

ASSESSMENT AND TEACHING OF SURGICAL SKILLS THROUGH SIMULATION IN SURGICAL TRAINING

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ABSTRACT

Objective: Assessment and Teaching of basic surgical skills to the trainees in a simulated environment outside the operating room.

Design: Cross sectional study.

Setting & Duration: Darul-Sehat Hospital and SESSI Hospital, Karachi. Two 1 day workshops of six hours duration each.

Methodology: Two one-day suturing and knot-tying workshops were held, where the students were invited to acquire the necessary knowledge and learn skills of suturing. Fifty-two undergraduate and 25 junior residents participated in the workshops. The suturing skills of the trainees were assessed before and after the training by Objective Structured Assessment of Technical Skills (OSATS), using a checklist. In the first workshop, a pre-training questionnaire was used to assess their knowledge about sutures and their perceptions about the workshop.

Result: All trainees believed that such workshops were useful. Significant improvement was seen in all post-training checklist scores of trainees. The improvement was more marked for undergraduate medical students.

Conclusion: Teaching of basic surgical skills is both feasible and advantages using simulation. Basic surgical skills should be taught to all medical and dental students regardless of their career aims, at all the medical colleges.

KEY WORDS: Basic Surgical Skills, Assessment, Training, Simulator

INTRODUCTION

Simulation has been used actively outside medicine, e.g. in training pilots of airplanes. However, the introduction of simulation in surgical training has been a slow process, especially in Pakistan. Even today, operation theatres form the only training grounds and patients the only models. Pressure on theatre time, accelerating pace of technical innovations in surgery, greater expectations of patients, and the need for surgeons to eliminate morbidity associated with the learning phase of any new

procedure, provide a stimulus for both surgical trainees and trained surgeons to introduce and practice techniques before bringing them to the operating theatre.

Suturing and knot-tying skills are essential for a successful practice, regardless of the field of specialization. Traditionally, however, it is taken for granted that students somehow pick these skills up along the way; only those who opt for surgery are taught them formally. The purpose of undergraduate education is to prepare the student for the practice of medicine. In a review of doctors training in New South Wales teaching hospital, it was found that about one-third considered themselves to be incompetent in technical skills. It is of interest that such comments were related to simple procedures like suturing simple wounds, removal of sutures, gloving and gowning^{1,2}. In 1997, it was reported that 43% of the general practitioners working in the Scottish Highlands and West Isles considered that they had inadequate training in minor surgery; of the 86% who wished to attend a training course, more than half believed that it was desirable to have their technical competence assessed by

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hospital consultant.³ Most university surgeons in USA run a "Surgical Club" where they teach basic surgical skills to undergraduates and residents, who find the experience quite rewarding.

Simulators and models used in the teaching environment have not been used with the same vigour for technical skills. Currently, assessment of the technical skills of trainees relies heavily on preceptor ratings. This type of rating may be very unreliable and so cannot be considered an adequate assessment of technical skill on which to base formative feedback or promotion decisions. More reliable and objective assessment of technical skill may be made by using a checklist, which is a form of Objective Structured Assessment of Technical Skills (OSATS).⁴

Such workshops are now being regularly conducted as part of the undergraduate and residency training programmes in our institutions.

METHODOLOGY

Examinees

Seventy-seven medical students participated in the suturing and knot-tying workshops. Fifty-two were undergraduate medical and dental students; 25 were junior residents from the general surgery training programme.

Examiner

Three General Surgery consultants and one senior registrar served as supervisors and examiners.

Assessment

A detailed checklist was prepared consisting of 19 task steps to be assessed (Appendix 1). The checklist was reviewed by faculty members of the Department of Surgery and the final consensus arrived at. All examiners were provided with the checklist before the examination and were asked to familiarize themselves with the materials.

