

# Revisiting the Cataract Surgery Curriculum for Ophthalmology Residents: A Narrative Review

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## Abstract

**Purpose:** To compare the educational model and complication rates of cataract surgery performed by ophthalmology residents in Iran with other countries and present suggestions for improvement

**Methods:** We reviewed a number of studies that investigated the complications of cataract surgery in relation to curriculum modifications from 2009 to 2011.

**Review:** Complication rates are higher in our country compared to others. In Iran, two studies in 2009 and 2011 reported high complication rates among residents. In the USA, the rate of Posterior capsular rupture (PCR) in resident-performed surgeries had a decreasing trend from 2001 to 2011, and the rate of Vitreous loss (VL) reached zero in 2011 after a substantial decrease in 2002 and small variations thereafter. The two Asian and European studies in 2006 and 2009 also reported lower complication rates than Iranian studies.

**Suggestion:** Simulation and wet lab training, exposure to the operating room, providing a portfolio, research shifts, evidence-based discussions with experienced surgeons could improve knowledge and experience of Iranian residents.

**Keywords:** Cataract Surgery, Training Curriculum, Quality Improvement, Residency, Iran

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## Introduction

Phacoemulsification cataract surgery is one of the most common intraocular surgical procedures performed by ophthalmology residents, and may have complications such as posterior capsular rupture (PCR) and vitreous loss (VL).<sup>1</sup> Phacoemulsification training is one of the fundamental parts of the residency program curriculum<sup>2</sup> and needs to ensure improved visual outcome in patients.<sup>3</sup> In the USA, the apprenticeship model was used for more than 100 years to train and

evaluate residency skills through direct supervision and feedback.<sup>4</sup> Then, to evaluate residency skills objectively, the Accreditation Council for Graduate Medical Education (ACGME) presented the competency based model according to which residents need to achieve competency in the six fields of patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice.<sup>5</sup>

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Different tools with acceptable validity and reliability have been developed to evaluate these skills.<sup>6-9</sup> The American Board of Ophthalmology has added teaching and assessing surgical competency to the aforementioned and this model seems to have improved outcomes of resident-performed surgeries.<sup>10</sup>

In Iran, the residency curriculum is developed by the Secretariat of the Council of Medical Education of the Ministry of Health and Medical Education. Phacoemulsification training takes place in the 2<sup>nd</sup> year curriculum of a four year residency program.<sup>11</sup> Considering the role of curriculums in reducing complications of cataract surgery,<sup>12,13</sup> here we aim to compare the educational model and complication rates in Iran with other countries and present suggestions for improvement.

## Review

For this report, we reviewed a number of studies that investigated the complications of cataract surgery in relation to curriculum modifications. In light of the low complication rates of their ophthalmology residents, our main focus was on studies from the USA to better evaluate the weak points of the Iranian residency program.

Table 1 presents a summary of the reviewed studies. In Iran, two studies in 2009 and 2011 reported high complication rates among residents. In the USA, the rate of PCR in resident-performed surgeries had a decreasing trend from 2001 to 2011, and the rate of VL reached zero in 2011 after a substantial decrease in 2002 and small variations thereafter. The two Asian and European studies in 2006 and 2009 also reported lower complication rates than Iranian studies.

**Table 1.** Performed studies on the complications of cataract surgery by residents

Author	Country	Study year	Year of residency	Sample size	Complication (%)	
					PCR	VL
Karp et al <sup>14</sup> TCC SST	USA	2001	3	348	11.5%	6.0%
Blomquist et al <sup>15</sup>	USA	2002	3	186	17.7%	11.8%
Quillen et al <sup>16</sup>	USA	2003	3	1,288	NA	4.3%
Randleman et al <sup>17</sup>	USA	2004	unknown	332	NA	4.8%
Unal et al <sup>18</sup>	USA	2004	unknown	302	8.9%	5.1%
Unal et al <sup>18</sup>	Turkey	2006	unknown	296	10.5%	6.4%
Bhagat et al <sup>19</sup>	USA	2007	3	719	6.7%	5.4%
Rutar et al <sup>20</sup>	USA	2009	2,3	320	NA	3.1%
Pouyeh et al <sup>21</sup>	USA	2011	2,3	94	2.1%	0
Briszi et al <sup>22</sup>	Germany	2012	4-5	600	3.8%	1.7%
Zare et al <sup>23</sup>	Iran	2009	2	767	PCR with VL: 13.4%	
Hashemi et al <sup>24</sup>	Iran	2011	2-4	500	9.6%	10.2%

