SILICONE OIL VS. GAS FOR THE TREATMENT OF FULL-THICKNESS MACULAR HOLE

PERTILE G., CLAES C.**

SUMMARY

The purpose of this study is to evaluate the anatomic and visual outcomes, as well as the complications, of macular hole surgery with SF_6-gas tamponade versus silicone-oil tamponade.

Fifty-four (54) eyes with idiopathic macular hole underwent vitrectomy and peeling of the internal limiting membrane (ILM) around the hole. Nineteen (19) eyes were treated with SF_6-gas tamponade (group 1) and the other thirty-five (35) eyes with silicone-oil tamponade (group 2).

An excellent anatomic success rate was obtained in both groups (94.7% in group 1 and 97.1% in group 2).

Nevertheless, the postoperative visual acuity (VA) in the group treated with silicone-oil tamponade was significantly better than in the group treated with gas tamponade (P=0.0217). Forty-seven (47) of the eyes in group 1 and 74% in group 2 achieved a VA=0.4 or better. The most frequent potentially vision threatening complication we observed was RPE alterations in 35% of the eyes in group 1 and in only one eye in group 2. None of the eyes developed a retinal detachment during the follow-up period.

In conclusion, the treatment of idiopathic macular holes by vitrectomy and ILM peeling provides a very good anatomic success rate. An excellent recovery of visual acuity, up to 1.0, was more frequently observed in the group treated with silicone oil tamponade.

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* *Middelheim Hospital*
Lindendreef, 1 B-2020 Antwerpen

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SAMENVATTING

Het doel van de studie is het vergelijken van de resultaten van de chirurgische behandeling van idiopatische maculaire gaten met vitrectomie en gas tamponade versus vitrectomie en siliconen-olie tamponade.

Bij 54 ogen van 52 patienten met idiopatische maculaire gaten stadium 3 of 4 werd een vitrectomie verricht met peeling van de membrana limitans interna rondom het gat. Bij 19 ogen werd SF_6-gas tamponade in isovolemische concentratie gebruikt (groep 1). Bij de andere 35 ogen werd gekozen voor siliconen-olie tamponade (groep 2).

Het anatomisch succes percentage bedroeg 94.7% in groep 1 en 97.1% in groep 2. Ondanks een zeer goed anatomisch resultaat in beide groepen, was de best gecorrigeerde postoperatieve visus 0.4 of beter in 47% van de ogen in groep 1 en in 74% in groep 2. De meest frequente potentieel visus bedreigende complicatie die wij bemerkt hebben was pigment epitheel alteratie in 35% van de ogen in groep 1 en in één oog in groep 2. Geen van de ogen heeft een netvliesloslating ontwikkeld gedurende de follow-up periode. Tot besluit: met beide technieken werd een goed anatomisch resultaat bereikt, maar de groep behandeld met siliconen-olie tamponade had een beter functioneel resultaat.

RÉSUMÉ

Cette étude compare deux techniques de traitement chirurgical du trou maculaire idiopathique. Les deux techniques comportent une vitrectomie, la première étant suivie par une tamponnade au gaz et la deuxième par une tamponnade à l'huile de silicone.

Cinquante-quatre (54) yeux de 52 patients avec trou maculaire idiopathique de stade 3 ou 4 ont subi une vitrectomie avec pelage de la limitante interne autour du trou. Dix-neuf (19) yeux furent traités par tamponnade au gaz SF_6 en concentration isovolémique (groupe 1), les autres 35 yeux furent traités par tamponnade à l'huile de silicone. Le pourcen-

tage de succès anatomigue fut de 94.7% dans le groupe 1 contre 97.1% dans le groupe 2. Malgré un très bon résultat anatomique dans les deux groupes, la meilleure acuité visuelle corrigée postopératoire était de 0.4 ou plus dans 47% des yeux du groupe 1 contre 74% dans le groupe 2. La complication la plus fréquente pouvant altérer l'acuité visuelle était une altération de l'épithelium pigmentaire. Ceci est survenu dans 35% des yeux du groupe 1 contre 2.8% dans le groupe 2. Aucun oeil n'a developpé un décollement de rétine pendant la période du suivi. En conclusion, un bon resultat anatomique est obtenu avec les deux techniques mais le groupe traité par tamponnade à l'huile de Silicone a un meilleur pronostic visuel.

