

# Impacts of Surgeons' Experience on Patients with Epiretinal Membrane: A Retrospective Study from 2015 to 2020 in Wenzhou Eye Hospital

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**Background:** To explore the impacts of surgeons' experience in patients with epiretinal membrane (ERM).

**Methods:** Patients with idiopathic ERM (334 eyes) who underwent PPV and membrane peeling were included in this study. The surgeries were performed by 9 surgeons. Patients were categorized into the experienced group (surgeons who had performed more than 5000 cases of PPV) and the regular group (surgeons who had performed less than 1000 cases of PPV). The patients were also categorized into five groups according to different preoperative best corrected visual acuity (BCVA): 20/100 or worse, 20/70-20/50, 20/40-20/30, 20/25 and 20/20. Impacts of preoperative BCVA, surgeons' experience, lens status, and internal limiting membrane (ILM) peeling on postoperative BCVA were analyzed.

**Results:** The postoperative BCVA was significantly better at 1 week and 1 month in the experienced group compared to the regular group ( $p = 0.022$  and  $0.045$ , respectively). There were no significant differences in postoperative BCVA at 3 months and 6 months between the two groups ( $p = 0.268$  and  $0.233$ , respectively). Postoperative BCVA at 6 months was similar in the 20/25 group and 20/20 group ( $p = 0.063$ ); both groups had better BCVA compared to the other three groups. The 20/100 or worse group had the greatest visual improvement among the 5 groups at 6 months.

**Conclusion:** This study suggested that although the experience of surgeons had no significant impact on the final BCVA following PPV and ERM removal, the BCVA during the early postoperative phase appeared to be better in the experienced group.

**Keywords:** surgeons' experience, epiretinal membrane, pars plana vitrectomy, best corrected visual acuity

## Background

Idiopathic epiretinal membrane (ERM) is a common disorder that is characterized by the cellular proliferation on the inner retinal surface.<sup>1</sup> The incidence of idiopathic ERM has been reported to range from 7% to 12% in the world.<sup>2-5</sup> Idiopathic ERM can lead to metamorphopsia, and aniseikonia, resulting in vision loss. Therefore, surgery is usually necessary to preserve the reduction of acuity in these patients.<sup>6</sup>

Pars plana vitrectomy (PPV) and ERM peeling have been considered the standard surgical treatments for ERM. A high rate of visual improvement and a low rate of complications were observed in patients who underwent ERM surgery previously.<sup>7-11</sup> The ERM Preferred Practice Pattern (PPP) guidelines suggest that the decision to intervene surgically in patients with ERM usually depends on the severity of patients' symptoms and the impacts on their daily activities.<sup>12</sup> The timing of surgical intervention indicated by best corrected visual acuity (BCVA) is not consistent. Most studies indicated that ERM patients with BCVA worse than 20/50 were good candidates for PPV and membrane removal.<sup>8,13-15</sup> Some studies suggested that the ERM surgery preserved and even improved the BCVA in patients with BCVA better than 20/50.<sup>9,11</sup> Meanwhile, it has been shown that the patients with lower preoperative BCVA had greater improvements in BCVA following ERM surgery, and those with better preoperative BCVA achieved better final BCVA.<sup>16,17</sup>

The impact of surgeons' experience on surgical outcome in patients with ERM has not been reported. The objectives of this study were to explore to investigate the impacts of surgeons' experience on the postoperative BCVA following PPV and ERM removal.

## Methods

This retrospective study was approved by the Ethics Committee of Eye Hospital of Wenzhou Medical University and was conducted in accordance with the tenets of the Declaration of Helsinki. Data were collected from patients who had idiopathic ERM and underwent PPV and membrane peeling at the Eye Hospital of Wenzhou Medical University from January 1, 2015, to January 1, 2020. A total of 334 patients (334 eyes) were included in this study. All patients underwent 23- or 25-gauge three-port PPV and membrane peeling. A posterior vitreous detachment was created using a vitreous cutter if the posterior vitreous detachment was not present. ERM was peeled with a pair of end-gripping intraocular forceps. Internal limiting membrane (ILM) was removed after indocyanine green (ICG) dyeing if the surgeon believed that ILM peeling could prevent re-ERM. Two hundred and eighty-seven patients had combined cataract procedure concurrently. All patients had a follow-up duration of at least 6 months.

