# Ultrasonographic pictures of intravitreal triamcinolone acetonide

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PURPOSE. *To evaluate ultrasonographic pictures of intravitreal triamcinolone acetonide (IVTA).*
METHODS. *Twenty-eight eyes from 28 patients who needed intravitreal injection of triamcinolone acetonide (4 mg/0.1 mL) were included in this study. A baseline ocular B-scan ultrasound examination was performed in all eyes before IVTA injection. Subsequent examinations were scheduled about 1 hour, 1 day, and 1 week after the injection and thereafter weekly up to complete sonographic disappearance of triamcinolone acetonide. Ultrasonographic pictures of IVTA and disappearance time of the medication were evaluated.*
RESULTS. *In all the eyes, IVTA was seen as multiple inhomogeneous markedly hyperechoic areas with various size and shape and nonuniform distribution through the vitreous cavity. Common pictures included localized bright hyper-reflective area, diffuse bright point-like echo sources, membranous surfaces, and subhyaloid opacities. IVTA deposited along acoustic interfaces and changed their ultrasonographic characteristics. IVTA facilitated visualization of posterior vitreous surface in seven patients. Opacities due to IVTA gradually cleared over a 3- to 7-week period.*
CONCLUSIONS. *The findings indicate that IVTA has a bright hyper-reflective ultrasonic image and should be considered as a differential diagnosis for vitreous opacity. IVTA can change the ultrasonographic pattern of the vitreous cavity and highlight membranous surfaces. (Eur J Ophthalmol 2009; 19: 263-7)*

KEY WORDS. *Intravitreal injection, Triamcinolone acetonide, Ultrasonography*

*Accepted: August 14, 2008*

## INTRODUCTION

There has been a recent surge of interest in the potential effects of intravitreal triamcinolone acetonide (IVTA) in the treatment of various intraocular proliferative, neovascular, and edematous diseases (1). This long-acting corticosteroid is available for ophthalmic use as a minimally water-soluble, injectable suspension. Particulate nature of the drug might play an important role in the pharmacokinetics of triamcinolone acetonide (TA) (2). Furthermore, because of this property the medication deposits in different parts of the clear vitreous gel and facilitates its visualization and handling (3, 4).

Many patients who need intravitreal injection of TA may have vitreous opacities and/or hazy ocular media, making fundus examination almost impossible. Some of these situations include proliferative diabetic retinopathy, postvitrectomy hemorrhage, uveitis, trauma, and blind painful eye (5-13). Ultrasound (US) can play an important role in the evaluation and follow-up of such cases. Because of its particulate nature, TA could potentially produce bright echo sources on B-scan. We

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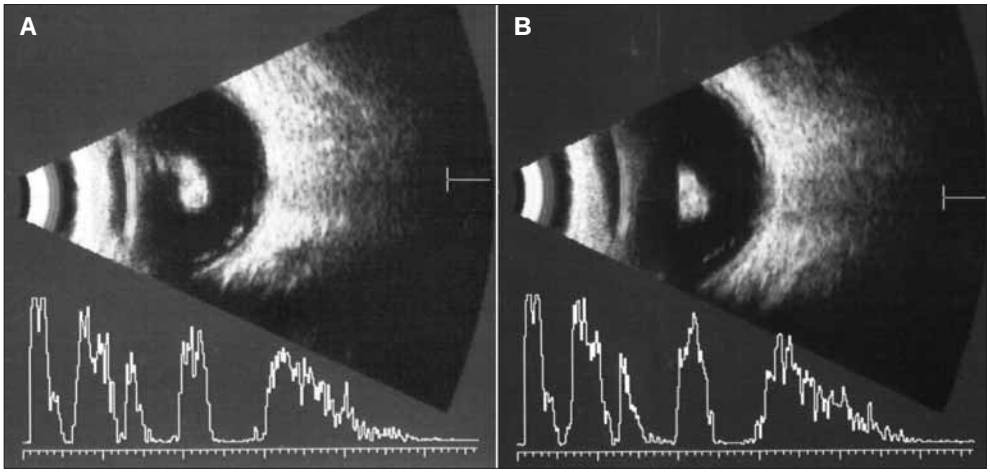


**Fig. 1 -** *Inhomogeneous markedly hyperechoic area surrounded by clear vitreous gel (clumplike opacity) produced by localized accumulation of intravitreal triamcinolone 1 hour after injection* **(A)** *and 7 days later* **(B)**.