PCR: Posterior capsular rupture, VL: Vitreous loss

## Conclusion

Cataract surgery and phacoemulsification training is an integral component of an ophthalmology residency program. However, with the spread of phacoemulsification and confirmation of its safety and efficacy, the necessity of training in extracapsular cataract extraction (ECC) faded.<sup>16</sup> One of the most important complications of cataract surgery is PCR with or without VL, which decreases considerably with increased surgeon expertise.<sup>25,26</sup> Phacoemulsification performed

by residents can result in a best corrected visual acuity (BCVA) of  $20/40$  or better in 88% of the patients<sup>27</sup>; improved results and lower complication rates can be achieved at higher levels of expertise. In addition to curriculum improvement and increased surgeon expertise, the lower incidence of complications can be owing to new equipment and new procedures.<sup>3,12,23,28</sup> Based on this review, complication rates showed a decrease in developed countries in 2012 although

second year residents, who are less experienced, have started to perform phaco since 2009; therefore, education may have a stronger impact than expertise.

In Iran, education is provided through conferences, lecturing, journal clubs, discussion, video surgery, morning reports and rounds, observed and clinical training in the operating room, wet labs, counseling with the supervising physician, and tele-education.<sup>11</sup> Among these methods, residents are most satisfied with journal clubs, lecturing, and wet labs, and least satisfied with evidence-based decision making and mortality-morbidity conferences.<sup>29</sup> Therefore, it could be argued that active learning has weak points and needs improvement in Iran. A study on learning styles also showed that Iranian residents are mostly assimilators<sup>30</sup> while nowadays, emphasis is placed on the converger style which is active learning with a problem-solving approach.<sup>31</sup>

Unlike in the USA<sup>2</sup> where 75% of residents attend the operating room as assistants and 40% experience their primary surgery in their first year of residency. The current first year curriculum in Iran only offers patient visits in the clinic and no exposure to the operating room. Earlier exposure to the operating room can enhance the residents' practical experience in the second year; however, this should not interfere with acquisition of first year skills such as patient care, familiarity with paraclinical departments, and interpersonal and communication skills. Iranian ophthalmology residents are relatively more satisfied with their competency in the operating room and outpatient rounds but are not satisfied with official education and feedback and discussion.<sup>29</sup>

According to previous studies in Iran, residents believe in evidence based medicine, but 80.3% of them have not received structured education in this regard and less than 20% of them have attended its workshops. About 72.3% of the clinical residents are unfamiliar with the Cochrane library; 19.7% are aware of it but do not use it, 4.2% seldom use it, and only 2.8% of them use it in decision-making.<sup>32</sup> About 50% of the residents are dissatisfied with the quality of the training they receive on evidence-based decision making.<sup>29</sup> Despite challenges, there is emphasis on evidence-based decision

making as a practice-based learning skill.<sup>33</sup> In the current curriculum, although good clinical practice and presentation of guidelines require research and evidence-based decision making capabilities, the role of research is not highlighted and residents are seldom involved in research activities except for their theses. Inclusion of research duties in addition to clinic and operating room shifts may be effective in this regard.

Including web-based education to the curriculum for system-based care and interaction with other ophthalmologists can also be helpful.<sup>5,11</sup> The positive effect of web-based training on the belief and confidence of the residents can improve patients' self-management.<sup>34</sup> The authors believe this method is rather neglected.

One criterion for practice-based learning by ACGME is portfolio, self-education and self-management.<sup>5</sup> Portfolio aims to help the learner have a sense of education and plan for their future. In the curriculum, self-education has been mentioned but the details are not discussed and no method has been proposed for its surveillance. It seems that universities should be committed to include this method in their curriculum since presenting a learning plan and its revision by residents can increase their competency.<sup>35</sup>

Wet lab learning was included in the Iranian curriculum for ophthalmology residency programs in 2011.<sup>11</sup> This was feasible for Iranian universities because they already had anatomy departments and animal labs. The effect of the wet lab training on reducing complications has been shown in other countries,<sup>8,10,22,36</sup> and can partly explain the higher rate of surgical complications in our country, specially that our residents start phaco with less experience (in the second year). However, structured execution of the curriculum is of great importance. Upon evaluation of the residents' satisfaction with the curriculum, 24.2% expressed dissatisfaction and 33.3% did not respond.<sup>37</sup> In a qualitative study on the attitude towards using EYESI in phaco training, the simulator received scores of 85 and 60 by residents and fellows, respectively. Fellows believed the device was useful for novice residents before exposure to the operating room, decreased the duration of education, increased its quality, developed eye-hand-foot coordination,

and decreased complications.<sup>37</sup> This method has also been used by others in stepwise education programs.<sup>38</sup> In the latest curriculum, education through wet lab depends on the department agenda. Future comparative studies can determine their role in changing the incidence of complications.