Patients were excluded from the study if they had any of the following conditions: ERM caused by retinal vascular disease, inflammatory retinal disease, uveitis, history of previous intraocular surgery other than cataract surgery, and ocular disorders that would affect BCVA (eg, macular holes, age-related maculopathy, retinal vein occlusion, diabetic retinopathy, advanced glaucoma, and central corneal opacity).

Data were retrieved from the inpatient and outpatient clinical records, including demographic information, history of additional ocular disorders, duration of visual symptoms, preoperative BCVA, lens status, details of the ERM surgery, postoperative BCVA at 1 week, 1 month, 3 months, and 6 months, and postoperative complications. The BCVA was measured using a logarithmic visual acuity chart. To investigate the impacts of surgeons' experience on the postoperative visual acuity, we divided the patients into two groups, the experienced group (surgeons who had performed more than 5000 cases of vitrectomy; the surgeries in this group were done by 5 surgeons) and the regular group (surgeons who had performed less than 1000 cases of vitrectomy; the surgeries in this group were done by 4 surgeons). There were 211 eyes in the experienced group and 123 eyes in the regular group, respectively.

Statistical analyses were performed using SPSS, version 22.0 for Windows (IBM Corp., Armonk, N.Y., USA). For statistical analysis, the logarithm of the minimum angle of resolution (logMAR) visual acuity was used. Data are presented as mean  $\pm$  SD. All data were tested for normality, and appropriate statistical tests were used for analysis. Changes in BCVA between any two time points were analyzed using a paired *t*-test. BCVA variations and distributions of BCVA values among groups were compared by a Fisher's exact test or a chi-square test. A *p*-value of less than 0.05 was considered statistically significant.

## Results

The baseline characteristics of the experienced and regular groups are summarized in Table 1. There were no significant differences in age, gender, duration of symptoms, ILM peeling, and phacovitrectomy between the two groups. The

**Table 1** Baseline Characteristics in the Experienced and Regular Groups

	Experienced Group	Regular Group	P value
Number of eyes	211	123	
Age (years)	66.3 $\pm$ 7.7	65.5 $\pm$ 7.9	0.568
Duration of symptoms (months)	21.4 $\pm$ 24.4	17.6 $\pm$ 19.9	0.100
Female/male	150/61	85/38	0.702
Phakic, n (%)	191 (90.5)	117 (95.1)	0.130
Phacovitrectomy, n (%)	179 (84.8)	108 (87.8)	0.451
ILM peeling, n (%)	167 (79.1)	92 (74.8)	0.358
BCVA (logMAR)	0.48 $\pm$ 0.34	0.50 $\pm$ 0.33	0.887

**Abbreviations:** ILM, internal limiting membrane; BCVA, best corrected visual acuity.

**Table 2** Distribution of Preoperative BCVA in the Experienced and Regular Groups

	Experienced Group (n = 211)	Regular Group (n = 123)	P value
20/100 or worse, n (%)	67 (31.8)	41 (33.3)	0.766
20/70-20/50, n (%)	64 (30.3)	35 (28.5)	0.717
20/40-20/30, n (%)	41 (19.4)	26 (21.1)	0.707
20/25, n (%)	21 (10.0)	14 (11.4)	0.681
20/20, n (%)	18 (8.5)	7 (5.7)	0.341

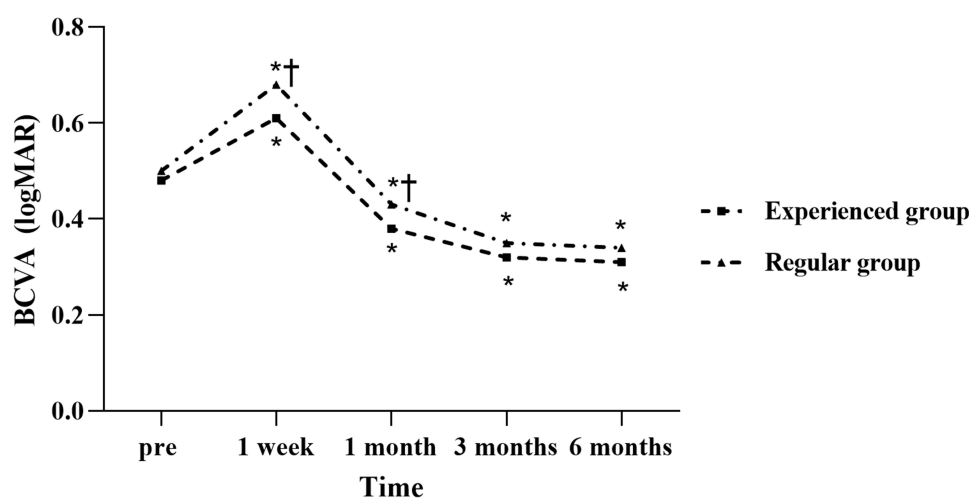
**Abbreviation:** BCVA, best corrected visual acuity.