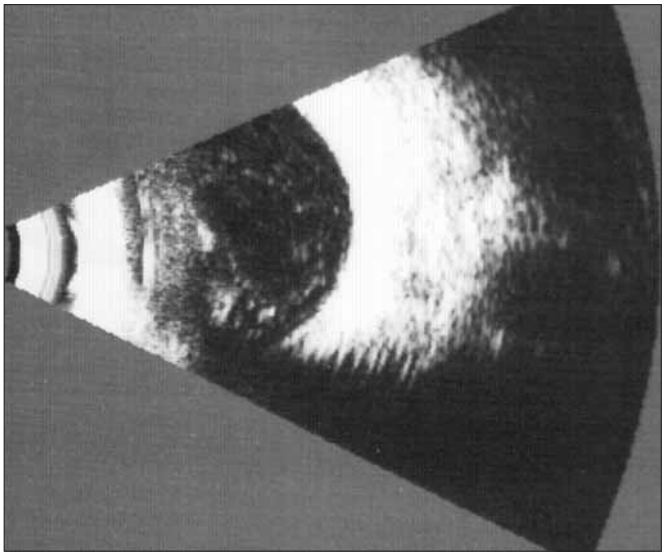

**Fig. 2 -** *Multiple small, inhomogeneous hyperechoic foci (pointlike opacities) with various size and shape and irregular margin scattered through vitreous cavity produced by intravitreal triamcinolone acetonide.*

undertook this study to evaluate and describe ultrasonographic pictures of IVTA.

## METHODS

Twenty-eight eyes from 28 patients were included in this study. Indications for IVTA injection included macular edema due to diabetes (7 patients, 25%), central retinal vein occlusion (4 patients, 14.3%), branch retinal vein occlusion (3 patients, 10.7 %), postcataract extraction cystoid macular edema (11 patients, 39.3%), and choroidal neovascularization (3 patients, 10.7%). Exclusion criteria included any ocular or eyelid infection, any media opacity precluding view of the vitreous or retina, glaucoma, previous vitrectomy, significant sonographic vitreous opacities such as vitreous membranes, vitreous hemorrhage, and asteroid hyalosis. Patients were enrolled in the study after they provided written, informed consent.

Before intravitreal injection all the patients underwent complete ophthalmic examinations including visual acuity, intraocular pressure, slit lamp biomicroscopy, and indirect ophthalmoscopy. A baseline ocular US examination was performed in all eyes before IVTA injection.

Intravitreal injection was performed in the outpatient clinic under aseptic conditions. After topical anesthesia, the eye was prepared using povidone iodine 5% and ciprofloxacin hydrochloride solutions; 0.1 mL (4 mg) of TA was injected superotemporally, 3.5–4 mm away from the limbus using a 27-gauge needle on a 1-mL syringe. Before the injection, air bubbles were carefully removed from the syringe. Topical ciprofloxacin eyedrop was instilled just after the procedure and then every 6 hours for 2 days. All the injected eyes underwent ocular US examination by the same researcher (M.A.K.). Multidirectional sections of each globe were obtained through the closed lid with conventional coupling gel, in supine position. Examinations were performed using a US scanner (CompuScan AB, Storz) and a 10-MHz mechanical sector transducer. Baseline US examinations were performed before intravitreal injections. Subsequent examinations were scheduled about 1 hour, 1 day, and 1 week after the injection and thereafter weekly up to complete sonographic disappearance of TA.

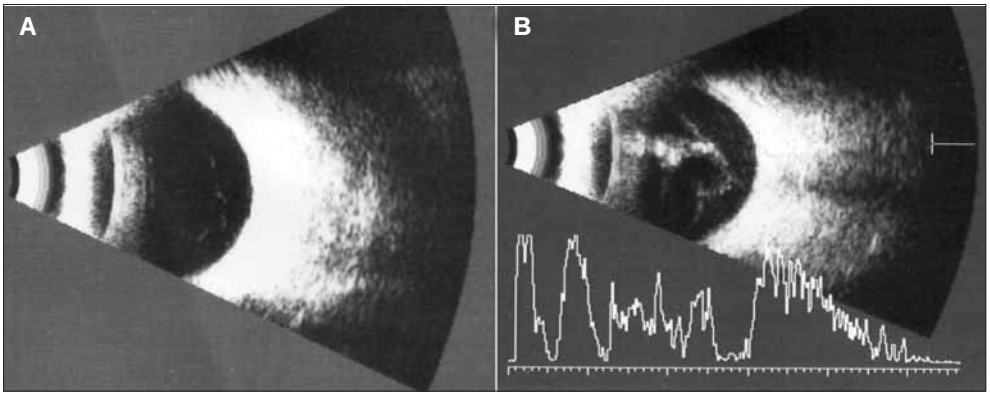


**Fig. 3 -** *Change in thickness of membranes after intravitreal injection of triamcinolone acetonide.* **(A)** *Axial scan before intravitreal triamcinolone acetonide (IVTA) injection showing a barely visible detached posterior vitreous.* **(B)** *Echographic follow-up after IVTA injection shows a linear dense vitreous opacity and highlighted detached posterior hyaloid with a pointlike disc insertion. Also note pointlike opacities in subhyaloid space.*

