ORIGINAL ARTICLE

# Surgical Treatment of Idiopathic Macular Hole – our Experience

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## SUMMARY

**Aim:** To evaluate the results of the idiopathic macular hole (IDM) surgical treatment. Surgery included pars plana vitrectomy (PPV) with the removal (peeling) of internal limiting membrane (ILM) and intraocular tamponade with a diluted expanding gas.
**Material and Methods:** A retrospective study included 100 eyes of 96 patients (10 men and 86 women) with IDM, that were operated at II. Eye Clinic SZU in Banska Bystrica from August 2008 to August 2012. Patients age ranged from 48 to 86 years, average 69.3 years. Mean follow-up time was 39.2 months. All patients underwent PPV with the ILM peeling. Intraocular air tamponade was used in 1-case, 16 % SF6 84-times and 12 % C3F8 15 times.
**Results:** Anatomical success of the operation was evaluated with OCT examination. After primary operation there were 92 (92 %) closed macular holes in our study. In 6 patients (6 %), we decided to reoperate with gas tamponade (SF6 2-times, C3F8 4 times). After the reoperations final anatomical success in our study was 97 eyes (97 %). Functional results we examined with Snellen. Improved best corrected visual acuity (BCVA) was observed in 85 eyes (85 %), no changes in 11 eyes (11 %), and deterioration in 4 eyes (4 %). Improvement in vision was following: 1 line – 18 eyes, 2 lines – 20 eyes, 3 lines – 18 eyes, 4 lines – 11 eyes, 5 or more lines in 18 eyes.
**Conclusion:** Pars plana vitrectomy with ILM peeling and gas tamponade is highly effective and safe treatment of idiopathic macular hole.

**Key words: idiopathic macular hole, pars plana vitrectomy, expanding gas.**

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## INTRODUCTION

Until the 1990s, idiopathic macular hole was considered untreatable. However, reports then emerged of an improvement of visual acuity following laser photocoagulation – Schocket in 1988 (14).
The first reports of the use of gases without vitrectomy in the case of macular hole appeared in connection with retinal detachment (12). Kroll et al. (11) indicated vitrectomy in these cases only following the failure of the primary surgery. According to Molfett et al. (12), the success rate of surgeries in this indication fluctuated from 61.5% in the case of vitreoretinal traction to 79.5% if no epiretinal membranes were present in the macula.
The initial reports from Kelly and Wendel from 1991 (5) on the results of pars plana vitrectomy in the case of idiopathic macular hole were not very encouraging. However, improvement of the surgical technique introduction of pigments for staining the epiretinal membranes and membrana limitans interna (MLI), as well as the use of intraocular tamponade using gases or silicon oil led to a substantial improvement of the postoperative results (1, 6 ,13).

## MATERIAL AND METHODOLOGY

The retrospective study enrolled 100 eyes of 96 patients who had undergone surgery at our clinic for IMH between August 2008 and August 2012. The study population comprised 10 men and 86 women in the age group of 48-86 years (the average age 69.3 years). The observation period was 2-60 months, 39.2 months on the average. Preoperatively 29 eyes (29%) were pseudophakic. In the study population there were 9 eyes (9%) with IMH in Gass 2 stage, 40 eyes (40%) in Gass 3 stage and 51 eyes (51%) in Gass 4 stage preoperatively (graph 1). After determination of the diagnosis at our vitreoretinal outpatient clinic, we attempt to include the patient in an surgery schedule within the time frame of 2-3 weeks. All patients underwent PPV under a wide angle display system with removal of the posterior membrane of the vitreous body and with a thorough check of the peripheral retina. In the next step, after staining with a pigment (membrane blue), MLI peeling was performed within the scope of 4-5 PD. After complete retinal tamponade using air there followed its replacement with diluted gas. Postoperatively, 1x tamponade using air was performed, 15x tamponade with 12% C3F8 (perfluoropropane) and 84x tamponade with 16% SF6 (sulphur hexafluorideFace--down positioning was recommended postoperatively for 3-5 days.
We evaluated the anatomical success of the surgery using OCT examination (Stratus).
We observed the functional effect on Snellen's optotypes at intervals of 1 month, 3 months, 6 and 12 months, and subsequently at annual intervals.

## RESULTS

Following primary IMH surgery, we achieved anatomical closure of the macular hole in 92 eyes (92%) in the study population. In 6 eyes (6 %) resurgery was performed (2x with SF6 tamponade and 4x with C3F8 tamponade). The final success rate of closure of the macular hole in the study population was 97 eyes (97%) after resurgery.

