Macular Diseases

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The macula (anatomically fovea), situated 3 mm lateral to the optic disc, is the most sensitive part of visual acuity. The foveola is a central 0.35 mm wide zone in the macula. The inner retinal layers in the margins of the pit are displaced laterally. Figure 3.1 displays the anatomical schematic diagram of the macula.

The macular diseases mainly involve congenital anomaly (congenital macular coloboma), central serous chorioretinopathy, vitreomacular traction syndrome, vitreous hemorrhage beneath the inner limiting membrane, macular edema, macular hole, macular atrophy and proliferative diseases of the macula, such as retinal angiomatous proliferation (RAP), choroidal neovascularization (CNV), and polypoidal choroidal vasculopathy (PCV).

Stereoscopic photography plays an important role in macular diseases [1–3]. In the past, stereoscopic slide film photography of the retina is the standard with which other imaging modalities have been compared when identifying age-related macular degeneration (AMD). The Age-Related Eye Disease Study, a multicenter prospective cohort study of 4757 participants designed to access the clinical course, prognosis, and risk factor for age-related macular degeneration and cataract, uses stereoscopic color fundus photographs in a standardized fashion by certified photographers [4, 5]. In ETDRS, besides the grading diabetic retinopathy severity by stereoscopic retinal photography, the clinically significant macular edema (CSME), which is one of the key factors affecting the visual acuity, is also diagnosed correctly by stereoscopic digital fundus photography. The kappa (κ) values among contact lens biomicroscopy (CLBM), slit-lamp biomicroscopy with 90D/78D or by stereoscopic pairs are more than 0.6. So, in most cases, the stereoscopic photography can be used as a diagnosis tool, especially for screening and telemedicine [4–6].

Abnormalities in macular diseases are various [3, 7, 8]. Drusen are yellow-white deposits within Bruch's membrane underlying the RPE and vary greatly in appearance, ranging from small round, flat spots in size and shape to large deposits even confluent with adjacent drusen. Geographic atrophy may show a sharply demarcated, usually circular zone of partial or complete depigmentation of RPE and exposure of underlying large choroidal blood vessels. The three kinds of choroidal neovascularization (type I, II, and III), which are correspondent with occult CNV, classic CNV, and retinal angiomatous proliferation (RAP), are more vividly and comprehensively shown on stereoscopic pairs than monoscopic and even OCT scans. The retina will be dome-shaped with intra-retinal exudates and cyst, accompanying by intra-retinal, sub-retinal and sub-RPE hemorrhages, sub-retinal and sub-RPE neovascularies, etc. The anastomosis between retina and choroid will be shown clearly on stereoscopic FFA pairs [7]. Macular holes are well-defined defects in the middle of the macula in various sizes. Sometimes, there is a thin membrane above the posterior retina called epi-retinal membrane (ERM).

Generally speaking, with the combination of stereoscopic photography and other high-tech tools such as OCT, more and more macular signs and characteristics will be explored.

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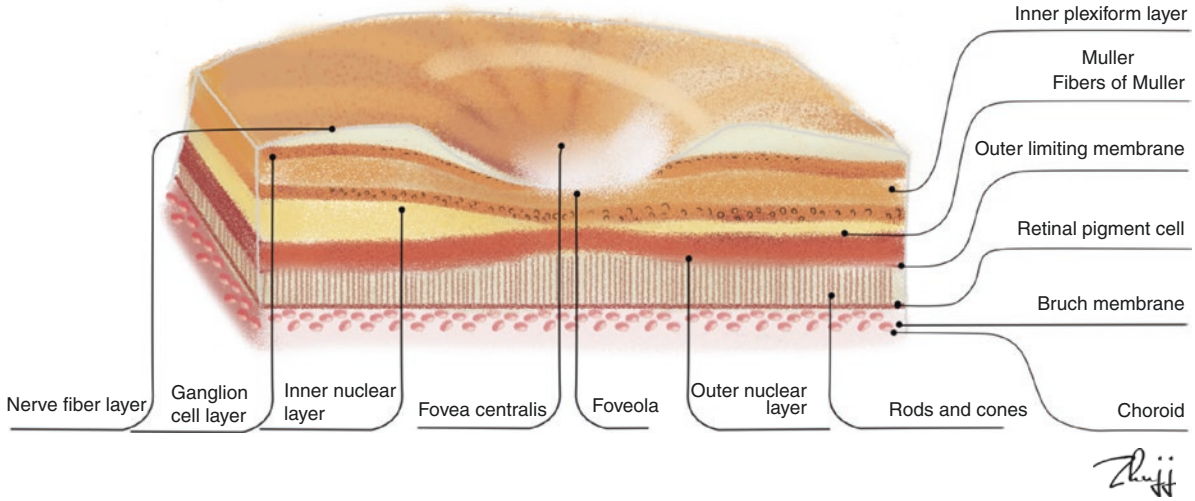

Fig. 3.1 Anatomical schematic diagram of the macula

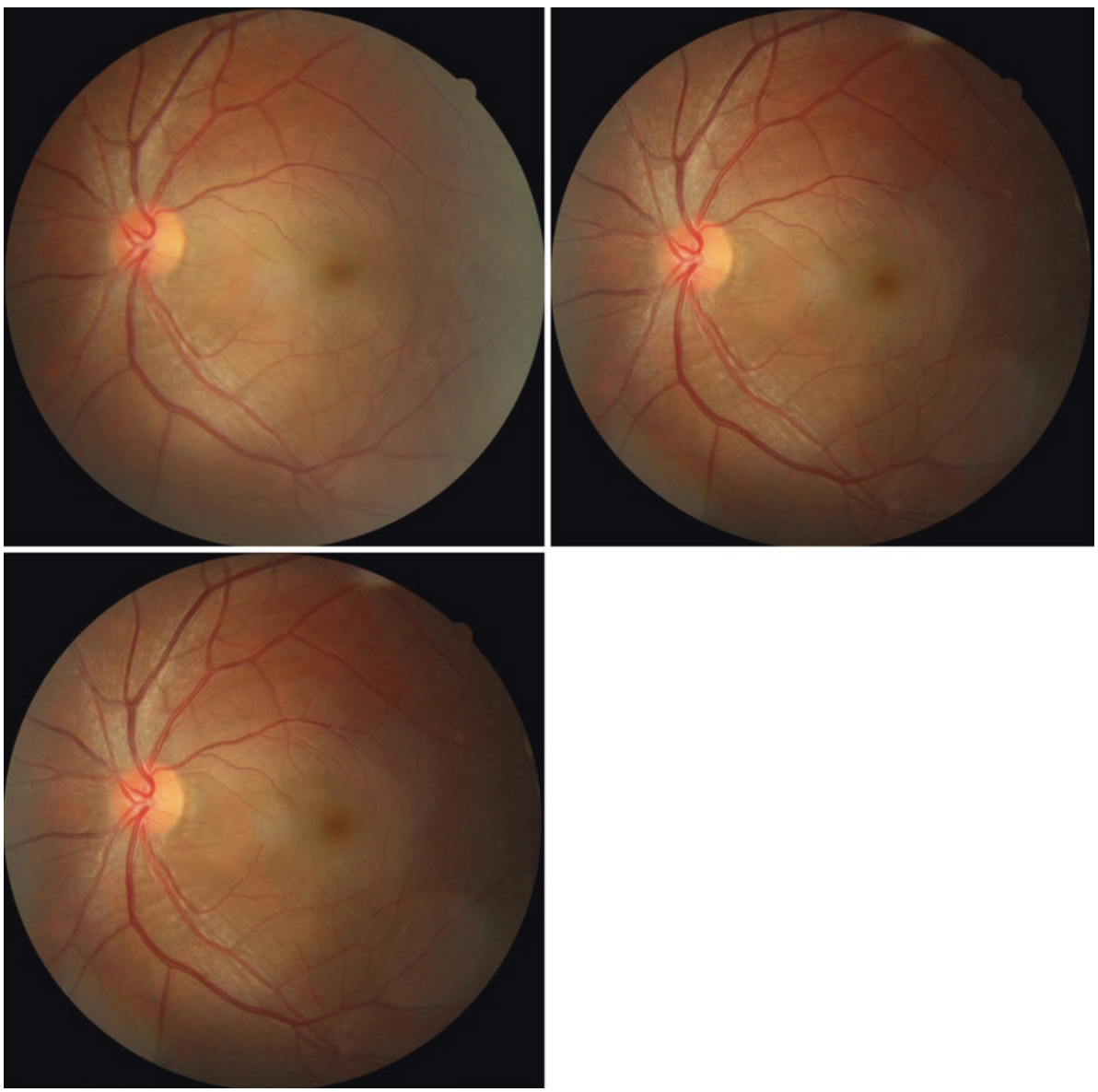

Fig. 3.2 Central serous chorioretinopathy
I. The central reflex was disappeared
II. The apex of sensory retinal detachment
III. Fold of ILM

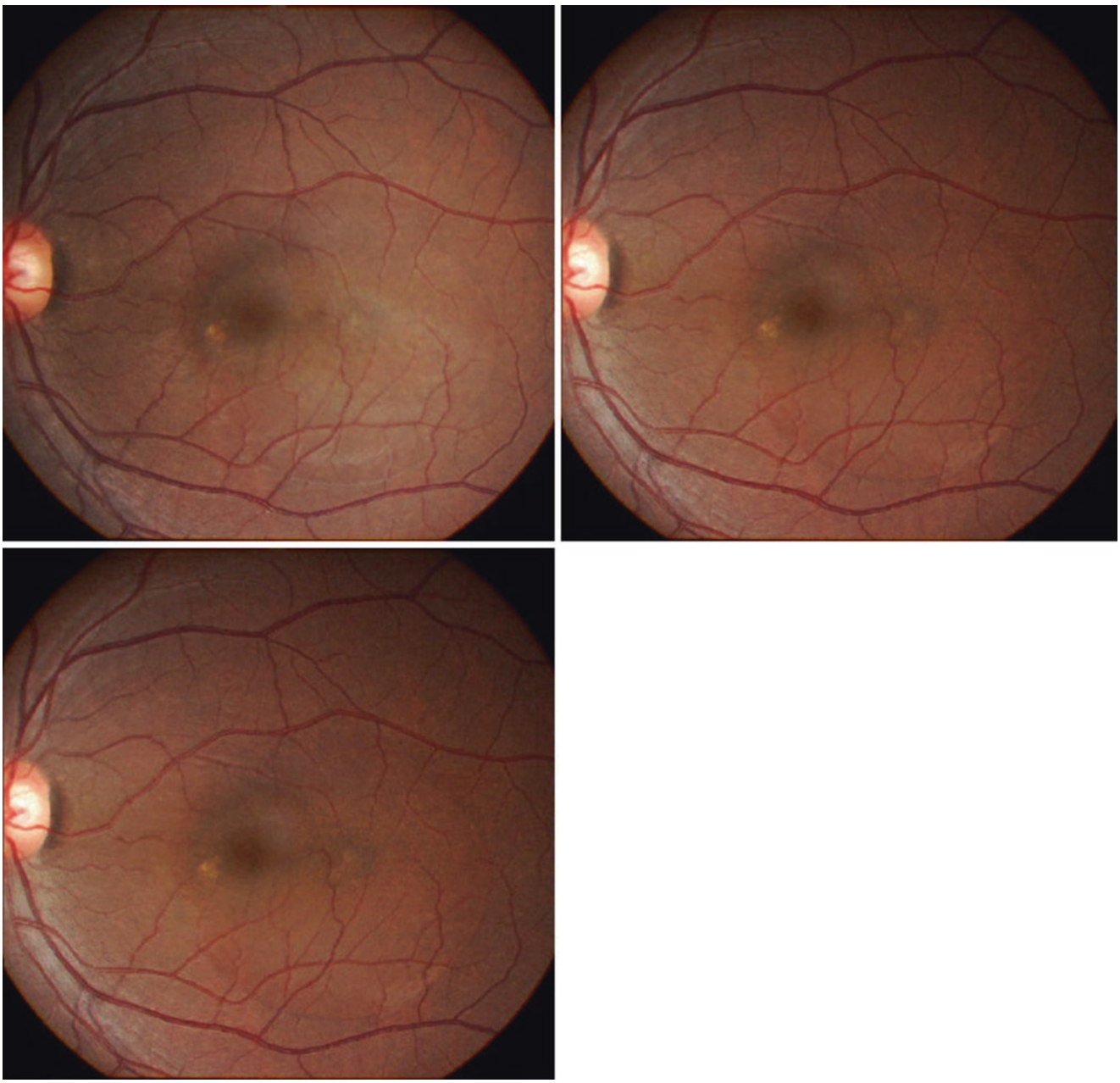

Fig. 3.3 Central serous chorioretinopathy
I. Leakage from venules inferior-nasal to the macula
II. The area of sensory retinal detachment

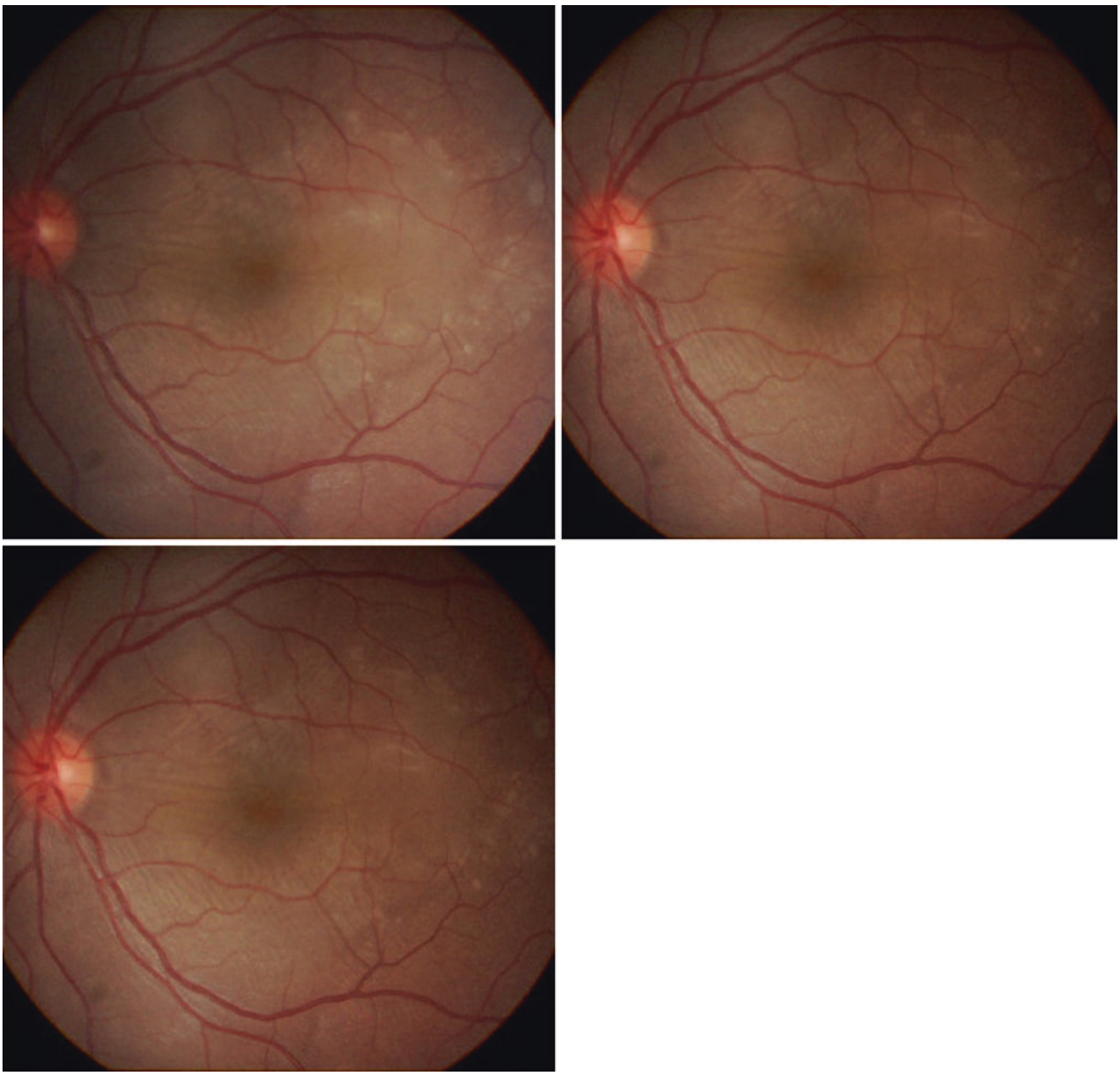

Fig. 3.4 Sensory retinal detachment
I. Apex of detachment
II. Fold of epiretinal tissue (ILM)
III. Intermediate retinal exudates
IV. Vessels located in the depressed area, which was lower than the area I