KEY WORDS

Macular hole, vitrectomy, complication, silicone oil.

MOTS CLES

Trou maculaire, vitrectomie, complication, huile de silicone.

INTRODUCTION

Idiopathic macular hole is an important cause of central vision loss in people aged 55 or older, especially females[8]. In the last ten years interest has focused on the surgical treatment of macular holes[12]. Several studies have confirmed that pars plana vitrectomy, posterior vitreous detachment and long-acting tamponade, with or without adjunctive substances[2,9,10,14,19,20], may achieve both anatomic closure and improved vision in many patients. When a gas tamponade is used, the patient should maintain a face-down position for at least 8 hours a day during the first postoperative week. the rigorous posturing requirements in the postoperative period may present difficulties, especially in elderly. For this reason few patients who were unable to keep the prone position for such a long period were treated in our clinic with silicone-oil tamponade instead of gas. As silicone-oil fills at least 90% of the eye, no positioning is required but the silicone-oil has to be removed after few weeks. As this group of patients obtained a good visual improvement, a study was started in order to compare the anatomic and visual outcomes of macular hole surgery with gas-tamponade versus silicone-oil tamponade.

PATIENTS AND METHODS

Fifty-four (54) eyes of 52 patients with idiopathic macular hole were included in this study. Only macular holes stage 3 or 4 were considered. The age ranged from 54 to 76 with a mean of 66 years. Seventy-nine (79)% of the patients were women. Thirty-one (31)% of the patients had bilateral macular hole. The pre- and post-operative examination included determination of the best-corrected Snellen visual acuity and slit-lamp biomicroscopy; the Watzke-Allen test was used. Goldmann visual field examination was performed in the eyes treated with silicone oil. All the eyes underwent pars plana vitrectomy with internal limiting membrane (ILM) peeling around the hole; posterior vitreous detachment was performed in stage 3 holes. The procedure was completed with SF_6-gas tamponade in 19 eyes (group 1) and with silicone-oil tamponade in the other 35 eyes (group 2). The mean preoperative visual acuity (VA) was not significantly different in the two groups (0.210 in group 1 and 0.215 in group 2). The mean follow-up was 13.7 (5-19) months in group 1 and 6.2 (3-13) months in group 2. Anatomic success was defined as when the edges of the macular hole were attached to the underlying retinal pigment epithelium with disappearance of the cuff of subretinal fluid surrounding the hole. Visual improvement was defined as an improvement of two or more Snellen-lines in the best corrected visual acuity. We considered functional success as anatomic closure of the hole and postoperative VA=0.4 or better.

RESULTS

The anatomic success rate was 94.7% (18/19) in the group treated with gas-tamponade and 97.1% (34/35) in the group treated with silicone-oil tamponade

Fig.1 and 2 show the preoperative and postoperative VA for each patient in the two groups. No patient in group 2 has a worse postoperative VA than the preoperative one. The mean

Fig.1 Pre-and post-operative VA in eyes treated with gas-tamponade

Fig.2 Pre- and post-operative VA in eyes treated with silicone-oil tamponade.

Fig. 3 Pre- and post-operative VA of the eyes treated with silicone-oil tamponade in the 10 patients with poor vision (VA < 0.2) in the fellow-eye. Most of them recovered reading ability.

Fig.4 Visual outcomes in the eyes with preoperative VA=0.4 or better that were treated with silicone-oil. All of them maintained a VA > 0.4.

postoperative VA in group 1 was 0.381 and 0.523 in group 2. The visual outcomes in these two groups show a statistically significant difference (P=0.0217). In 47% of the eyes treated with gas tamponade the postoperative best corrected VA was 0.4 or better, compared with 74% with silicone-oil tamponade. In the second group 20% of the eyes achieved a postoperative VA = 0.8 or better. Usually ophthalmologists are much more cautious when proposing surgery in patients with poor vision in the fellow eye because of potential severe complications of the surgical procedure in the only eye. In these patients, a careful evaluation of the risk-benefit ratio is very important. Fig. 3 shows the visual outcomes of the eyes treated with silicone-oil tamponade in patients with a VA<0.2 in the fellow eye. Most of them recovered reading ability by surgery[10].