Considering the process of residency education in Iran, our suggestions for enhancing the curriculum and active learning are as follows:

- Simulation and wet lab training in the first year before exposure to the operating room and demanding an activity report from the residents. If the results of this field and the number of operations are requested in writing, reporting continues in a structured fashion. Senior residents should be present during these sessions to comment on possible mistakes. However, these require facilities in the hospital, specially simulation equipment that helps surgeons develop eye-hand-foot coordination.
- Exposure to the operating room in the medical stage of residency as an observer after simulation and wet lab training.
- Requiring residents to provide a portfolio in the beginning of the medical stage and after each in-training exam for promotion. The portfolio can be used to compare the needs and expectations of the residents in each residency year in order to identify the missing items. The score of the portfolio can be considered part of the Promotion Exam. The portfolio can be used to compare the needs and expectations of the residents in each residency year in order to identify the missing items. However, its coordination with the department agenda is a limiting factor.
- Requiring residents to take research shifts along with clinical shifts from the second year. Qualitative studies and focus group discussions with residents on the subject of eliminating barriers to evidence-based practice can be helpful and show the weak points that need correction or improvement.
- Holding evidence-based discussions with experienced surgeons in the clinic with

feedback starting from the second year when phaco training starts. A defect concentration diagram can be a helpful tool to explore the main causes of complications during phaco surgery, and presenting curriculum evaluation methods to universities. In the present curriculum, evaluation of curriculum implementation only applies to the ethical section. Required tools for clinical departments should be defined and evaluation results in hospitals should be forwarded to the university annually.

## References

1. Fishkind WJ. Complications of phacoemulsification: avoidance, recognition, and management. New York: Thieme Medical Publishers, Inc; 2002.
2. Rowden A, Krishna R. Resident cataract surgical training in United States residency programs. *J Cataract Refract Surg* 2002;28(12):2202-5.
3. Randleman JB, Wolfe JD, Woodward M, Lynn MJ, Cherwek DH, Srivastava SK. The resident surgeon phacoemulsification learning curve. *Arch Ophthalmol* 2007;125(9):1215-9.
4. Moorthy K, Munz Y, Sarker SK, Darzi A. Objective assessment of technical skills in surgery. *BMJ* 2003;327(7422):1032-7.
5. Swing SR. The ACGME outcome project: retrospective and prospective. *Med Teach* 2007;29(7):648-54.
6. Taylor JB, Binenbaum G, Tapino P, Volpe NJ. Microsurgical lab testing is a reliable method for assessing ophthalmology residents' surgical skills. *Br J Ophthalmol* 2007;91(12):1691-4.
7. Gauba V, Tsangaris P, Tossounis C, Mitra A, McLean C, Saleh GM. Human Reliability Analysis of Cataract Surgery. *Arch Ophthalmol* 2008;126(2):173-7.
8. Ezra DG, Aggarwal R, Michaelides M, Okhravi N, Verma S, Benjamin L, et al. Skills acquisition and assessment after a microsurgical skills course for ophthalmology residents. *Ophthalmology* 2009;116(2):257-62.
9. Privett B, Greenlee E, Rogers G, Oetting TA. Construct validity of a surgical simulator as a valid model for capsulorhexis training. *J Cataract Refract Surg* 2010;36(11):1835-8.
10. Rogers GM, Oetting TA, Lee AG, Grignon C, Greenlee E, Johnson AT, et al. Impact of a structured surgical curriculum on ophthalmic resident cataract surgery complication rates. *J Cataract Refract Surg* 2009;35(11):1956-60.
11. Educational curriculum for ophthalmic residency. Tehran: Iranian Council for Gergraduate Medical Education. Iranian Ministry of Health and Medical Education; 2011;1-46.
12. Corey RP, Olson RJ. Surgical outcomes of cataract extractions performed by residents using phacoemulsification. *J Cataract Refract Surg* 1998;24(1):66-72.