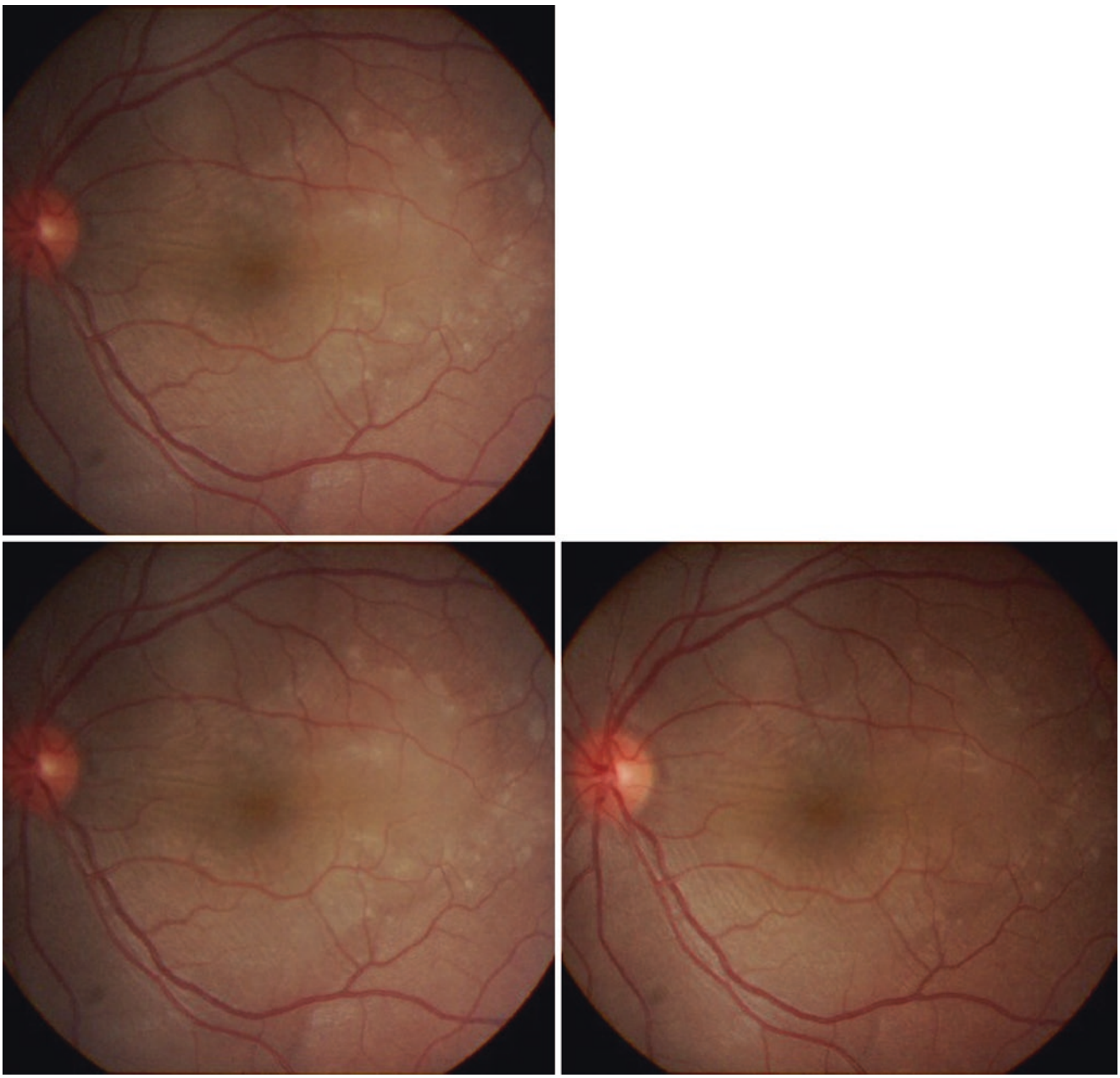

Fig. 3.5 Central serous chorioretinopathy
I. Retinal detachment in the posterior pole
II. One of the apexes of detachment
III. Bottom of detachment
IV. The other one of apexes of detachment
V. Retinal fold

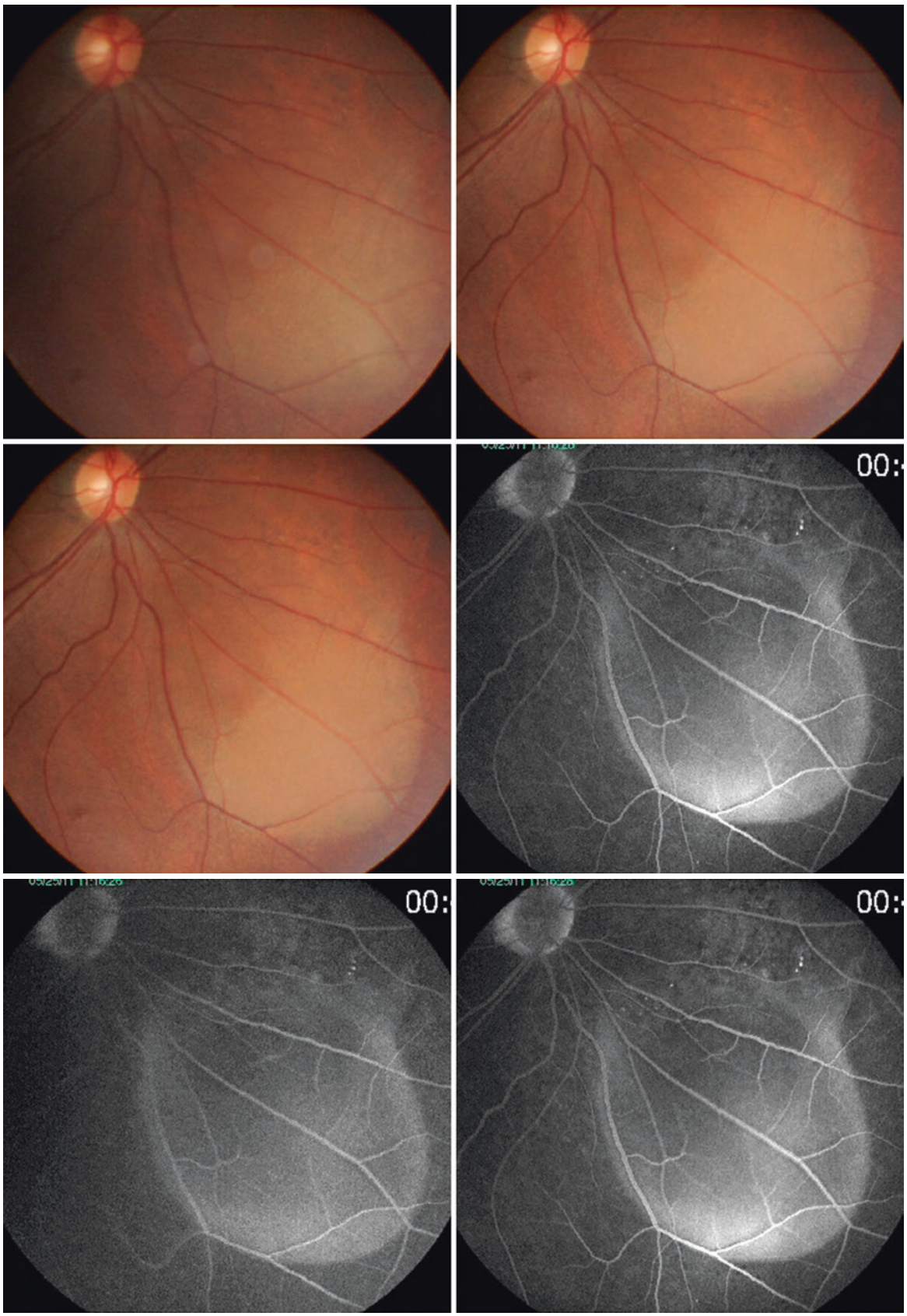

Fig. 3.6 Pouch-shaped retinal pigment epithelium detachment
I. The area of RPE detachment, which was larger in the color photograph than in the fluorescein angiography
II. Apex of detachment
III. Sub-RPE fluid
IV. Blocked fluorescence by hemorrhage and intermediate hyperfluorescence

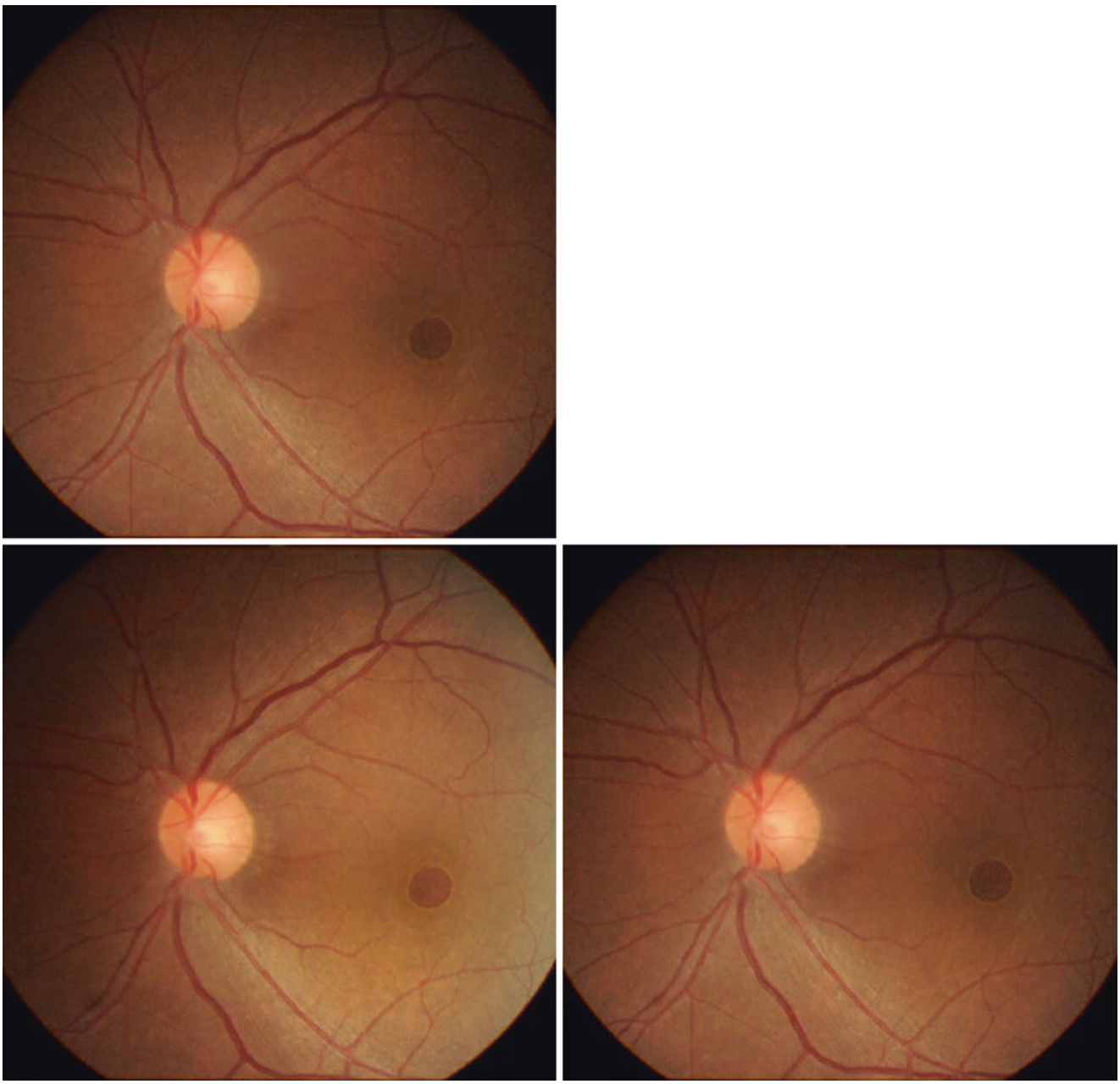

Fig. 3.7 Idiopathic macular hole
I. Full thickness macular hole
II. Shallow retinal detachment in the adjacent area

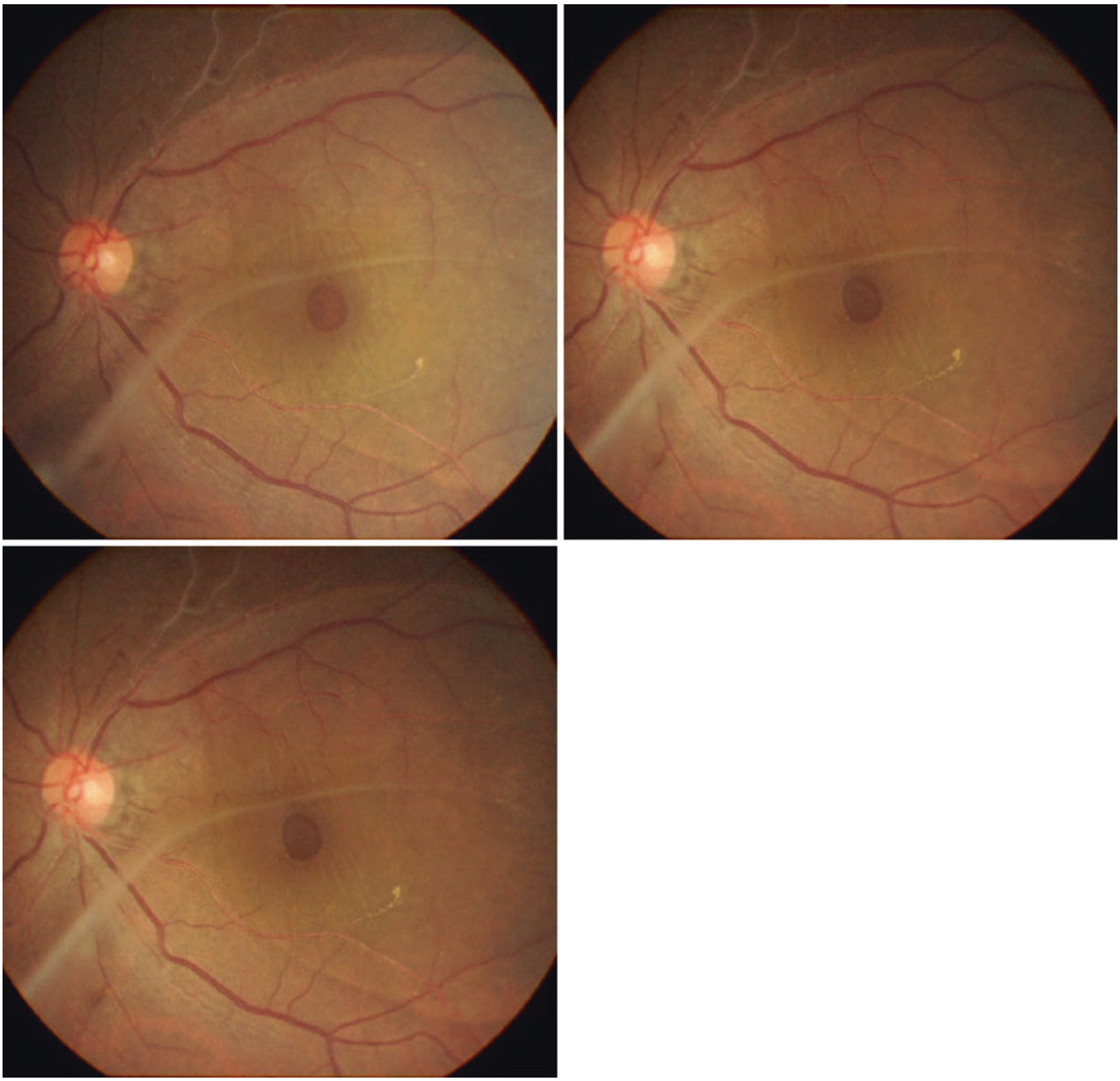

Fig. 3.8 Secondary macular hole
I. Full thickness macular hole
II. Proliferative membrane in the vitreous
III. Retinal detachment
IV. Ghost vessels
V. Segmented sheath in the retinal arteries
VI. Artery-Vein crossing of the superficial retinal artery and deep retinal vein
VII. ILM fold