We evaluated the success rate of closure of IMH according to the stage of the disorder. In Gass 2 stage the success rate for closure of IMH following primary surgery was 8 eyes (88.9 %), after resurgery 9 eyes (100 %). In Gass 3 stage the success rate of the primary surgery was 40 eyes (100 %). In Gass 4 stage we achieved a success rate of the primary surgery in 44 eyes (86.3 %), after resurgery the resulting success rate of surgical intervention in this subgroup was 48 eyes (94.1 %).

We evaluated the functional results on Snellen's optotypes. We achieved an improvement of the best corrected visual acuity in 85 eyes (85 %), stabilisation of vision in 11 eyes (11 %), whilst there was a deterioration in 4 eyes (4 %) (graph 2). There was an improvement of BCVA by 1 row of Snellen's optotypes in 18 eyes, by 2 rows in 20 eyes, by 3 rows in 18 eyes, by 4 rows in 11 eyes, and by 5 or more rows in 18 eyes.

Preoperatively, there were 48 eyes (48 %) with BCVA 0.04-0.1, 52 eyes (52 %) had BCVA within the range of 0.2-0.4. 13 eyes (13 %) in the study population had a resulting BCVA within the range of 0.04-0.1, in 41 eyes (41 %) we achieved BCVA of 0.2-0.4 and BCVA of 0.5-1.0 in 46 eyes (46 %) (graph 3).

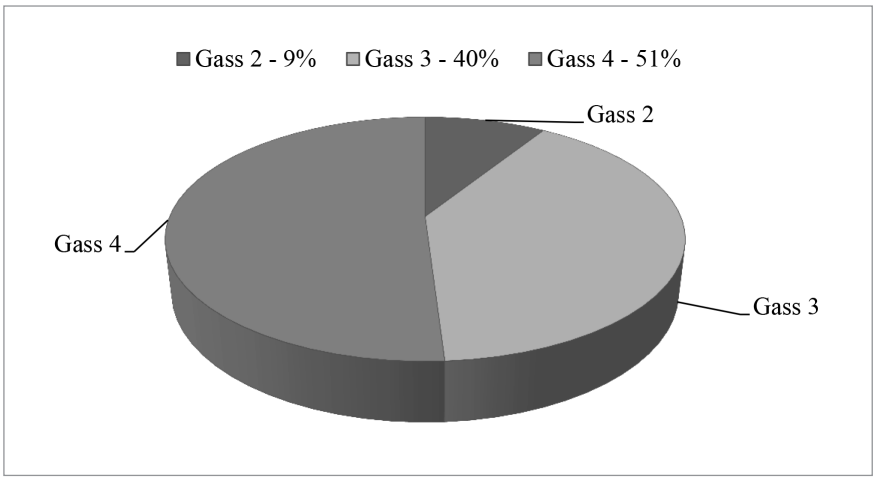
In the study population, of early complications we recorded a transitional increase inf intraocular pressure in 9 eyes (9 %). Of later complications we proceeded to resurgery due to rhegmatogenous retinal detachment upon closure of the macular hole in 1 case (1 %), with a successful result. Over the entire observation period we proceeded to subsequent cataract surgery in 56 eyes, in all cases without complications. This represents a requirement for cataract surgery in 78.9 % of phakic eyes in the aforementioned observation period!

## DISCUSSION

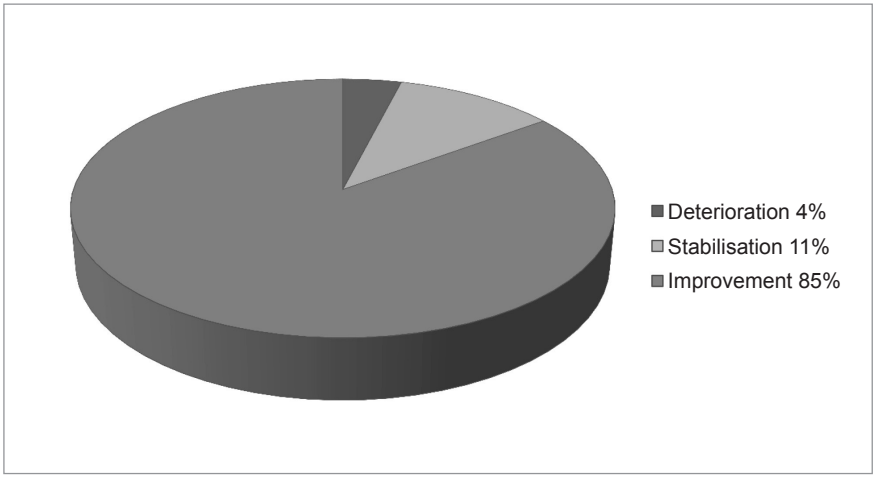
Prognostic factors before the surgery, the potential undesirable effects of pigments, the scope of necessary MLI peeling, the type of tamponade, and whether and how long to position still remain the subject of discussion.