Appendix I. Checklist for Skin Suturing

Item	Done correctly	Not done correctly
Selects appropriate suture, needle holder and forceps	1	0
Needle loaded 1/2 to 2/3 from tip	1	0
Bite distance from the skin edge-5mm	1	0
Angle at which bite taken - 90°	1	0
Single attempt while taking bites in the skin	1	0
Movement occurs at wrist	1	0
Forceps used to hold skin or s/c tissues (minimum use)	1	0
Whether takes bites from both skin edges in one go/separately	1	0
Equal bites on both sides	1	0
Whether needle touched with hand	1	0
Number of knots taken	1	0
Knot is square or not	1	0
Knot is too tight or too loose	1	0
Suture breaks or not	1	0
Knot is on the incision line or on one side	1	0
Distance of cutting the suture from the knot	1	0
Suture board moves or not	1	0
Skin edges are everted or inverted	1	0
Inter sutural distance - 0.5 to 1cm	1	0
Maximum Total Score	19	
Total Score Examiner		

Pre-training and a post-training questionnaire were devised so as to assess the knowledge of the students, to gain insight into their expectations and perceptions about the workshop; this was used only in the first workshop.

Examination

Two one-day suturing and knot-tying workshops were held one year apart, where the students were invited to acquire the necessary knowledge and skills for suturing tissues.

Time - 9am to 3pm on a Sunday.

Place - Lecture theatre; Media-35mm colour slides, video film.

Mode - Lecture, group discussion, interaction and hands-on suturing workshop.

Schedule - 9am - Introduction to the need of suturing skills. Filling of pre-training questionnaire by the trainees.

9-10am - Pre-training assessment of the skin suturing skills of the trainees was done by the trainers using the checklist (Appendix 1).

This was followed by an interactive lecture using 35mm slides on suture materials, indications of appropriate sutures, benefit vs. harm of different sutures, and needles. The students were taught basic concepts like "cheese though effect of suture" with the help of a cheese cutter and other models. A 15-minute film on suture was shown.

11:00am - Question and answer session - tea break

11:30am - A video film demonstrating various skin suturing techniques (simple interrupted, continuous, vertical mattress, horizontal mattress, subcuticular) on an animal model was shown. The faculty then demonstrated the knot-tying technique and various skin suturing techniques on a skin simulator (a piece of foam). This was followed by a hands-on practice session by students under supervision by the faculty.

1:30pm - Lunch break

2:00pm - Post-training assessment of trainees was conducted by examiners using a checklist shown in Appendix 1. The students were given the following problem:

"Close a clean lacerated wound on the abdominal wall which has a tendency for inversion of edges. Demonstrate 3 interrupted sutures and needle of your choice".

In the first workshop, apart from assessment of surgical

skills, knowledge about sutures and the perception about the workshop were also assessed by a post-training questionnaire.

RESULTS

Seventy-seven students (32 in the 1st workshop and 45 in the 2nd workshop) participated in the suture and knot-tying workshops. Fifty-two were undergraduate medical and dental in the general surgery training programme. Ten junior residents were in the 2nd year of training and 15 were in the 1st year. Eight junior residents had attended the workshop earlier. None of the undergraduate had attended the workshop earlier. Sixty-two students filled the pre-training questionnaire and 52 trainees filled the post-training questionnaire. In the first workshop, 14 students expected the workshop to improve their skills, practical and theoretical knowledge. Seven students expected the workshop to improve their skills, practical skills. Two students believed it would improve only their theoretical knowledge. One student mentioned his expectations as "guarded". Sixteen students said that the training improved their practical skills and theoretical knowledge. Two said that it improved their practical skills. All of them felt that such training is needed periodically. Ten felt that the frequency should be once every six months, 7 felt that it should be once a year, and 1 student felt that it should be conducted less often than once a year. When asked about the timing of such workshops 11 felt that it should be held at the beginning of junior residency, 3 felt that it should be held during the undergraduate course in the 3rd year, 3 felt it could be held anytime, and 1 felt it should be held in the middle of junior residency. Sixteen answered that such training would improve their confidence to do real-life surgery, while 2 said that they were not sure.

a) Skill Assessment

The skin suturing skills of the trainees were assessed by OSATS using the checklist which consisted of 19 task steps.

The pre and post-training score are given in Table I.

Task step number 10 (whether needle touched with hand) and step number 17 (suture board moves or not) were performed incorrectly by maximum number of students (63.4% and 59.61% respectively). During post-training assessment considerable improvement was seen with Step 10 and Step 17 being performed incorrectly by 30.76% and 34.61% students respectively. The pre-training and the post-training checklist scores were also compared separately for undergraduate students and General trainees (Table II).