## RESULTS

The mean age of the patients was 58.93 ± 10.50 years (range from 28 to 81 years). Seventeen (60.7%) patients were male and 11 (39.3%) were female. Eighteen eyes (64.3%) were phakic and 10 eyes (35.7%) were pseudophakic. Intravitreal injections were performed successfully in all eyes with no major complication and all subjects completed follow-up course. In all the eyes TA was seen as multiple markedly hyperechoic areas with various size and shape, and nonuniform distribution through the vitreous cavity, without acoustic shadowing or posterior reverberation artifact. The opacities had different configurations. One or a combination of the following pictures was seen in each eye:

1) Localized, inhomogeneous markedly hyper-reflective area (clumplike opacity) with lobulated margin in vitreous cavity which was surrounded by relatively echolucent vitreous gel (Fig. 1). This kind of opacity is caused by localized accumulation of TA particles in midvitreous cavity and indicates gelatinous nature of the vitreous. This picture was the most common form and was seen in 15/28 (53.6%) eyes.

2) Multiple small, inhomogeneous hyperechoic foci (pointlike opacities) with various size and shape and irregular margin scattered through vitreous cavity (Fig. 2). This picture is most likely due to dispersion of TA in the more liquefied parts of vitreous. This picture was seen as a part of opacity in 8/28 (28.6%) eyes. Sometimes in late stages of drug absorption, accumulation of TA particles produced several small bright echoes similar to pictures of mild asteroid hyalosis. Similar pointlike opacities are seen in the presence of vitreous hemorrhage, asteroid hyalosis, and endophthalmitis.

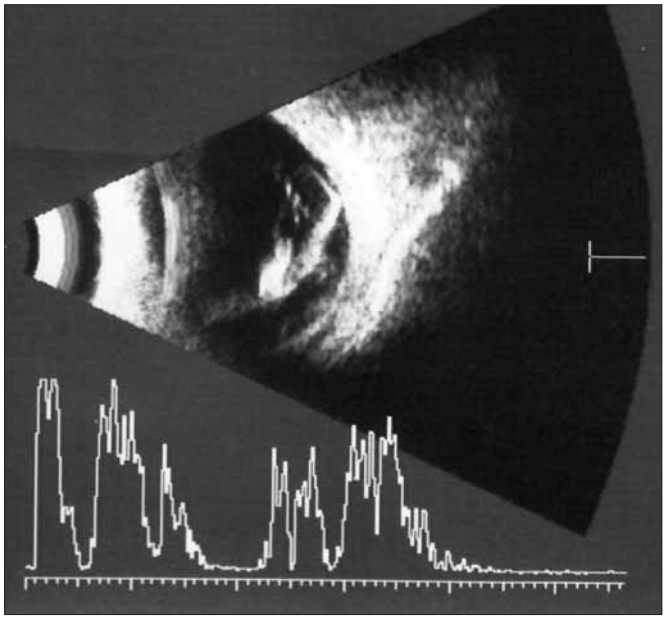

**Fig. 4 -** *Thickened posterior hyaloid face due to intravitreal triamcinolone acetonide accumulation, and also penetration of the drug particles in subhyaloid space.*

3) Membranous opacities (Figs. 3, 4, and 5B): In this pattern organization of IVTA creates interfaces that may appear as continuous echogenic lines in the vitreous cavity (pseudo-membranous appearance). Sometimes IVTA particles deposit along acoustic interfaces or fine membranes and change their acoustic behavior and produce markedly thick, hyperechoic, membrane-like structures with hazy inner surface. This picture is similar to precipitation of vitreous hemorrhage over the lower half of detached vitreous.

4) Subhyaloid opacities: In patients with posterior vitreous detachment (PVD), sometimes after IVTA injection the