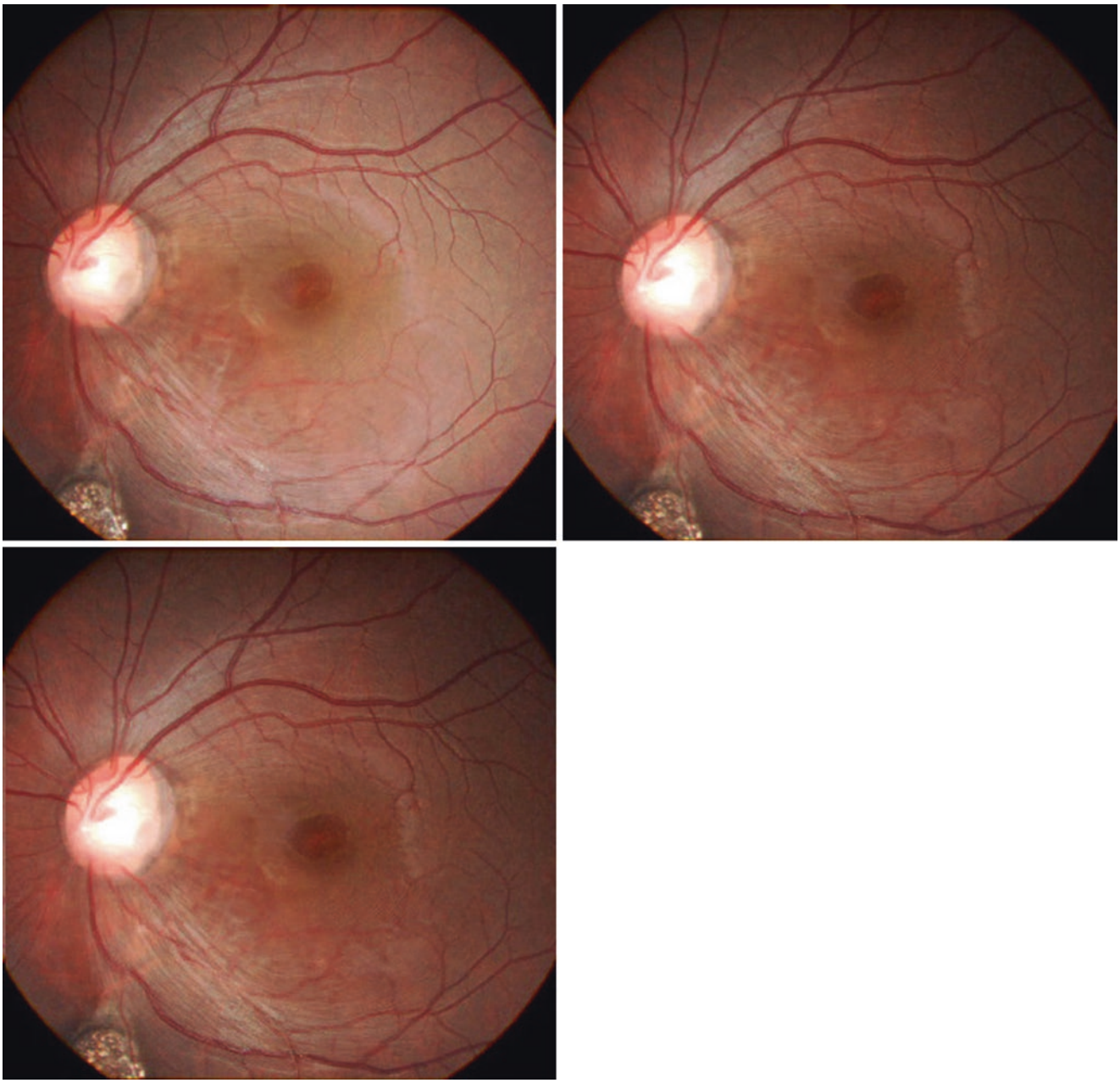

Fig. 3.9 Macular hole secondary to optic disc pit
I. Full thickness macular hole
II. Shallow retinal detachment in the adjacent area
III. Fold of posterior hyaloids and ILM, the retinal vessels were obscure
IV. Choroidal coloboma
V. Optic disc pit

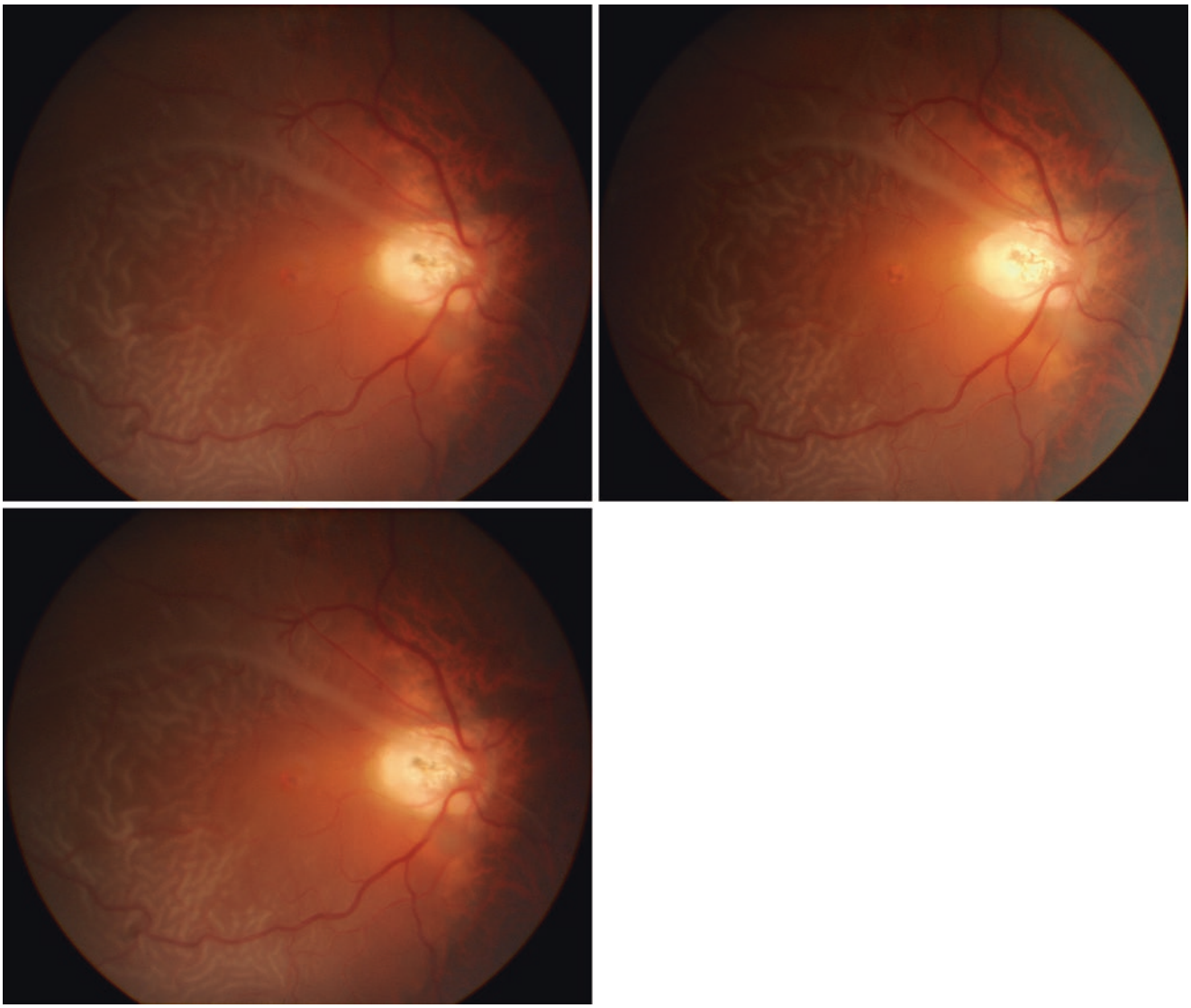

Fig. 3.10 Retinal detachment secondary to macular hole
I. Full thickness macular hole, approximately 1/4 PD in diameter
II. Retinal detachment and fold
III. Proliferation under the retina like a streak
IV. Peripapillary atrophy

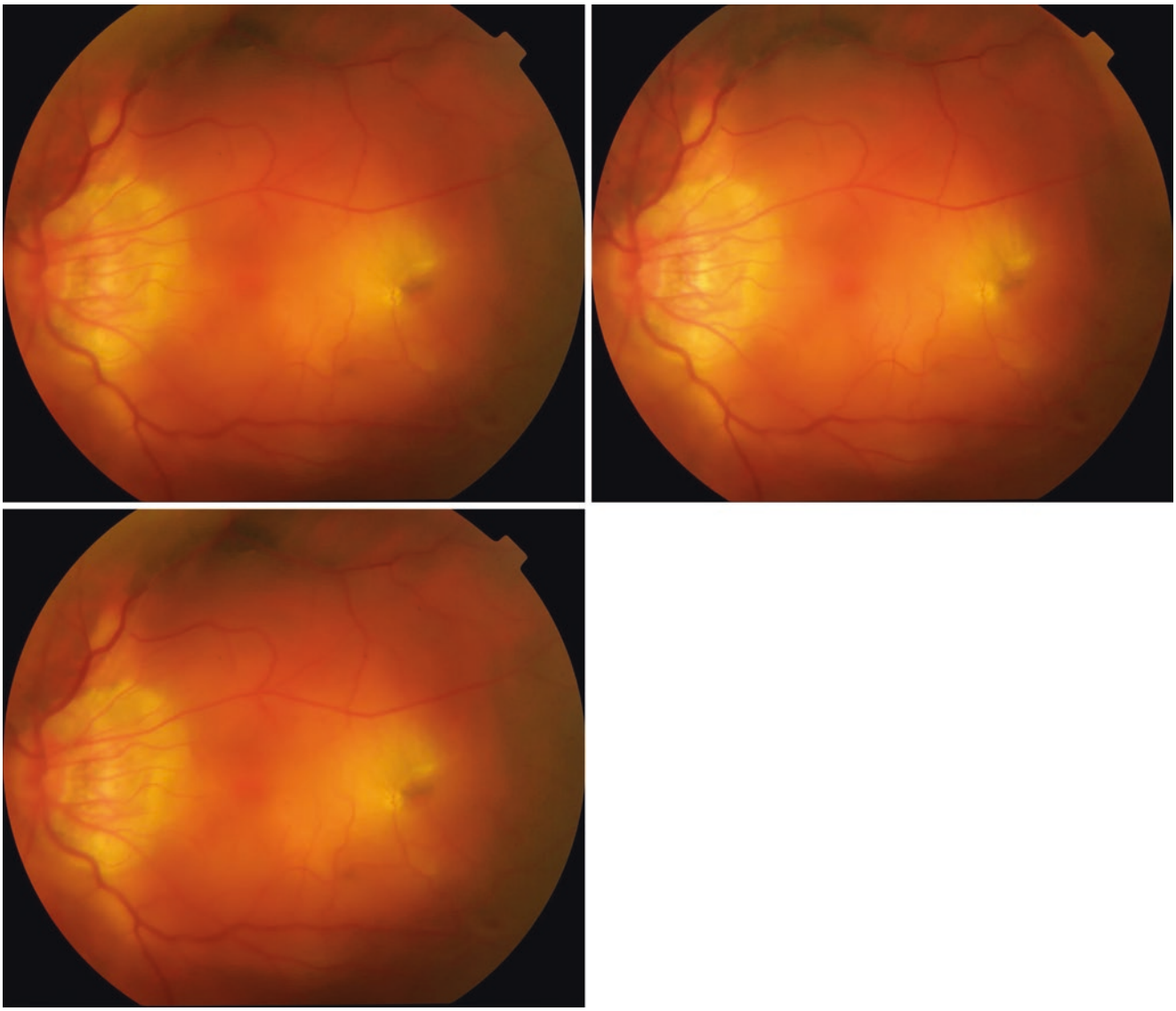

Fig. 3.11 Retinal detachment secondary to juxta foveal hole
I. Suspected para-macular hole, approximately 1/4 PD in diameter, which was confirmed by OCT
II. Detached macula
III. Vitreous band
IV. Peripapillary atrophy

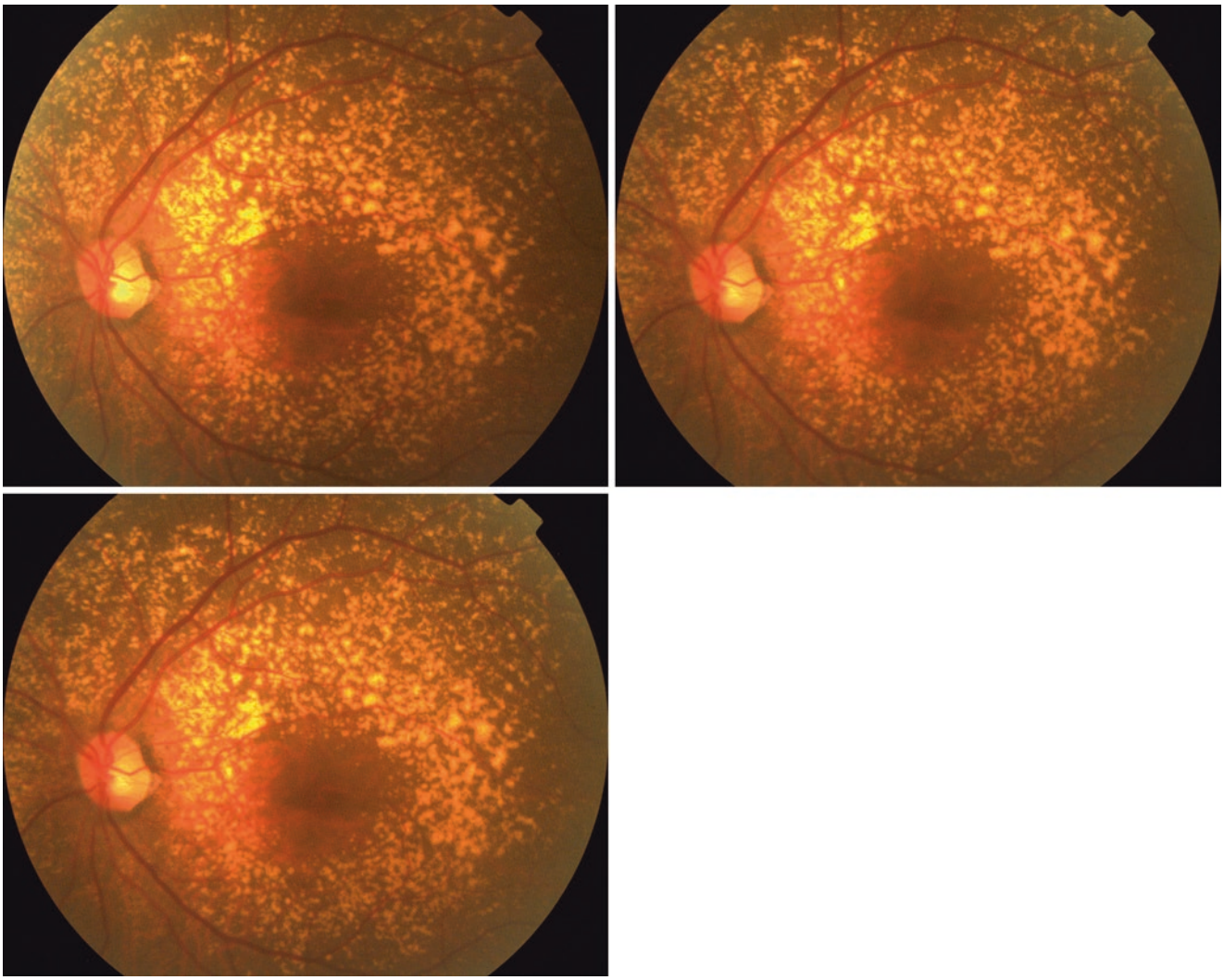

Fig. 3.12 Dry age-related macular degeneration
I. Diffused hard drusen
II. Confused soft drusen
III. Macula uninvolved

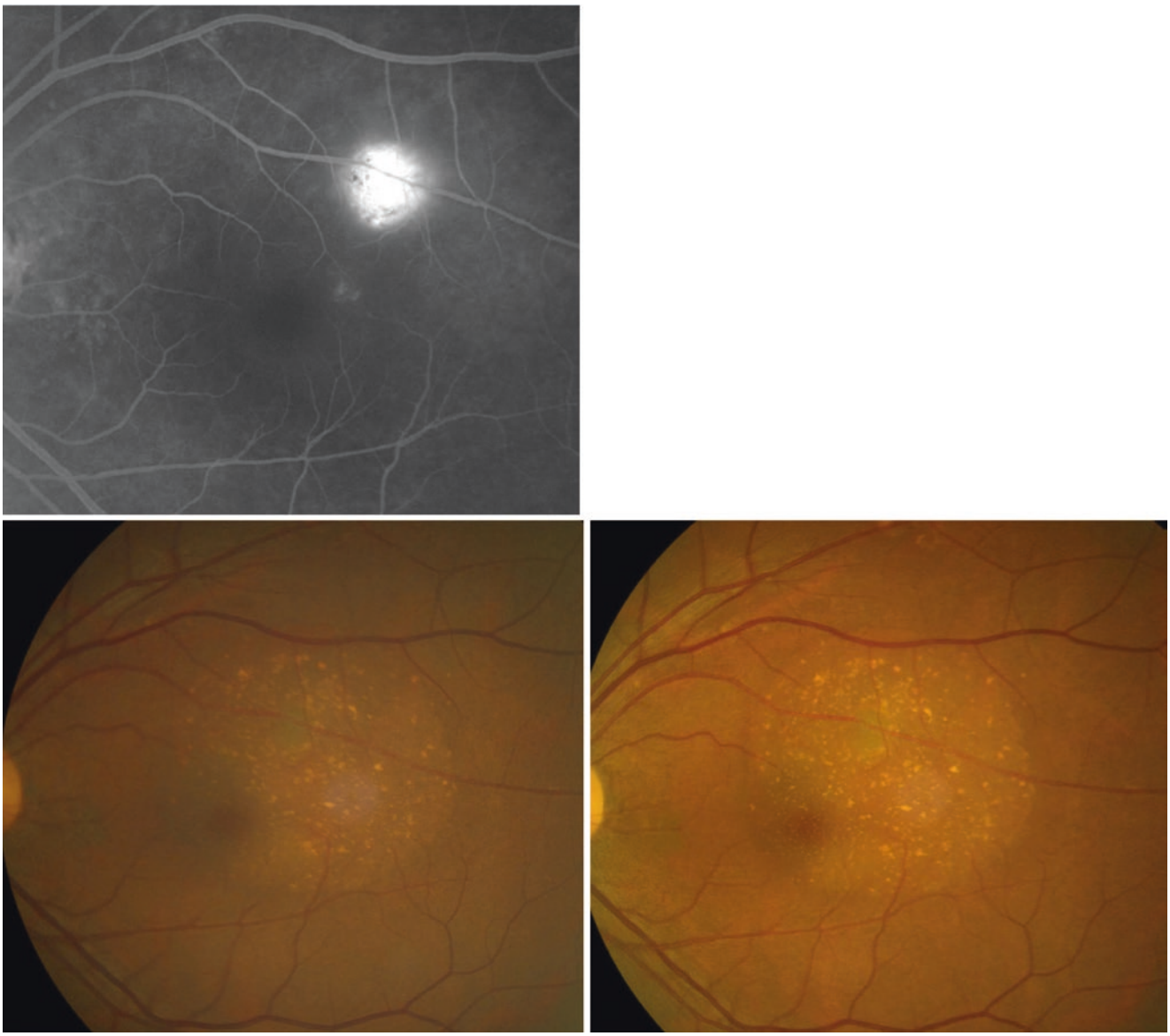

Fig. 3.13 Juxtafoveal choroidal neovascularization
I. Juxtafoveal choroidal neovascularization
II. RPE detachment and exudates
III. The area of sensory retinal detachment
IV. Macular edema

