



## Sonographic Features and its Association with Visual Outcome and Microbiological Profile in Acute Post Cataract Surgery Endophthalmitis - A Prospective Analysis

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### Abstract

**Background and Aims:** Cataract surgery is the commonest eye surgery performed worldwide. Endophthalmitis is a sight threatening complication of cataract surgery which causes reduced vitreous clarity and media opacities and precludes visualization of the posterior segment. Ultrasonography is done in cases of suspected endophthalmitis with poor media clarity. This study aims at evaluating, baseline sonographic features of acute post-cataract surgery endophthalmitis and its association with initial vision, final visual outcome and microbiological profile.

**Materials and Methods:** This prospective study conducted at Aravind Eye Hospital, Madurai, South India, included all patients who presented with clinical symptoms and signs of endophthalmitis, between January 2014 to December 2015. They underwent A-mode and B-mode ultrasonography and were managed with either 'tap and inject' strategy or primary vitrectomy and followed up for three months. The sonographic features like vitreous opacities, vitreous membranes, retinal detachment, choroidal detachment, posterior vitreous detachment, and retino-choroidal thickening were documented and their association with vision at presentation, microbiological profile and final visual acuity was studied.

**Results:** There were 54 patients (54 eyes), their mean age was  $59.9 \pm 19.2$  years and male : female ratio was 1:1. Of them, 33 patients (61.1%) had dense vitreous opacities, 16 patients (29.6%) had dense vitreous membrane, 3 patients (5.6%) had retinal detachment and 1 patient (1.9%) had choroidal detachment. Median retino-choroidal thickening was found to be 1.82 mm (1.67-1.96 mm). Increased retino-choroidal thickening ( $P = 0.049$ ) and dense vitreous opacities ( $P = 0.000$ ) was significantly associated with poor initial presenting acuity. The occurrence of retinal detachment was significantly associated with poor final vision ( $P = 0.006$ ) and infection by virulent organisms ( $P = 0.028$ ).

**Conclusion:** In conclusion, sonographic warning signs are associated with infection by virulent organisms and poor visual outcome.

**Keywords:** Cataract; Endophthalmitis; Ultrasonography; Vitrectomy; Visual Acuity

### Abbreviations

RD: Retinal Detachment; CD: Choroidal Detachment; PVD: Posterior Vitreous Detachment; RCT: Retino-Choroidal Thickening

### Introduction

Endophthalmitis is a potentially sight threatening complication following ocular surgery, trauma to the eye and endogenous

infections. Owing to the increasing number of ocular procedures every year, post-operative endophthalmitis is on the rise [1]. The incidence of post cataract surgery endophthalmitis in India has been reported to range from 0.02% to 0.09%, whereas worldwide incidence ranges from 0.02% to 0.26% [2]. Endophthalmitis is an inflammation of the inner coats of the eyeball, thereby presents

with reduced vitreous clarity and media opacities, which prevent visualization of posterior segment. There may be associated retinal or choroidal detachment in such patients, which may not be visible on routine fundus examination. Ultrasonography serves as a safe and readily available modality to aid in the diagnosis of infectious endophthalmitis. It is invariably done in all cases of suspected endophthalmitis with poor media clarity [3]. There are few studies correlating the sonographic features and the final visual outcome, but the results are inconclusive and the features reported are not specific for acute post cataract surgery endophthalmitis [4,5].

### Aim of the Study

Hence, this study aims at evaluating baseline sonographic features in acute post-operative endophthalmitis and its association with vision at presentation, final visual outcome, and microbiological profile.

### Materials and Methods

This prospective observational study was conducted in Aravind Eye Hospital, Madurai, South India, from January 2014 to December 2015, after approval of Institutional Review Board. All patients who presented with symptoms of redness, pain, and diminution of vision within 6 weeks following cataract surgery, both operated in-house and in other centers, were included in our study. Endophthalmitis following other ocular procedures, trauma and endogenous causes were excluded. Those who presented with corneal ulcers and opacities for whom vitrectomy could not be performed, were also excluded from our study. All patients were admitted and their baseline data including age, postoperative day of presentation, and symptoms were documented. Visual acuity was recorded using Snellen’s visual acuity chart. Anterior segment examination and fundus examination was done using slit lamp biomicroscopy and indirect ophthalmoscopy, respectively. Combined A-scan and B-scan (Ultrascan, Alcon) was performed for all included patients, by two expert retina physicians. Sonographic features documented were vitreous opacities and vitreous membranes graded as none, mild, moderate, and dense; retinal detachment (RD), choroidal detachment (CD), posterior vitreous detachment (PVD), and degree of retino-choroidal thickening (RCT), graded as present or absent.

