Enhancing the clinical skills of undergraduate medical students through simulation-based training using indigenous subcutaneous swelling models.

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KEYWORDS

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ABSTRACT

Simulation-based learning is a novel teaching approach that involves fabricating clinical situations to immerse students in realistic scenarios, that aid in acquiring new skills without involving real patients prioritizing patient safety. It serves as an opportunity to combine theoretical knowledge with practical application providing valuable hands-on experience before students venture out to practice medicine preparing them to handle complex situations without anxiety. The integration of Simulation-based training into the medical curriculum has proven to be efficient as evidenced by multiple articles related to the use of simulation in education that were used as references. This was further substantiated by the overwhelming response obtained from this study which was conducted to explore the efficiency of simulation models in teaching the clinical examination of subcutaneous swellings among undergraduate medical students, who expressed that these models helped them in better understanding and retaining of the concept acquired.

1. Introduction

Simulation is the imitation through a model of procedures and systems whose representations mirror the operations of real-life processes or systems. Simulations, moreover, are deliberately constructed interactive classes created by educators to give students that valuable hand-on training, hence enabling better performances from them. While this could establish a very dynamic environment of learning where learners could evaluate their errors and improve on them, it prepares the learner to deal with real situations with a firm footing. Simulations serve as a key practice area for surgical education for students before they take the plunge into independent execution upon the surgical population. Faculty can then read, evaluate, and identify certain domains of competency to be improved upon based on a student's performance across various scenarios[1,2].

The main aim of this study is to find out the effectiveness of the use of simulation models in teaching such clinical examination techniques that help establish the looming subcutaneous swellings-it remains an important competency for aspiring medical professionals. Students were taught some theoretical aspects prior to each practical test by means of lectures, which form a high-level basis for the rationale guiding the application of simulation models. The innovative nature of this approach was useful for having students visually and deliberately clarify the distinct clinical signs associated with the various types of subcutaneous swellings, as well as enhance their tactile skills with a cleaner sense of realism.

Mastering these clinical examination skills is important, as these competencies are very much necessary to document and manage very many instances that may present in the course of medical practice. Our research encompassed 298 Phase 2 MBBS students who participated in a structured educational intervention, after which the data were collected using a pre-planned and rigorously designed questionnaire. This tool was used to determine student engagement with simulation-based training and perceptions of its efficacy in developing their clinical examination skills.

II. Aim and Objective

The objective is to assess the perceptions and exposure of undergraduate medical students to simulation based training in subcutaneous swelling.

III. Methodology

The present study was conducted at Sri Ramachandra Medical College in Chennai on Phase 2 MBBS students who had already undergone clinical postings in the department of general surgery. With approval from the Institutional Ethics Committee, all Phase 2 MBBS students willing to take part in the study were recruited. The selected subjects were trained to carry out clinical examinations with the help of local indigenous simulation models for subcutaneous swellings. Before doing the clinical demonstrations, they attended lecture class that addressed essential theoretical concepts associated with subcutaneous swellings. Students were then organized into groups of five, during which faculty members demonstrated examination findings on the simulation models. During this clinical skill training, faculty demonstrated the systematic method of clinical examination of subcutaneous swellings using indigenously developed simulation models. Using these models, they demonstrated all the clinical findings in various subcutaneous swellings like lipoma, sebaceous cyst, neurofibroma, dermoid cyst in a single setting. The pathognomonic clinical signs like slip sign in lipoma, punctum and skin pinchability in sebaceous cyst, bone indentation and presence at site of bony fusion in dermoid cyst, vertical mobility in neurofibroma and typical consistency in each of these swellings, were all clearly demonstrated using these novel indigenous subcutaneous swelling simulation model. After this demonstration, each student had the chance to conduct an independent examination.

Upon completing their surgical rotations, we collected data using a carefully constructed and validated questionnaire designed to evaluate the students' exposure to and opinions on the subcutaneous swelling simulation models. This questionnaire was distributed to the students, and the resulting data were documented for later analysis.

Fig.1: Subcutaneous swelling Simulation model

IV. Results

At the end of the surgical postings, we had participation from 298 Phase 2 MBBS students. Analysing the responses(Table.1) revealed that only 53 students (17.79%) had prior experience with simulation-based learning, while a substantial majority, 245 students (82.21%), indicated they had no such exposure. After their clinical training using the subcutaneous swelling simulation model, 279 students (93.62%) displayed proficiency in palpation of a lipoma and successfully identified related specific signs using the simulation model. Furthermore, 285 students (95.63%) accurately recognized the characteristics of a sebaceous cyst through palpation. Confidence in identifying a neurofibroma was reported by 279 students (93.62%), and 276 students (93%) successfully differentiated a dermoid cyst from other subcutaneous swellings, showcasing a strong grasp of clinical skills.