Although the visual outcome after macular hole surgery is independent of the preoperative VA, we noticed that all the eyes with preoperative VA=0.4 or better that were treated with silicone-oil tamponade retained a VA > 0.4, so all of them obtained functional success (Fig.4).

The potential importance of patient's age, sex, stage of the hole, preoperative VA and presen-

Fig.5 Mean pre- and post-operative VA in three groups of patients: with symptoms for less then 3 months, between 3 and 6 months, and for longer than 6 months. The longer duration of the symptoms was correlated with worse visual outcome.

ce of epiretinal membranes was assessed. None of these factors were predictive of the final visual outcome. Fig.5 shows the relation between duration of symptoms and postoperative visual outcome in three groups of eyes treated with silicone-oil tamponade: those, which were symptomatic for less than three months, between 3 and 6 months and for longer than six months. The duration of the macular hole was estimated based on the time the patient first noted substantial visual loss. As reported in other studies[21], the longer duration of symptoms was correlated with worse visual outcome.

Various complications have been documented after macular hole surgery[1], such as retinal pigment epithelium (RPE) changes[5,6,18], peripheral retinal breaks, retinal detachment, progression of cataract, endophthalmitis and visual field defects[3,4,13,15,17]. The incidence of RPE disturbances has been reported in a rate up to 75%[18]. In addition, retinal detachment is a well-known complication after vitrectomy. The reported incidence of this complication ranges from 1% to 14%[16]. Tab.1 summarises the postoperative complications observed in the two groups of eyes in this study.

RPE alterations usually developed during the first two months and were much more frequent in eyes treated with gas tamponade. As all the

	GROUP 1		GROUP 2
Pigment epithelium alterations	35.3%		2.7%
Retinal detachment	0		0
Cataract		<	
Visual field loss	?		9%
Ocular hypertension	15.7%		72%

Tab. 1 Incidence of complications observed in the group treated with gas (group 1) and in the group treated with silicone-oil tamponde (group 2).

operations of group 1 were performed by the same surgeon and those of group 2 by 2 surgeons with different experience in macular hole surgery, a learning curve is not likely to be the main explanation of the different incidence of RPE-alterations between the two groups.None of the eyes developed a retinal detachment. More rapid progression of cataract was noticed in the group treated with silicone-oil tamponade. For this reason in some patients cataract extraction was considered at the time of silicone-oil removal. A large number of eyes treated with silicone-oil developed a transient ocular hypertension. Usually, discontinuing the corticosteroids allowed the IOP to return to normal levels. Sometimes topical anti-glaucoma therapy was used in addition. In one patient affected by open-angle glaucoma, early removal of silicone-oil was considered because of severe IOP elevation. None of the patients without a history of glaucoma suffered from IOP elevation after removal of silicone-oil. Visual field loss is another known complication of vitreous surgery. Unfortunately we don't have adequate documentation concerning the visual field of the eyes treated with gas tamponade. In the group treated with silicone-oil, 3 of 33 (9%) patients with normal preoperative visual field developed a peripheral sector visual field defect. None of them was symptomatic.

DISCUSSION

The purpose of this study was to compare the anatomic and visual outcomes, as well as the complications of macular hole surgery in eyes treated with vitrectomy and gas tamponade versus vitrectomy and silicone-oil tamponade. The surgical technique with vitrectomy, removal of

cortical vitreous in stage 3 holes and ILM peeling around the hole permits an excellent anatomic success rate independently of the tamponade used, and even without the use of adjuvants. Nevertheless, a significant higher rate of functional success (VA=0.4 or better) was obtained in the group treated with silicone-oil tamponade (74%) than in the group treated with gas tamponade (47%)(Tab.2). A visual recovery up to 1.0 is possible with this technique. In addition, the surgical outcome in the group treated with silicone-oil is independent of the patient's positioning.