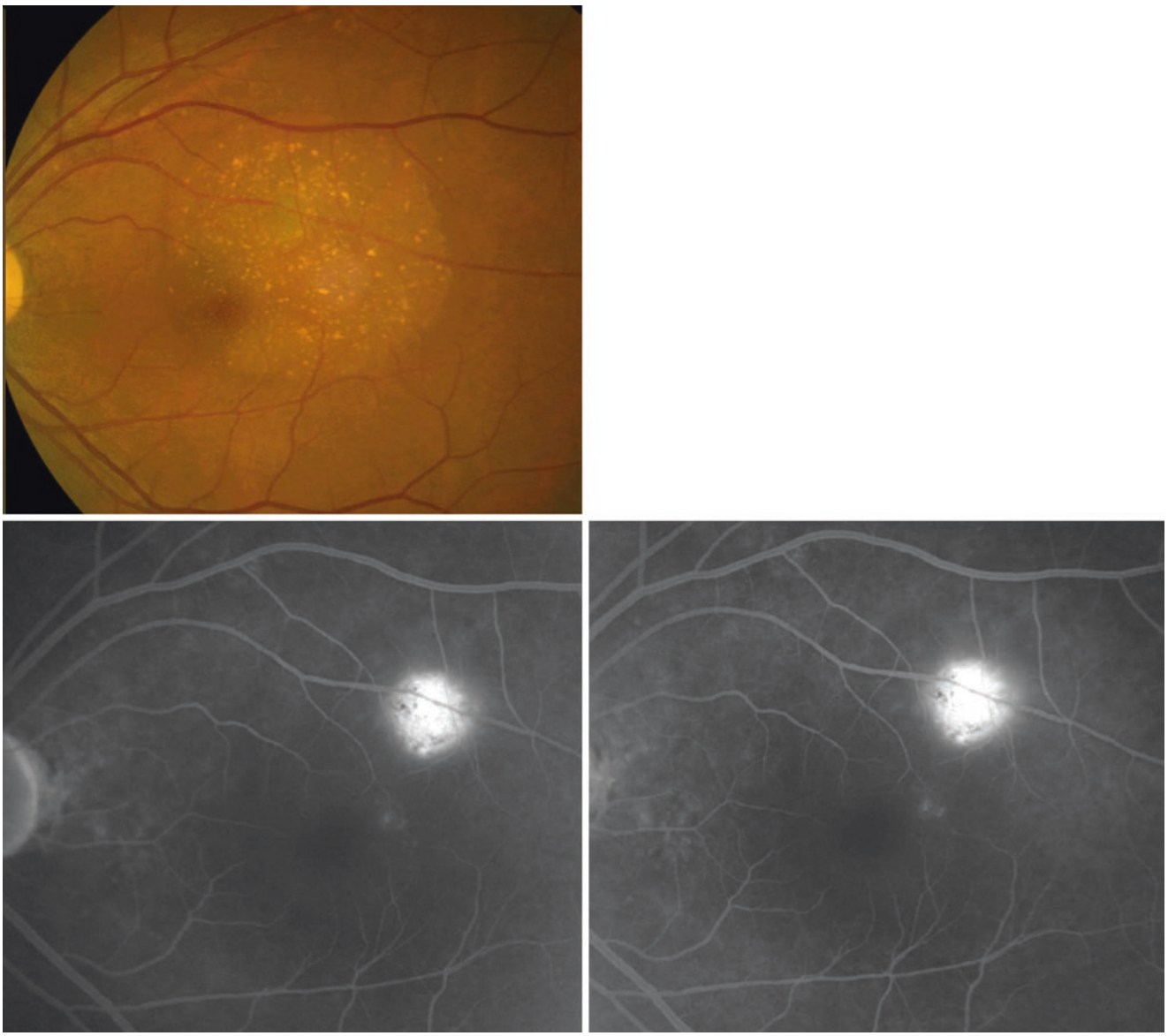

Fig. 3.13 (continued)

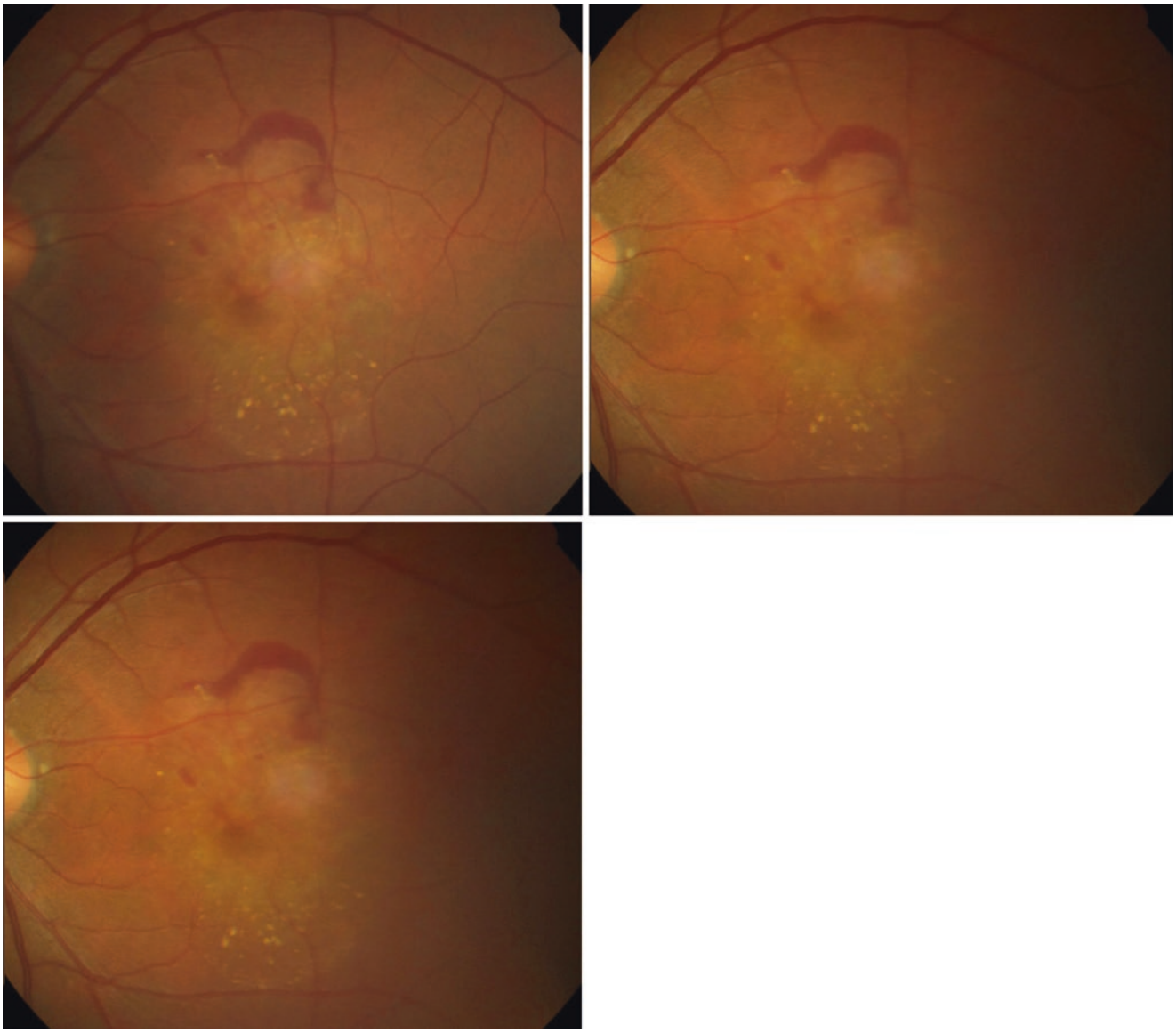

Fig. 3.14 Choroidal neovascularization
I. Subfoveal CNV
II. Superficial retinal exudates
III. Exudates in the inner retina
IV. Deep retinal hemorrhage
V. Suspected area of CNV

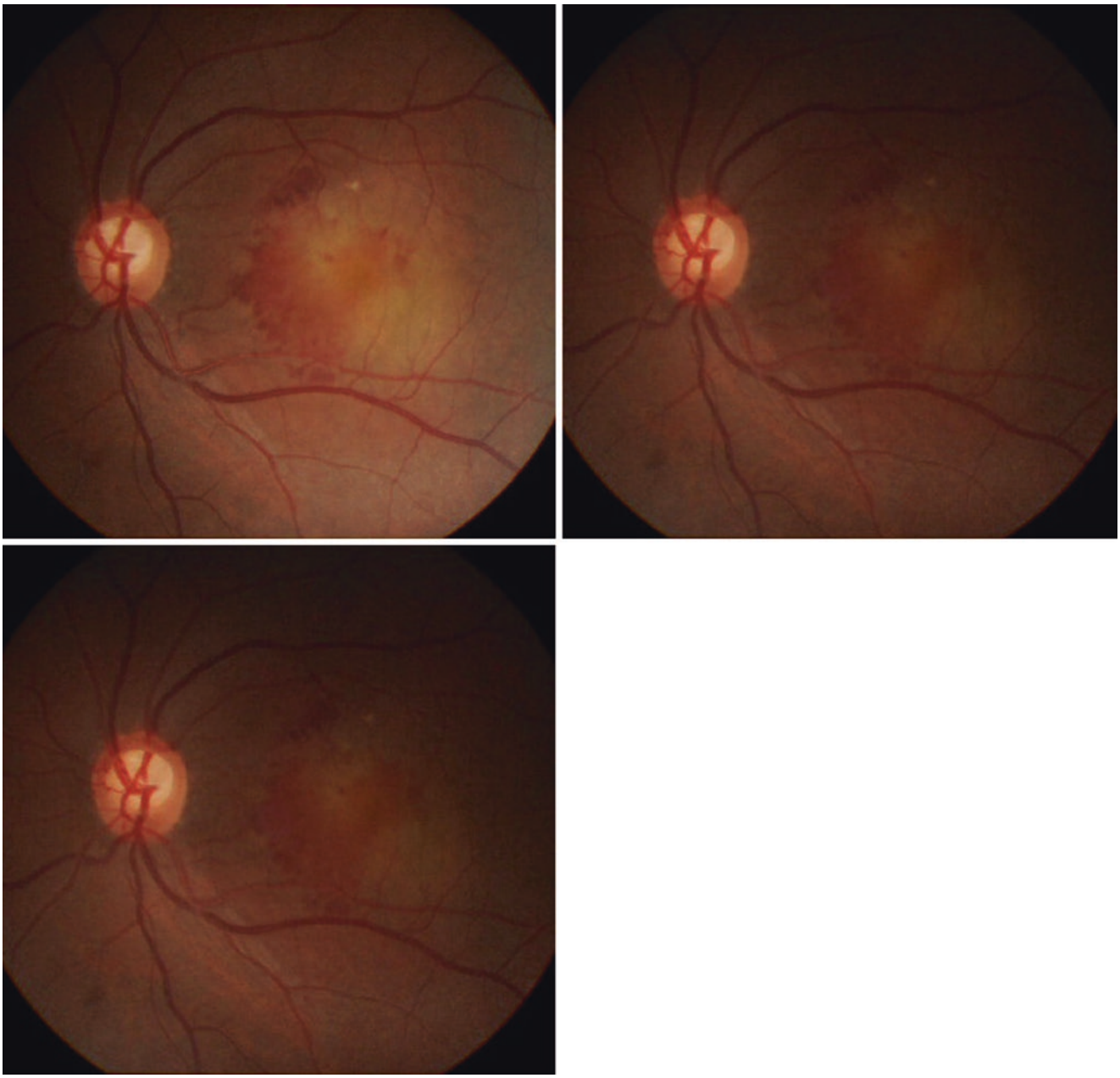

Fig. 3.15 Choroidal neovascularization
I. Subfoveal choroidal neovascularization
II. Intra-retinal hemorrhage around the lesion

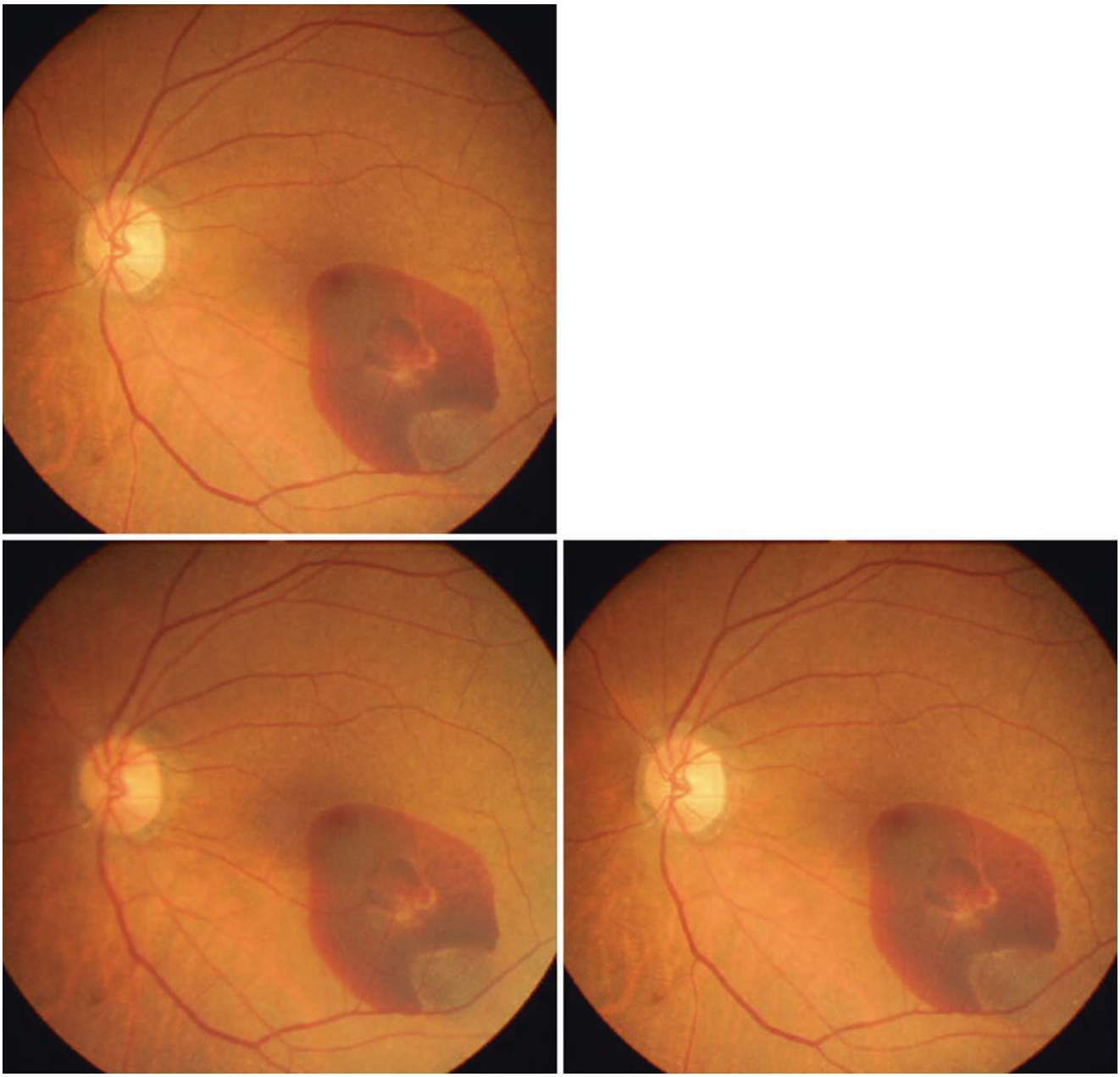

Fig. 3.16 Juxtafoveal CNV
I. Suspected area of CNV
II. Sensory retinal detachment
III. Sub-RPE hemorrhage
IV. Sub-retinal hemorrhage