Feedback analysis showed that 294 out of 298 students (98.66%) perceived simulation models as being more effective than traditional lectures with videos in enhancing their understanding of the clinical examination of subcutaneous swellings. Additionally, 286 participants (95.97%) agreed that simulation-based learning significantly improved their confidence in conducting thorough examinations of subcutaneous swellings. A large majority, accounting for 277 out of 298 students (92.95%), found the models to be highly realistic.

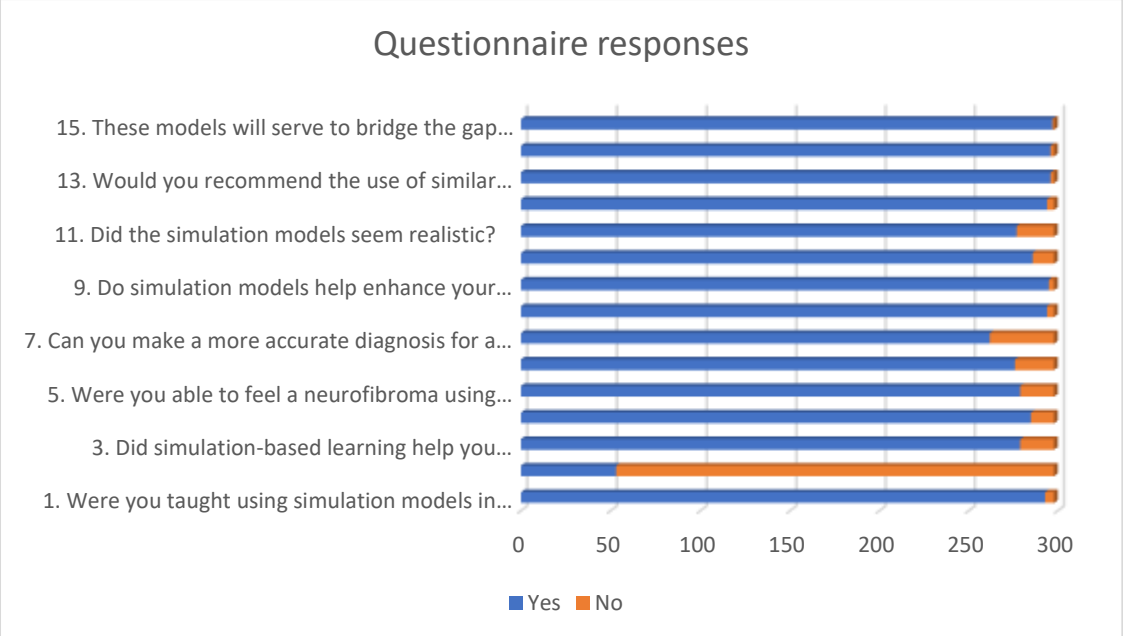
A significant number conveyed that these models greatly enhanced their understanding and retention of examination techniques, considerably increasing their confidence when interacting with real patients. Furthermore, the participants remarked on the striking realism of the models, underscoring the importance of such innovative educational tools in connecting theoretical knowledge with practical application. Moreover, an overwhelming 296 students (99.33%) expressed a strong desire for greater integration of simulation-based learning within their curriculum and wanted to extend its application to other subjects as well. An equal number (99.33%) favoured the introduction of such teaching models into junior cohorts. There was a general consensus among participants regarding the efficacy of simulation-based learning in bridging the gap between traditional PowerPoint instruction and practical patient care. Therefore, this study not only highlights the positive effects of simulation-based training on student learning outcomes but also advocates for its broader implementation across various subjects in the medical curriculum to ensure comprehensive clinical competence.

Table:1 Questionnaire with students responses

Question	Yes	No
1. Were you taught using simulation models in surgery postings this year?	293	5
2. Did you have access to simulation-based learning before?	53	245
3. Did simulation-based learning help you understand how a lipoma feels on palpation?	279	19
4. Were you able to feel how a sebaceous cyst feels on palpation using the models?	285	13
5. Were you able to feel a neurofibroma using models?	279	19

