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Comparison of the efficacy of vitrectomy combined with different filling procedures in the treatment of rhegmatogenous retinal detachment of macular detachment

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Abstract: Background and purpose: To compare the clinical efficacy of vitrectomy combined with silicone oil tamponade and perfluoropropane (C3F8) tamponade in the treatment of macular hole retinal detachment(MHRD).Methods: The clinical data of 55 patients with MHRD who were treated in our hospital from January 2022 to January 2023 were retrospectively analyzed,They were divided into silicone oil group (n=25) and C3F8 group (n=30) according to the surgical methos. The differences in macular hole closure, retinal detachment and replacement, vision recovery and postoperative complications between the two groups were compared.Result: Three months after surgery, there was no significant difference in the macular hole closure rate between the C3F8 group and the silicone oil group (P>0.05),There was no significant difference in retinal reattachment rate between C3F8 group and silicone oil group (P>0.05),the best corrected visual acuity after surgery was significantly improved in both the C3F8 group and the silicone oil group, and the C3F8 group was better than the silicone oil group (P<0.05),there was no significant difference in the incidence of complications between the C3F8 group and the silicone oil group (P>0.05). Conclusion: Vitrectomy combined with intraocular tamponade for MHRD can effectively reposition retina and close macular holesImprove the patient's best corrected visual acuity, and the vision recovery in the C3F8 group was better than that in the silicone oil group.

Keywords: Vitrectomy; Intraocular Tamponade; Macular Detachment Rhegmatogenous Retinal Detachment; Macular Hole Closure; Retinal Detachment Replacement

Introduction

The main cause of macular detachment type rhegmatogenous retinal detachment (MHRD) is high myopia,long axis is the main clinical structure in patients with high myopia, the lengthening of the ocular axis can lead to an increase in the anterior and posterior traction of the vitreous body, forming a macular hole, which in turn leads to MHRD[1].Vitrectomy combined with intraocular tamponade is a common treatment option for the clinical treatment of MHRD, and the surgical success rate can reach more than 80%,however, there is still some controversy over the choice of intraocular fillers[2]. Silicone oil is a "popular player" for intraocular fillers, it has the advantages of good durability, good transparency and high surface tension,can effectively inhibit the growth and contraction of fibrous membrane, maintain retinal reattachment,However, silicone oil has the risk of emulsification, and once emulsified, it will not only easily block the corners of the eyes, causing glaucoma, but also easily cause cannon keratopathy [3-4].Perfluoropropane (C3F8) is a long-lasting gas that has little toxicity to intraocular structures. It has the advantages of easy operation, long pressing time, and no need for secondary surgery to remove it, however, C3F8 gas will gradually be absorbed by the human body, and the remaining small bubbles have less pressing effect. As the degree of activity increases, there is a possibility of secondary retinal detachment [5].There has been controversy about the application of the two in MHRD. Based on this, this study compared the clinical efficacy of intravitreal silicone oil filling and C3F8 surgical methods by observing the closure of macular hole, retinal detachment and reattachment, vision recovery and postoperative complications, in order to provide clinical reference. It is reported as follows.

1. Objects and methods

1.1 Research object

The clinical data of MHRD patients treated in our hospital from January 2022 to January 2023 were retrospectively analyzed.

Inclusion and exclusion criteria

Inclusion criteria: (1) Meet the diagnostic criteria of MHRD [6]; (2) Age ≥18 years old; (3) No obvious vitreoretinal hyperplasia; (4) Eye axis>26mm ; (5) Diopter> > -6.0D.

Exclusion criteria: (1) Complicated with retinal breaks in other locations; (2) Complicated with other fundus diseases, such as retinal vein obstruction, diabetic retinopathy, etc; (3) Mental disorders and lack of self-care ability; (4) Incomplete postoperative follow-up treatment.A total of 55 patients were included and divided into silicone oil group (n=25) and C3F8 group (n=30) according to the surgical method. The general data of patients in the two groups were homogeneous and comparable (P>0.05), see Table 1. The study was approved by the Medical Ethics Society of the hospital.

