Original Article

Simulation Cataract Surgery, an Analysis on its Impact on the Training of Post Graduate Trainees

Simulation Cataract Surgery - Analysis

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ABSTRACT

Objective: To assess impact of simulation of eye surgery skills on training of post graduate trainees at Dow University of Health Sciences.

Study Design: Cross-sectional study

Place and Duration of Study: This study was conducted at the Simulation Laboratory of Dow University Health Sciences for a period of 3 months from 1st March 2025 to 30th May 2025.

Methods: This study of 3 months duration after approval from institutional review board. Data regarding capsular rhexis and intracapsular maneuvers was taken from the Eyesi simulator system. Average score, minimum score, maximum score and total time taken were analyzed. They were then documented on and analyzed on SPSS version 25.

Results: The data of 11 trainees was analyzed over a period of three months. The mean average score for Capsular rhexis was 86.13 with a standard deviation of 8.655. The mean of total time taken was 46.45 minutes with standard deviation of 14.955. Regarding intracapsular navigation the mean of total time was 19.90 minutes with a standard deviation of 6.53 The mean of average score was 75.7 with a standard deviation of 9.44.

Conclusion: The individual scores of simulations showed that learning on it was a variable curve with improvement in the end.

Key Words: Simulation, Intracapsular maneuvers, phacoemulsification, capsular rhexis

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INTRODUCTION

This is a cross sectional regarding simulation system for eye cataract surgery and how the skills of the post graduate trainees at Dow University of health sciences improved with it. The Eye Si simulation system was used by the trainees. It provides a better setup than wet lab as it conforms to the human eye. There are other simulators such as MicroVis Touch and Phaco Vision but Eysesi was the one available in our institution[1]. Verbal instructions are in the program and at the end scoring is done so the candidate gets to know where he/she needs to improve. It is available in very few universities in our country as its expensive.

In studies done internationally it was seen that the trainees` surgery time shortened and there were less complications as compared to those who didn't undergo simulation training[2].

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Amongst the surgeries done in ophthalmology, phacoemulsification is more popular. Therefore, trainees need to master the procedure and it's better that they practice on simulation systems and wet lab rather than human eye initially[3].

Amongst the more frequently seen problems encountered during cataract surgery are posterior capsular rent and vitreous prolapse. These are more frequent in surgeries done by trainee doctors[4].

During Covid times patient interaction had to be limited. Various alternatives were utilized such as online clinics and simulation were particularly helpful[5]. When we train on patients there are more complications and results are not that good either. These parameters were significantly improved when the residents initially trained on simulation[6].

In the developing countries there are much more cataract patients than in the developed world. This is because of lack of access of medical facilities to the population living in the peripheries. Economic problems also enhance this issue. Therefore, all the more reason that ophthalmologists are properly trained for cataract surgery to reduce the bulk of patients[7].

Another positive aspect of simulation training is the fact that patient exposure to trauma is minimized. Therefore, the popularity of this training system has increased in trainee ophthalmologists (8).

METHODS

This study was conducted at the simulation laboratory at Dow university of Health Sciences. Eleven Third year and fourth year post graduate trainees of fellowship of Ophthalmology were included in this study. Initially approval was taken from the Institutional review board of Dow University of Health Sciences to conduct this study. Data regarding capsular rhexis and intracapsular maneuvers were taken from the Eyesi simulation system.

The Eyesi simulation system was installed at Dow University in 2023. Training of ophthalmic trainees started around October of the same year. We analyzed the simulation data of the fellowship trainees for a period of approximately three months from 1st March 2025 to 30th May 2025. Each step was practiced by the trainees till a score of 70% was obtained three times consecutively. Then only could they proceed to the next step of training on simulation. They continued practice till their scores improved.

The data was then typed in and analyzed on SPSS version 25.

Inclusion criteria: Third- and fourth-year fellowship trainees of ophthalmology. Capsular rhexis and intracapsular maneuvers on simulation.

Exclusion criteria: Brunescent cataracts, errant capsular rhexis, capsular rent management were not included.

Operational Definition:

Capsular rhexis and intracapsular maneuvers were analyzed on the basis of:

Precision

Time taken

Complication avoidance.

These were observed for a period of 3 months.

RESULTS

It was observed that the score of simulation training were variable, that is they didn't necessarily have an upward spike but dipped in between and then finally improvement was seen.

The data of 11 trainees was analyzed. The mean average score for Capsular rhexis was 86.13 percent with a standard deviation of 8.655. The minimum score was 70 percent and maximum 97 percent. The mean of total time taken was 46.45 minutes with standard deviation of 14.955.

Regarding intracapsular navigation the mean of total time was 19.90 minutes with a standard deviation of 6.53. The mean of average score was 75.7 with a standard deviation of 9.44. The minimum score was 63 percent and maximum was 90 percent.

Table No.1: Capsular Rhexis.