The decision of initial vitreous tap and injection of intravitreal antibiotics, or vitrectomy was left to the discretion of the treating surgeon. Intraocular samples for microbiological analysis were collected during anterior chamber tap, vitreous tap or during vitrectomy. All samples were inoculated immediately and sent for gram stain, KOH stain and cultured in blood agar, Sabouraud’s agar, Thioglycolate broth and Brain heart infusion broth. No transport media was used. Those who worsened with conservative management underwent salvage core vitrectomy. Snellen’s visual acuity of

all patients was documented at discharge, at one month and at 3 months follow up. A standard logMAR scale was used for statistical analysis. LogMAR Visual acuity is described as follows: no light perception - 4.0, perception of light - 3.0, Hand movements - 2.6 and finger counting - 2.3 [6]. Continuous variables like age, time of presentation after surgery, initial vision, final vision and retino-choroidal thickness were expressed as mean with standard deviation or median with interquartile range based on their normality of distribution. Categorical variables like gender, hypopyon, fibrillary membrane, vitreous opacities, vitreous membranes, RD, CD, PVD were expressed in percentage. Change in visual acuity was defined as one line increment or decrement from presenting vision at 3 months follow-up. The association between sonographic findings and presenting vision, microbiological profile, final vision and change in vision was analyzed using Kruskal Wallis test or Fisher’s exact test depending on the number of subgroups in each category. P-value of less than 0.05 was considered as statistically significant.

### Results

We had 54 patients (54 eyes) with acute post cataract surgery endophthalmitis, of whom 27 were males and 27 were females. Their mean age was 59.9 ± 9.6 years. The median duration of presentation after cataract surgery was 14.5 days (2 to 55 days). 26 patients (48.1%) had hypopyon at presentation and 41 patients (75.9%) had fibrillary membrane over the intraocular lens. Red reflex was absent in 44 patients (81.5%) and faint red glow was present in 9 patients (16.7%). B-scan ultrasound showed vitreous echogenicity in all the patients. Retinal detachment and choroidal detachment were present in 3 patients (5.6%) and 1 patient (1.9%) respectively. Median retinochoroidal thickening was found to be 1.82 mm (1.67 to 1.96 mm). Initial management done was vitreous or aqueous tap and intravitreal antibiotics in 42 patients (77.8%), primary vitrectomy in 24 patients (44.4%) (Table 1). At third month, 47 patients (87%) had improvement in vision and 3 patients (5.6%) had decrement in vision.

Presentation	Median with IQR <sup>#</sup> /N (%) <sup>*</sup>
Presenting visual acuity in log MAR <sup>#</sup>	2.3 (1.02 - 2.6)
Post-operative day of presentation <sup>#</sup>	14.5 (7.0 - 22.2)
Initial management	
a) Tap and inject <sup>*</sup>	42 (77.8%)
b) Vitrectomy <sup>*</sup>	24 (44.4%)
Final visual acuity in log MAR <sup>#</sup>	0.3 (0.2 - 0.8)

**Table 1:** Clinical characteristics, initial treatment, and final outcome.

<sup>#</sup>: Median with Interquartile range.

<sup>\*</sup>: Number (percentage).

**Microbiological profile**

Among the 54 samples (54 eyes) for microbiological analysis, 41 (75.9%) were culture negative, 8 (14.8%) had grown Coagulase Negative *Staphylococcus* (CONS), 2 (3.7%) had *Staphylococcus aureus*, 1 (1.8%) had *Streptococci* and 1 (1.8%) had *Pseudomonas* growth. The sonographic features found in these patients include vitreous debris, vitreous membranes, retinal detachment, choroidal detachment, total or incomplete posterior vitreous detachment and increased retino-choroidal thickening. Due to small number of positive isolates, we classified the microbiological profile as culture negative, CONS, and virulent organism group (which included *Staphylococcus aureus*, *Streptococci* and *Pseudomonas*) [7]. The sonographic features of all the three groups were analyzed separately (Table 2). Mean final visual acuity was 0.4 logMAR in the culture negative group, 0.3 logMAR in the CONS group and 2.3 logMAR in the virulent organism group. Among the 8 patients in CONS group, 6 (75%) had dense vitreous opacities, 3 (37.5%) had dense vitre-

ous membranes and none of them had retinal detachment, choroidal detachment, or posterior vitreous detachment. Dense vitreous opacities and dense vitreous membranes were also more in virulent organism group when compared to the other groups. On comparing the three groups with vitreous opacities as none, mild and moderate and dense, no significant association was found (P = 0.621, Fischer’s exact test). We did not find any significant association between three culture groups and vitreous membranes graded as none, mild and moderate and dense (P = 1.000, Fischer’s exact test). However, presence of retinal detachment had significant association with virulent organism group. Of the three patients who had retinal detachment, two (66.6%) belonged to virulent organism group and one (33.3%) to culture negative group (P = 0.028, chi square test). Also, there was a statistically significant correlation between retino-choroidal thickening and virulent organism group (P = 0.009, Kruskal Wallis test). Other findings like CD and PVD had no association with the microbiological profile.

