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Original article

Use of Simulation for Identification and Strengthening of Weaker Surgical Technical Objectives - A Pilot Study

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ABSTRACT

Introduction: In the beginning, even simple surgical procedure may encounter technical difficulty for trainee that increases operative time and expose patient to the risk of complications depending on complexity of procedure; using simulation, simple or complex procedure can be practiced and shown positive effect on outcome. Hence it is wise to identify weaker technical objectives (i.e. skills) of procedure and strengthen it. Present study was aimed to assess whether simulation is effective in pointing out 'weaker skills' in the procedure using 'Objective Structured Assessment of Technical Skills, (OSATS) and can these weaker skills be strengthened by simulation practice. **Methods:** A pilot study was conducted in which first all participants were assessed for adequate knowledge and skills for skin suturing before demonstration and practice (Pre test). Secondly participants were exposed to ideal, stepwise demonstration of skills with explaining the importance of each step along with correlation of knowledge. Participants were asked to practice ideal skin suturing for one hour. All participants were then asked to perform skin suturing and suture removal. Evaluation was done as before. All participants were then assessed for knowledge and skills for skin suturing. (Post test). **Results:** There was significant improvement between pre-test and post test score of OSATS in most of weaker skills and knowledge; some skills were not improved significantly with one hour practice. **Conclusion:** It is evident that simulation is effective identifying weaker skills but some skills needs more practice for improvement.

KEYWORDS: Simulation, OSATS.

INTRODUCTION

Psychomotor skills need practice for its perfection which needs platform for practice. Even the minor surgical procedure may lead to professional harm to patient and increase of operative time due to inexperience of trainee doctor which is inappropriate in the best interest of the patients [1]. Simulation provides interactive platform which replicates real clinical scenario without exposing patients at risk [2]. A simulation study amongst the gynaecologists of seven different countries, it is observed that 80% have performed 'incorrect' knotting meaning thereby simulation is better tool for identification of the weaker or inappropriate practices [3].

Simulation of the different fidelity are available for practice of the surgical skills for improvement, even the low fidelity simulation model are as effective as high fidelity models of simulation [4, 5]. A study has depicted that the skills acquired through simulation models of any fidelity is being effectively transformed to solve the real life problems [6]. A statement that practice makes man perfect stands false if the practices itself is incorrect and will lead to expertise in 'wrong practice', hence the present study was undertaken to assess the effectiveness of simulation for identifying and strengthening of the weaker objectives of the basic of skin suturing as it has non-threatening environment.

MATERIALS AND METHODS

Present prospective pilot study was conducted after approval of institutional ethical committee in basic surgical skills lab in Nodal centre for MET at Jawaharlal Nehru Medical College, Sawangi (Meghe) Wardha for advanced MET course in which 10 (ten) MBBS interns from the department of surgery have participated. Study was conducted from July 13 to Jan 14.

Polyurethane surgical suturing model and module for skin suturing in the surgical skills lab was utilized for this educational research. Validated pre and post-test questioners and Objective structures assessment of technical skill (OSATS) checklist was used for assessment of set objectives of skin suturing.

Pre and post test questioners for assessment of knowledge.

1. Which needle holder (short/long) is used for skin suturing?
2. Which suture material is ideal for skin suturing?
3. Which forceps (plain/toothed) is to be used in skin suturing?
4. How should be movement of hand while suturing?
5. What is ideal way of grasping needle in needle holder?
6. How must be the entry and exit point of needle from incision?
7. How must be the edges of sutured wound at completion?
8. Which is secure knot?
9. What must be the length of cut ends of sutures?
10. What is the ideal way of removing sutures?

Structured objectives for assessment technical skills in ideal skin suturing.

1. Identifies proper instrument for skin suturing.
2. Holds needle holder and tooth forceps ideally.
3. Identifies proper suture material for skin suturing.
4. Pierces needle perpendicular to skin surface.
5. Pierces needle at proper distance from previous suture.
6. Pierces needle at same distance from incision.
7. Hand movements are supination and pronation.
8. Knots suture correctly with square knot.
9. Edges of suture are slightly everted.
10. Cut the suture material leaving proper length for suture removal.
11. Suture removal is done by cutting suture from skin side.

PART I: All the participants were first assessed for knowledge for skin suturing using questioner (Pre test). All participants were asked to perform six ideal intermittent vertical mattress skin sutures and suture removal. Evaluation was done by objective structured assessment of technical skill as per checklist.

PART II: Ideal, stepwise skin suturing was demonstrated with explaining the importance of each step along with correlation of knowledge. Participants were asked to practice ideal skin suturing for one hour. All participants were then asked to perform six ideal intermittent vertical mattress skin sutures and suture removal. Evaluation was done as before. All the participants were again assessed for knowledge for skin suturing. (Post test)

DATA ANALYSIS: Paired t- test was used for comparing pre and post assessment of theoretical knowledge and OSATS before and after demonstration and practice, $p < 0.05$ will be considered statistically significant.