	Pre-training	Post-training
Mean	10.9	15.23
SD	4.36	3.01
Skewness	-0.275	-0.268
Kurtosis	2.45	14.66
Median	11.0	16.0
Range	1-18	10-19

Table I. Pre and post-training check list score

The pre-training and post-training scores for the entire group were skewed while the pre and post-training scores for MBBS students were normally distributed. The pre-training and the post-training scores for Junior Residents were skewed. A statistically significant improvement in the post-training scores was noticed for both. However, the improvement in the group of undergraduate students was more marked.

b) Knowledge Assessment

In the first workshop, the knowledge of the trainees was assessed using a pre and post-training questionnaire; each consisted of 9 questions. The data in the pre and post-training questionnaire were skewed (Table III). A statistically significant improvement was found in the post-training scores, however, the improvement was not as marked as that noted for skill assessment.

DISCUSSION

Proper teaching of operative skills to trainees is increasingly constrained by operative time, complex procedures and medico-legal concern⁵. There are ethical concerns about teaching basic skills on a patient. Prolonged anaesthesia time while a budding surgeon struggle with the process of a surgical exercise cannot be considered to be in the best interests of the patient. Similarly, attempting to learn in a highly stressful environment in

Table III. Workshop I

	Pre-training questionnaire scores	Post-training questionnaire scores
Mean	4.44	4.48
SD	2.22	2.88
Skewness	0.33	0.07
Kurtosis	1.9	1.4
Median	4.0	5.0

	Student	Junior Resident
Pre-training		
Mean	9.75	13.47
SD	4.33	3.12
Post-training		
Mean	15.25	16.12
SD	2.10	2.02

Table II. Checklist scores of students and residents

which the objective is the accomplishment of a therapeutic procedure is an invitation to the development of error patterns in motor behaviour. The cost of the theatre time makes the operating room an inappropriate venue for teaching and testing basic surgical skills to junior level trainees. Consequently, surgical trainees have less and less opportunity to learn basic surgical skills and procedures on living human patients.

Simulator models, in contrast, provide a controlled setting to practise, and available concurrent feedback provides a more organized and inclusive approach to the learning of basic surgical skills⁶. There are several models by which residents can learn technical skills outside the operating room. However, the degree of fidelity with respect to simulating the living human patients varies widely among different models. Simulation must be seen as an adjuvant to, rather than a replacement for, training in the operating theatre.

Workshops and courses in basic surgical skills have been organized in the United States and Europe. Bevan⁷ demonstrated using simulated materials. Hoffmann⁸ and Greenhalgh⁹ use animal viscera for simulated training. Such simulated teaching has yet to gain popularity in Pakistan. The primary objectives of these workshops were to provide the trainees with an opportunity to assess and improve their technical skills.

It is essential to evaluate the efficacy of teaching some aspects of technical skill development outside the operating room in a bench setting. Training without evaluation may lead to perfection of gross mistakes. The Objective Structured Assessment of Technical Skill (OSATS) using a checklist is a reliable and valid assessment tool for technical skills.^{4,10} Kopta⁶ reported high inter-rater reliability when a checklist approach was used to assess technical competence of orthopaedic trainees. Lossing and Gretzch¹¹ employed a checklist approach in a multiple station format to assess the efficacy of a course on technical skills given to clinical clerks. Winckle and

colleagues¹² reported on the reliability and validity of global rating forms and operation-specific checklists as tools used in evaluating the operative skills of residents in the operating room.

The majority of the students showed significant improvement in surgical skills in the post-training scores. However, it remains to be seen whether it ultimately affects the surgical performance of the trainees.^{13,14} All were unanimous in their belief that such workshops are useful and should be conducted from time to time.

The more early the trainee in his training, the more improvement could be seen. The improvement was more in the under-graduate students as compared to the Junior Resident (Table II). Although a significant difference was noted in the pre and post-training questionnaire scores used to assess knowledge of the trainees, the improvement was not marked (Table III).

It is felt that such workshops may also leads to an increased interest in a surgical career. The time spent together, away from the pressure of the operating theatre may lead to close relationships of the trainees with their peers and teachers.^{13,15} This will help to improve the operating environment.

CONCLUSION

Teaching basic surgical skills in the workshop setting is both feasible and advantageous using simulation. Basic surgical skills should be taught to all medical students regardless of their career aims.

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