	GROUP 1	**GROUP 2**
Anatomic success rate	94.70%	97.10%
Functional success rate (VA=0,4 or better)	47%	74%
Visual improvement of 2 or more Snellen lines	52.60%	74.40%
Mean postoperative VA improvement	0,16	0,313

Tab. 2 Surgical outcomes in the group treated with gas tamponade (group 1) and in the group treated with silicone-oil tamponade (group 2)

A further visual improvement can be expected in phakic eyes after cataract extraction. Progression of cataract is a complication of any vitreous surgery, so we are not going to discuss this point. The most frequent potentially vision threatening complication that we observed was RPE alterations in 35% of the eyes treated with gas tamponade and in only one eye treated with silicone-oil tamponade. The etiology of these changes remains uncertain[5-7,16,18]. Speculations include the possibility that the combination of face down positioning with prolonged intraocular gas contact may compromise choriocapillaris perfusion, or that the light exposure in combination with gas contact on an already compromised macula may be responsible. None of the eyes developed a retinal detachment in the follow-up period. The use of silicone-oil was associated with transient increased intraocular pressure (IOP) in 72% of the patients. Increased IOP occured most often between the 2nd and the 4th week after surgery and usually responded well to discontinuation of corticosteroids. In addition, treatment with topical antiglaucoma agents was necessary in some cases. The increased IOP was successfully controlled in all but one eye, which had a preoperative history of glaucoma. In this case early removal of silicone-oil had to be considered. In most of the patients the anti-glaucoma therapy could be withdrawn successfully within few weeks. None of the eyes that had no preoperative history of glaucoma suffered from increased IOP after silicone-oil removal. No known complication from increased IOP developed in any of the eyes. There are several possible explanations for the increased IOP associated with the use of silicone-oil. One possible mechanism is a decreased uveoscleral outflow from silicone-oil contact, but it does not explain why the incidence of increased IOP is considerably higher in eyes treated for macular holes than for other diseases (PVR, trauma, proliferative diabetic retinopathy etc.). As the IOP during the first postoperative week is usually normal we can conclude that narrow anterior chamber because of silicone-oil overfilling is not responsible for IOP increase. In addition, it's difficult to explain why eyes that underwent macular hole surgery with silicone-oil tamponade seem to be more likely to develop corticosteroid-induced glaucoma. Peripheral visual field loss has been observed after vitreous surgery. Several hypotheses have been suggested[3,4,13,15,17]: interoperative trauma to the optic nerve, traction on the nerve fiber layer during posterior hyaloid peeling, ocular compression during face down positioning with consequent ophthalmic perfusion alterations, toxicity or dry up effect of gas on the retina. The reported visual field loss after macular hole surgery ranges from 12% to 23%. Unfortunately, we don't have at our disposal a complete visual field documentation of the eyes treated with gas tamponade. In the group treated with silicone-oil we observed a peripheral sector visual field defect in 3 of 33 eyes without preoperative history of glaucoma. All of them were asymptomatic. A combination of mechanisms may be involved, and even if gas should not be considered as the only cause of visual field defects after macular hole surgery,

it probably exerts an additional harmful effect on the nerve fiber layer.

CONCLUSION

The surgical treatment of idiopathic macular holes with vitrectomy and ILM peeling, both with gas or silicone-oil tamponade, may achieve an excellent anatomic success rate, even without the use of adjuvants[11]. Nevertheless, in this study the visual outcome in eyes treated with silicone-oil tamponade is statistically significantly better than in those treated with gas tamponade. At the same time, the surgical outcome with silicone-oil tamponade is independent of the patient's positioning. Considering the very low rate of vision threatening complications, we can conclude that vitrectomy with silicone-oil tamponade is a safe technique for the treatment of macular holes.

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Requests for reprints:
G. Pertile
Oogheelkunde A.Z.Middelheim
Lindendreef, 1, B-2020 Antwerpen