Table 1 Comparison of general data between the two groups[n（%）, $\bar{x}$±s]

Groups	Number	Age(years)	Gender		Course of disease (d)	Eye axis（mm）
			Man	Woman		
Silicone oil group	25	40.25±9.34	12(48.00)	13(52.00)	9.07±3.12	24.55±0.45
C3F8 group	30	41.33±9.87	16(53.33)	14(46.67)	9.26±3.08	24.49±0.52
x^2/t		0.414	0.155		0.226	0.453
P		0.681	0.694		0.822	0.653

1.2 Treatment methods

All patients underwent routine 23G pars plana three-channel vitrectomy,which was performed by the same experienced ophthalmopathy surgeon.During the operation, the vitreous body was fully cut to relieve the traction force existing around the retinal tear. Autologous blood and gas-liquid exchange were used in the eye to completely reposition the retina after surgery,a retinal laser is used to seal the retinal tear area.Before the end of the operation, 15% C3F8 was filled into the vitreous cavity of the C3F8 group, and silicone oil was injected into the vitreous cavity of the silicone oil group. After surgery, the C3F8 group was used face-down position until gas absorption, and the silicone oil group was used face-down position until the retina was stabilized and the silicone oil was removed. Routine administration of tobramycin and dexamethasone eye drops, 4 times a day, and atropine ophthalmic gel, twice a day, for 3 weeks.

1.3Observation indicators

(1) Macular hole closure: Three months after surgery, retinal tomography was used to observe the closure of macular holes in the two groups (macular hole closure standard: closure of the neuroepithelial layers at both ends of the macular hole).

(2) Retinal detachment and reattachment: Three months after surgery, the retinal reattachment of the two groups was observed using a slit lamp.

(3) Postoperative visual acuity recovery: The best corrected visual acuity of the two groups was tested using the International Standard Visual Vision Chart[7].before and 3 months after surgery.

(4) Complications: The incidence of complications such as high intraocular pressure, macular edema, and lens opacity within 3 months after surgery in the two groups was analyzed.

1.4 Statistical analysis

All data were statistically analyzed by SPSS25.0 software. Measurement data conforming to normal distribution were expressed as mean ± standard deviation ($\bar{x}$±s), and t-test was used for inter-group comparisons; counting data were expressed as number of cases and rate (%), and inter-group comparisons were used for 2 test; P<0.05 was used for statistical significance.

2. Results

2.1 Comparison of macular hole closure, retinal detachment and reattachment between the two groups was conducted.

Three months after surgery,no significant differences were found in the macular hole closure rate and the retinal detachment reduction

rate between the two groups (P > 0.05).

Table 2 Comparison of macular hole closure and retinal detachment and reattachment between the two groups [n (%)]

Groups	Number	Macular hole		Retinal detachment	
		Closed	Unclosed	Reset	Unreset
Silicone oil group	25	20(80.00)	5(20.00)	18(72.00)	7(28.00)
C3F8 group	30	25(83.33)	5(16.67)	19(63.33)	11(36.67)
x^2		0.102		0.465	
P		0.750		0.155	

2.2 Comparison of postoperative visual acuity recovery between the two groups

Three months after surgery,the best corrected visual acuity of C3F8 group and silicone oil group was significantly improved, and C3F8 group was better than silicone oil group (P < 0.05).

Table 3 Comparison of postoperative visual acuity recovery between the two groups（$\bar{x}$±s）

Groups	Number	Best corrected vision	
		Before operation	Three months after surgery
Silicone oil group	25	1.52±0.43	1.22±0.32
C3F8 group	30	1.49±0.46	0.98±0.28
t		0.248	0.966
P		0.805	0.005

2.3 Comparison of complications between the two groups

Three months after surgery,there was no significant difference in postoperative complications between the two groups (P > 0.05).