Avgscore					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	70.00	1	9.1	9.1	9.1
	76.57	1	9.1	9.1	18.2
	78.50	1	9.1	9.1	27.3
	81.33	1	9.1	9.1	36.4
	85.30	1	9.1	9.1	45.5
	87.60	1	9.1	9.1	54.5
	90.00	1	9.1	9.1	63.6
	92.60	1	9.1	9.1	72.7
	93.00	1	9.1	9.1	81.8
	95.30	1	9.1	9.1	90.9
	97.33	1	9.1	9.1	100.0
	Total	11	100.0	100.0	

Statistics of intracapsular navigation.		
Avgscore		
N	Valid	11
	Missing	0
Mean		75.7455
Median		75.3000
Std. Deviation		9.44440
Range		26.70
Minimum		63.30
Maximum		90.00

Table No.2: Intracapsular Navigation.

Avgscore					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	63.30	1	9.1	9.1	9.1
	65.30	1	9.1	9.1	18.2
	68.00	1	9.1	9.1	27.3
	70.00	1	9.1	9.1	36.4
	70.40	1	9.1	9.1	45.5
	75.30	2	18.2	18.2	63.6
	82.60	1	9.1	9.1	72.7
	83.00	1	9.1	9.1	81.8
	90.00	2	18.2	18.2	100.0
	Total	11	100.0	100.0	

DISCUSSION

Simulation surgery training is available in very few institutes in Pakistan because of its high cost. Dow University has procured it since a few years especially since training was getting affected in the Covid era. Therefore, research is also limited in this regard, thus the rationale for this study. In the Eyesi simulation system there is a model eye with openings at different positions to allow for entry of probes that take on the role of instruments[3].

In a study by Momin SN, Memon AS, et al conducted at the Agha Khan University in 2022, which included 8 trainees and consultants, capsular rhexis was analyzed

exclusively on simulation for a period of 1 month[9]. They saw eventual improvement in scores of capsular rhexis. In our study we have analyzed data for Intracapsular maneuvers and capsular rhexis for a period of 3 months. We also observed an irregular graph with dips in between and eventual success in mastering the step.

Another study by Zubair Z and Zubair U in 2020 highlighted the lack of wet lab and simulation training facilities in Pakistan[10]. They were of the view that such facilities would decrease the brain drain from our country as training would improve.

As reported in a study done at Kerala in 2022, because of lack of training opportunities, 30 to 50% trainees in the developed countries and about 70% trainees in the developing world have difficulty in operating without supervision (3). In a study at UK there was 40% decrease in the rate of posterior capsular rent even after a few days of training on simulation[11].

There was 70% decrease in posterior capsular rent by the trainees after simulation training, as observed by Dean[12]. In a study at UK by Ferris et al this was reported to decline by 38%[13]. Studies by Bergqvist et al and McCannel are similar to ours as they also observed decreased complications in surgery but didn't compare with surgery on patients[14].

It would greatly enhance performance of trainees if simulation for surgery were included in their curriculum. As not only do they have near to life scenarios for surgery steps practice but they also get evaluation for their performance and get scores out of 100[15]. This has been implemented by International council of Ophthalmology of East Africa. They have a program for development of surgical skills of trainees before doing surgery on patients[16]. According to the (OLIMPICS) Improvement initiative in cataract surgery and (GLASS) The glaucoma simulated surgery trial, skills and confidence both are enhanced with simulation training[17].

In the French pedagogic multicentric study it was tried to fathom how much teaching time is required on simulation for trainees. They assigned two, four-hour simulation trainings to all 16 trainees and an assessment cataract surgery also on simulation at the end of these sessions. The lowest scores were on emulsification[18].

Another study assessed trainees for Manual Small Incision Cataract Surgery according to steps in the Help MeSee MSICS standard procedure for testing. They found that even the expert phacosurgeons didn't achieve the required results for MSICS, this being a different type of cataract surgery[19].

There are some negative aspects of simulation training according to some studies such as the one by Puri et al. They deemed interaction and advice by the teachers to be more effective than simulation training[14]. Overall it is the preferred system of teaching for beginner trainees as also discussed in a recent workshop at College of Physicians and surgeons Pakistan. This workshop was conducted by Dr. James Innes who is lead of simulation skill lab of Royal College of ophthalmology UK.

Some review studies have also been done regarding simulation one such being by Rothschild et al in 2020 which shows simulation improvement of posterior capsular rhexis and less of the other steps involved in cataract surgery. Another study by Ahmed T M, et al was a review of 165 articles regarding simulation training and how training can be improved with this tool[20].

CONCLUSION

Simulation training helps improve the cataract surgery learning curve in ophthalmology trainees. It should be incorporated in the teaching curriculum of post-graduation. The limitation of our study is that simulation data wasn't compared with surgical data on humans by the trainees. The study needs to be followed up with that.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Nargis Nizam Ashraf, Tarique Saleem
Drafting or Revising Critically:	Nargis Nizam Ashraf, Tarique Saleem
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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