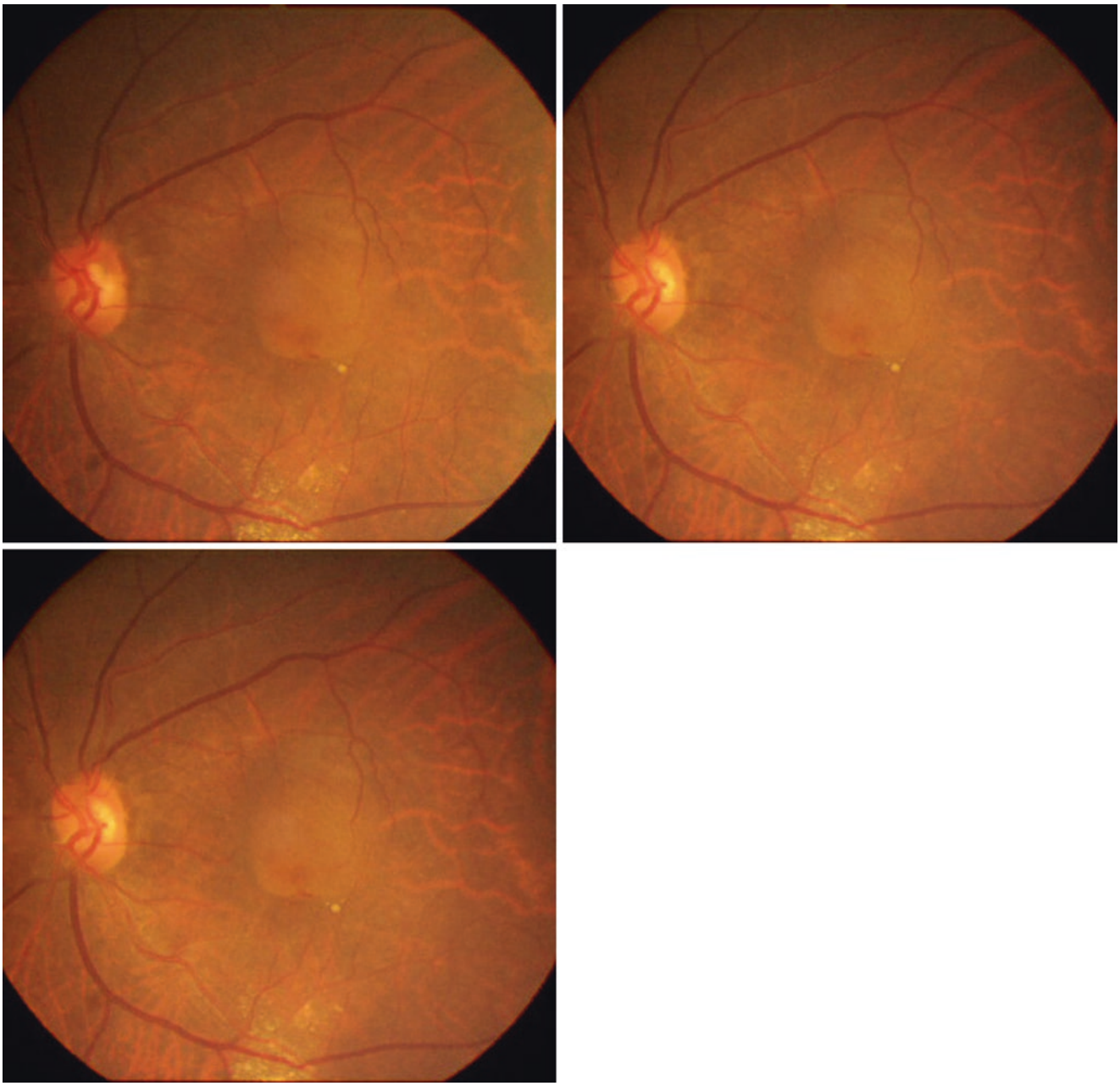

Fig. 3.17 Sub-macular choroidal neovascularization
I. Sub-macular choroidal neovascularization
II. Small thread-like hemorrhage
III. Dotted exudates
IV. Localized narrowing of retinal vessels and drusen

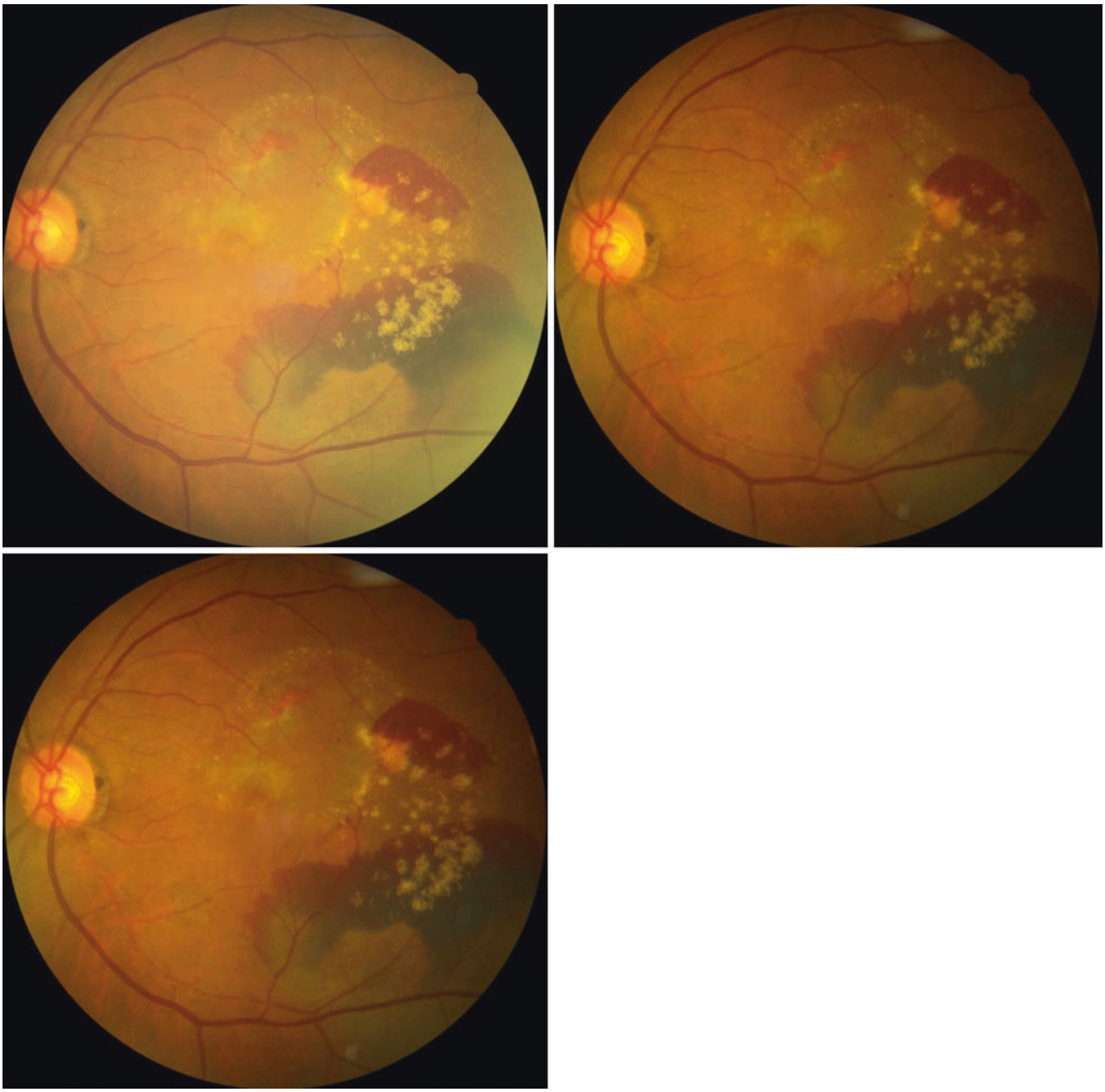

Fig. 3.18 Polypoidal choroidal vasculopathy
I. Multiple suspected polypoidal lesions
II. Deep retinal hemorrhage
III. Superficial retinal exudates
IV. Sub-retinal hemorrhage
V. Sub-RPE hemorrhage

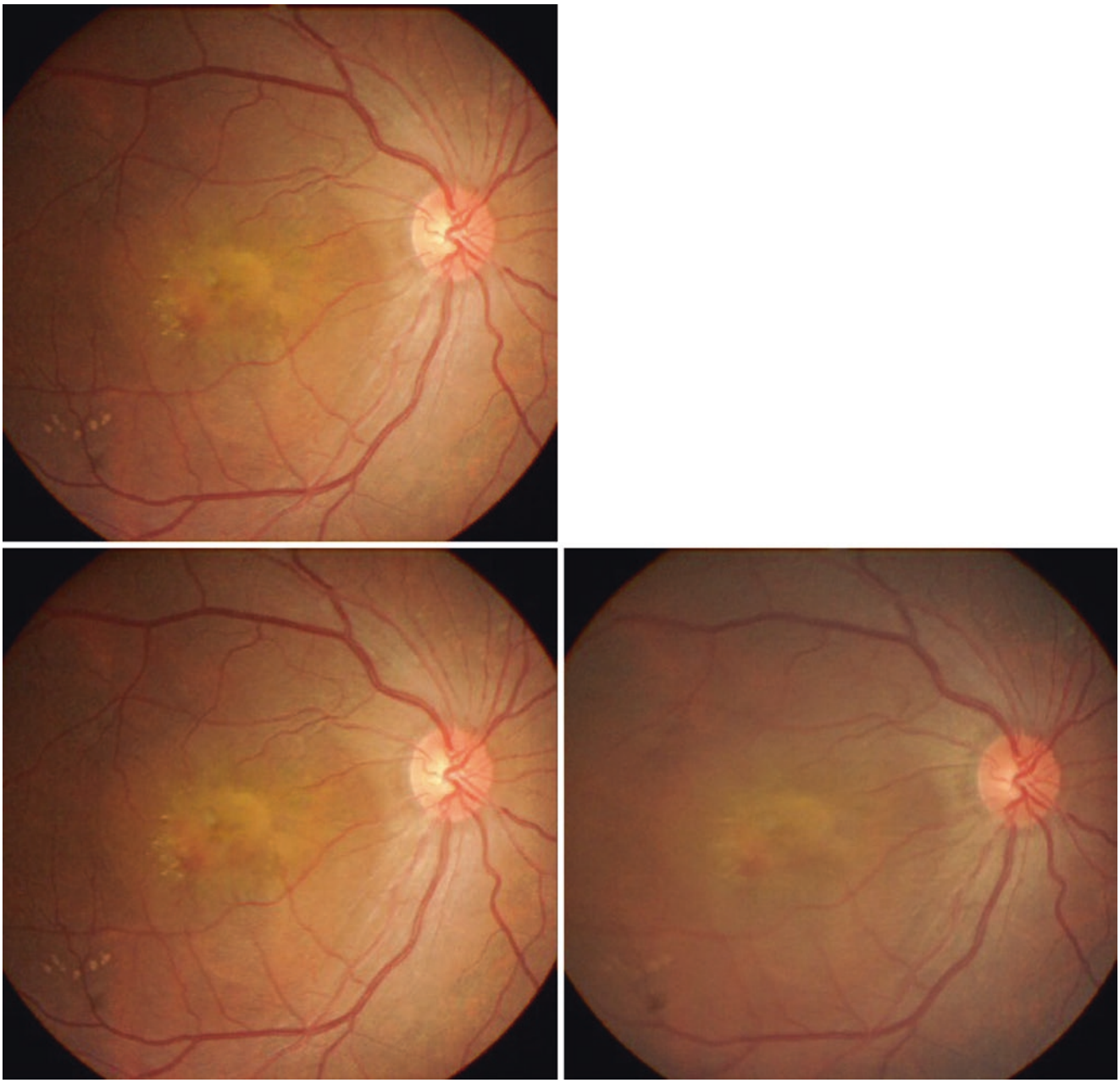

Fig. 3.19 Retinal angiomatous proliferation (RAP)
I. Intra-retinal neovascularization
II. Sub-retinal choroidal neovascularization
III. Deep retinal exudates
IV. White-dotted sub-retinal exudates

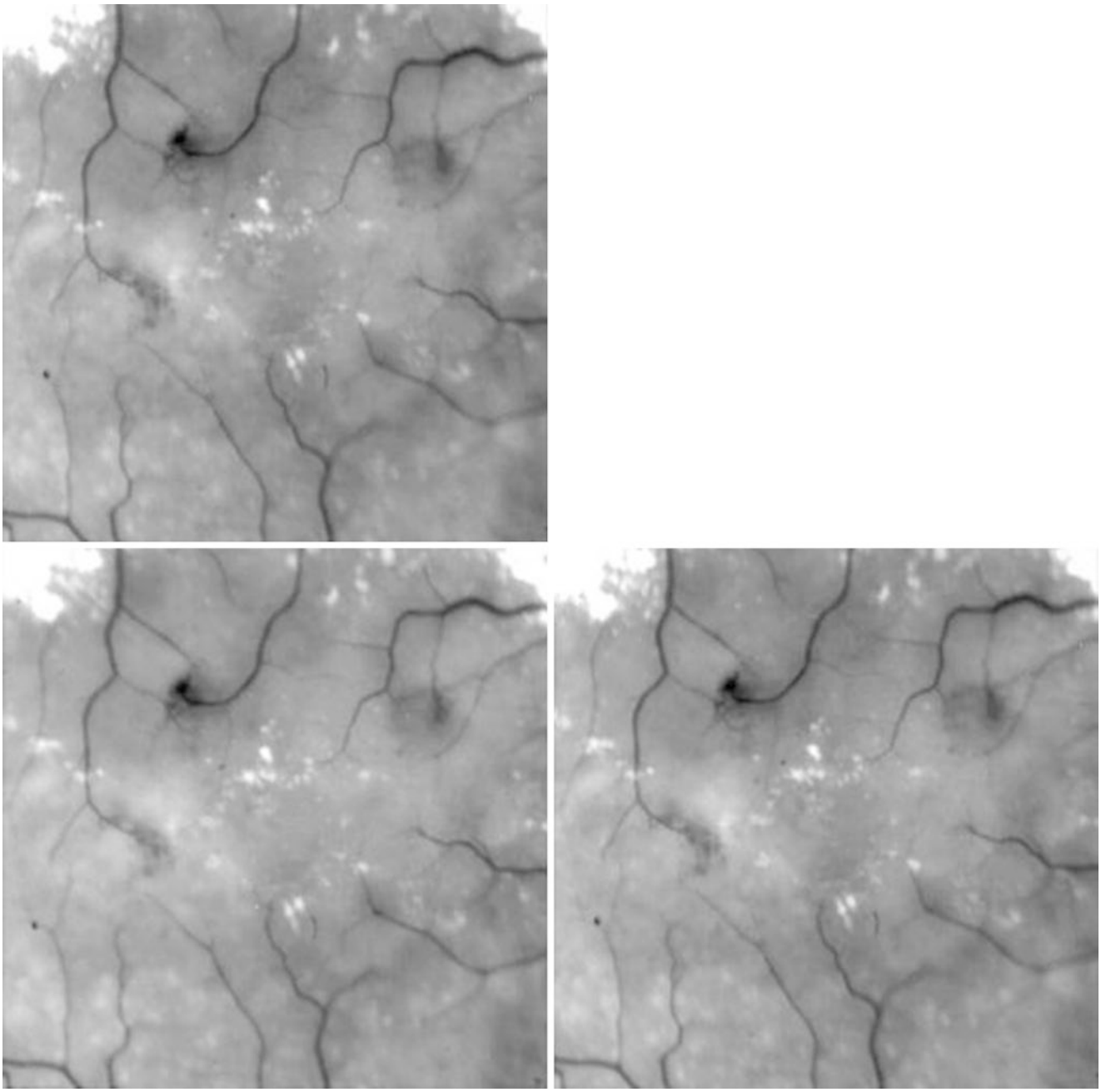

Fig. 3.20 Retinal angiomatous proliferation (RAP) on FFA
I. Intra-retinal neovascularization
II. Sub-retinal choroidal neovascularization
III. Elevated fovea and scattered exudates

