

Ultrasound biomicroscopic imaging in intermediate uveitis

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Abstract

Background—Clinical examination of the region of the eye mainly affected in patients with intermediate uveitis is difficult and often hampered by media opacities. In that perspective ultrasound biomicroscopy (UBM) promises to be a valuable additional diagnostic tool.

Methods—UBM was performed at a sound frequency of 50 MHz on 26 eyes of 13 patients with intermediate uveitis in order to determine configuration of pars plana, peripheral retina, and vitreous. Findings of ophthalmoscopy with scleral indentation and UBM were compared.

Results—In 18 of 26 eyes pathological structures such as membranous or fluffy vitreous condensations were identified by UBM. Among these UBM revealed pathological findings which were not visible on funduscopy in nine eyes. Most importantly, vitreoretinal adhesions with traction on the retina were imaged in four eyes. However, in three eyes vitreous opacities being visible on funduscopy were not identified by UBM.

Conclusion—UBM seems to be a valuable diagnostic technique for the evaluation of patients with intermediate uveitis. Longitudinal studies will have to determine the relevance of UBM findings for the individual clinical course and their influence on therapeutic decisions.

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According to the anatomical uveitis classification proposed by the International Uveitis Study Group, intermediate uveitis represents a disease process mainly taking place at the posterior ciliary body, pars plana, peripheral retina, and underlying choroid.¹ It was first described by Schepens in 1950.² The pathogenesis of intermediate uveitis is still unclear.³ An association with certain systemic diseases, especially multiple sclerosis and sarcoidosis, is known.^{4,5} Moreover, a link to some HLA patterns seems to exist, though association appears variable.⁵⁻⁷ Clinically, intermediate uveitis usually affects both eyes in various degrees. Anterior segment involvement (for example, keratic precipitates, posterior synechiae) is mostly mild. Nevertheless, complicating cataract formation may be significant. The vitreous is infiltrated by cells and often diffusely opacified. Characteristically in the lower vitreous dense infiltrations presenting as "snowballs" or "snowbanks" can be observed.⁴⁻⁸ According to Böke a subtype classification of intermediate uveitis has been

established.⁹ He distinguished the diffuse inflammatory type, characterised by dust-like opacities and snowball-like precipitates but no massive snowbank-like exudates; the exudative type, characterised by extensive exudations over the ora and pars plana; and the vasoproliferative type, characterised by vascular sheathing, occlusion, and neovascularisation. Owing to their location in a shielded angle, anatomical structures mostly affected by intermediate uveitis are often not readily accessible on funduscopy. In many cases indirect binocular ophthalmoscopy with scleral indentation or use of an indenting contact glass is helpful.^{10,11} Nevertheless, cataract, synechiae, and dense vitreous opacities of inflammatory or haemorrhagic origin may prevent detailed assessment. In this diagnostic dilemma ultrasound biomicroscopy (UBM) promises to be a valuable instrument. UBM has been used for various diagnostic problems affecting ciliary body, pars plana, and peripheral retina.¹²⁻¹⁵ The use of UBM in intermediate uveitis was first described by Garcia-Feijoo and coworkers in a single case.¹⁶ The aim of our study was to determine the potential and usefulness of UBM as a diagnostic procedure in intermediate uveitis on a larger cohort of patients at one time.

Patients and methods

We examined 26 eyes of 13 patients (Table 1). Nine of our patients were female and four male, the average age was 32 (13-75) years. The diagnosis of intermediate uveitis was based on the above mentioned clinical features. The one patient who was already 75 years old at the time of examination has suffered from the disease for several years and has shown typical clinical symptoms of intermediate uveitis at the onset and further clinical course. According to the subtype classification of Böke,⁹ 16 of the eyes were of the diffuse inflammatory type (type 1), four eyes were of the exudative type (type 2), and six eyes were classified being of the vasoproliferative type (type 3). The stage of the disease process varied: three eyes had undergone pars plana vitrectomy and five eyes peripheral transconjunctival retinal cryocoagulation. In two eyes both surgical procedures had been performed. Vitrectomy had been indicated in three eyes because of recurrent vitreous haemorrhage, and persisting cystoid macular oedema and macular pucker in one eye each. Seven patients did not receive any local or systemic medical treatment, whereas six patients were taking systemic corticosteroid therapy at the time of UBM. Two of those six patients were addition-