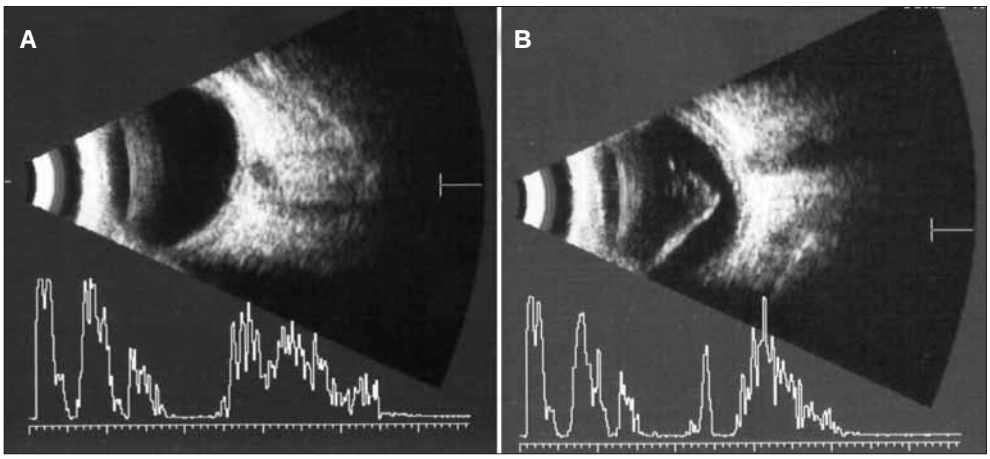


**Fig. 5 -** *Visualization of posterior vitreous detachment (PVD) after intravitreal triamcinolone acetonide (IVTA) injection: no PVD is seen in preinjection sonography* **(A)***; visible posterior vitreous surface after IVTA injection in the same eye* **(B)***.*

drug particles enter subhyaloid space and produce diffuse minute opacities between the posterior vitreous face and the retina (Figs. 3B and 4). Endophthalmitis or subhyaloid hemorrhage can also produce a similar picture. In our study, this picture was seen in 7/28 (25%) eyes and in all of them posterior vitreous surface was highlighted due to TA deposition over it; in one of them, the PVD was not detected before IVTA injection (Fig. 5).

In our study, ultrasonic opacities due to IVTA gradually cleared over a 3- to 7-week period and the opacities disappeared completely 3 weeks after injection in 3/28 (10.7%), 4 weeks in 10/28 (35.7%), 5 weeks in 11/28 (39.3%), 6 weeks in 3/28 (10.7%), and 7 weeks in 1/28 (3.6%) eyes. The mean time for ultrasonographic disappearance of IVTA was 5 weeks.

## DISCUSSION

The normal clear vitreous appears black or acoustically empty on B-scan ultrasonography. Opacification of the vitreous gel can occur from a number of causes, such as aging, inflammation, infection, and hemorrhage (14). To our knowledge, this is the first published report concerning ultrasonographic pictures of IVTA. Given the widespread use of this medication in various ocular diseases, TA particles should be added to the list of differential diagnoses of vitreous opacities.

Endophthalmitis is an important complication after IVTA injection. Infectious endophthalmitis and sterile pseudoendophthalmitis may be seen following IVTA (2, 15-17). It is crucial to differentiate the two in order to treat cases of an infectious nature effectively and to avoid the complications of unnecessary treatment in sterile cases (2). IVTA could potentially mask the symptoms of endophthalmitis after IVTA injection. Echography is very useful for determining the severity and extent of infection in the eye with endophthalmitis. The first step in the evaluation is to assess the vitreous cavity for the presence of inflammatory opacities and membranes (18). Therefore, the ophthalmologist and sonologist need to be familiar with ultrasonographic pictures of IVTA. In postinjection endophthalmitis, the opacities possibly start near the injection site but as the infection spreads, the opacities become more evenly distributed throughout the vitreous cavity. In our series, opacities of IVTA settled down inferiorly during subsequent examinations and density of opacity decreased around the injection site. Therefore, we propose this echographic finding as a useful diagnostic point in clinically challenging cases.

Another new finding in our patients was ultrasonic enhancement of some vitreoretinal pathologies by TA. In seven patients, the PVD picture was enhanced; in one of them, the PVD was not detected before IVTA injection (Fig. 5). Deposition of TA over acoustic interfaces enhances sound reflectivity at these levels and highlights them (ultrasonic visualization). However, this phenomenon could potentially increase thickness and reflectivity of a membrane and lead to misinterpretation of the picture. Echographic findings in the patients with dense membrane formation can often be confusing even to the most seasoned echographer (14).

In our study, we used 4 mg/0.1 cc dosage (most popular dose); however, higher doses may cause different sonographic pictures. Also, we excluded patients who had previous total or subtotal vitrectomy from our study. In

such patients, the pictures may be different. Vitreous consistency and the degree of its syneresis is another potential factor for different sonographic pictures of IVTA. Performing a baseline US examination after IVTA injection can aid the examiner in interpretation of subsequent pictures.

In summary, our findings indicate that IVTA has a bright hyper-reflective ultrasonic image and should be considered as a differential diagnosis for vitreous opacity. Echographic shapes produced by IVTA include clumplike, pointlike, membranous, and subhyaloid opacities. IVTA might change the reflectivity of acoustic interfaces in the vitreous cavity and cause misinterpretation of the images. Baseline US examination after IVTA injection might help the examiner in interpreting US pictures during the early postinjection period, especially in patients with opaque media.

*The authors have no relevant financial interest in any aspect of this article.*

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