

Original Article

Comparison of intra- and postoperative complications of phaco between sequential and combined procedures of 23-gauge vitrectomy and phaco



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Abstract

Purpose: To evaluate the intra- and postoperative complications of phacoemulsification in sequential and combined procedures of 23-gauge vitrectomy and cataract surgery.

Methods: The medical records of 376 patients who underwent phacoemulsification in a vitrectomized eye (sequential group) and 458 patients who underwent combined vitrectomy and phacoemulsification (combined group) were retrospectively reviewed. Main outcome measures were intra- and postoperative complications of phacoemulsification surgery. Surgical indications were a progressed cataract with various retinal conditions.

Results: The most common intraoperative complication during phacoemulsification was posterior capsule rupture in both groups. The rate of this complication was higher in the sequential group (18 eyes, 4.8%) than in the combined group (7 eyes, 1.5%) ($p = 0.006$). The most common early postoperative complication was transient high intraocular pressure (68 eyes, 14.8%) and late postoperative complication was pupillary in the synechia combined group (82 eyes, 17.9%). The most common early postoperative complication was transient high intraocular pressure (29 eyes, 7.7%) and late postoperative complication was posterior capsule opacification (27 eyes, 7.2%) in the sequential group. Fibrinous exudation occurred more in the combined group (57 eyes, 12.4%) than in the sequential group (19 eyes, 5.1%) ($p = 0.000$).

Conclusion: Both sequential and combined cataract surgeries seemed to be safe. Combined surgery could be preferred in harder cataracts and zonular dehiscence.

Keywords: Phacoemulsification, Vitrectomy, Combined, Sequential, Complication

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<http://dx.doi.org/10.1016/j.sjopt.2017.04.005>

Introduction

Cataract and vitreoretinal diseases often occur simultaneously or cataract is a predictable consequence of vitreoretinal surgery.¹ The surgical management of patients with cataract and vitreoretinal disease usually represents a challenging problem for vitreoretinal surgeon.

Phacoemulsification in vitrectomized eyes can be difficult because of the lack of vitreous support and unstable anterior

chamber depth.^{1–3} Combined surgery presents challenges such as longer surgical time and increased postoperative inflammation.^{4,5} Both of these procedures have advantages and disadvantages, and there is still a debate, either these procedures are done separately or together.

The aim of the present study was to focus on intra- and postoperative complications of phacoemulsification in sequential and combined procedures of 23-gauge pars plana vitrectomy (PPV) and cataract surgery. The visual acuity was

Received 14 June 2016; received in revised form 21 March 2017; accepted 9 April 2017; available online 20 April 2017.

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Peer review under responsibility of Saudi Ophthalmological Society, King Saud University



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not one of the primary outcomes because of the different prognoses of underlying vitreoretinal pathology.

Materials and methods

This retrospective study included 458 eyes of 458 patients who underwent combined 23-gauge PPV and cataract surgery (the combined surgery group) and 376 eyes of 376 patients who underwent cataract surgery in a previously 23-gauge vitrectomized eye (the sequential surgery group) between January 2009 and June 2013. Informed consents were obtained from all patients before surgery. Institutional Ethics Committee of Research and Training Hospital approval has been obtained.

The surgical indications were a progressed, visual acuity reducing cataract in combination with different retinal conditions. In case cataracts interfered with the adequate visualization of the retina or were dense enough to require extraction within the next one year, combined procedure was preferred. Exclusion criteria were previous PPV, penetrating ocular trauma and a follow-up time shorter than 6 months.

All patients had a complete preoperative examination including slit-lamp biomicroscopy, intraocular pressure (IOP) measurement and fundus examination. The intraocular lens power was calculated using the IOL-master (Carl Zeiss Meditec, Germany).

Surgical technique

Combined procedures were performed with retrobulbar anesthesia and cataract surgeries with parabolbar anesthesia. All operations were performed by the same surgeon (S.A.H), using the cataract surgical system (Infiniti Vision System, Alcon Inc. Forth Worth, TX, USA) and DORC Associate 2.500 vitrectomy system (DORC, Zuidland, the Netherlands).

