring, thereby utilizing simulation as an education and assessment tool. Most of previous studies have compared simulation based training to traditional teaching, video assisted teaching and computer screen based simulator. Limitations of this study could be that due to time constraints of curriculum, we could not reinforce the skills or check retention memory of such training after a period of three to six months. Similarly cross over designs with other scenarios were not feasible due to time constraints. Even though teams could be scored for core competencies, individual scoring was not possible in complex scenarios.

5. Conclusions

Our study showed significant improvement in clinical knowledge after being exposed to the simulation based workshop. This study also identified sub competencies with low scores which need to be practiced further to become better clinicians. It will be difficult to predict whether newly acquired skills will be retained and whether such training gets translated to patient safety. Refresher courses may be needed to reinforce such training. However such training does enhance confidence to tackle clinical emergencies, improves communication skills and team work.

6. Acknowledgement

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