

Intra-retinal Cotton Wool Spots and Their Relation to Epiretinal Membrane Contraction and Induced Retinal Distortion

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ABSTRACT

Background: Idiopathic Epiretinal membranes (ERM) may cause a wide variety of retinal abnormalities due to tangential traction on the retinal surface. These tractional changes may lead to retinal vascular leakage and oedema or rarely, a mechanical blockage of the axoplasmic flow resulting in a cotton wool spot (CWS).

Aim: To follow the pre-operative location and time course of disappearance of cotton wool spots after ERM peeling and to document changes in retinal distortion in the post-operative period.

Methods: This study examines four cases of epiretinal membranes associated with apparent cotton-wool spots involving the central fovea. The time course of onset and disappearance of the white spots in relation to contraction and removal of the epiretinal membrane were examined. The retinal distortion produced by membrane contraction was evaluated by using four reference points on the perimacular vascular branches in preoperative and postoperative photographs taken with the same camera and projected at the same magnification.

Results: The intra-retinal white spots, which appeared preoperatively to lie in the center of the fovea, proved to have been pulled in from more peripheral retina by the epiretinal membrane. These white areas were associated with surprisingly great distortion of the inner retina. Stretching of the inner retina seemed to play a larger role in the retinal distortion.

Conclusions: Tangential traction caused by ERM may cause interruption in axoplasmic flow and the resultant CWS indicate reversible visual loss.

Keywords: Cotton wool, epiretinal membrane, retinal distortion

INTRODUCTION

The tangential traction produced by epiretinal membranes is responsible for a wide range of retinal abnormalities. These include wrinkling of the internal limiting lamina or of the inner retina, full-thickness retinal folds, tethering or straightening of retinal vessels, foveal ectopia, and traction sensory retinal detachment. These tractional retinal changes may in turn lead to retinal vascular leakage and edema. CWS is accumulation of cytoplasmic debris in the retinal nerve fibre layer^{5,6}.

MATERIAL AND METHODS

Four consecutive patients with Epiretinal membranes associated with intra-retinal cotton wool spots were evaluated. Patients with Idiopathic Epiretinal membranes, Snellens visual acuity of 6/18 or worse, awareness of visual distortion and binocular interference, absence of co-existing ocular disease or systemic vascular disease were included in the study. All patients underwent vitrectomy and membrane peeling. The following assessments were made postoperatively.

1. The movement and time course of disappearance of CWS.
2. Changes in retinal distortion, estimated by measuring the distance between four reference retinal vascular branches.
3. Subjective changes in visual function based on the patient's symptom score for visual distortion.
4. Objective changes in visual function based on the Snellen's vision testing.

Time course of disappearance of CWS was documented by serial fundal photographs taken at Post-operative day 1, 7, 14, 30 and 180. The retinal distortion produced by membrane contraction was evaluated by using reference points on the perimacular vascular branches in preoperative and postoperative photographs taken with the same camera and projected at the same magnification. Distortion was calculated by superimposing Pre and Post-operative photographs and measuring the distance between the perimacular vascular reference point assigned to each patient. Patients were asked to score their visual distortion and visual symptom on Amsler chart on a scale of 0-5. (Table 2). Objective improvement in visual acuity was recorded on Snellen's acuity testing on each visit of the patient.

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RESULTS

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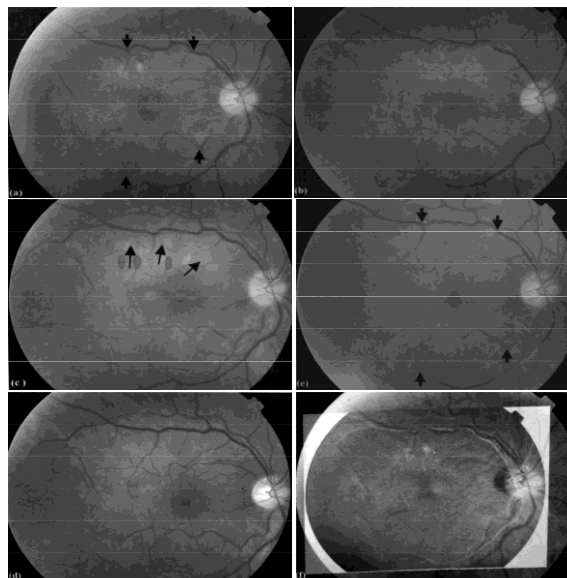


Fig. 1: (Patient 1) (a) fundus photograph of the right eye showing Epiretinal membrane and centrally located CWS. (b) fundus photograph, on first post-operative day (c)Centrifugal course of the CWS on day 7(d)2 weeks post-op(e) 6 months post-op (f)Superimposed pre and post-op photographs to demonstrate retinal distortion

Table 1: Demonstrating measurements of retinal distortion (microns) in all four patients.

Pt. No.	Pre-op measurement	6 months Postop measurement	Measured Distortion
1	3300 microns	5500microns	2200 microns
2	4500 microns	5400 microns	900 microns
3	4100 microns	5800 microns	1700 microns
4	3900 microns	5300 microns	1400 microns

Table 2: Symptom score based on distortion on Amsler grid chart testing.