6. Were you able to understand how a dermoid cyst feels on palpation using models?	276	22
7. Can you make a more accurate diagnosis for a swelling case based on the knowledge acquired from the session?	262	36
8. Were the models useful in helping you understand the clinical examination of subcutaneous swellings better than the usual method of teaching?	294	4
9. Do simulation models help enhance your knowledge and skills more than lectures?	295	3
10. Did the use of models improve your confidence in clinically examining subcutaneous swellings better than the usual teaching methods?	286	12
11. Did the simulation models seem realistic?	277	21
12. Did you find the session useful?	294	4
13. Would you recommend the use of similar models for teaching about other common surgical conditions?	296	2
14. Do you recommend the use of these models for your junior batches?	296	2
15. These models will serve to bridge the gap between PowerPoint teaching and teaching with real patients.	297	1

Fig.2: Questionnaire Responses



V. Discussion

The outcomes of this research highlight the profound effect of simulation-based training on improving the clinical examination abilities of undergraduate medical students, specifically in the evaluation of subcutaneous swellings. By adopting a structured methodology that merges theoretical understanding with targeted clinical examination skills, this approach signifies a shift in medical education towards more engaging and efficient frameworks. A notable portion of students in this study displayed impressive skills in recognizing and examining different subcutaneous swellings and demonstrating the pathognomonic clinical findings of each subcutaneous swellings, showcasing the ability of simulation models to connect theoretical concepts with practical execution. Moreover, the overwhelmingly optimistic feedback from the students showed that they regarded simulation learning as vital in understanding clinical principles. This emphasizes the need to embed simulation techniques within medical curricula to not only augment confidence in clinical abilities but also prepare students for real-life experiences in patient care. Such findings point to clinical simulation as being transformative because it is considered an approach to learning in medical training.

This discussion seeks to contextualize these findings within the broader framework of medical education research, emphasizing the pedagogical implications and providing suggestions for future practices.

Enhanced Learning Through Simulation

Using simulation models to teach examination techniques constitutes a good rationale to fuse active learning strategies into medical education. Prior studies have shown that the traditional lecture-fed style of teaching is inferior to hands-on, native manipulation training, indicating that a simulation environment is very safe for the students to learn and make mistakes without jeopardy for patient safety. [3,4]. Our study demonstrated that this hands-on experience not only provided students with vital clinical skills but also significantly increased their confidence—a key element for achieving successful clinical practice.

Students prefer simulation-based learning over other things, pointing toward the shift in educational methodology within the medical sector. Modern-day medical students are increasingly shifting to a hands-on learning environment where they can actually apply what they have learned, get instant feedback, and improve their skills. Research indicates that such involvement in the learning process leads to improved retention of skills and knowledge over time[5]. The overall consonance of this study with the previous research in this area proposes that simulation-based methods should be supplemented in other medical fields by medical institutions.

Objective Assessment and Proficiency Development

The study effectively evaluated the training program through a carefully designed questionnaire that objectively assessed the students' skills and perceptions. It was observed that there was a significant level of skill in identifying and palpating subcutaneous swellings, which builds confidence that the training was effective and, more importantly, indicates the justification to use validated assessment tools to measure educational interventions[6]. Interestingly, the data indicate that, with not much prior simulation exposure, students were able to develop a high level of competency, thereby underscoring the importance of simulation as an integral part of clinical education. Moreover, the authentic features of the simulation

models enabled students to acquaint themselves with the types of lesions they may encounter on the field. Such realism makes the learning process richer and better prepares the students for clinical situations, which often seem very intimidating[7]. These findings therefore offer support to the assertion that realistic simulations create a more immersive and active learning environment, harmonizing theoretical knowledge and practical clinical applications, far better than the conventional methods on their own[8,9].

Recommendations for Curriculum Integration

Given the positive reinforcement and effectiveness that come to notice through this simulation-based learning model, it is time that medical schools reassess their curricular trends. Such a general request by students to bring in more simulation-based training, especially among junior years, opens up the avenues for curriculum improvement[10]. Permeating from basic courses into the area of simulation would allow students to practice basic skills at an early stage of their medical education, affirming a culture of competence into their later clinical training[11,12]. Further studies should concentrate on checking the lasting impact of simulation training on clinical practices carried on during internships and residencies. Other facets of simulation can be expanded to grant students the necessary flexibility for confronting complex clinical settings and other pathologies[13,14].

Conclusion

Our study highlights the paramount impact created by simulation training in honing crucial clinical examination skills in surgery. The overwhelming student preference for this training approach reinforces the importance for educators and curriculum developers to adopt innovative teaching strategies that emphasize active and practical learning experiences. By doing so, we can better prepare future healthcare professionals with the confidence and skills necessary to navigate the intricacies of patient care. Continued advocacy for integrating simulation across multiple disciplines will not only enhance educational quality but ultimately lead to improved patient care, aligning medical training with the realities of modern medical practice.

Author's Contribution

All the authors have contributed to the study and this manuscript has been reviewed by all of them prior to submission.

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