Sonographic features	Culture negative n (%)	CONS n (%)	Virulent organisms* n (%)
<b>Vitreous opacities</b>			
Dense	23 (56.1%)	6 (75%)	4 (80%)
Mild and Moderate	17 (41.5%)	2 (25%)	1 (20%)
None	1 (2.4%)	0 (0)	0 (0)
<b>Vitreous membranes</b>			
Dense	12 (29.3%)	3 (37.5%)	2 (40%)
Mild and Moderate	13 (31.7%)	2 (25%)	1 (20%)
None	16 (39%)	3 (37.5%)	2 (40%)
<b>Retinal detachment</b>			
Absent	40 (97.6%)	8 (100%)	3 (60%)
Present	1 (2.4%)	0 (0)	2 (40%)
<b>Choroidal detachment</b>			
Absent	40 (97.6%)	8 (100%)	5 (100%)
Present	1 (2.4%)	0 (0)	0 (0)
<b>PVD#</b>			
Absent	34 (82.9%)	8 (100%)	5 (100%)
Present	7 (17.1%)	0 (0)	0 (0)

**Table 2:** Sonographic features in three groups of microbiological culture.

CONS: Coagulase Negative staphylococci.

\*: Virulent organisms –*Staphylococcus*, *Streptococcus*, and *Pseudomonas*.

#: PVD-Posterior Vitreous Detachment.

**Vision at presentation, final visual outcome, and improvement in the vision**

The median vision at presentation was 2.3logMAR (0.2 to 4.0) and visual acuity at presentation had a statistically significant association with dense vitreous opacities (P = 0.000, Kruskal Wallis test). Also, retino-choroidal thickening had a statistically significant correlation with presenting visual acuity (P = 0.049, Spearman’s correlation). Of the 54 eyes, improvement in vision was noted in 50 patients (92.5%) and in remaining 4 (7.5%), vision remained unchanged at 3 months. There was a statistically significant association between improvement in vision and absence of retinal detachment (P-0.04, Fischer’s exact test). None of the other ultrasonographic features were associated with change in vision at three months (Table 3). Among 33 patients with dense vitreous opacities, 31 patients (93.9%) had improvement in vision, 1 patient (3%) had

decreased vision and vision in the other 1 patient (3%) was static at third month. 15 out of 17 patients (88.2%) with dense vitreous membranes had an improvement in vision and the other two remained static (11.8%). We had only one patient with choroidal detachment who showed improvement in vision. The median final vision at 3 months was 0.3 logMAR (0.0 to 4.0 logMAR). Final visual acuity had a statistically significant association with the presence of retinal detachment, (P = 0.006, Fischer’s exact test) but other sonographic features had no impact on the final visual outcome. Also, a statistically significant difference was noted between the groups with and without retinal detachment in B-scan on comparing their mean final visual acuity (RD present- 2.7logMAR vs RD absent-0.4 logMAR, P < 0.01, t-test). Mean final visual acuity of all the sonographic categories are depicted in figure 1 and 2.

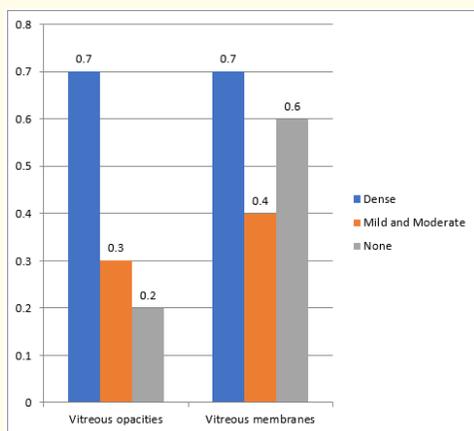
Sonographic feature	Presenting Vision (logMAR)	Final Vision (logMAR)	Change in vision (logMAR)	Micro-organisms isolated in culture p-value
Vitreous opacities	0.000 <sup>a</sup>	0.508 <sup>a</sup>	0.236*	0.621*
Vitreous membranes	0.278 <sup>a</sup>	0.865 <sup>a</sup>	0.619*	1.000*
Retinal detachment	0.118*	0.006*	0.041*	0.028*
Choroidal detachment	0.948*	0.296*	1.000*	1.000*
Posterior vitreous detachment	0.062*	0.576*	0.401*	0.628*
Retino-choroidal thickening	0.049 <sup>#</sup>	0.342 <sup>#</sup>	0.196 <sup>a</sup>	0.009 <sup>a</sup>