13. Noecker RJ, Allinson RW, Snyder RW. Resident phacoemulsification experience using the in situ nuclear fracture technique. *Ophthalmic Surg* 1994;25(4):216-21.
14. Karp KO, Albanis CV, Pearlman JB, Goins KM. Outcomes of temporal clear cornea versus superior scleral tunnel phacoemulsification incisions in a university training program. *Ophthalmic Surg Lasers* 2001;32(3):228-32.
15. Blomquist PH, Rugwani RM. Visual outcomes after vitreous loss during cataract surgery performed by residents. *J Cataract Refract Surg* 2002;28(5):847-52.
16. Quillen DA, Phipps SJ. Visual outcomes and incidence of vitreous loss for residents performing phacoemulsification without prior planned extracapsular cataract extraction experience. *Am J Ophthalmol* 2003;135(5):732-3.
17. Randleman JB, Srivastava SK, Aaron MM. Phacoemulsification with topical anesthesia performed by resident surgeons. *J Cataract Refract Surg* 2004;30(1):149-54.
18. Unal M, Yücel I, Sarici A, Artunay O, Devranoğlu K, Akar Y, et al. Phacoemulsification with topical anesthesia: Resident experience. *J Cataract Refract Surg* 2006;32(8):1361-5.
19. Bhagat N, Nissirios N, Potdevin L, Chung J, Lama P, Zarbin MA, et al. Complications in resident-performed phacoemulsification cataract surgery at New Jersey Medical School. *Br J Ophthalmol* 2007;91(10):1315-7.
20. Rutar T, Porco TC, Naseri A. Risk factors for intraoperative complications in resident-performed phacoemulsification surgery. *Ophthalmology* 2009;116(3):431-6.
21. Pouyeh B, Galor A, Junk AK, Pelletier J, Wellik SR, Gregori NZ, et al. Surgical and refractive outcomes of cataract surgery with toric intraocular lens implantation at a resident-teaching institution. *J Cataract Refract Surg* 2011;37(9):1623-8.
22. Briszi A, Prahs P, Hillenkamp J, Helbig H, Herrmann W. Complication rate and risk factors for intraoperative complications in resident-performed phacoemulsification surgery. *Graefes Arch Clin Exp Ophthalmol* 2012;250(9):1315-20.
23. Zare M, Javadi MA, Einollahi B, Baradaran-Rafii AR, Feizi S, Kiavash V. Risk factors for posterior capsule rupture and vitreous loss during phacoemulsification. *J Ophthalmic Vis Res* 2009;4(4):208-12.
24. Hashemi H, Mohammadpour M, Jabbarvand M, Nezamdoost Z, Ghadimi H. Incidence of and risk factors for vitreous loss in resident-performed phacoemulsification surgery. *J Cataract Refract Surg* 2013;39(9):1377-82.
25. Ang GS, Whyte IF. Effect and outcomes of posterior capsule rupture in a district general hospital setting. *J Cataract Refract Surg* 2006;32(4):623-7.
26. Gimbel HV, Sun R, Ferensowicz M, Anderson Penno E, Kamal A. Intraoperative management of posterior capsule tears in phacoemulsification and intraocular lens implantation. *Ophthalmology* 2001;108(12):2186-9; discussion 2190-2.
27. Khanna RC, Kaza S, Palamaner Subash Shantha G, Sangwan VS. Comparative outcomes of manual small incision cataract surgery and phacoemulsification performed by ophthalmology trainees in a tertiary eye care hospital in India: a retrospective cohort design. *BMJ Open* 2012;2(5).
28. Tarbet KJ, Mamalis N, Theurer J, Jones BD, Olson RJ. Complications and results of phacoemulsification performed by residents. *J Cataract Refract Surg* 1995;21(6):661-5.
29. Mostafaei A, Hajebrahimi S. Perceived satisfaction of ophthalmology residents with the current Iranian ophthalmology curriculum. *Clin Ophthalmol* 2011;5:1207-10.
30. Ghajarzadeh M, Adili-Aghdam F. [Learning styles of medical residents of different disciplines in Tehran University of Medical Sciences]. *Razi Journal of Medical Sciences* 2012;19(94):27-32.
31. Bitran M, Zúñiga D, Pedrals N, Padilla O, Mena B. Medical students' change in learning styles during the course of the undergraduate program: from 'thinking and watching' to 'thinking and doing'. *Canadian Medical Education Journal* 2012;3(2):e86-97.
32. Amini M, Sagheb MM, Moghadami M, Shayegh M. [The rate of knowledge and practice of medical residents of Shiraz Medical School in regard to evidence-based medicine]. *Strides in Development of Medical Education* 2007;4(1):30-5.
33. Falzer PR, Garman DM. Evidence-based decision-making as a practice-based learning skill: a pilot study. *Acad Psychiatry* 2012;36(2):104-9.
34. Yank V, Laurent D, Plant K, Lorig K. Web-based self-management support training for health professionals: a pilot study. *Patient Educ Couns* 2013;90(1):29-37.
35. Lee AG, Carter KD. Managing the new mandate in resident education: a blueprint for translating a national mandate into local compliance. *Ophthalmology* 2004;111(10):1807-12.
36. Lee AG, Greenlee E, Oetting TA, Beaver HA, Johnson AT, Boldt HC, et al. The Iowa ophthalmology wet laboratory curriculum for teaching and assessing cataract surgical competency. *Ophthalmology* 2007;114(7):e21-6.
37. Katibeh M, Eskandari A, Ziaei H, Javadi MA. [The EYESI simulator for training ophthalmology residents]. *Bina J Ophthalmol* 2011;17(2):155-61.
38. Mamalis N. Teaching surgical skills to residents. *J Cataract Refract Surg* 2009;35(11):1847-8.