No distortion	0
Distortion barely detectable	1
One quadrant involved	2
Two quadrants involved	3
Three quadrants involved	4
Four quadrant involved	5

Table 3: Pre and post-operative vision and symptom score

	Pt.1	Pt. 2	Pt.3	Pt.4
Preop VA	6/36	6/60	6/18	6/36
Preop symptom score	5/5	4/5	4/5	3/5
Postop VA (6 months)	6/6	6/18	6/12	6/12
Postop symptom score (6 months)	1/5	2/5	2/5	2/5

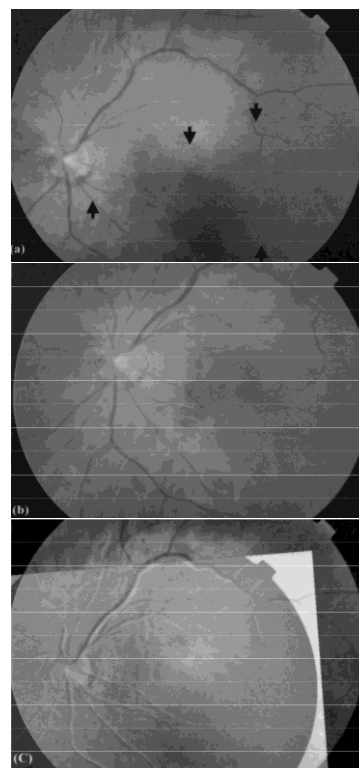


Fig.2: (Patient 2). Fundus photograph of the left eye showing (a) Preoperative photograph demonstrating epimacular membrane with cotton wool spots (b) six months post-op(c) Superimposed pre and post operative photographs demonstrating retinal distortion.

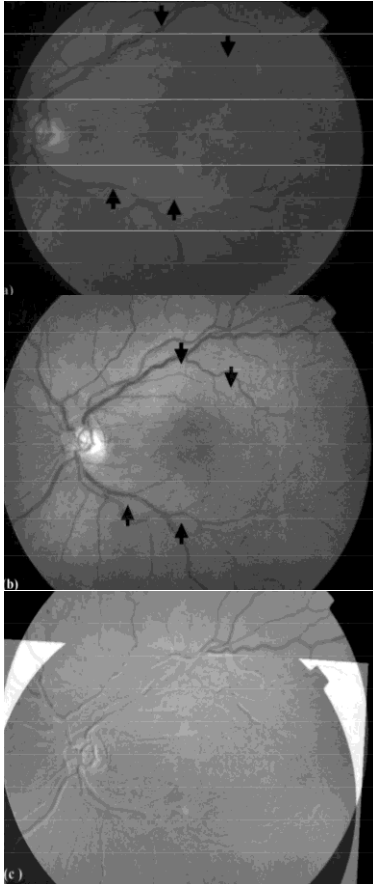


Fig. 3: (Patient 3). Fundus photograph of the left fundus showing. (a)Preoperative (b) 6 months post-operative photograph(c)Superimposed Pre and Post-operative photographs to demonstrate retinal distortion.

DISCUSSION

Very few articles in literature on the surgical treatment of macular pucker have noted the presence of intraretinal white spots, presumably cotton-wool spots, associated with epiretinal membranes^{1,2,3}. The more common association of ERM is with wrinkling of internal limiting membrane, straightening of retinal vessels, full thickness retinal folds, foveal ectopia and tractional retinal detachment. Cotton-wool spots usually are associated with vascular occlusive diseases such as diabetes⁷, retinal vasculitis of various etiologies⁸, hypertension⁹, retinal vein occlusions^{10,11}, giant cell arteritis¹² etc.

The time course of resolution of cotton-wool spots in vascular diseases, however, is not so rapid as that seen in our patients.⁶ In acute vascular occlusions, such as occur in hypertension, cotton-wool spots usually persist 4 to 6 weeks, whereas in chronic vasa-occlusive disease, such as diabetes, they may persist over 6 months⁶. In all of our patients, the cotton-wool spots disappeared within 14

days of membrane removal. This seemed too rapid for ischemic infarcts that might have been caused by vascular damage due to the membrane contraction. In addition, none of the patients had evidence of any systemic or ocular vascular disease.

Maximum changes in retinal distortion also occurred in the same time period. Our observations suggest that CWS in ERM's may be caused by retinal distortion as suggested by Mischel⁴. The marked visual improvement in all our cases indicates that CWS are good prognostic signs. The above findings all seem consistent with the concept that these apparent cotton-wool spots are produced when marked distortion of the nerve fiber layer obstructs axonal flow, the concept proposed by Michels.² The retinal distortion demonstrated in the current study supports the concept that epiretinal membrane contraction might cause sufficient tangential traction on the nerve fiber layer to interrupt axoplasmic flow as postulated by Jorge et al⁴. We believe that these membranes cause contraction acutely give rise to early symptoms and surgery therefore leads to good results.

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