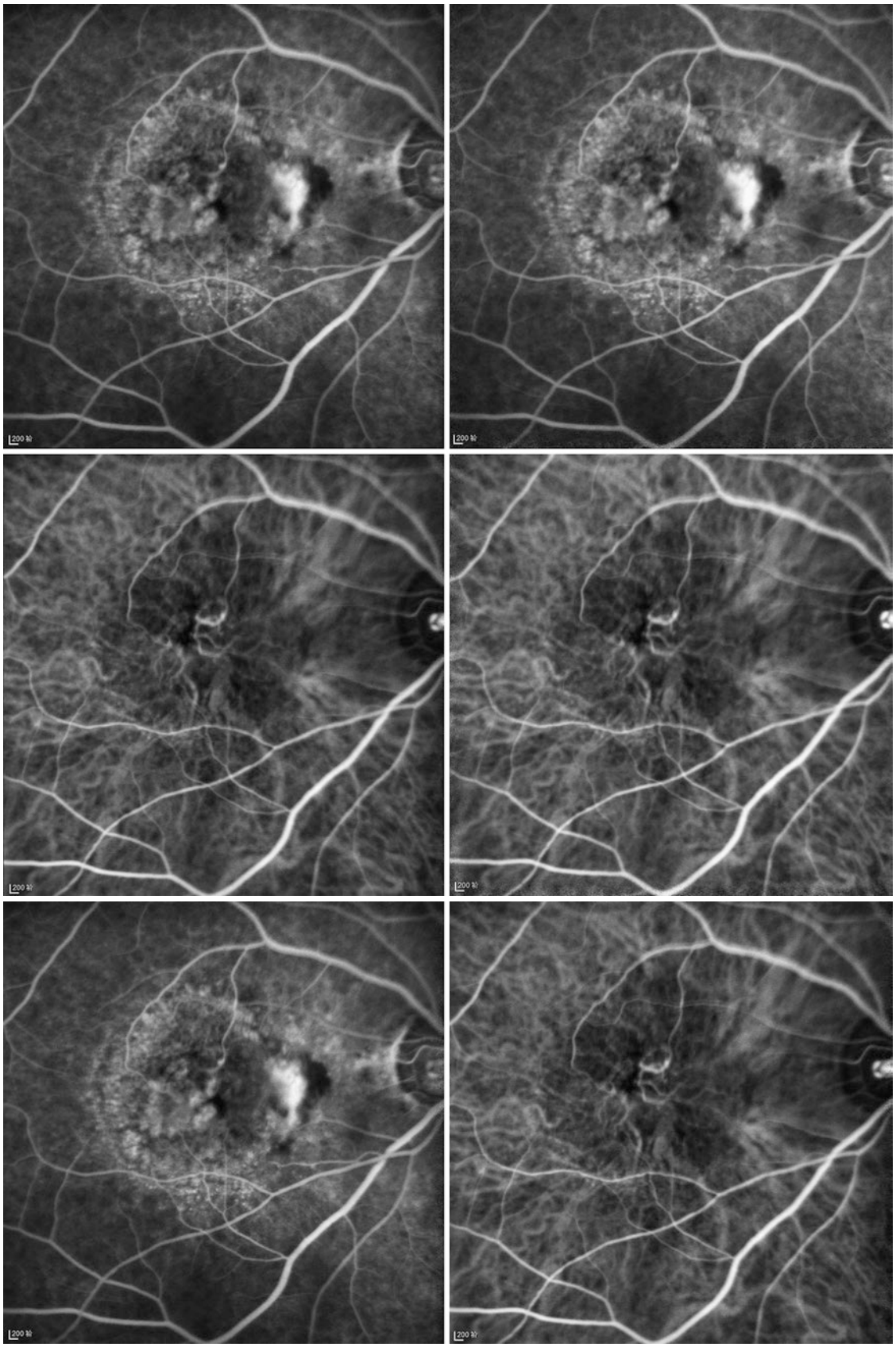

Fig. 3.21 Retinal angiomatous proliferation (RAP) on FFA
I. Intra-retinal neovascularization on early FFA
II. Intra-retinal neovascularization on mid-stage FFA
III. Fluorescent leakage of neovascular of neovascular

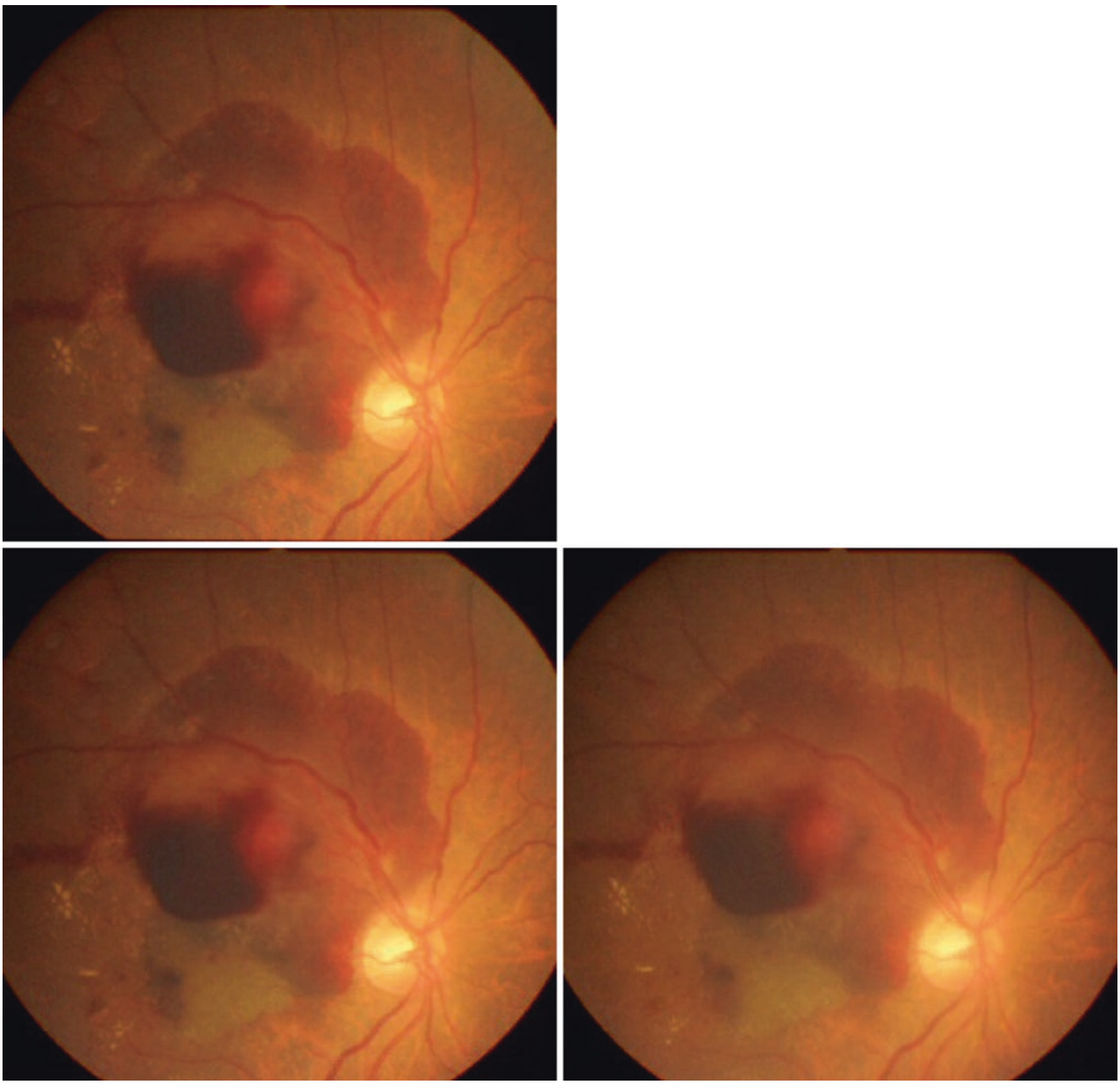

Fig. 3.22 Polypoidal choroidal vasculopathy
I. Orange elevation
II. Vitreous hemorrhage
III. Sub-retinal hemorrhage
IV. Chronic sub-RPE hemorrhage
V. Intermediate retinal exudates

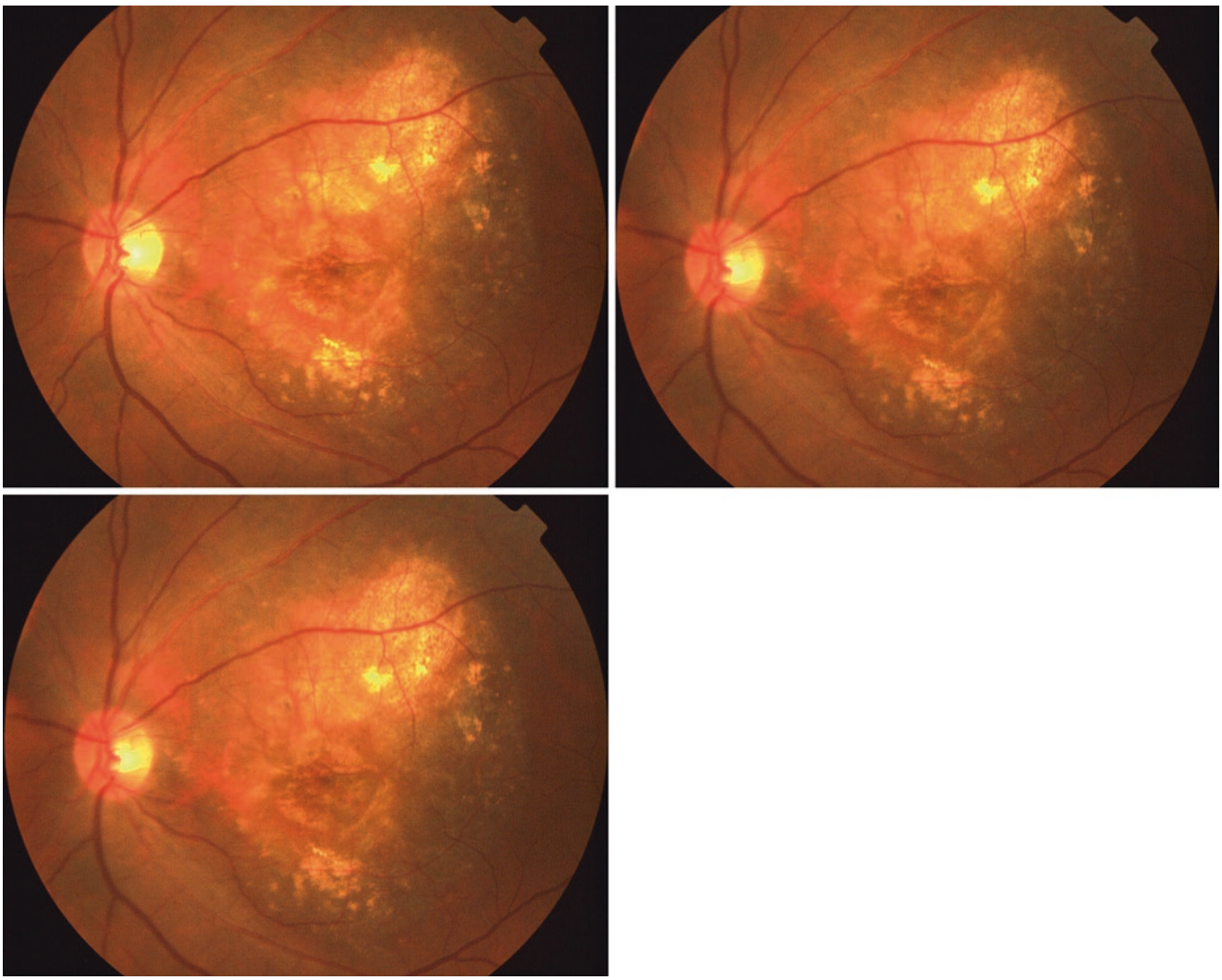

Fig. 3.23 RPE tear
I. Folded RPE in triangle shape
II. Exposed sclera
III. Intra-retinal exudates

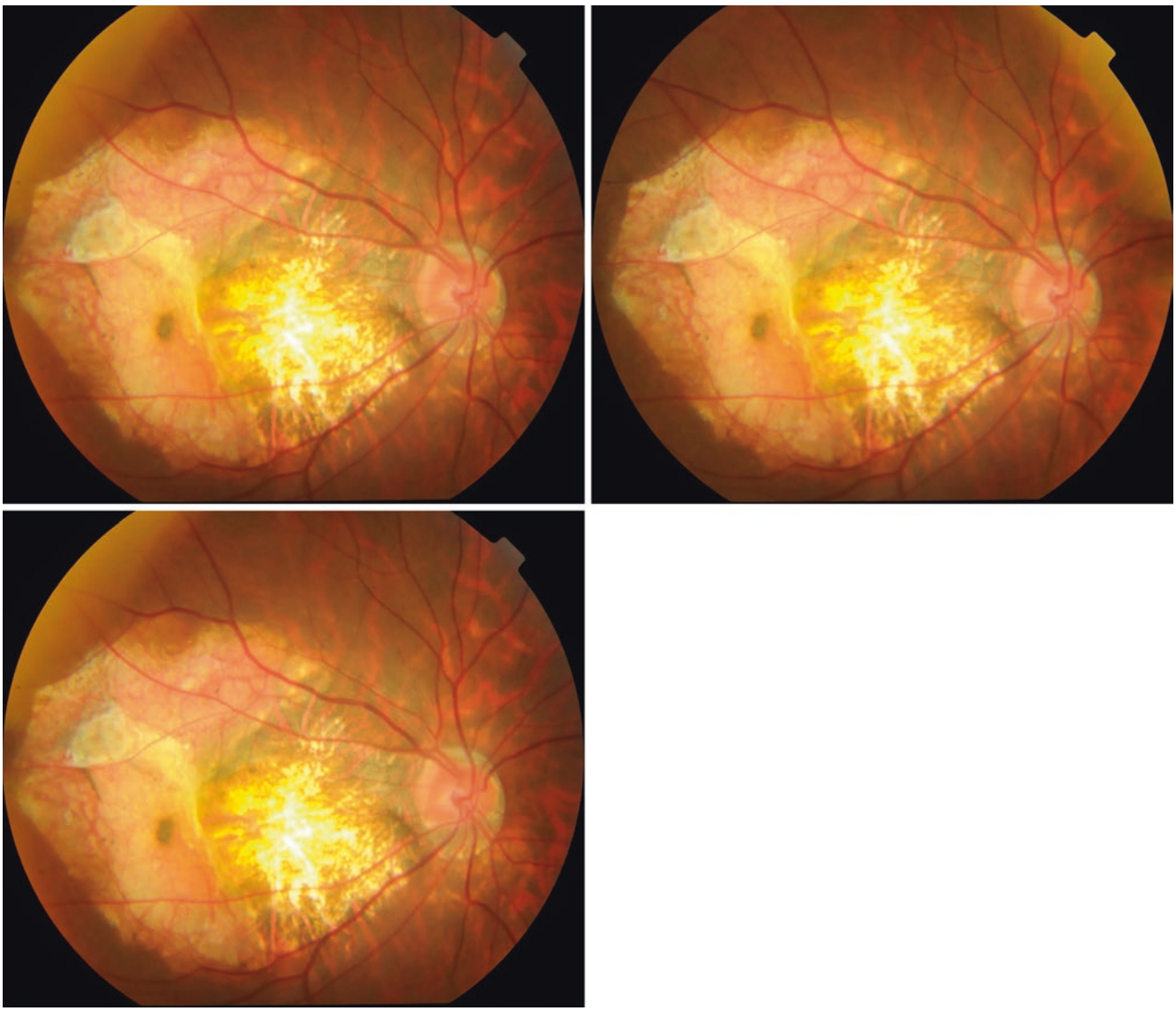

Fig. 3.24 RPE tear
I. Folded RPE or RPE tear
II. Exposed sclera
III. Normal RPE area
IV. Geographic atrophy of macula

