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Bleb grading by photographs versus bleb grading by slit-lamp examination

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ABSTRACT.

Purpose: **Using a bleb-grading system clinically facilitates long-term follow-up of patients with previous glaucoma surgery. Clinical evaluation of these patients can be challenging for untrained ophthalmologists. Morphological bleb configuration might influence planning of follow-up visits in glaucoma patients due to different and individual prognosis after trabeculectomy. In this study, we compared the MaBAGS (Mainz Bleb Appearance Grading System), a classification system for filtering blebs with other classification systems (MBGS/Moorfields Bleb Grading System, IBAGS/Indiana Bleb Appearance Grading Scale) in reference to usability and reliability and compare it to grading by bleb photographs.**

Methods: **Forty-two eyes of 31 patients after trabeculectomy were included. Three observers, two senior and one junior observer, graded all blebs using MaBAGS, MBGS and IBAGS during slit-lamp examination. Bleb photographs were reviewed at least 4 weeks after clinical examination. Statistical analysis was performed to determine agreement between the observers using intraclass correlation coefficients.**

Results: **With MaBAGS, excellent and good levels of agreement were found for vascularity indices, Seidel test and transparency. Parameters for area and height yielded moderate agreement, while indices for conjunctival mobility and microcysts failed to show satisfying levels of agreement. Using MBGS resulted in excellent and good interobserver consistency for parameters regarding subconjunctival blood, Seidel test, and central and peripheral vascularity. Height and nonbleb vascularity reached moderate levels of agreement. Agreement for area parameters was low. With IBAGS, good levels of agreement were found for height and vascularity, and moderate for extent. In all grading systems, consistency was considerably better between the two experienced observers compared to the inexperienced grader.**

Conclusions: **MaBAGS shows good reproducibility. Using such a grading system improves precision of the description of a highly variable clinical finding. The reliability of grading by slit-lamp examination exceeds that of grading on photographs.**

Key words: Bleb grading – filtering bleb – glaucoma surgery – trabeculectomy

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Introduction

Trabeculectomy is still the most effective filtrating surgery even though more and more surgical options arise. Long-term data show efficient control of intraocular pressure (IOP) in up to 67% of initially successful trabeculectomies after 15 years (Chen et al. 1997; Jones et al. 2005; Landers et al. 2012).

In the follow-up care of these patients, the ophthalmologist focuses on the bleb as the functional part of the trabeculectomy (Picht & Grehn 1998; Cantor et al. 2003). Use of a classification system for filtering blebs according to clinical morphologic parameters can assist the clinician with this (Cantor et al. 2003; Wells et al. 2004), but clinical evaluation of these patients can be challenging, especially for untrained ophthalmologists.

Our group designed MaBAGS (Mainz Bleb Appearance Grading System) to rarefy the systematic clinical evaluation of filtering blebs. Using different clinical parameters might improve the precision of the description of this highly variable clinical finding. In this study, we compared our system with other classification systems (MBGS/Moorfields Bleb Grading System, IBAGS/Indiana Bleb Appearance Grading Scale) in reference to usability and reliability. We furthermore included grading by two senior and one junior glaucoma specialist to evaluate interobserver reliability and compared the usability of photographs in bleb grading.

Materials and Methods

Forty-two eyes of 31 patients (14 male, 17 female) were enrolled in a prospective masked study at the Medical University Center, Department of Ophthalmology, Johannes Gutenberg University, Mainz, Germany. Mean age of all patients was 68.8 ± 6.7 years (range 50–83 years). All subjects had undergone trabeculectomy with (39 eyes) or without antimetabolites (3 eyes) for medically uncontrolled primary or secondary open-angle glaucoma (40 eyes) or chronic angle-closure glaucoma (2 eyes). Surgery preceded clinical examination for bleb morphology from 1 day to 9 years (median 87 days). Informed consent was obtained from all participants.

Exclusion criteria were patient age below 18 years, prior glaucoma surgery involving conjunctiva, prior cataract or minimal invasive surgery including laser and cyclodestructive treatment <6 months before study entry.