distribution of preoperative BCVA in the experienced group and regular group is shown in Table 2; there were no significant differences between the two groups. There were no significant differences between the experienced group and the regular group in preoperative BCVA ( $p = 0.887$ ). Both groups had significantly worse BCVA ( $p < 0.05$ ) at 1 week and significantly better BCVA ( $p < 0.05$ ) at 1, 3 and 6 months compared to their corresponding baselines. The experienced group had a significantly better BCVA compared to the regular group at 1 week and 1 month postoperatively ( $p = 0.022$  and  $0.045$ , respectively). However, there were no significant differences in BCVA at 3 months and 6 months between the two groups ( $p = 0.268$  and  $0.233$ , respectively) (Figure 1).

The time courses of postoperative BCVA were compared in 5 groups of different levels of preoperative BCVA (Figure 2). At 6 months postoperatively, the BCVA was similar in the 20/25 group and 20/20 group ( $p = 0.063$ ), better than that in the other three groups. The 20/100 or worse group had the greatest visual improvement among the 5 groups at 6 months. There was no BCVA improvement in the 20/20 group (Figure 3).

Subgroup analysis was performed on patients with pseudophakia and ILM peeling. Visual improvement at 6 months was more significant in the phakic eyes with phacovitrectomy ( $0.18 \pm 0.22$  logMAR,  $n = 287$ ) compared to the pseudophakic eyes with vitrectomy ( $0.10 \pm 0.11$  logMAR,  $n = 26$ ,  $p = 0.024$ ). Eyes with ICG staining and ILM peeling ( $n = 259$ ) showed similar final BCVA to the eyes without ICG staining and ILM peeling ( $p = 0.368$ ). Eyes with ILM peeling showed similar BCVA to the eyes without ILM peeling preoperatively ( $p = 0.727$ ) and 1 week ( $p = 0.181$ ), 1 month ( $p = 0.498$ ), 3 months ( $p = 0.723$ ), and 6 months ( $p = 0.368$ ) postoperatively.

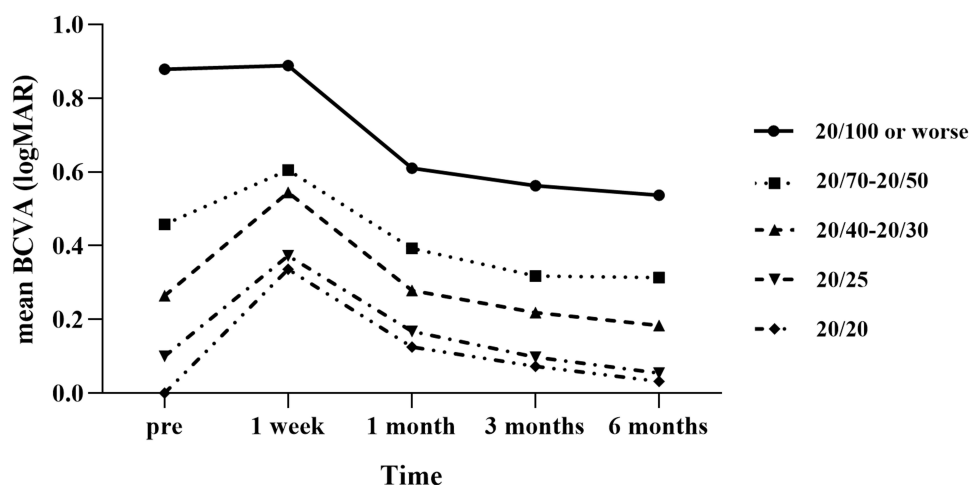
During follow-up, no endophthalmitis, retinal detachment, glaucoma or recurrent ERM was observed in any of the patients. Eleven patients (3.3%) had transient elevation of intraocular pressure (IOP) postoperatively; they all recovered after administering topical medications. Six patients (1.8%) developed cystoid macular edema postoperatively; they were