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Table 1 Patient characteristics, clinical, and ultrasound biomicroscopy (UBM) findings

Patient	Age	Sex	Eye	VA	Subtype	PPV	Cryo	Syst therapy	Activity	Anterior segment	Posterior segment	UBM
1	23	F	R	6/6	3	Yes	Yes	None	Inactive	Cataract, posterior synechiae, poor mydriasis	No vitreous opacities	Dense vitreous condensation, traction
			L	6/7.5	3	Yes	No		Inactive	Cataract	No vitreous opacities	Vitreous condensation, traction
2	34	M	R	6/12	3	No	Yes	None	Active	Posterior synechiae	Light vitreous opacities	Vitreous condensation and membranes
			L	6/24	3	Yes	Yes		Active	Glaucoma	No vitreous opacities	Vitreous condensation and membranes
3	48	M	R	6/7.5	1	No	No	None	Inactive	Normal	No vitreous opacities	Normal
			L	6/7.5	1	Yes	No		Inactive	Pseudophakia	No vitreous opacities	Normal
4	75	F	R	6/15	1	Yes	No	Steroids	Active	Pseudophakia	No vitreous opacities	Normal
			L	6/10	1	No	No		Active	Pseudophakia	Vitreous opacities	Vitreous membranes, traction
5	13	M	R	6/24	1	No	Yes	MTX, steroids	Active	Cataract	Vitreous opacities	Normal
			L	6/15	1	No	Yes		Active	Cataract	Vitreous opacities	Vitreous membranes, traction
6	31	F	R	6/7.5	2	No	Yes	None	Active	Cataract, keratic precipitates	Snowballs	Dense vitreous condensation and membranes
			L	6/12	2	No	Yes	None	Active	Cataract	Snowballs	Vitreous condensation
7	34	F	R	6/7.5	1	No	No	None	Inactive	Normal	No vitreous opacities	Vitreous membranes
			L	6/30	1	No	No		Inactive	Cataract	No vitreous opacities	Normal
8	17	M	R	6/24	1	No	No	Steroids	Active	Glaucoma, keratic precipitates	Vitreous opacities	Vitreous membranes
			L	6/6	1	No	No		Active	Normal	Normal	Vitreous membranes
9	18	F	R	6/6	3	No	No	None	Active	Normal	Vitreous opacities, blood	Vitreous membranes
			L	6/6	3	No	No		Inactive	Normal	Vitreous opacities	Normal
10	46	F	R	6/15	2	No	No	Steroids	Active	Cataract, posterior synechiae	Snowballs	Vitreous membranes
			L	6/6	2	No	No		Active	Normal	Snowballs	Vitreous membranes
11	44	F	R	6/10	1	No	No	None	Active	Normal	Vitreous opacities	Normal
			L	6/48	1	No	No		Active	Normal	Vitreous opacities	Vitreous condensation and membranes
12	15	F	R	6/38	1	No	No	CYA, steroids	Active	Poor mydriasis	Poor visibility	Vitreous condensation and membranes
			L	6/20	1	No	No		Active	Cataract, poor mydriasis	Poor visibility	Dense vitreous condensation and membranes
13	20	F	R	6/6	1	No	No	Steroids	Inactive	Aphakia	Normal	Normal
			L	6/60	1	No	No		Active	Aphakia	Vitreous opacities	Vitreous membranes, traction

MTX=methotrexate; CYA=cyclosporin A.

ally being treated with methotrexate or cyclosporin. Systemic medical therapy was initiated in patients with an active inflammatory process that could not be controlled by local therapy or showed complications such as cystoid macular oedema. Three eyes showed posterior synechiae and in nine eyes clinically relevant cataract was present. Three eyes were pseudophakic and two eyes aphakic. In two patients intermediate uveitis was associated with multiple sclerosis, whereas in the other patients no systemic diseases known to be related to intermediate uveitis were present.