**Table 3:** Correlation of ultrasonographic findings with visual acuity and microbiological profile.

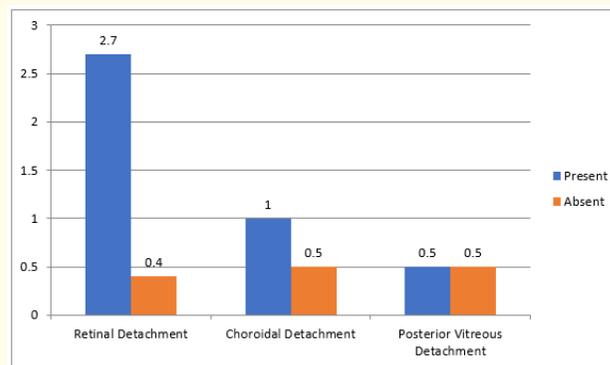
<sup>a</sup>: Kruskal Wallis test.

<sup>#</sup>: Spearman’s correlation test.

\*: Fischer exact test.



**Figure 1:** Comparison of Mean final visual acuity between the three groups of vitreous opacities and vitreous membranes.



**Figure 2:** Mean final visual acuity of RD, CD and PVD.

### Discussion

Endophthalmitis following cataract surgery, is a serious complication that may lead to visual loss. The visual outcome depends on virulence of organisms, disease severity and timing of intervention [8]. Clinical evaluation is often limited by media opacities, in which case B-scan can be helpful for studying the details of posterior segment [9]. In the Endophthalmitis Vitrectomy study, ultrasonography was used to detect retinal or choroidal detachment in cases with opaque media [10]. The ultrasound features of infectious endophthalmitis were first described by Oksala in three patients with vitreous abscess [11]. Ossoinig. described the occurrence of retino-choroidal thickening and vitreous membranes in severe endophthalmitis [12]. Chan., *et al.* reported the presence of anterior vitreous opacities and retinochoroidal thickening in all the studied 11 patients [13]. Thakker., *et al.* have reported the ultrasound abnormalities found in 54 patients with endophthalmitis which predominantly included severe vitreous debris, moderate and severe membranous debris and loculated pockets of vitreous debris. They noted choroidal thickening in 16.7%, CD in 14.8%, and RD in 7.4% of the eyes. More than one-fifth of the patients had retinal and choroidal detachments in that study [14]. In our study, 5.6%

of patients had RD and 1.9% patients had CD. This difference may be due to the fact that they included all types of endophthalmitis.

The correlation of ultrasound features with visual outcome and microbiology was studied in the past (Table 4). Dense vitreous opacities were associated with poor presenting vision in our study, which is in concordance with the study by Dacey., *et al* [4]. They also reported an association between dense vitreous membranes, retinal, choroidal detachment, and poor final vision. Similarly, Rachitskaya., *et al.* had described an association between dense vitreous membranes, RD, CD and poor final vision [5]. Our study found a statistically significant association between presence of retinal detachment and poor final vision. In a study by Patil., *et al.* *Staphylococcal epidermidis* was most common isolated organism, cultured in 8 (33.4%) out of 28 eyes. They found an association between dense vitreous opacities and virulent organisms like *Staphylococcus aureus* and *Pseudomonas* [15]. Coagulase negative *staphylococci* was the most common organism isolated in our study (18.5%). The presence of retinal detachment and retino-choroidal thickening had a significant association with virulent organisms in our study.

Study	Type of study and study period	Number of patients included	Association with poor final vision
Dacey., <i>et al.</i>	Retrospective, 1981-1992	136	Dense vitreous opacities (P=0.007) Vitreous membranes (P = 0.06) RD (P=0.003) Extent of RD (P = 0.004) CD (P = 0.002)
Aleksandra., <i>et al.</i>	Retrospective, 1996-2010	149	Dense vitreous opacities (P=0.005) Marked membranes (P = 0.0001) RD (P<0.0001) CD (P<0.0001)
Patil., <i>et al.</i>	Prospective, 1997-1999	28	Dense vitreous opacities (P=0.03)
Present Study	Prospective, 2013-2015	54	RD (0.004)

**Table 4:** Comparison of final outcome by ultrasonographic features in previous studies and present study.

### Limitation of the Study

The limitations in our study include smaller sample size and subjective grading of ultrasound features with varied gain settings. The inter observer variations may introduce potential errors in interpretation. Further trials might be needed to prove its utility

in acute endophthalmitis using standardized ultrasonographic features and constant gain settings.

### Conclusion

Ultrasonographic features at the initial presentation can be much useful in guiding the management of endophthalmitis, par-

ticularly in patients with reduced media clarity and severe endophthalmitis caused by virulent organisms. The presence of retinal detachment and retinobulbar thickening in ultrasound can alert the clinicians to proceed with aggressive treatment even before the arrival of culture results.

### Conflict of Interest

None declared.

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