A COMPARATIVE STUDY OF INDIGENOUS MODEL-ASSISTED INNOVATIVE AND CONVENTIONAL SURGICAL TEACHING IN A TERTIARY HEALTHCARE CENTRE
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ABSTRACT

BACKGROUND
Surgical teaching and learning needs lots of practical exposure and hands on training. It often becomes difficult to demonstrate practically hundreds of medical student’s steps of surgical examination, various surgical minor or major procedures on living patients. Three-dimensional demonstration of theoretical topics helps in easy understanding of the subject. On many occasions, theory classes using lectures and slide projection techniques become cumbersome and monotonous for both teachers and students leading to failure to achieve fruitful results. Computer and 3D simulator-assisted teaching may help in some cases, but yet to become available in many developing countries. Without proper practical knowledge when a surgical action is attempted on a living patient, there is always a chance of error. Keeping all these facts in view and the limited teaching resources available, over hundred self-made inexpensive teaching models are developed out of scrap materials and are used to teach medical students in medical colleges of Assam and the results compared with conventional teaching.

MATERIALS AND METHODS
In this study, the efficacy and effectiveness of the model-assisted teaching is compared with that of conventional teaching over a span of two years.

RESULTS
Some of the shortcomings of conventional teaching can be overcome by model-assisted teaching in terms of overall student attendance in the classes and the acceptance and understanding of the topic concerned.

CONCLUSION
These models help in filling the voids in surgical learning and can be used as an effective adjunct to conventional surgical teaching.

KEYWORDS
Model-Assisted Teaching, Innovative Surgical Teaching.

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INTRODUCTION: Conventional teaching in surgery comprises of didactic lectures, tutorials, clinics, seminar and CME. One of the common methods that have a special place in the student’s training programs is lecture. Lecture is a simple, fast and cheap method to present the vast issues to a lot of groups of learners.[1] But, students may lack interest in such classes. Therefore, there is often too much teaching, but too little learning. Inactiveness of the students, tiring long lectures, one-way communication and fast forgetting of the issues are the disadvantages of this method.[2] Another hurdle is the scarcity of suitable clinical cases with positive findings. Proper demonstration on a non-willing and uncooperative patient to hundreds of medical students usually creates a non-congenial atmosphere.

Operative steps cannot be demonstrated clearly to each and every student during busy OT schedule. Computer simulation and 3D teaching facilities are not always available or affordable. All these factors make conventional teaching less effective in the long term. According to studies in lecture method, about 80% of presented trainings are forgotten within 8 weeks.[3] Medical education is ever evolving. One of the reasons for this evolution is concern for the patient’s safety. "To Err is Human", a landmark report released by the Institute of Medicine (IOM) in 1999[4] estimated that medical errors cause injury to approximately 3% of hospital patients and results in a minimum of 44,000 and perhaps as many as 98,000 deaths per year in the United States. Cost to manage the medical error related outcome is also enormous throughout the world. The annual cost attributable to all adverse drug events and preventable adverse drug events for a 700-bed American Teaching Hospital was estimated by one study as $5.6 million and $2.8 million, respectively.[5] Theoretical knowledge without practical exposure mainly in surgical practice is a great hindrance in achieving a desirable outcome.
Clinical skills development now a days strongly recommended by many of the medical schools.[6] With these things in mind, an attempt was made to improvise the outcome of teaching by introduction of models made out of day-to-day scrap materials. The present study was carried out to compare model-based teaching to conventional teaching.

MATERIAL AND METHODS: The present study was carried out during 2014-15 for both theory and tutorial classes of final year MBBS batch. In 2014, classes taken were conventional where as in 2015 classes were model-assisted. During 2014, fifteen theory classes for the whole batch (100 students) and nine tutorial classes of a group of 20 students and during 2015 fourteen theory again of the whole batch and ten tutorial classes of a group of 25 students were undertaken. In model-assisted classes, indigenously built, inexpensive teaching models (Fig. 1) developed out of scrap materials (Table 1) were used. These models are created to include various clinical and operative topics (Table 2 and 3). Fig. 2, 3, 4, 5, 6 - demonstrate how some of the models are made out of scrap. Fig. 2 demonstrates a multipurpose doll suffering from various surgical disorders, e.g. lipoma, sebaceous cyst, osteoma, fissure in ano, piles, fistula, etc. It has an inbuilt anorectum where a thorough rectal examination can be carried out in various positions. Per rectal, one can feel the enlarged benign prostate, its lobes, median fissure, its firmer consistency and upper border.

Examination of individual diseases can be done with specific clinical findings. Fig. 3 is a model to demonstrate anatomy of vagus nerve, various types of vagotomy, Gastrojejunal Anastomoses (GJA). One can do GJA layer by layer, therefore, acquiring a clear conception of how GJA functions. Use of gastrointestinal clamps, tissue forceps and other surgical instruments, various types of sutures and suturing technique, corner stitch maybe demonstrated in the procedure. Fig. 4 belongs to a model for discussing the topic of acute urinary retention and its management. One can clearly demonstrate how to put a Foley’s catheter per urethra. All the steps in catheterisation can be demonstrated even with the near real feeling of the actual procedure. Fig. 5 model relates to the topic of urethral stricture and its management. Urethral dilatation with tour de maitre and Faggot’s method can be effectively demonstrated and repeatedly practised. Fig. 6 model is meant to develop the surgical skill of knotting at surface and depth, ligation of tubular structures either manually or with instrument. Model-assisted and conventional classes are taken on general surgical topics (Table 2 and 3) and the results are analysed subsequently.