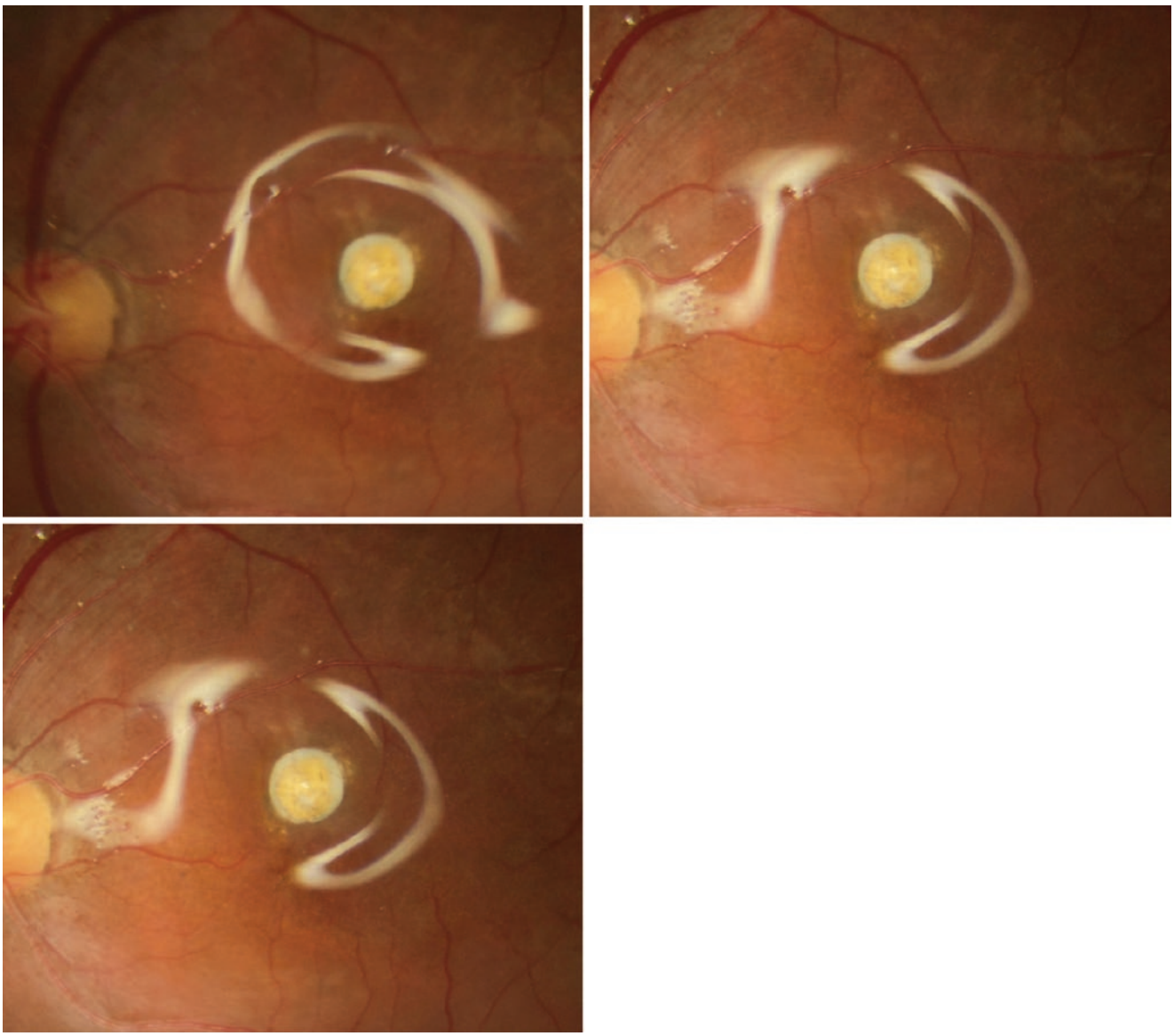

Fig. 3.25 Silicone oil tamponade of PCV
I. Chronic choroidal lesion
II. The retinal artery went over the retinal vein
III. The reflex of silicone oil
IV. Deep retinal hemorrhage

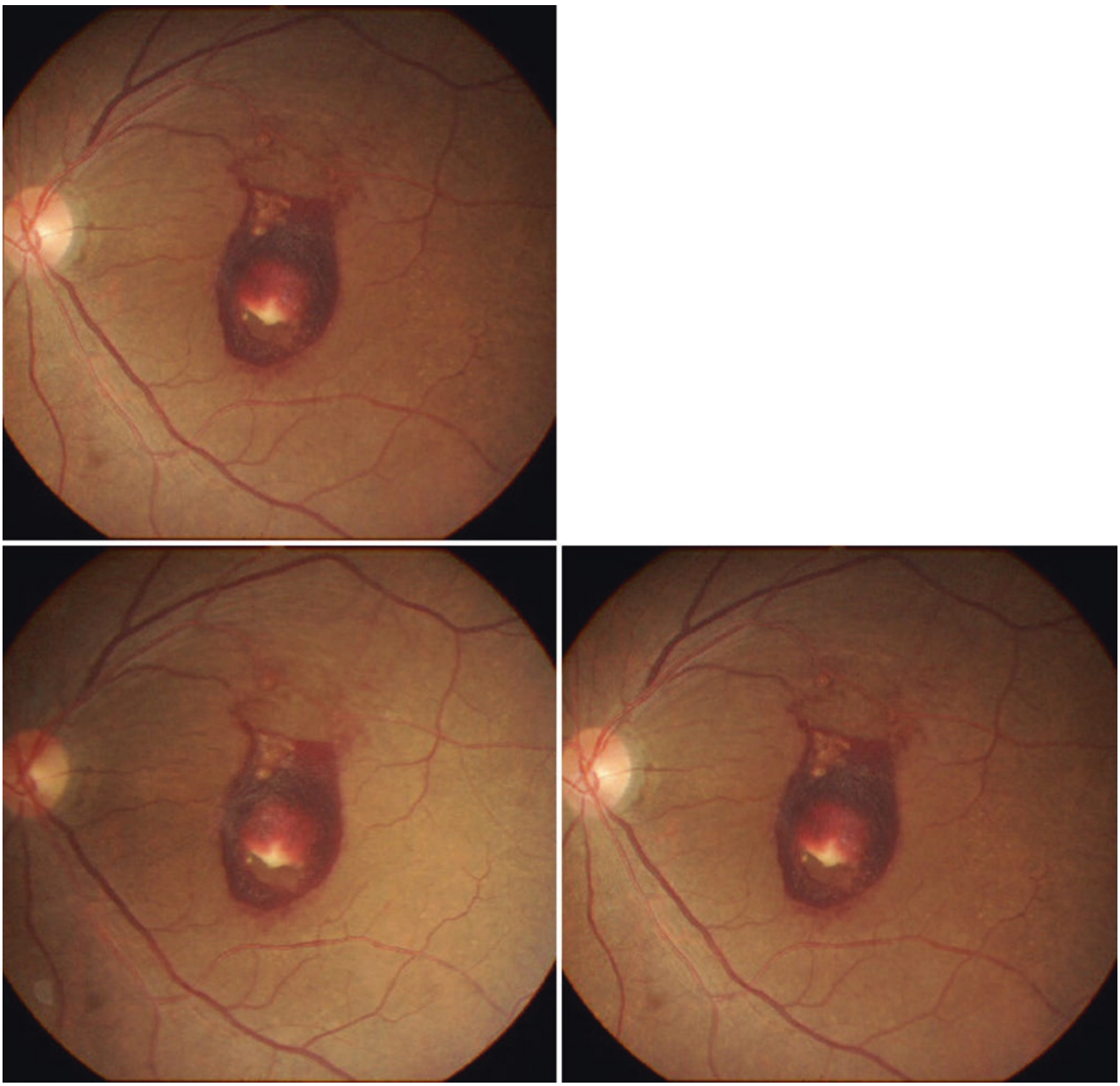

Fig. 3.26 Macular hemorrhage
I. Thickened posterior hyaloid and strong reflex
II. Yellow-white epiretinal hemorrhage
III. Sub-retinal hemorrhage

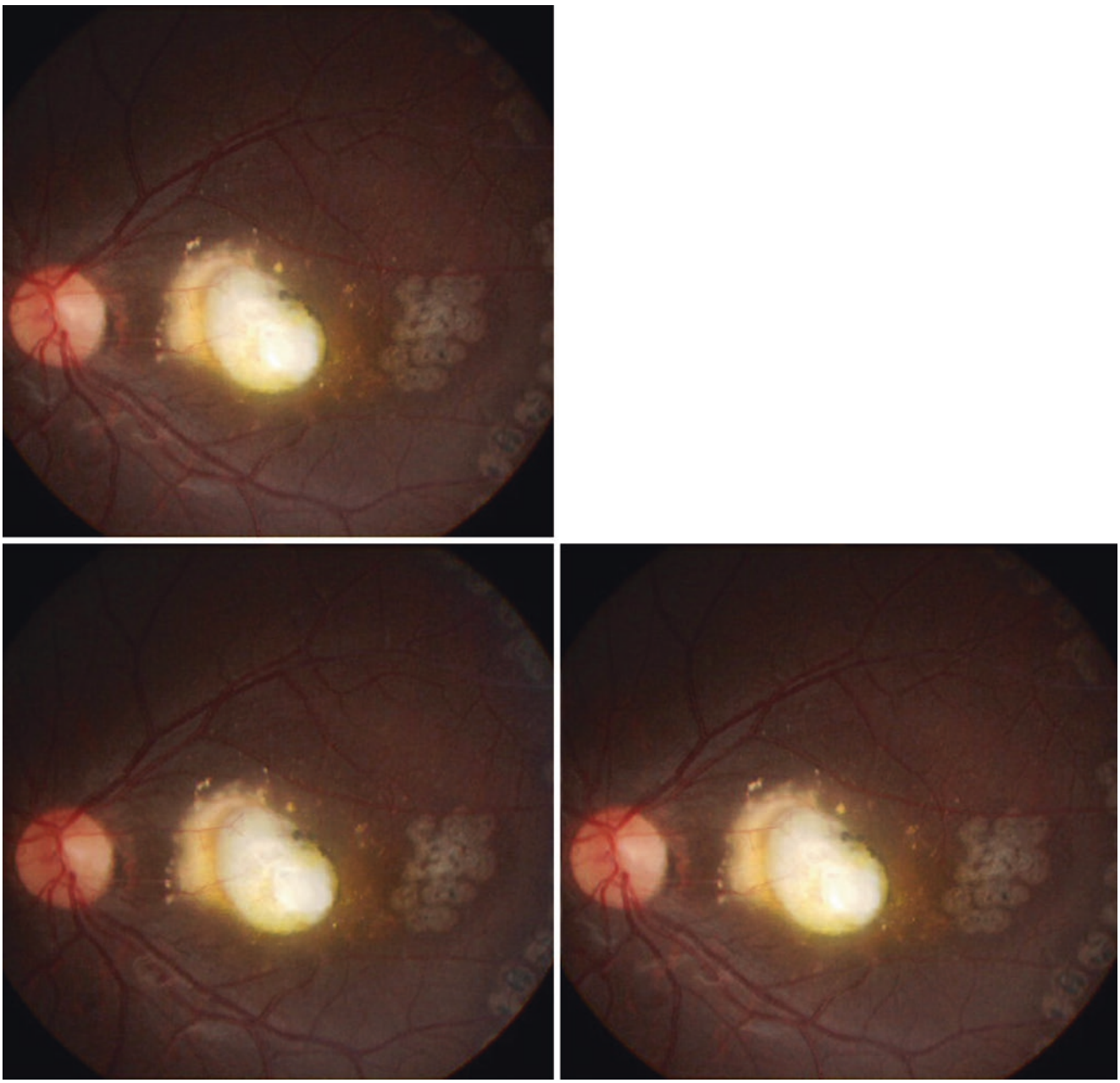

Fig. 3.27 Sub-macular choroidal neovascularization membrane
I. Apex of elevation and appeared white
II. The second layer of exudates
III. The third layer of exudates and appeared yellow-white
IV. Pigment proliferation and small sub-retinal membrane

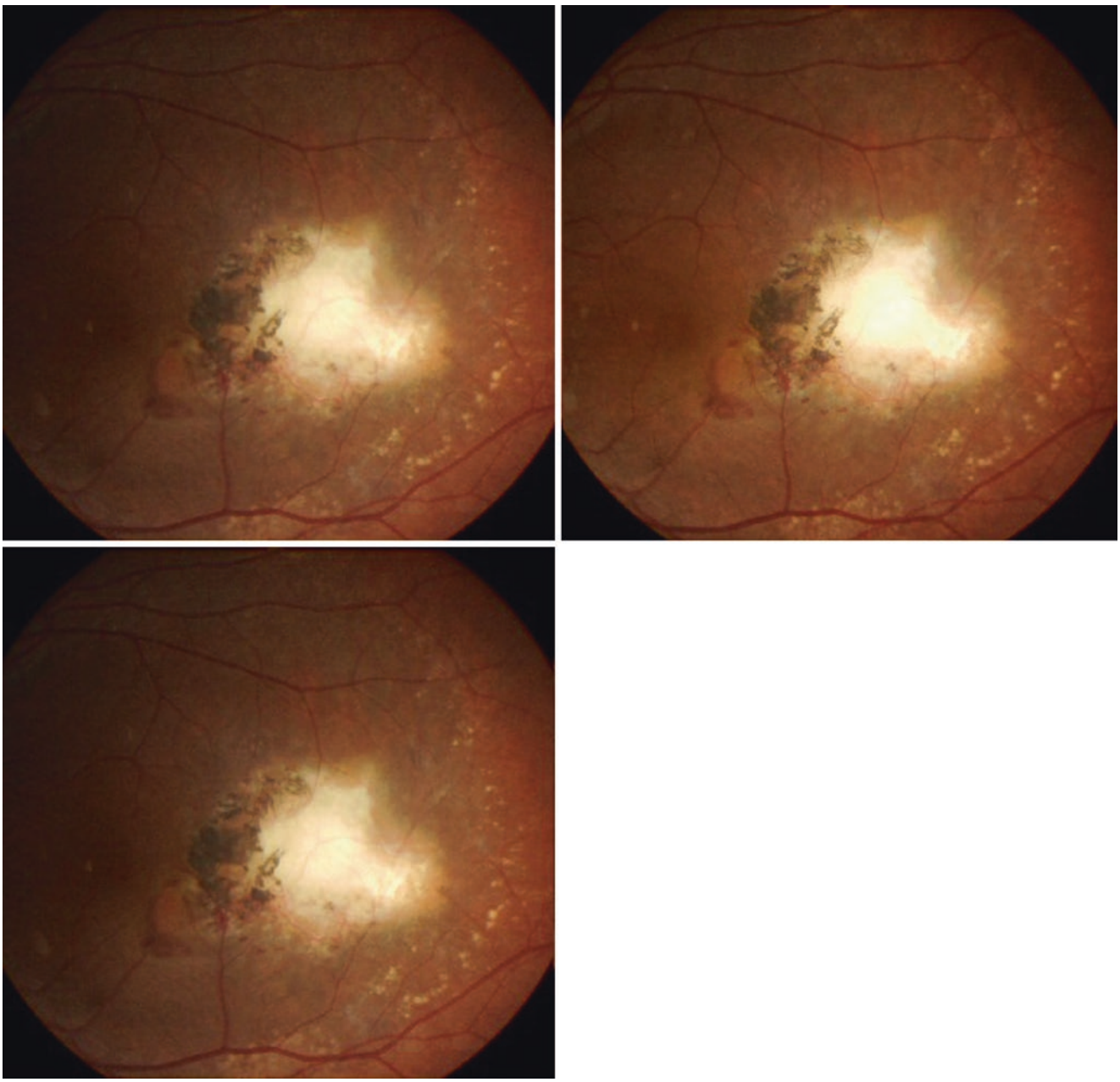

Fig. 3.28 Juxtafoveal sub-retinal mixed choroidal neovascularization
I. Sub-retinal grey scar
II. Sub-retinal choroidal neovascularization
III. Sub-retinal pigment proliferation
IV. Sub-retinal hemorrhage
V. Epiretinal hemorrhage
VI. Scattered sub-retinal dotted exudates

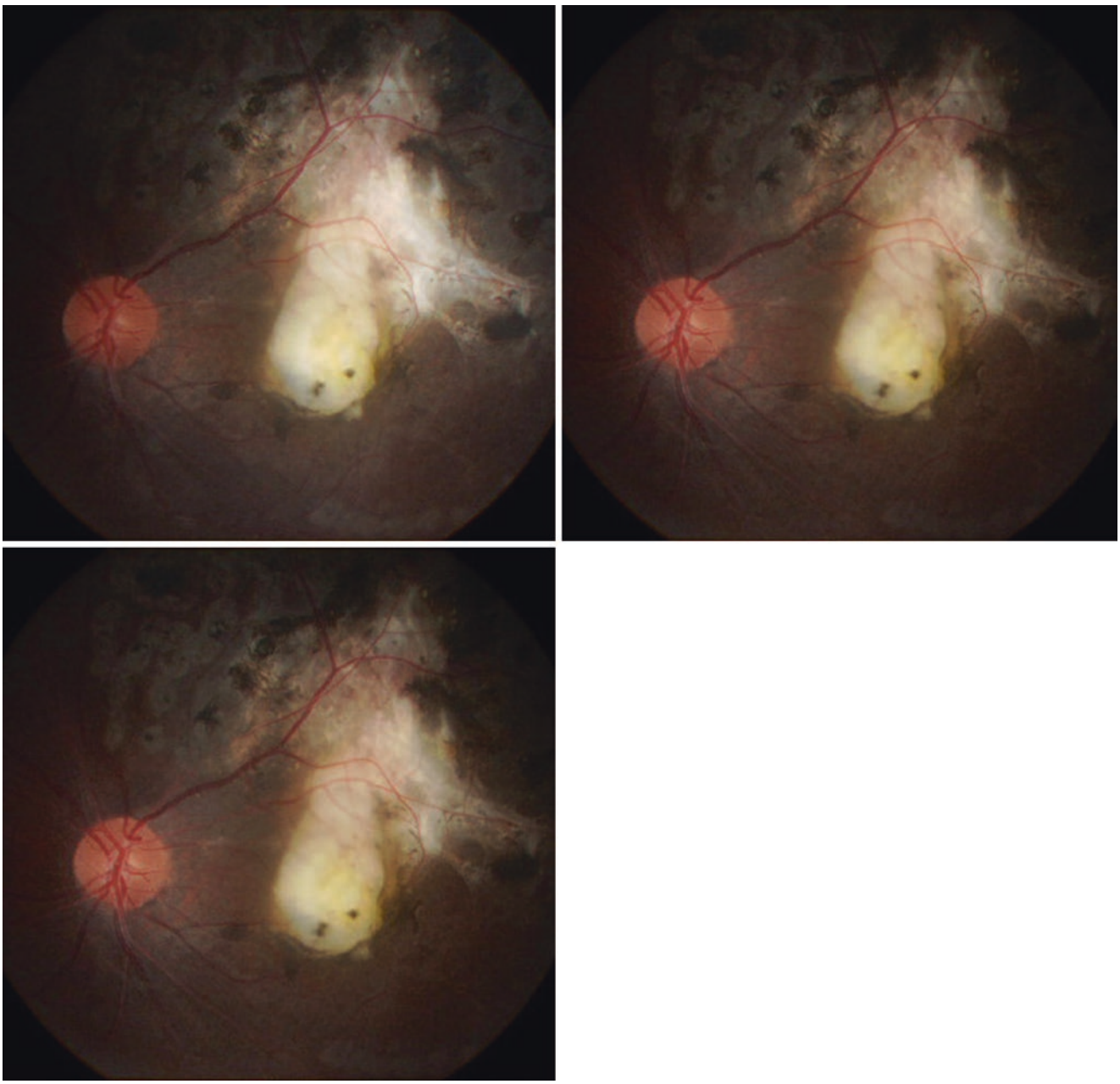

Fig. 3.29 Sub-macular fibrous membrane
I. Apex of sub-retinal membrane
II. Suspending retinal vessels
III. Pigment proliferation
IV. Retinal artery sheath
V. The retinal artery went over the membrane