Three observers – two ophthalmologists specializing in glaucoma (D.H., J.W.) and one postgraduate resident of ophthalmology (C.B.) – evaluated all blebs using MaBAGS, MBGS and IBAGS on the same day by slit-lamp examination with each observer being unaware of the findings reported. Bleb photographs were reviewed at least 4 weeks after clinical examination and also graded using MaBAGS, MBGS and IBAGS.

MaBAGS evaluates central and peripheral vascularity, microcysts, bleb transparency, area, height, mobility of bleb conjunctiva, and Seidel test. Table 1 shows range and notes for each parameter. Bleb height is estimated as multiples of corneal thickness (Picht & Grehn 1998; Klink et al. 2005). For height, vascularity and transparency, standard photographs are available to compare with (Figure 1). Table 2 displays the comparison of MaBAGS, MBGS and IBAGS.

After bleb evaluation, intraocular pressure (IOP) was measured using Goldmann applanation tonometry.

For bleb photographs, microcysts, mobility and Seidel test were not evaluated.

Statistical analysis was performed with SPSS for Windows statistical software (version 17.0, SPSS, Chicago, Illinois, USA). Consistency and absolute agreement of a single rater's judgement and of the mean of all 3 observers were calculated with the intraclass correlation coefficient (ICC) using a 2-way random model (Landis & Koch 1977).

Levels of agreement obtained with the ICC statistics of >0.80 were defined as excellent agreement, levels between 0.80 and 0.61 as good agreement, levels between 0.60 and 0.41 as moderate agreement, levels between 0.40 and 0.21 as fair agreement, and levels < 0.21 as poor agreement.

Analysis of the agreement of the two experienced observers compared to the inexperienced observer was performed using agreement in absolute number of cases.

Results

On slit-lamp examination (Table 3), MaBAGS showed excellent levels of agreement for central and peripheral vascularity indices (both 0.82) and Seidel test (0.84), moderate agreement for area (0.47) and height (0.59), and good agreement for transparency (0.69). Indices for mobility (−0.20) and microcysts (0.18) failed to show satisfying levels of agreement. Using MBGS resulted in excellent levels of agreement for central vascularity (0.84), good agreement for peripheral vascularity (0.74), moderate agreement for nonbleb vascularity (0.60), and excellent agreement for Seidel test (0.81). Poor agreement was found for central (0.15) and maximum (0.39) area, and moderate agreement for height (0.53). Excellent levels of agreement were found for subconjunctival blood. With IBAGS, good levels of agreement were found for vascularity (0.73), good agreement for Seidel test, moderate agreement for extent (0.44), and good agreement for height (0.61).

On photographs (Table 4), with MaBAGS good levels of agreement were found for central (0.71) and peripheral (0.64) vascularity. Height (0.40) and transparency (0.25) showed fair agreement, while area (0.17) resulted in poor agreement. MBGS showed good agreement for central (0.80), peripheral (0.73) and nonbleb vascularity (0.66). Moderate levels of agreement were found for subconjunctival blood (0.44), fair agreement for height (0.32), and poor agreement for central (0.08) and maximum (0.17) area. Using IBAGS, good levels of agreement were found for vascularity (0.79), fair agreement for height (0.30), and poor agreement for area (0.17).

Tables 5 and 6 show the results of the interobserver agreement on slit-lamp examination and on photographs, respectively.

Table 1. Mainz bleb appearance grading system.

Parameter	Range	Notes
Height	0–3	Flat (0) to high (3)
Central vascularity	0–4	Avascular (0) to severe (3); 4 = cork screw vessels
Peripheral vascularity	0–4	Avascular (0) to severe (3); 4 = cork screw vessels
Bleb transparency	0/1	0 = transparent, 1 = nontransparent
Microcysts	0–2	None (0), many (2)
Conjunctival mobility	0–2	0 = immobile, 1 = slightly mobile, 2 = Tenon cyst
Area	0–3	<1 to >4 hours; 0 = no definite area
Seidel test	0–2	0 = no leakage, 1 = diffuse, 2 = streaming leakage

Discussion

The precise observation and documentation of the filtering bleb as the functional part of the trabeculectomy is the key to effectively monitor patients after filtering glaucoma surgery. Even small changes – identifiable by routine slit-lamp examination – can lead to therapeutic decisions with major impact on the patient.