In the sequential group cataract surgery was initiated with two limbal paracenteses created in the superonasal and superotemporal quadrants. After the anterior chamber was filled with viscoelastic material (sodium hyaluronate), the superior corneal incision at the superior quadrant was completed with a disposable, angled, 2.8 mm or 3.0 mm ophthalmic slit knife. An anterior continuous curvilinear capsulorhexis (CCC) was performed with a diameter 5.0 to 5.5 mm. After hydrodissection, phacoemulsification was done using the stop-and-chop technique in almost all cases. A bimanual technique for irrigation/aspiration (IA) was performed for cortex removal. The anterior chamber (AC) was then reformed with viscoelastic material and a hydrophobic acrylic foldable intraocular lens (IOL) was implanted in the

capsular bag by an injector. Even in cases with posterior capsular defect, the surgeon could be able to implant a foldable IOL into the capsular bag. Residual AC viscoelastic material was aspirated using bimanual I/A. To ensure AC integrity stromal hydration was performed at the 2 paracentesis sites and 0.1 cc cefuroxime was injected into the AC.

In the combined surgery group, phacoemulsification was performed prior to PPV. In this group, before phacoemulsification, oblique beveled microcannulas were placed 3.5 mm behind the limbus. At the end of the cataract surgery, the corneal wound was closed with a single 10–0 nylon suture to prevent wound leakage and provide anterior chamber depth during PPV. Pars plana vitrectomy was performed using a 23-gauge high-speed vitreous cutter using the wide-field fundus visualization system. Various additional procedures were performed included hyaloid membrane peeling, epiretinal membrane peeling, photocoagulation, fluid-gas exchange and gas or silicone oil injection. For the stabilization of the AC, the viscoelastic material filled during IOL implantation was removed at the end of the vitrectomy. Suturing with 7–0 vicryl suture was seldom needed but may be used if leakage was detected.

Postoperatively, moxifloxacin and prednisolone acetate eye-drops were used 6 times a day for 1 week with eventual tapering during the next 3 weeks. Mydriatics were only used when moderate or severe anterior chamber inflammation had occurred. The suture was removed after 2 weeks postoperatively. Postoperative examinations were conducted at first day, first week, and 1, 3, 6 months, with a final visit at various times.

Statistical analysis was performed using the chi-square test to compare the indications and complication rates. *P* value < 0.05 was considered to be statistically significant.

Results

There were 286 women, 172 men (mean age: 62.3 ± 10.98 years) in the combined group and 194 women, 182 men (mean age: 59.8 ± 12.35 years) in the sequential group. In the sequential group, the median interval between PPV and subsequent phacoemulsification was 1–12 months (mean: 3.5 months). The mean postoperative follow-up time was mean 16 (6–42) months in the combined group and mean 15 months (6–42) in the sequential group. There wasn't any significant difference in the follow-up time between the groups (*p* = 0.001).

Table 1 shows the characteristics of the patients and the PPV indications in both groups. Proliferative diabetic

Table 1. Characteristics of the patients and pars plana vitrectomy indications in both groups.

	Combined surgery	Sequential surgery	<i>p</i>
<i>Characteristics of the patients</i>			
Number of patients	458	376	NS
Mean age, years	62.3 ± 11	59.8 ± 12	NS
Male:Female, <i>n</i>	172: 286	182: 194	NS
Diabetes mellitus, <i>n</i>	271	241	NS
Systemic Hypertension, <i>n</i>	255	203	NS
<i>Indications of vitreoretinal surgery</i>			
Proliferative diabetic retinopathy (Vitreous hemorrhage, taut posterior hyaloid)	215 (46.9)	139 (37)	0.00
Epiretinal membrane	78 (17)	38 (10.1)	0.00
Retinal detachment	73 (15.9)	124 (33)	0.00
Macular hole	23 (5)	45 (12)	0.00
Vitreous hemorrhage due to other retinal vascular disease	69 (15.1)	30 (8)	0.00

P by Pearson chi-square test, NS: not significant.

retinopathy was the most common indication for the vitreo-retinal procedure in both groups.

Following vitrectomy, the most frequently used endotamponade was balanced salt solution (BSS) (sequential: 42%, combined: 39%) or C3F8 gas (perfluoro propane) (sequential: 35.9%, combined: 41.9%). Silicon oil (1300 centistokes) (sequential: 12%, combined: 15%) or air (sequential: 10%, combined: 3.9%) were less common in both groups.

