Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v29i02.7142

# EVALUATION OF CONTRAST SENSITIVITY IN DETECTING SUBCLINICAL OPTIC NEUROPATHY FOLLOWING ETHAMBUTOL THERAPY

**Dr. Sarbori Saha[1*], Dr. Diki Ongmu Shenga[2]**

[1*]Associate Professor, Dept of Ophthalmology, Mata Gujri Memorial Medical College & Hospital, MGM University, Bihar
[2]Assistant Professor, Dept of Ophthalmology, Sikkim Manipal Institute of Medical Sciences, Gangtok, Sikkim

***Corresponding author:** Dr. Sarbori Saha
*Associate Professor, Dept of Ophthalmology, Mata Gujri Memorial Medical College & Hospital, MGM University, Bihar

## Abstract
Ethambutol, widely used in the treatment of tuberculosis, is associated with the risk of optic neuropathy, potentially leading to irreversible vision loss if not detected early. Subclinical optic toxic neuropathy, characterized by early changes in optic function without overt symptoms, can be challenging to diagnose using standard ophthalmic tests. Contrast sensitivity measurement has emerged as a sensitive tool for detecting these early changes. This study aims to evaluate the effectiveness of contrast sensitivity testing in identifying subclinical optic neuropathy in patients undergoing ethambutol therapy, providing critical insights into early intervention and management

## Introduction
The ethambutol hydrochloride is a bacteriostatic anti tubercular drug. It can cause optic neuropathy, potentially leading to vision loss. The incidence ranges from 0.62%[1]to 63%[2] in various studies. It depends upon the dose and duration of the therapy. The duration of the therapy may cause ocular toxicity which may vary from 1[3] month to 8[4] months. Ocular toxicity may be reversible within 3 months after the cessation of the therapy.
However earlier the side effect is detected the chance of recovery is better.

The parameters used for visual functions study include best collected visual acuity, pupillary reaction, fundoscooy for optics changes, colour vision, contrast sensitivity, visual field and visual evoked potential.
Simple visual acuity and colour vision testing are not very useful for early detection. The visual field analysis and visual evoked potential testing are not affordable for the general screening. The Pelli Robson's contrast sensitivity chart is commonly used to access the visual function in various ocular diseases involving the optic nerve. This suggested that the chart might be useful in the early detection of toxic optic neuropathy during Ethambutol therapy. Detecting subclinical optic toxicity early is crucial for preventing permanent damage.
Our purpose of study was to detect the ocular toxicity at an early stage during the Ethambutol therapy

with the help of contrast sensitivity testing by Pelli Robson'schart.

**Materials and method**

The prospective randomised study include 35 patience of newly diagnosed adult cases of Tuberculosis. They received Ethambutol ( 25 mg/kg of body weight) along with other antitubercular agent. The severe tubercular diseases were excluded from the study. The patience with previous ocular disorders that may affect the evaluation were also excluded .Before the initiation of the therapy the borderline best connected visual activity ,colour Vision fundii and contra sensitivity where examined. The cases where follow up monthly until 2 months after the completion of Ethambutol therapy. The patients were advised to attend immediately in case of visual impairment noticed by them.

Ethambutol therapy was stopped in case of any loss of visual function noticed. Those patients were examined every two weeks until 4 months after the cessation of the therapy .The BCVA was obtained at each visit and was converted to log MAR values for statistical analysis.

The colour vision was tested by using 38 colour plates of ishihara chart . The colour vision was graded as normal or abnormal .Up to 3 in correctly identify plates were included within the normal limit. The pupillary reaction and fundus changes were graded as normal or abnormal.

The Pelli Robertson's variable Contrast sensitivity chart consists of 16 groups of three letters distributed on 8 lines. All letters are of the same size. The contrast of each three letters decreases in logarithmic steps from the top to the bottom .The last group in which two of the triplets were read correctly at

1 m distance determine the scoring . Lighting was 85 cd/ $m^n$ .The dimension of the chart was standard 64 x 85 CM. The scoring of each letter was 0.5 units at

1 m distance. The normal value was taken as greater or equal to 1.65 log unit in each eye.

The visual field (VF) was examined for the patients who showed any visual abnormality during the follow up period. The visual films where tested with a Humphrey in 30-2 automated perimetry programmed. The deterioration of visual field was defined as a difference in mean deviation of-3 dB or less.

**Results**

Age of the patients range from 20-49 years, mean ( 32.2 +/- 8.03). There were 23 males and 15 females. 32 patients had pulmonary tuberculosis and 6 had extra permanently tuberculosis .

The best line BCVA was 6/6 to 6/9 in each eye in all the patients .The comparison of contrast sensitivity scores between the best line values and subsequent follow up visits showed reduction of contrast sensitivity during therapy in two patients.