Table 4 Comparison of complications between the two groups [n (%)]

Groups	Number	Intraocular hypertension	Macular edema	Crystal turbidity
Silicone oil group	25	3(12.00)	1(4.00)	1(4.00)
C3F8 group	30	4(13.33)	2(6.67)	3(10.00)
x^2		0.067	0.026	0.110
P		0.796	0.871	0.740

3. Discussion

MHRD is a type of retinal detachment involving the macula, which has a serious impact on vision. Once it is discovered that timely surgical treatment is needed to close the tear and reposition the retina, if not treated, irreversible vision loss can occur [8].Vitrectomy is the first choice for the clinical treatment of retinal detachment MHRD. It can improve the retinal reattachment rate by removing turbid refractive matrix by relaxing the vitreous body [9].However, due to the complex condition of MHRD, the efficacy of single vitrectomy is limited and it is difficult to achieve the best treatment effect. It is often combined with intraocular tamponade to better reposition the retina and close the macular hole.

C3F8 and silicone oil are both commonly used intraocular fillers. The results of this study show that the retinal reattachment rate in the C3F8 group is 63.33%, and that in the silicone oil group is 72.00%. The retinal reattachment rates of the two surgical methods are both high, but there is no significant difference.Research by Yan Zhongyang et al.[10]research showed the retinal reattachment rate in the C3F8 group was 60%, and the retinal reattachment rate in the silicone oil group was 88.24%. The reattachment rate in the silicone oil group was significantly higher than that in the C3F8 group. Different from this result,The speculated reason may be that C3F8 gas will gradually be absorbed by the

human body, and its residual bubbles have less pressing effect. As the patient's activity increases, the incidence of retinal detachment again increases, which in turn reduces the retinal reattachment rate in the C3F8 group.Both groups of patients without retinal reattachment experienced significant atrophy of retinal pigment epithelium cells and choroid. The speculated reason was that the patient's retinal pigment epithelium cells and choroid shrank significantly, resulting in significant weakening of the adhesion between the choroid layer and the retinal neuroepithelial layer, making retinal detachment prone to occur in surgical methods whether it is C3F8 filling or silicone oil filling [11].Due to the loss of adhesion of retinal pigment epithelial cells, atrophy of the retina and choroid in the macula area and long ocular axis caused by high myopia, the closure rate of macular holes in patients is not ideal [12].Previous studies have shown [13] that the macular hole closure rates in the C3F8 group and the silicone oil group are 75.84% and 72.39% respectively. This study shows that the macular hole closure rates in the C3F8 group and the silicone oil group are 83.33% and 80.00%, respectively, which is higher than previous studies.The speculated reason is that in addition to performing vitrectomy to relieve the pulling force, this study also used autologous blood to cover the operation, which can effectively improve the success rate of the operation. Autologous blood has the characteristics of rapid coagulation, and its rich growth factors can also promote tear healing[14]. However, there was no significant difference in the rate of macular hole closure between the two groups.

The results of this study also showed that the best corrected visual acuity after surgery was significantly improved in both the C3F8 group and the silicone oil group, and the C3F8 group was better than the silicone oil group. The speculated reason is that when silicone oil replaces the natural vitreous body, it will cause physical compression on the retina and cause damage or even apoptosis of ganglion cells. Its hydrophobic nature will cause retinal dehydration and cause siphonage disorder and apoptosis in Müller cells. Its toxic effect will cause damage to the retina and choroidal vasculature.In addition, the increase in intraocular pressure during silicone oil filling leads to increased mechanical pressure and choroid thinning. The change in the refractive state of the eye caused by silicone oil filling may also lead to choroid thinning. As the silicone oil filling time is prolonged, it will also cause the inhibition of retinal microvascular structure is aggravated, which results in lower best corrected visual acuity than in the C3F8 group [15].In addition, this study found that there was no significant difference in the complication rate 3 months after surgery between the two groups, indicating that both surgical methods are safe.

To sum up, vitrectomy combined with intraocular tamponade for the treatment of MHRD can effectively reposition the retina and close the macular hole, and improve the patient's best corrected vision.There was no significant difference between the C3F8 group and the silicone oil group in relocating the retina and closing the macular hole, but the best corrected visual acuity after surgery in the C3F8 group was better than that in the silicone oil group, and the C3F8 did not require a second operation to remove the silicone oil, which could effectively reduce the patient's financial pressure and surgical pain.However, this study still has shortcomings. This study is a small-sample retrospective trial, and the sample selection is inevitably biased, and the follow-up time is short. Long-term analysis can be conducted subsequently for further in-depth discussion.

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