Before ultrasound imaging slit lamp biomicroscopy and applanation tonometry were performed. After pupils were dilated with tropicamide and phenylephrine 5% eye drops, the fundus was examined by indirect binocular ophthalmoscopy with scleral indentation. UBM imaging was conducted using an ultrasound biomicroscope with a transducer operating at a sound frequency of 50 MHz (UBM 840, Zeiss-Humphrey, San Leandro, CA, USA). Gain setting was 80 dB providing a spatial resolution of approximately 50 µm and a penetration depth of 5 mm. For local anaesthesia tetracaine eye drops were applied and afterwards a plastic ocular cup was placed between the eyelids. The eye cup was filled with methylcellulose, serving the transducer as coupling medium to the globe. During each examination radial scanning of the anterior chamber angle/ciliary body region and the pars plana

and peripheral retina was conducted in all clock hours, but with emphasis on the lower circumference of the eye. During the examination patients were asked to look in different directions, so that the area of pathology would become more easily accessible for imaging.

As a control group a cohort of 10 age matched probands who had no history of ocular inflammation were examined with the same technique.

Results

Imaging of the anatomical region of interest was possible in all eyes without complications. Pathological lesions appeared as vitreous condensations or membranes of various configuration and extent. They were located over the peripheral retina and pars plana and sometimes also extended towards the pars plicata (Fig 1). On UBM fluffy condensations of the vitreous presented a homogeneous internal structure (Figs 1–3). In some cases condensations showed a jagged surface with thin processes extending into the vitreous (Fig 1, 3), whereas in patients after pars plana vitrectomy the surface appeared smooth (Fig 2). It was also possible to image very delicate vitreous opacities located directly over the peripheral retina (Fig 4).

Eighteen of the 26 eyes (69.2%) showed pathological lesions on UBM, whereas eight of the 26 eyes (30.8%) appeared normal. In 14 eyes (53.8%) results of UBM and funduscopy

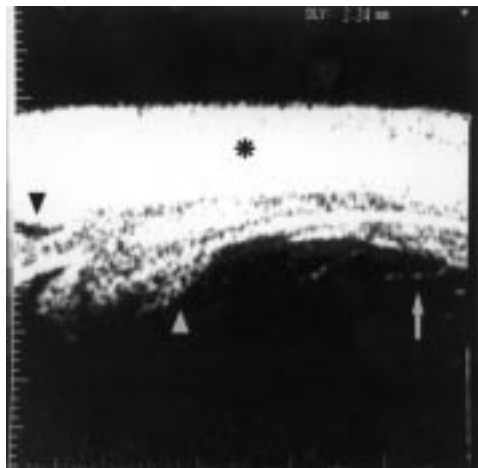


Figure 1 Patient 6, left eye. Vitreous condensation (arrow) overlying the pars plana with extension to the pars plicata (white arrowhead). Sclera (asterisk). Anterior chamber angle (black arrowhead).

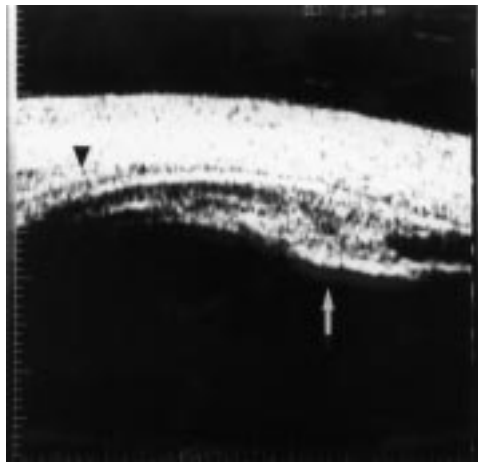


Figure 2 Patient 1, left eye. Vitreous condensation with smooth surface (arrow) overlying the pars plana and peripheral retina in a phakic patient after pars plana vitrectomy. Anterior part of the pars plana (arrowhead).