Many authors note that the development of visual functions after an anatomically successful IMH surgery is a long-term and dynamic process (7, 8, 9, 10). From our experiences it is possible to state that rehabilitation of visual functions may persist for up to 6 to 12 months. The duration of the disorder has a pronounced influence on the result of the operation. From the analysis of the study population it is evident that patients mostly come for examination in an advanced stage of the disease (graph 1).

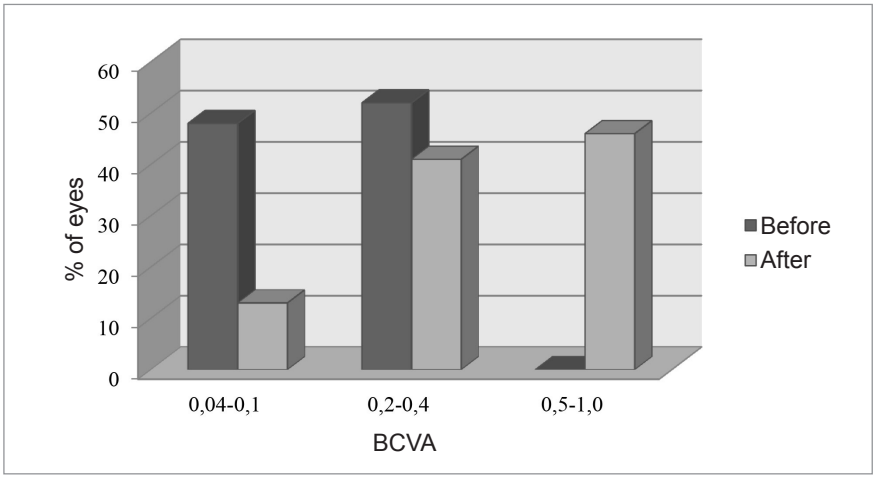
A number of published scientific works focus on searching for the most suitable and successful surgical techniques. Sung Soo Kim et al. (2008) in their retrospective study (6) compared the success rate of closure of idiopathic macular hole after PPV with tamponade with 20% SF6 and 16% C3F8. They achieved comparable results in both groups of patients. The success rate of the surgery was 90% upon SF6 tamponade and 91% upon




Graph 1. Preoperative composition of study population according to stage of disorder




Graph 2. Functional results – BCVA




Graph 3. BCVA before and after surgery

C3F8 tamponade.
In 2009 Eckardt (3) published his pilot study in which he observed closure of macular hole following pars plana vitrectomy with MLI peeling and tamponade using air in a face-down position, using OCT (optical coherence tomography) which was suspended on a mobile frame. He determined that closure of the macular hole was achieved on the first day in 58.3 % of eyes, in 75 % of eyes on the second day and in 91.6 % of eyes on the third day. In other eyes revitrectomy was conducted with repeated tamponade by air within 3-5 days. In the study population he achieved a definitive success rate of closure of macular hole using the aforementioned surgical technique of up to 97%.
In 2009 Christensen et al. (1) published the results of a randomised clinical study, the aim of which was to evaluate the anatomical and functional results of pars plana vitrectomy with or without MLI peeling upon idiopathic macular hole in stage Gass 2 or Gass 3. They determined a statistically significant difference in the closure of macular hole after MLI peeling in both stages of the disorder. In Gass 2 stage they achieved a closure of the macular hole after MLI peeling in 100 % of eyes, without MLI peeling the rate was 55 % of eyes. In Gass 3 stage the success rate of closure of the macular hole after MLI peeling was 89 % upon staining of MLI with trypan blue pigment and 91 % upon staining of MLI with indocyanine green, without MLI peeling closure of the macular hole was achieved in 36 % of eyes.
In 2009 Mittra et al. (2009) (13) published the results of their study, in which they focused on the significance of the length of positioning of patients after macular hole surgery using the technique of PPV with gas tamponade. In 84 % of eyes SF6 tamponade was used, and in 16 % of eyes C3F8 was used. Peroperatively they conducted MLI peeling in 95 % of eyes. In their study population of 56 eyes they achieved a success rate of closure of the macular hole in 93 % after 1 day of positioning, after resurgery with subsequent positioning of 1 week they achieved closure of the macular hole in 98 % of eyes. According to the authors a positioning period of 1 day after the surgery is therefore sufficient.
In 2010 Tatham and Banerjee (15) published the results of a meta-analysis in which they observed the significance of positioning of patients face down following macular hole surgery. The analysis incorporated 9 clinical studies, which compared the postoperative results upon positioning patients for 24 hours or less, and 5-10 days. The results of the meta-analysis did not demonstrate a statistically significant difference in the success rate of closure of macular hole in the indicated two groups. However, the result of the analysis may be influenced by the quality of the included clinical studies. In conclusion they state that it would be necessary to conduct a prospective randomised controlled study on the above theme.
In 2010 Karkanová et al. (4) published the results of an examination of the electrical function of the retina using ERG in the postoperative period following IMH surgery. Within a short 3-month observation period they observed a statistically significant improvement of retinal function in the fovea, but in the parafoveal area they observed a significant deterioration of retinal function, which to a great extent corresponded with the area of MLI peeling. The results of a long-term observation will be very interesting.