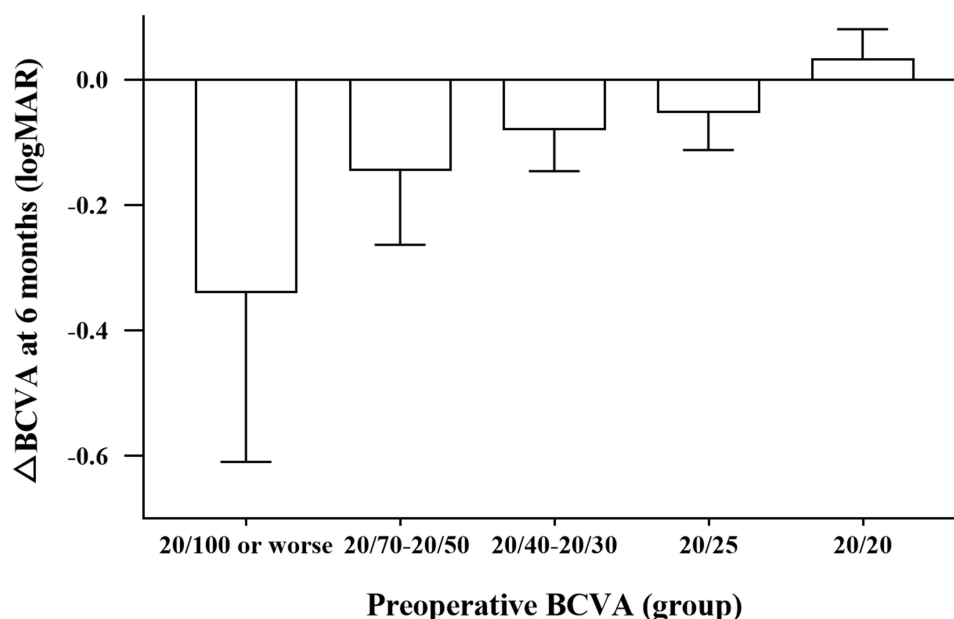
**Figure 1** Preoperative and postoperative BCVA at 1 week, 1 month, 3 months and 6 months in the experienced and regular groups.

Notes: \*Indicates a significant difference ( $p < 0.05$ ) compared to the preoperative baseline; †Indicates a significant difference ( $p < 0.05$ ) compared to the experience group.

**Abbreviation:** BCVA, best corrected visual acuity.



**Figure 2** Preoperative and postoperative BCVA at 1 week, 1 month, 3 months and 6 months in the 20/100 or worse, 20/70-20/50, 20/40-20/30, 20/25 and 20/20 groups.



**Figure 3** Change of BCVA in the 20/100 or worse, 20/70-20/50, 20/40-20/30, 20/25 and 20/20 groups at 6 months postoperatively.

treated with intravitreal or periocular injection of steroids during the observation period of the study. The steroid treatment reduced macular cystoid edema and improved visual acuity without IOP elevation.

## Discussion

For the eyes that underwent ERM removal, there were no significant differences in the distribution of preoperative BCVA between the experienced group and the regular group, suggesting that the surgical indication for ERM surgery was consistent in the two groups in our hospital. The postoperative BCVA at 1 week and 1 month were better in the experienced group compared to the regular group. It revealed that patients in the experience group could gain better early postoperative vision. However, the *p* value between the two groups at 1 month was close to 0.05, and the significance may be a coincidence. The postoperative BCVA was similar in the two groups at 3 months and 6 months, suggesting that the experience of surgeons had no impact on final BCVA postoperatively. This was the first time to study the impacts of surgeons' experience on the postoperative BCVA following ERM surgery. The dividing method was relatively subjective and not reported previously.

However, the average PPV cases for experienced group surgeons and regular group surgeons were 7490 (range 5643–8916) and 795 (range 591–911), respectively. The average cases in experienced group were approximately 10 times than regular group; therefore, it could be considered that there was a difference between the two groups. In our study, we found that BCVA recovery time was shorter in the experienced group compared to regular group.