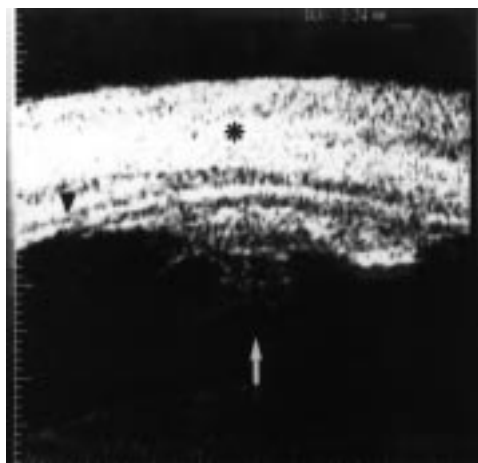


Figure 3 Patient 6, right eye. Vitreous condensation overlying the pars plana and peripheral retina with thin filaments extending into the vitreous (arrow). Anterior part of the pars plana (arrowhead). Sclera (asterisk).

examination corresponded well concerning the presence of pathological findings. In nine eyes (34.6%) UBM revealed pathological findings which were not identified on funduscopy

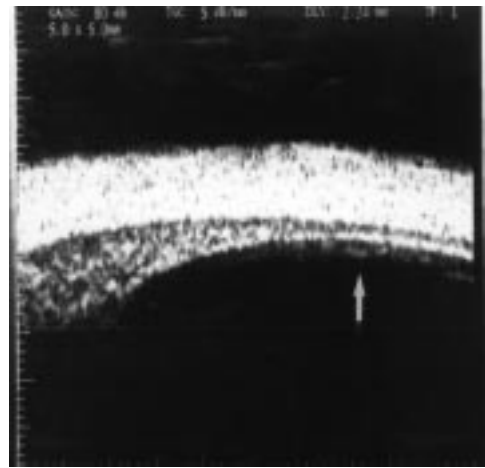


Figure 4 Patient 5, left eye. Delicate epiretinal condensations of the vitreous (arrow).

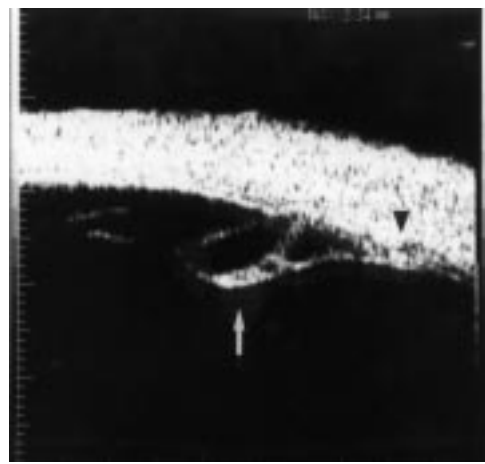


Figure 5 Patient 1, right eye. Vitreous condensation with tractional force on the peripheral retina (arrow) and towards the pars plana (arrowhead).

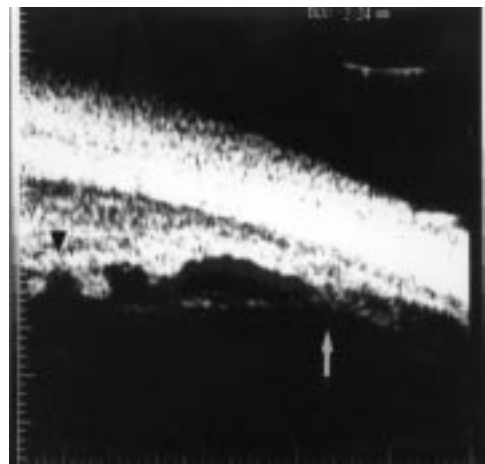


Figure 6 Patient 11, left eye. Vitreous condensation with tractional force on the pars plana/peripheral retina (arrow). Pars plicata (arrowhead).