## CONCLUSION

Pars plana vitrectomy with MLI peeling and retinal tamponade with diluted expanding gas represents a highly effective and safe surgical treatment of idiopathic macular hole. From the analysis of our sample group it is evident that patients mostly come for examination in the advanced stages of the disease, in which the possibility of anatomical and functional improvement significantly decreases. The progression of cataract in our observation period after the aforementioned operation demonstrates the significance of the possibility of planning and implementation of a combined cataract surgery together with a macular hole surgery. We believe that in future this combined operation shall become the gold standard in the macular hole surgery.

## LITERATURE


1. Christensen, U.C., Krøyer, K., Sander, B. et al.: Value of internal limiting membrane peeling in surgery for idiopathic macular hole stage 2 and 3: a randomised clinical trial. In Br J Ophthalmol, 2009; 93, 8: 1005–1015.
2. De Molfetta, V., Arpa, P., Vinciguerra, P. et al.: The treatment of retinal detachment with macular hole in the myopic patient. In NEETENS, A. et al. (ed.) Modern concepts in vitreo-retinal diseases. Antwerp: UIA Press, 1985, p. 301.
3. Eckardt, C.: Macular hole surgery with air tamponade and OCT-based duration of prone positioning. In Retina Today, 2009; 4: 61–63.
4. Karkanová, M., Vlková E., Došková H., Kolářil P..: Vliv operace idiopatické makulární díry s peelingem MLI a plynnou tamponádou na elektrickou funkci sítnice. Čes a Slov Oftal, 66; 2010, 2: 84–88.
5. Kelly, N.E. Wendel, R.T.: Vitreous surgery for idiopathic macular holes. Results of a pilot study. In Arch Ophthalmol, 109; 5: 654–659.
6. Kim, S.S., Smiddy, W.E., Feuer, W.J. et al.: Outcomes of sulfur hexafluoride (SF6) versus perfluoropropane (C3F8) gas tamponade for maculare hole surgery. Retina, 2008; 28, 10: 1408–1415.
7. Kolář, P., Vlková, E.: Dlouhodobé výsledky chirurgického řešení idiopatické makulární díry s peeling vnitřní limitující membrány. Čes a Slov Oftalmol, 2006; 1: 34–41.
8. Korda, V., Dusová, D, Studniăka, J. et al.: Chirurgické řešení makulární díry. Čes a Slov. Oftal, 2005, 61, 316–320.
9. Krásnik, V.: Chirurgická liečba idiopatickej makulárnej diery. Súborný referát. Čs Oftal, 55, 1999, 6, 377–383.
10. Krásnik, V., Strmeň, P., Javorská, L.: Dlhodobé sledovanie zrakových funkcií po anatomicky úspešnej chirurgickej liečbe idiopatickej diery makuly. Čes. a slov. Oftal., 57, 2001, No.2, s. 80-87.
11. Kroll, P., Busse, H., Berg, P. et al.: 1985. Intraokuläre Therapie makulalochbedingter Netzhautveränderungen. In Klin Monatsbl Augenheilkd, 1985; 187, 6: 499–502.
12. Landers, M.B., Yamanashi, B.S.: The treatment of retinal detachments secondary to macular holes. In South Med J, 1973; 137, 12: 1–4.
13. Mittra, R.A., Kim J.E., Han, D.P. et al.: Sustained postoperative face-down positioning is unnecessary for successful macular hole surgery. In Br J Ophthalmol, 2009; 93, 5, 664–666.
14. Schocket, S.S. - Lakhanpal, V. - Miao, X.P. et al.: Laser treatment of macular holes. In Ophthalmology, 1988, 95, 5, 574–582.
15. Tatham, A., Banerjee, S.: Face-down posturing after macular hole surgery: a meta-analysis. In Br J Ophthalmol, 2010, 94, 5, 626–631.