Intraoperative complication rates in both groups are summarized in Table 2. The most common intraoperative complication during phacoemulsification was posterior capsule rupture with or without vitreous loss, with a higher rate in the sequential group (18 eyes, 4.8%) than in the combined group (7 eyes, 1.5%) ($p = 0.006$). Zonular dehiscence was found more frequent in the sequential group (13 eyes, 3.5%) than in the combined group (6 eyes, 1.3%) ($p = 0.039$). Both of these intraoperative complications were found to be statistically significant in the sequential group.

Postoperative complication rates in both groups are summarized in Table 3. In the sequential group, the most frequent early (1 month or less postsurgery) postoperative complication was high IOP (>24 mmHg) (29 eyes, 7.7%) and late (more than 1 month after surgery) postoperative complication was posterior capsule opacification (PCO) (27 eyes, 7.2%). In the combined group, the most common early complication was high IOP (68 eyes, 14.8%) and late postoperative complication was pupillary synechia (82 eyes, 17.9%). The postoperative IOP in the sequential group was moderately elevated (range, 24–30 mmHg) in 19 (5%) eyes and highly elevated (range, 30–45 mmHg) in 10 (2.7%) eyes. The postoperative IOP in the combined group was moderately elevated (range, 24–30 mmHg) in 46 (10%) eyes and highly elevated (range, 30–45 mmHg) in 22 (4.8%) eyes.

Most of the cases with elevated IOP returned to normal values following administration of antiglaucomatous drugs within one week after surgery. Ten eyes (2.2%) in the com-

bined group and 5 eyes (1.3%) in the sequential group entered with elevated intraocular pressure requiring antiglaucomatous therapy permanently.

One of the main early postoperative complications was fibrinous exudation, which occurred more in the combined group (57 eyes, 12.4%) than in the sequential group (19 eyes, 5.1%) ($p = 0.000$), and this complication was statistically significant. Fibrinous reaction subsided after administration of topical steroids or peribulbar steroids within 2 weeks after surgery.

Two cases (0.5%) in the sequential group and 12 cases (2.6%) in the combined group with retinal detachment underwent additional interventions.

Discussion

Several studies reported that postoperative complications of the combined and sequential surgery are more common than the cataract surgery alone.^{3–6} Phacoemulsification in vitrectomized eyes could be challenging due to the lack of vitreous support, unstable anterior chamber depth, floppy posterior capsule, weak zonules and a dense cataract.^{1–3} Combined surgery offers disadvantages such as prolonged surgery time and stress on the surgeon, increased postoperative inflammation and posterior synechia, and higher possibility of posterior capsule opacification.^{4,5}

In our study, the most common intraoperative complication during phacoemulsification was posterior capsule rupture with a higher rate in the sequential group than in the combined group, and the difference was statistically significant. Another statistically significant intraoperative complication was zonular dehiscence, which occurred more in the sequential group than in the combined group. These seemed to be caused by the lack of vitreous support and harder cataract in the sequential group. Other intraoperative complications were iris trauma, nucleus drop, and capsulorhexis

Table 2. Intraoperative complications in both groups.

Intraoperative complications	Combined surgery group (n = 458), n (%)	Sequential surgery group (n = 376), n (%)	p
Posterior capsule rupture	7 (1.5)	18 (4.8)	0.00
Iris trauma	3 (0.7)	8 (2.1)	0.06
Nucleus drop	0 (0)	2 (0.5)	0.20*
Zonular dehiscence	6 (1.3)	13 (3.5)	0.04
Capsulorhexis problems	2 (0.4)	5 (1.3)	0.16

P by Pearson chi-square test.

P* by Fisher's Exact Test.

Table 3. Postoperative complications in both groups.

Postoperative complications	Combined surgery group (n = 458), n (%)	Sequential surgery group (n = 376), n (%)	p
<i>Early (≤ 1 month postoperatively)</i>			
High intraocular pressure (>24 mmHg)	68 (14.8)	29 (7.7)	0.00
Fibrinous exudation	57 (12.4)	19 (5.1)	0.00
Endophthalmitis	2 (0.4)	2 (0.5)	0.83
<i>Late (> 1 month postoperatively)</i>			
Pupillary synechia	82 (17.9)	23 (6.1)	0.00
Posterior capsule opacification	69 (15.1)	27 (7.2)	0.00
IOL dislocation	14 (3.1)	2 (0.5)	0.00
Retinal detachment	12 (2.6)	2 (0.5)	0.02

P by Pearson chi-square test.

problems. All these complications were more common in the sequential group. We think that CCC problems were related to lack of the vitreous support and to the swollen cataract after PPV.