The optimal timing of PPV and ERM peeling procedure is still debatable. Visual benefit and potential complications of the ERM surgery affect surgeons' decisions on the timing of the surgery. Most surgeons perform PPV and ERM removal in the patients with a preoperative BCVA worse than 20/40 although the rate of complications after ERM removal is extremely low. PPV and ERM removal have been performed in patients with BCVA better than 20/40, even up to 20/20.<sup>9–11,17</sup> Nakashizuka et al included ERM patients with preoperative BCVA of 0.046 logMAR or better.<sup>9</sup> The BCVA was significantly improved from  $-0.09 \pm 0.08$  logMAR to  $-0.13 \pm 0.07$  logMAR 12 months postoperatively, and no complications were observed in these patients. Moisseiev et al retrospectively analyzed 44 eyes underwent PPV and ERM peeling; all the eyes had a preoperative VA better than 20/40.<sup>10</sup> The average VA was improved from 20/36 to 20/27 at the final follow-up (more than 6 months). Reilly et al<sup>11</sup> demonstrated a statistically significant improvement in VA in 140 eyes at 1-year visit (20/35) compared to the preoperative VA (20/40). The results were similar to our study, and all preoperative BCVA groups except the 20/20 group achieved visual improvements at 6-month follow-up. Patients with better preoperative BCVA had a smaller improvement in vision, while those with poorer preoperative BCVA showed a greater improvement following ERM surgery.<sup>16,17</sup> Consistent with previous studies, our study revealed that 20/100 or worse group had the greatest visual improvement.

It is widely recognized that cataract progresses after PPV although small-gauge instruments are applied.<sup>18</sup> It is debatable whether routine phacovitrectomy for all patients with ERM peeling or phacovitrectomy should only be performed in patients with coexisting vision affecting cataract. Leisser et al suggested that combined phacoemulsification with PPV and membrane peeling had a higher odds ratio for developing new intraretinal cystoid changes postoperatively.<sup>19</sup> In our study, macular cystoid edema occurred in 6 eyes postoperatively, accounting for only 2% of all phacovitrectomy eyes; they all recovered after intravitreal or periocular injection of steroids. Hamoudi et al reported that there were no significant differences in postoperative BCVA and anatomical outcomes in ERM patients with phakic eyes who underwent phacovitrectomy compared to those who underwent sequential cataract surgery.<sup>20</sup> However, it has been shown that the ERM patients who underwent combined surgery with cataract extraction had faster visual recovery and more significant BCVA improvement 6 months postoperatively.<sup>10</sup> Most patients in our study underwent PPV and ERM peeling combined with cataract surgery. The phakic eyes that underwent phacovitrectomy had significantly greater visual improvement compared to the pseudophakic eyes with vitrectomy.

It is still controversial whether removing ILM is necessary in ERM patients. A meta-analysis indicated that ILM peeling achieved better postoperative visual outcomes compared to the non-peeling procedures, especially in a long period of time.<sup>21</sup> ILM removal during ERM surgery has been shown to reduce the rate of ERM recurrence.<sup>22</sup> However, some studies showed similar postoperative visual improvement with or without ILM removal.<sup>23,24</sup> ILM peeling may increase the risk of damage to the structure of retina and cause swelling of the arcuate nerve fiber layers or even macular hole formation.<sup>8,25</sup> In our study, ICG staining was used to assist ILM peeling. However, ICG staining has a risk for toxic effects possibly affecting results. In our study, the eyes with ICG staining and ILM peeling showed similar final BCVA to the eyes without ICG staining and ILM peeling. In addition, there were no significant differences in BCVA at 1 week, 1, 3, and 6 months postoperatively between eyes with ILM peeling and without ILM peeling. It is suggested that ILM peeling has no impact on BCVA recovery time.

There are some limitations in the study. Firstly, this is a retrospective study. Mixing phakic and pseudophakic patients and patients who underwent phacovitrectomy may have effects on postsurgical BCVA with possible bias. Secondly, we used BCVA as a unique measurement in ERM surgery; other visual functions, for example, aniseikonia and metamorphopsia, were not evaluated.

## Conclusions

In conclusion, this study suggested that although the experience of surgeons had no significant impact on the final BCVA following PPV and ERM removal, the BCVA during the early postoperative phase appeared to be better in the experienced group.

## Abbreviations

PPV, Pars plana vitrectomy; ERM, Epiretinal membrane; BCVA, Best corrected visual acuity; ILM, Internal limiting membrane; ICG, indocyanine green; PPP, Preferred Practice Pattern; logMAR, Logarithm of the minimum angle of resolution; IOL, Intraocular lens; IOP, Intraocular pressure.

## Data Sharing Statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

## Ethics Approval and Consent to Participate

This retrospective study was approved by the Ethics Committee of Eye Hospital of Wenzhou Medical University and was conducted in accordance with the tenets of the Declaration of Helsinki. Written informed consent was obtained from all participants for their clinical records to be used in this study.

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## Disclosure

None of the authors have any financial or conflicting interests to disclose.

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