RESULTS AND OBSERVATIONS: A comparative study of conventional and model-assisted classes carried out in terms of student’s attendance (Table 4a and 4b) and their results in terms of student’s acceptability/understanding (Table 5) of the topic concerned. Average attendance of the students in conventional theory class was 81.8% whereas in model-assisted theory class it was 94.7%.

In tutorial class, it was respectively 78.3% and 97.6%. Students were found to be more interested in model-assisted teaching. The theoretical conception acquired in model-assisted class was much higher than conventional class. Accuracy of practical demonstration of the topic-related activities was much higher in model-assisted classes.
Figure 4. Urethral catheterisation. Items used—Elastocrepe transparent box, kerosene jar outlet, rubber tube.

Figure 5. Urethral dilatation. Items used—Plastic funnel, LPG tube, wooden block, Knitting stick, Syringe barrel.

Figure 6. Surgical Knot Practice board. Items used—Wooden block, Mineral water bottle, Curtain hook, Curtain spring wire.
Simulation tools serve as an alternative to the real patient. Utilisation of simulation can be defined as any educational activity that seeks to achieve educational goals via experimental learning. A simulator is defined as a device that enables the operator to reproduce or represent phenomena likely to occur in actual practice. On the other hand, simulation-based education can be defined as any educational activity that utilises simulative aides to replicate clinical scenarios. Simulation tools serve as an alternative to the real patient.

**DISCUSSION:** Simulation has been defined as a situation in which a particular set of conditions is created artificially in order to study or experience something that is possible in real life or a generic term that refers to the artificial representation of a real world process to achieve educational goals via experimental learning. A simulator is defined as a device that enables the operator to reproduce or represent under test conditions phenomena likely to occur in actual performance. On the other hand, simulation-based medical education can be defined as any educational activity that utilises simulative aides to replicate clinical scenarios. Simulation tools serve as an alternative to the real patient.
Trainers can make mistakes and learn from them without the fear of distressing the patient. Simulators can be classified according to their resemblance to reality into low-fidelity, medium-fidelity and high-fidelity simulators. Simulation laboratories are quite costly. A single high-fidelity simulator with its monitoring system and other necessary equipment may cost up to $200,000. These simulators are mostly used in developed countries and mainly engaged in anaesthesia, emergency medicine and trauma, intensive care medicine, obstetrics, paediatrics and radiology as well as for the use of other professionals such as nurses, paramedics and respiratory therapists. Employing medical simulation techniques can help move medical training from the old “See One, Do One, Teach One” method into a “See One, Practice Many, Do One” model of success. Simulation-based teaching has proved to reduce risks to both patients and learners. It has also proved to be effective in both undergraduate and postgraduate education as well as faculty development.

The present model-assisted surgical teaching though indigenous and very basic technique is effective and its fabrication cost is almost nil or negligible as mostly discarded scrap materials are used. There is no fear of rough handling leading to wear and tear as remaking is very easy. Though high-tech simulators may aesthetically look better, but our models are quite effective in teaching, the beginners and imparting a reasonable 3D visual and handling experience. Some of the opinions expressed by the students related to model-assisted teaching are worth mentioning:

1. Model-assisted teaching helps in clear understanding and prolong remembering of a surgical topic.
2. Impact of model-assisted teaching is 6-7 times greater than conventional teaching.
3. Model-assisted classes are special, informative, practical and generate interest in the subject.
4. Model-assisted teaching is a sensible supplement to conventional teaching with (human) patients. It takes care of scarcity of varieties of patients (indoor/outdoor). It also prevents unnecessary mental/physical trauma to patients by repeated examination by students during learning phase. Hesitancy and fear of examining an uncooperative patient is also not present in model-assisted teaching.
5. Model-assisted teaching helps students in clarifying doubts, allows understanding clearly, the correct and incorrect method of applying theoretical knowledge in clinical and operative surgery. It helps in knowing the method of rectification of mistakes, which otherwise maybe dangerous in human patients. Models are reusable and feeling during their use is very natural.
6. Model-assisted teaching is based on the principle of, “I hear, I forget, I see, I remember, I do, I understand.”
7. 3-dimensional effect of model teaching is very helpful in learning and understanding of a topic.
8. Inexpensive scrap items from which the models are prepared proves - “Nothing is useless in this world for a man with creative mind.” Till the arrival of computer assisted or any other better teaching technique in the developing country like ours, model-assisted teaching will definitely help in progress towards the goal of achieving fruitful teaching.

Areas of Improvisation/Future Suggestions:
1. Improvised and cost-effective models can be made available commercially for individual use.
2. Model-assisted teaching should be included in the academic curriculum. Evaluation of a student’s conception is better attainable by including models in practical examinations.

CONCLUSION: Conventional surgical teaching with the help of living patients is no doubt desirable, but model-assisted teaching if supplemented in the early learning phase would certainly take care of short comings of present day academics in a developing country till the high-tech computer 3D simulators become available. Training through models should be viewed as an adjuvant and not a replacement for learning with real patients.

REFERENCES