Perception of all participants was assessed on Likert's scales with a questioner, whether there is any improvement in self confidence about skin suturing skills after practising for one hour with use simulation. Likert's scale has five levels of agreements. Strongly suggest highest level of agreement or disagreement, neither represent neutral about any positive or negative effect on the skill whereas only agree or disagree suggest some positive or negative effects on the skills.[7]

Likert's Question: Does Simulation have increased confidence in ideal skin suturing.

Likert's Scale: Strongly Agree Agree Neither Disagree Strongly Disagree

RESULTS

In the present study total number of participants (N) were 10 with mean pre test knowledge score 1.10 and mean post test score 8.00. Std. deviation was 1.10 and 2.10 respectively. P – Value was < 0.05(0.000) which show that there was statistically significant increase in knowledge regarding skin suturing(table 1).

In pre test, objective numbered 4,5,6,7,9,10, and 11 were difficult for most of the participants whereas 2, 8 were difficult for 40-50% participants with use of objectives structured assessment of technical skills (OSATS). There was significant ($P<0.05$) improvement in the objectives 2, 4, 5,6,10 and 11, were as for one objective in which test was not applicable as there was no improvement in performance in pre and post demonstration phase(Table 2).

In present study 70% of participant strongly agree and 30% participant agree for increase in the self confidence regarding ideal skin suturing(Table 3).

Table 1: Knowledge Score of Pre and Post Test

	Mean	N	Std. Deviation	Std. Error Mean	Difference	t-value	p-value
Pre Test	1.10	10	1.10	0.34	6.90±2.33	9.36	0.000
Post Test	8.00	10	2.10	0.66			

Table 2: OSATS Scores on Pre and Post Demonstration

Sr. No	Objectives	Pre Test	Post Test	$\chi 2$-value	p-value
1	Pick- ups proper instrument for skin suturing.	9(90%)	10(100%)	1.05	0.30
2	Holds needle holder and tooth forceps ideally	6(60%)	10(100%)	5.00	0.025
3	Pick -ups proper suture material for skin suturing	9(90%)	10(100%)	1.05	0.30
4	Pierces needle perpendicular to skin surface.	1(10%)	8(80%)	9.89	0.001
5	Pierces needle at proper distance from previous suture	0(0%)	5(50%)	6.66	0.009
6	Pierces needle at same distance from incision.	0(0%)	7(70%)	10.77	0.001
7	Hand movements are supination and pronation.	0(0%)	0(0%)	NA	--
8	Knots suture correctly with square knot.	5(50%)	8(80%)	1.97	0.15
9	Edges of suture are slightly everted	0(0%)	2(20%)	2.22	0.13
10	Cut the suture material leaving proper length for suture removal.	0(0%)	10(100%)	20.00	p<0.0001
11	Suture removal is done by cutting suture from skin side	2(20%)	10(100%)	13.33	0.0003

Table 3: Feedback about Self Confidence in Ideal Skin Suturing

Likert's Scale	No of subjects	Percentage (%)
Strongly Agree	7	70.00
Agree	3	30.00
Neither	0	0.00
Disagree	0	0.00
Strongly disagree	0	0.00
Total	10	100.00

DISCUSSION

In our study, it was observed that there was significant improvement ($p < 0.00$) in knowledge for ideal skin suturing which was due to proper assembly of previous knowledge acquired during medical education and correlation of the same for the ideal skin suturing. Results of our study are similar to the study of V. V. Shindholimath et al [1].

Simulation with objectives structured assessment of technical skills (OSATS) it was possible to point out the weaker objectives. In pre-demonstration assessment, it was observed that no participant was able to perform needle piercing at proper distance from previous sutures, piercing of needle at same distance from incision, supination and pronation movements, slight eversion of edge, and cutting of suture with proper length for suture removal.

Whereas piercing the needle perpendicular skin was performed by only one participant, two participants can perform suture removal by cutting the suture from skin surface so as to avoid prevent intrusion of infection. Selection of proper instruments and suture material was done by 90% participants, ideal holding of the instrument was possible for 60% participants, and correct knotting was done by 50% of participants. Thus weaker objectives of procedure were well identified with use of simulation with OSATS, above observation supports that, simulation was effective in pointing the weaker objectives for suturing skills i. e. out of eleven objectives, the objectives numbered 4, 5, 6, 7, 9, 10, and 11 were weaker in 80% participant in pre demonstration phase.

After ideal demonstration of skin suturing, participants were allowed practice correct technique for an hour, OSATS after practice showed significant ($P<0.05$) improvement in the parameters 2,4,5,6,10 and 11 suggesting simulation was effective in strengthening of weaker objectives [1]. Whereas correct hand movement, i.e. supination and pronation movement of hand was not improved in any participant. There was no significant improvement in the objective 'slight eversion of the edge'. Improvement was in only two participants after one hour of practice on simulation which underlines the importance of the extended focused practice of weaker objectives to attain level of professional efficiency or expertise for intended psychomotor skills [8, 9].