**Patient 1**------- A 57 years old male diagnosed as pulmonary tuberculosis was started on antitubercular treatment including Ethambutol. The baseline contrast

8 log unit in each eye. The contrast sensitivity was reduced to 1.65 long unit in right eye and 1.4 log unit in left side on 4th visit, that is, after 2 months of ethambutol therapy. There was a generalized reduction in the visual field in both eyes on perimetry. The Ethambutol was stopped. Till the last follow up the contrast sensitivity and the visual field were not improved.

**Patient 2**----- A 39 years old male was suffering from pulmonary tuberculosis antitubercular regimen including a Ethambutol was started. His baseline contrast sensitivity was 1.75 log unit in right eye and 1.65 log unit in left side. It was reduced to 1.5 and 1.45 log unit in right time and left side respectively at 3 months follow up. All the other parameters were within normal limit. Immediately Ethambutol was stopped. The contrast sensitivity and visual field was not improved until the last follow up.

**Discussion**

Ethambutol is a butanol derivative drug. It is commonly used as an oral anti tubercular agent. The drug is well tolerated but the major side effect is a dose related ocular toxicity that is retrobulbar

neuritis. Leibold reported that at the dose of 35mg/ kg body weight/ day, the retrobulbar neuritis was found in 18% out of 58 pulmonary tuberculosis patients[4]. At the dose of 25 mg/ kg body weight / day the incidence lower to 2.25% to 6%. The mechanism is still unknown. It may be due to copper and zinc depletion from the retina[2] with the decreasing cytochrome oxidase activity .
Ethambutol ocular toxicity may be of two types Central and peripheral the papillomacular bundle is affected in Central variety like toxic amblyopia. It is characterized by reduced visual activity, central scotoma and red green colour vision defects. Fundus will be externally normal and pupil may be reacting. The visual acuity , contrast sensitivity fundus and pupillary reaction will be normal with associated peripheral visual defect.
The Ethambutol toxicity has been shown to be reversible in various studies. The maximum improvement in visual function occurs during 2 to 4 months after the cessation of the therapy. Permanent visual loss has been reported in which patient eventually develop optic atrophy. The recovery time depends upon the early recognition of signs and symptoms.

Two methods of reducing the risk of optic nerve damage.
1. A dose as low as 15 mg/kg body weight / day.
2. Careful assessment of visual function of patience on Ethambutol.

Saroux et al suggested a monthly check up with FM contrast sensitivity test[5].Leibold suggested of regular checking of BCVA and visual field[3]. The use of routine visual equity testing is not sufficient as the visual activity, colour vision, visual field may remain normal in the presence of subjective visual disturbance.

Pelli Robson's contrast sensitivity chart is also a simple method like testing of visual activity [6] . The colour vision defect (red green) has been reported in Ethambutol toxicity usually is reversible [7].
In our study colour vision defect was not seen in any patient. This is due to the fact that the Ischihara chart is not so sensitive[8]. None of the patient showed abnormal fundus picture like disc edema, hyperaemia and blurring of optic disc margin. The incidents of visual field defect is 0.32% to 11.8%..
In our study one patient should non specific generalized reduction in sensitivity on both eyes after 4 months of the initiation of the therapy.

**Conclusion**

The study confirms the utility of contrast sensitivity measurement in detecting subclinical optic neuropathy induced by ethambutol therapy. Contrast sensitivity testing proved to be a sensitive and effective tool for identifying early toxic changes in optic function that precede clinical symptoms. Regular monitoring of patients using this method can facilitate early intervention, potentially preventing irreversible vision loss. The findings advocate for the incorporation of contrast sensitivity tests in routine ophthalmic evaluations for patients on ethambutol therapy, ensuring timely detection and management of optic toxicity.

**References**

1. Narang RK, Varma BMD. Ocular toxicity of ethambutol (A clinical study). *Ind J Ophthalmol.*1979;1:37-40
2. Polak BCP, Leys M, vanLith GHM.Blue – yellow color vision changes as early symptos of ethambutol oculotoxicity. *Ophthamologica,Basel.1985;*191:223-226 3.Chatterji VKK, Buchanan DR, Friedman AJ,green M.Ocular toxicity following ethambutol in standard dosage.*Br j Dis Chest.*1986,80:288-291
4. Sivakumaran P, Harrison AC , Marschner J.Martin P.Ocular toxicity from ethambutol: A review of four cases and recommended precautions. *N Z Med J. 1998; 111(1077): 428-430*
5. *Saraux H, Bechetpille A,Nou B.* Optic Neuritis caused by ethambutol.Nouv Presse Med 1973;2:2692

6. Elliot DB, Sanderson K , Conkey A. The reliability of Pelli- Robson contrast sensitivity chart.*Ophthal Physiol Opt.* 1990;10:21-24
7. Salmon JF, Carmichael TR, Welsh NH. Use of contrast sensitivity measurement in the detection of sub clinical ethambutol toxic optic neuropathy.*Br. J Ophthalmol.1987;71:192-196*