The use of a classification system for filtering blebs can guide the clinician at this – which is even more important, if different observers follow up the same patient or the examiner is relatively inexperienced. Since this is clinical routine, we tried to alleviate follow-up of glaucoma patients after glaucoma surgery, and to structure bleb grading. MaBAGS was therefore designed to rarefy the systematic clinical evaluation of filtering blebs.

Today, several classification schemes for filtering blebs are used, with MBGS and IBAGS being the most common. MBGS was developed based on a telemedicine study (Crowston et al. 2004; Wells et al. 2004) and evaluates

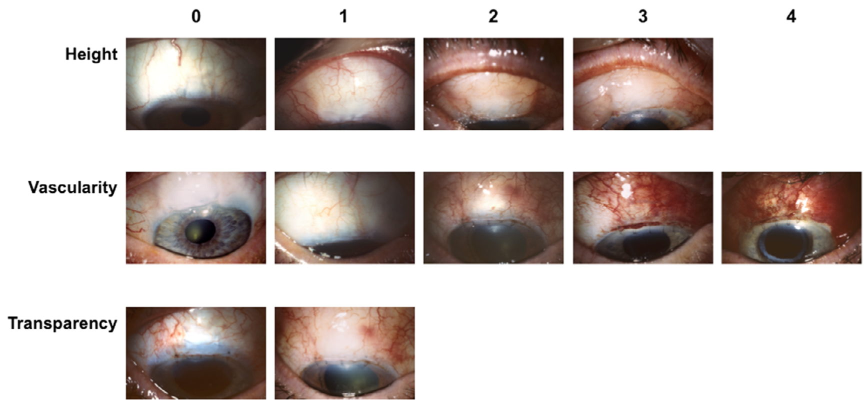

Fig. 1. Standard photographs for MaBAGS.

Table 2. Comparison of clinical bleb-grading systems.

Parameter	MaBAGS	MBGS	IBAGS
Height	+	+	+
Area	+	+†	+
Vascularity	+‡	+§	+
Seidel test	+	+	+
Subconjunctival blood	–	+	–
Bleb transparency	+	–	–
Microcysts	+	–	–
Conjunctival mobility	+	–	–

+ = is included in this classification system; – = is not included in this classification system.
† Central/maximum.
‡ Central/peripheral.
§ Central/peripheral/nonbleb.

Table 3. Results of interobserver agreement on slit-lamp examination; intraclass correlation coefficient (single rater, absolute agreement).

Parameter	MaBAGS	MBGS	IBAGS
Height	0.59	0.53	0.61
Area	0.47	0.15/0.39†	0.44
Vascularity	0.82/0.82‡	0.84/0.74/0.60§	0.73
Seidel test	0.84	0.81	0.79
Subconjunctival blood		0.93	
Bleb transparency	0.69		
Microcysts	0.18		
Conjunctival mobility	−0.20		

† Central/maximum.
‡ Central/peripheral.
§ Central/peripheral/nonbleb.

5 parameters (bleb height and area, vascularity, Seidel test and subconjunctival blood). Initially, MBGS used a grading range from 1 to 10, which was reduced to 1 to 5 to improve practicability (Wells et al. 2004, 2006). IBAGS was established using bleb photographs and contains 4 parameters (bleb height and area, vascularity, and Seidel test) (Cantor et al. 2003). Wells et al. (2006) compared IBAGS and MBGS in a prospective manner and found both methods to be clinically reproducible with high levels of interobserver agreement, with MBGS capturing extra vascularity data with probable clinical implications. MaBAGS extends the parameters bleb height and area, vascularity, and Seidel test to bleb transparency, conjunctival mobility in bleb area and microcysts, as we believe that these parameters are important for the judgement of a functioning or nonfunctioning bleb. Table 2 shows a comparison of the parameters included in MaBAGS, MBGS and IBAGS.