Lee et al. compared the complications of phacoemulsification between the combined and sequential surgeries and found that phacoemulsification in vitrectomized eyes was more challenging and had a higher rate of posterior capsule rupture than the one in combined with vitrectomy. They could not find any significant risk factor for posterior capsule rupture in the sequential surgery. In the same study, rates of lens dislocation, iris trauma, and zonular dehiscence during phacoemulsification did not differ among the combined, sequential, and cataract surgery alone groups. The authors reported that they prevented and managed these problems by keeping the bottle height low, using a low flow rate, and by dilation of the small pupil by second instruments or iris hooks.¹

In our study, the most common early postoperative complication was transient IOP elevation which developed statistically more in the combined group than in the sequential group, especially in eyes with fibrinous exudation and endotamponade. The postoperative IOP was moderately elevated in 5% eyes in the sequential group and in 10% eyes in the combined group, whereas it was highly elevated in 2.7% eyes in the sequential and in 4.8% eyes in the combined group. Chung et al. found increased postoperative IOP in 55.8% after combined surgery.⁷ In a study of 513 cases of combined surgery, Mueller et al. observed postoperative IOP elevation in 37.7% eyes with a range of 22–30 mmHg and in 15.4% eyes with a range of 31–40 mmHg.⁸

One of the main early postsurgical anterior chamber complications was fibrinous reaction, which subsided after administration of topical steroids within 2 weeks after surgery. Fibrinous exudation in the anterior chamber occurred statistically more frequent after combined surgery than in the sequential group, particularly in cases of proliferative diabetic retinopathy and especially with the use of endolaser. Supporting our results, several studies reported fibrinous exudation significantly more in the combined group.^{7,9} Mueller et al. reported a significant correlation between the use of endolaser and cryocoagulation and postoperative anterior chamber inflammatory response in a large series of 513 eyes with combined surgery.⁸

Posterior synechia was found statistically more frequent in the combined group than in the sequential group. The formation of posterior synechia was remarkably more frequent in eyes with postoperative fibrinous exudation. These findings are consistent with results of Treumer et al., who reported posterior synechia more frequent in eyes with increased anterior chamber inflammation after combined surgery.⁹ Shinoda et al. reported promoting factors for posterior synechia such as proliferative diabetic retinopathy, expanding gas tamponade, fibrin deposition and endolaser coagulation.¹⁰

Opacification of the posterior capsule has been mentioned previously as a frequent postoperative anterior segment complication in eyes with combined surgery.¹¹ Sood et al. reported that postoperative anterior uveitis was associated with an increased risk for PCO and a longer rehabilitation period.⁶ The rate of PCO in our study was also statistically higher in the combined group due to increased inflammation as we postulated. However, in contrast to our

study, Roh et al. reported a higher rate of PCO in their sequential group when compared to their combined group.¹²

We observed postoperative IOL dislocation more often after the combined than after the sequential surgery. All the eyes with the IOL dislocation in the combined group had endotamponade C3F8. In a study, IOL dislocation was reported in 12 of 134 eyes after combined procedure, and all 12 eyes had long acting gas tamponade (C3F8 17%).¹³

Some posterior segment complications have occurred, but we especially wanted to discuss about the cataract surgery complications. Posterior segment surgery complications were similar to those following a single operation for vitreoretinal diseases.

In this study we review our experience with a large series. In particular our sequential group consists of more patients than the sequential groups in similar studies.^{1,9} Also similar proportion of the number of the groups in our study could allow a better comparison result, as to our opinion. All operations in our study were performed by the same surgeon using the same technique, which can be an advantage in comparing the complications of the surgical procedures. However, we have study limitations such as the lack of the records of visual acuity and cataract grading and the retrospective design of the study. The aim of the present study was to focus on intra- and postoperative complications of the combined and sequential surgeries. The visual acuity was not one of the primary outcomes because of the different prognoses of underlying vitreoretinal pathology.

Conclusion

Both combined and sequential surgeries seemed to be safe. Intraoperative complications developed more in the sequential group and postoperative complications were more frequent in the combined group. Combined surgery could be preferred in harder cataracts and zonular dehiscence as it provides more stable anterior chamber conditions during the phacoemulsification. Further studies are needed to find out which of the procedures could be recommended one over the other.

Conflicts of interest

Authors declare that there is no conflict of interest.

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