performed under scleral indentation. In most cases these additional lesions consisted of vitreous membranes and fluffy condensations over the peripheral retina and pars plana. Additionally, in four out of these nine eyes vitreoretinal adhesions that seemed to have a tractional force on the retina were visible (Figs 5, 6). In none of these eyes did funduscopy

reveal any hints for vitreoretinal traction. In contrast, in three of the 26 eyes (11.5%) funduscopy showed vitreous opacities which were not imaged with UBM. Five of the 26 eyes (19.2%) were rated normal on funduscopy and UBM. The results of clinical and UBM examination of each individual of our study are listed in Table 1.

In the control group four out of 10 eyes (40%) showed delicate membranous structures in the anterior vitreous. They were all aligned parallel to the surface of the ciliary body and extended towards the posterior surface of the lens. Vitreoretinal adhesions and signs of traction could not be demonstrated in any of the eyes of the control group; vitreous condensations were not visible as they were in patients with intermediate uveitis.

Discussion

Because of its ability to provide images of almost microscopic resolution, UBM has become increasingly important for the evaluation of structures of the anterior segment of the eye.

Since intermediate uveitis predominantly affects structures which are not easily accessible by conventional clinical examination, UBM promises to provide valuable additional information. Other diagnostic imaging techniques, such as conventional ultrasound or magnetic resonance imaging, are not suitable for this diagnostic problem because of their limited spatial resolution or high costs. Additionally, conventional ultrasound techniques at sound frequencies of 8–10 MHz are only of limited value due to technical difficulties imaging structures of the anterior segment and peripheral retina, even when employing a water bath technique.

Those delicate membranous structures we identified in our patients are of uncertain clinical significance. Similar linear lesions were found in patients with necrotising scleritis and with scleral melt after cryotherapy.^{15 17} It can be assumed that they may represent vitreous fibrils and probably are a relatively uniform reaction of the vitreous to inflammation. On the other hand similar structures, though distinctively less marked, sometimes can also be imaged in normal eyes. Therefore, the distinction between normal and pathological structures might be difficult. In our control group we also saw membranes in the vitreous, but they tended to show morphological differences in respect of their alignment and extent compared with membranes in eyes with intermediate uveitis. Most probably membranes in normal eyes represent structures of the anterior vitreous cortex.¹⁴

In four eyes UBM revealed vitreoretinal adhesions that seemed to put tractional forces on the peripheral retina. On funduscopy with scleral indentation traction on the retina was revealed in none of these eyes. This is of special interest since in intermediate uveitis retinal detachment occurs at an increased rate.^{18 19} Moreover, Malinowski found an increased risk of retinal detachment in patients with significant cataract formation. This observation was

explained by assumed disturbances in the vitreous base due to more intense inflammation and would support the need for a sensitive diagnostic technique especially in patients with media opacities. Of those four eyes in our study that showed signs of vitreoretinal traction on UBM, cataract was present in two cases. The other two eyes were aphakic and pseudophakic, respectively. Our findings suggest that UBM could indicate patients at risk of retinal complications at an early stage, though longitudinal studies are necessary to confirm this presumption.

In three eyes UBM did not pick up vitreal changes that were visible on funduscopy. There is no apparent explanation for this. In all three eyes the vitreous showed a moderate infiltration by cells and diffuse turbidity, but no condensations or snowballs, so that there were no defined structures that could be made visible by UBM.

Overall, despite the restrictions of a one time point study, our findings indicate that UBM is an interesting new diagnostic instrument for the assessment of patients with intermediate uveitis. In patients with media opacities as well as in situations with clear media it adds helpful information to the findings of clinical examination. Future investigations and a longitudinal follow up will have to show the indication for vitreoretinal procedures or initiation of therapy with anti-inflammatory agents, if the additional information this technique provides is to influence therapeutic decisions. Moreover, in situations where the diagnosis of intermediate uveitis has not been confirmed and clinical symptoms are unspecific, UBM might be helpful in differential diagnosis.

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