In this study, MaBAGS shows good reproducibility compared to MBGS and IBAGS. The average measure ICC values were comparable for criteria included in all 3 bleb-grading systems. In MaBAGS, especially mobility of the bleb-surrounding conjunctiva, microcysts failed to show acceptable levels of agreement. Klink et al. (2008) had better levels of agreement regarding microcysts using Würzburg bleb classification score (WBCS). This is due to the fact that in our study, one observer was not experienced in judging filtering blebs routinely. The agreement between the two experienced observers in grading the quantity of microcysts was high as shown in Table 5. Thus, these parameters depend more on the observer's experience leading to lower interobserver agreement. As conjunctival mobility and transparency have not been examined before in regard to interobserver agreement, we are not able to compare our data with other study groups.

Furthermore, in our study we found average levels of agreement to be lower if grading of filtering blebs was performed on photographs compared to slit-lamp examination. One reason might be that photographs present less 3-dimensional information compared with slit-lamp examination. On the other hand, grading of blebs based on photographs is not routinely carried out, so there might be a training bias. Nevertheless, we decided to include photographs to compare MaBAGS with photograph-derived classification systems like MBGS, even if some properties, such as microcysts or conjunctival mobility, are better visible in slit-lamp examination using different illumination directions.

The aim of our prospective follow-up study is to assess the value of the criteria in MaBAGS including microcysts, conjunctival mobility and transparency, in terms of short-term and long-term success of filtering blebs measured in IOP-lowering potential. This has been performed first for the Würzburg bleb classification score (WBCS) (Klink et al. 2005) evaluating the impact of cataract surgery on the filtering bleb. They found that the number of corkscrew vessels and of general vascularization of the bleb significantly increased in the first days after cataract surgery.

Table 4. Results of interobserver agreement on photographs; intraclass correlation coefficient (single rater, absolute agreement).

Parameter	MaBAGS	MBGS	IBAGS
Height	0.40	0.32	0.30
Area	0.17	0.08/0.17†	0.17
Vascularity	0.71/0.64‡	0.80/0.73/0.66§	0.79
Subconjunctival blood		0.44	
Bleb transparency	0.25		

† Central/maximum.
‡ Central/peripheral.
§ Central/peripheral/nonbleb.

Table 5. Results of interobserver agreement on slit-lamp examination; agreement among all observers/experienced observers.

Parameter	MaBAGS	MBGS	IBAGS
Height	24%/68%	49%/67%	33%/53%
Area	26%/79%	12-17%/61-63%†	35%/65%
Vascularity	39-47%/73-77%‡	30-37%/56-63%§	30%/65%
Seidel test			
Subconjunctival blood		98%/100%	
Bleb transparency	77%/93%		
Microcysts	44%/79%		
Conjunctival mobility	9%/67%		
Seidel	81%/89%		76%/91%

† Central/peripheral.
‡ Central/peripheral.
§ Central/peripheral/nonbleb.

Table 6. Results of interobserver agreement on photographs; agreement among all observers and experienced observers.

Parameter	MaBAGS	MBGS	IBAGS
Height	31%/60%	26%/36%	19%/36%
Area	31%/40%	2–10%/12–17%	17%/33%
Vascularity	17–45%/26–50%	17–38%/43–50%	21%/38%
Subconjunctival blood		79%/83%	
Bleb transparency	45%/50%		

Limitations of this study are the small number of eyes included, the different kinds of glaucoma, and lack of the comparison with WBCS. Though indices for mobility and microcysts seem to be problematic, especially for inexperienced graders, we think that the observation of these additional parameters is important, as it improves the precision of the description of a highly variable clinical finding and describes the function of the bleb more accurately. Furthermore, Sacu et al. (2003) showed that the detection of microcysts in the first 2 weeks after surgery may serve as prognostic indicator of good subsequent IOP development and hence outcome of surgery. It would be therefore interesting to evaluate blebs over time using three experienced observers.

In summary, MaBAGS shows good reproducibility in this first study compared to the well-established MBGS and IBAGS. In our opinion, using more clinical parameters improves precision of the description of a highly variable clinical finding, even if it complicates the classification procedure. Ongoing studies are subject to assess clinical impact of morphologic information as conjunctival transparency and mobility of the filtering bleb. However, the experience of the observer influences grading quality and hence interobserver consistency considerably.

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