In present study though low fidelity model, polyurethane foam were used for the simulation of skin suturing clearly portrayed that there was significant improvement in most of the objectives of skin suturing within short duration of practice in all participant suggesting that fidelity of simulation is not a hurdle in improvement of basic surgical skills and can be used for assessment and improvement of weaker technical objectives.

Similar results were observed by Rafael Denadai et.al [5] where he grouped participant's in 1) Theoretical teaching of skin suture by using video as control group, 2) Training of the participants with low fidelity synthetic ethylene vinyl acetate bench model, and 3) participants training with high fidelity pig feet skin suture simulation model. All exposed to practice for an hour. Control group was compared with the simulation model training groups and found that performance of 'simulation groups' was significantly better than the 'theoretical teaching group' and there was no difference of performance in high or low fidelity simulation group. In simulation model group, there was significant improvement in self confidence. In present study, simulation was equally effective in identification of the 'weaker surgical objectives' in each participants and improvement in majority of weaker objectives in all participants [5].

Technical difficulties due to weaker surgical objectives, there will be increase operative time, increase time consumption for completing the procedures leads to wastage of time of other associated experts and paramedical staff; ultimately it leads to the significant economic burden on institution or health service system [10]. In present study 70% of participant strongly agrees and 30% agree that they have increased in confidence for skin suturing with one hour practice on polyurethane foam simulation model after explaining steps of ideal skin suturing along with demonstration on the simulation.

As with limited duration of practice in simulation lab, all participants were improved in quality and confidence in skin suturing outside the operating room, so it can be used for rehearsal to anticipate and limit the hazards during actual surgery which lead to increased patient care and safety. [11]

Many studies revealed that skills acquired with simulation will definitely be transferred in operating room so it is wise to use appropriate model of simulation technology for enhancement of basic skills and as well newer upcoming skills like complex anastomosis, endoscopic, laparoscopic or interventional skills through appropriate simulation, which will increase the patient's safety outside operation theatre so that patients' body parts will not be used as learning material for practice of the skills. [2, 4, 9, 10, 11, 12, 13]

CONCLUSION

Simulation was effective in identification of 'weaker' surgical skills and 'strengthens' those weaker skills to improve surgical outcome. There was increase in self confidence and improvement in surgical skills which intern increases the patient safety by shifting the learning out of operating room without exposing patients at risk. Poly urethane bench model simulation which was low fidelity model showed improvement in skin suturing. It provided non threatening environment in learning phase and allowed for error correction. With increasing duration of deliberate practice, simulation has positive impact on confidence and quality of ideal skin suturing procedure.

REFERENCES

1. V. V. Shindholimath, A. Goyal, A. Srivastava, S. Aggarwal. Teaching and assessment of surgical skills through simulation in surgical training. Indian Journal of Surgery. 2003; 65: 483-487.
2. Stephanie Tache, Naboth Mbembati, Nell Marshall, Frank Tendick, Charles Mkony, Patricia O'Sullivanl. Addressing gaps in surgical skills training by means of low cost simulation at Muhimbili University in Tanzania. Hum Resour Health. 2009; 7: 1478-1491.
3. Thomas Ind. Surgeon's Knot: Old skills, new training. Correspondence. The Lancet. 2002; 360(9336):874
4. PN Khalil, M Siebeck, W Mutschler, KG Kanz. The use of chicken legs for teaching wound closure skills. Eur J Med Res. 2009; 14 (10): 459-460.
5. Rafael Denadai, Marie Oshiiwa, Rogerio Saad- Hossne. Does bench model fidelity interfere with the acquisition of suture skills by novice medical students? Available at http://dx.doi.org/10.1590/S0104-42302012000500019
6. Anastakis DJ, Regehr G, Reznick RK, Cusimano M, Murnaqhan J, Brown M et al. Assessment of technical skills transfer from bench training model to the human model. Am J Surg. 1999; 177(2): 167-70.
7. Analyzing Likert data- The journal of extension. Available at http://www.joe.org/joe/2012april/tt2p.shtml
8. K. Anders Ericsson. Deliberate Practice and the Acquisition and Maintenance of Expert Performance in Medicine and Related Domains. Academic Medicine Supplement 2004; 79(10):s70-s81.
9. Geb W Thomas, Brian D Johns, J Lawrence Marsh, Donald D Anderson. A review of the role of simulation in developing and assessing orthopedic surgical skills. Iowa Orthop J. 2014; 34: 181–189.
10. Sandra L.Montbrun, Helen MacRae. Simulation in surgical Education. Clin colon rectal surg. 2012; 25(3):158-165.
11. Marvin P. Fried, Richard Satava, Suzanne Weghorst, Anthony Gallagher, Clarence Sasaki, Douglas Ross et al. The *use* of surgical *simulators to reduce errors*. In Rockville (MD) editor. *Advances in Patient Safety*: From Research to Implementation 2005; *4: 165-177*.
12. Richard K. Reznick, Helen MacRae. Teaching surgical skills- Change in the Wind. The Engl. J of med. 2006; 355:2664-2669.
13. Mathtew P. Thomas. The role of simulation in development of technical competence during surgical training: a literature review. IJME, 2013; 4: 48-58.

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