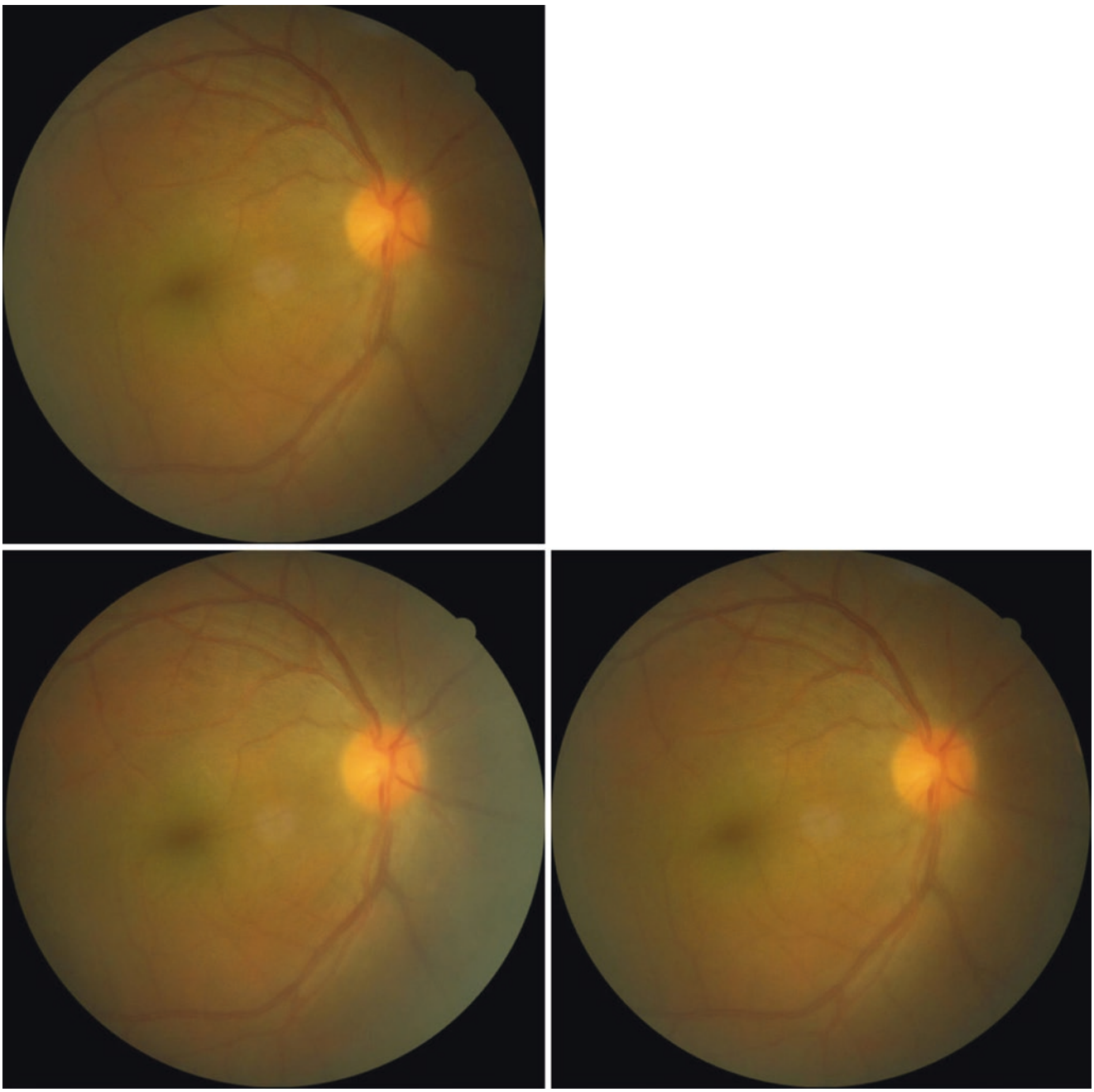

Fig. 3.30 Macular edema
I. Elevation of macula and loss of central reflex
II. The retinal artery went beneath the retinal vein

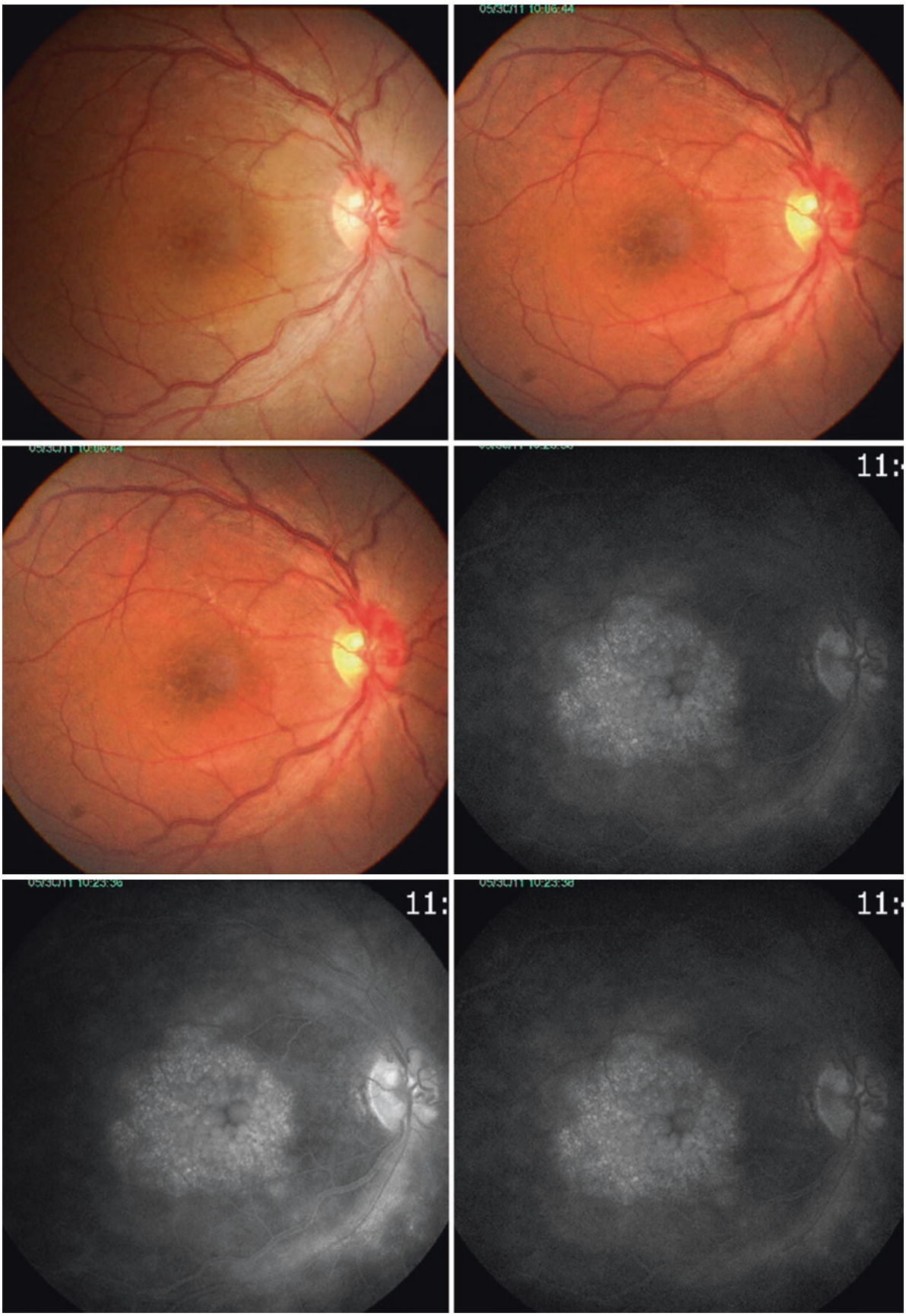

Fig. 3.31 Macular edema
I. Cystoid macular edema
II. Distorted veins on the optic disc
III. Vitreous opacities

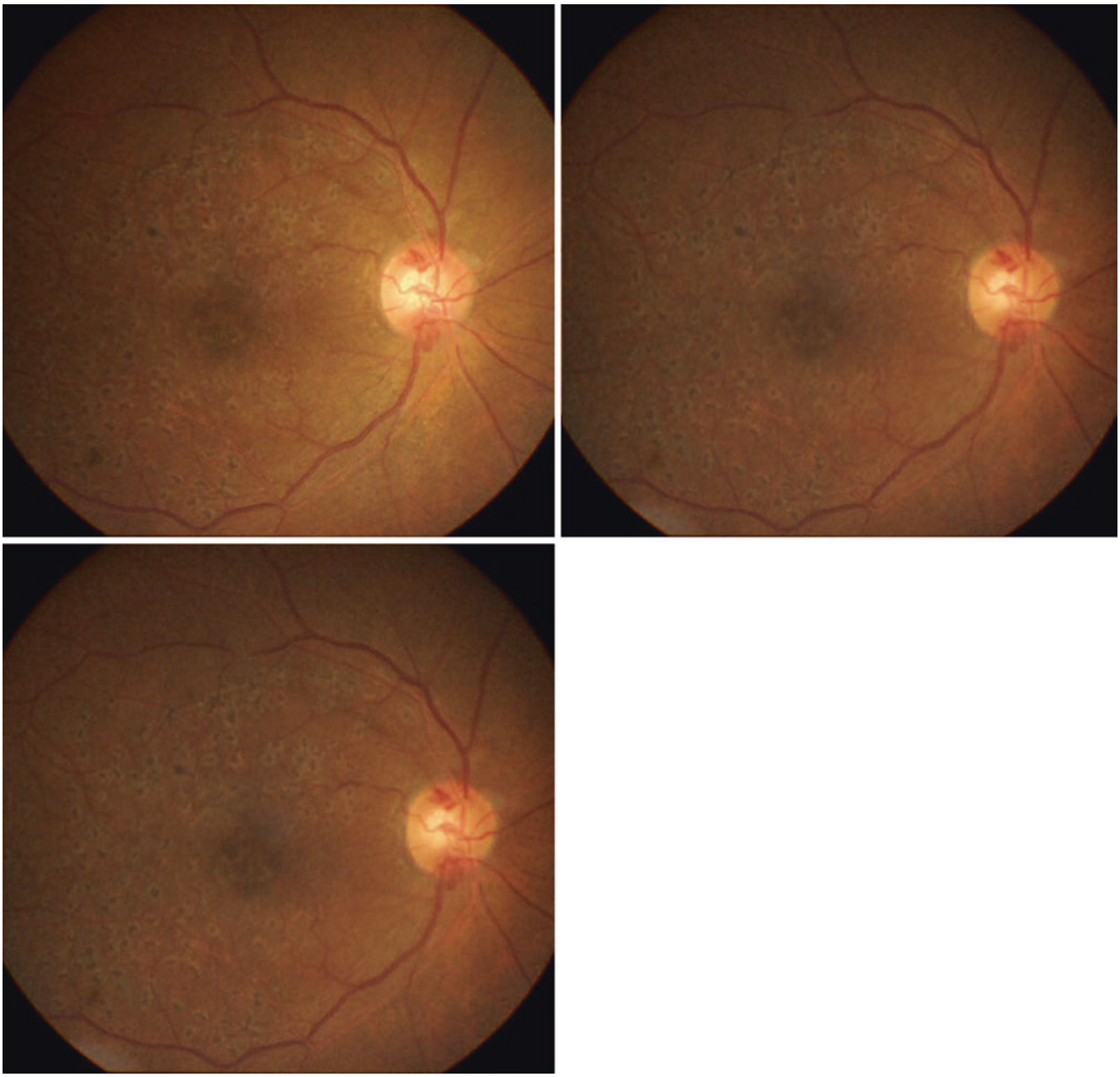

Fig. 3.32 Macular edema after grid laser treatment
I. The macula was flat
II. Laser spot
III. The end of retinal vein was dilated
IV. Neovascularization of the optic disc

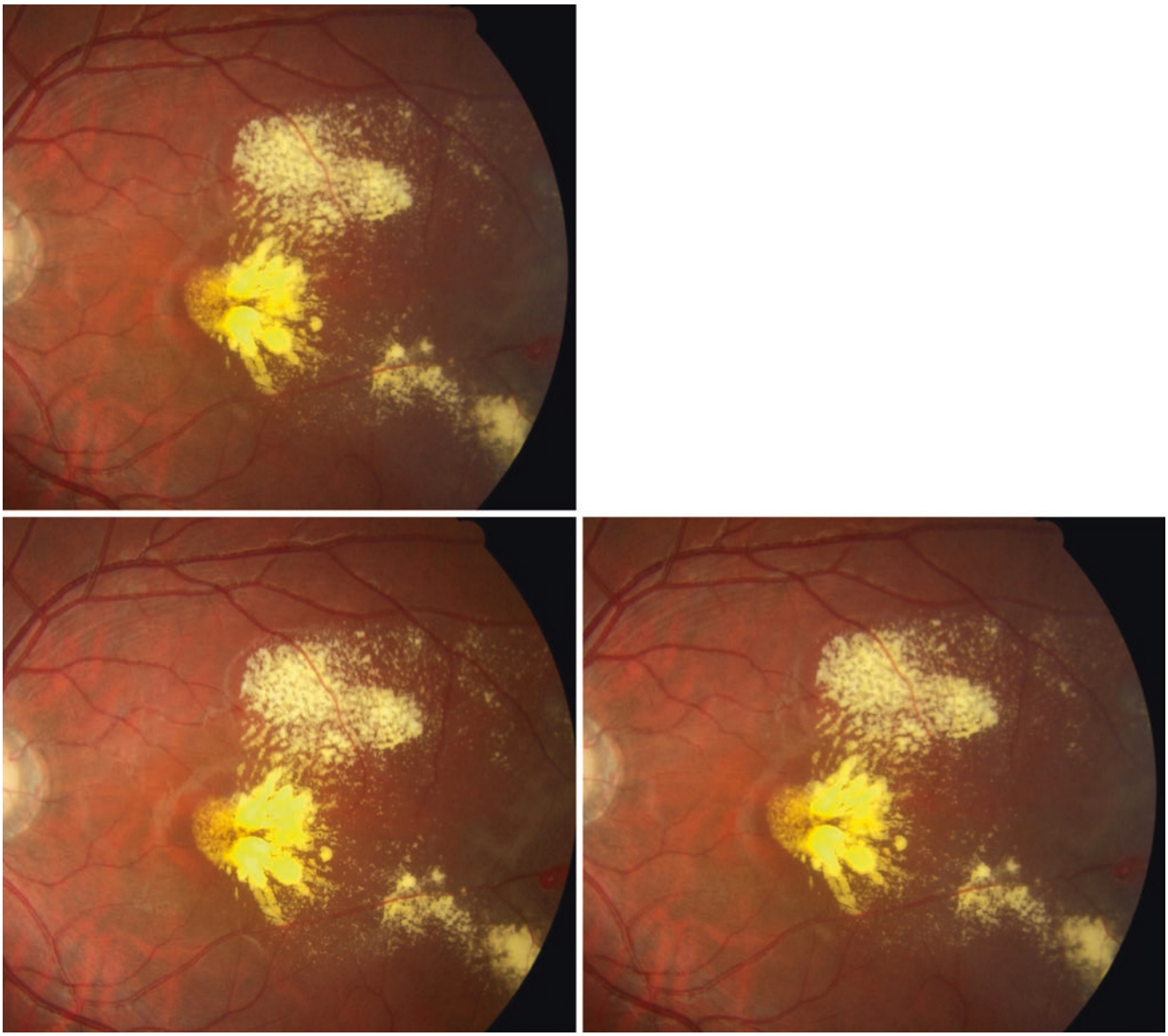

Fig. 3.33 Macular radial hard exudates
I. The end of retinal artery was dilated
II. Superficial retinal exudates
III. Deep retinal exudates
IV. Grey-whitish exudates

Fig. 3.34 Juxtafoveal telangiectasis
I. The area of macular edema
II. The deep retinal vessels were dilated
III. Intermediate retinal exudates

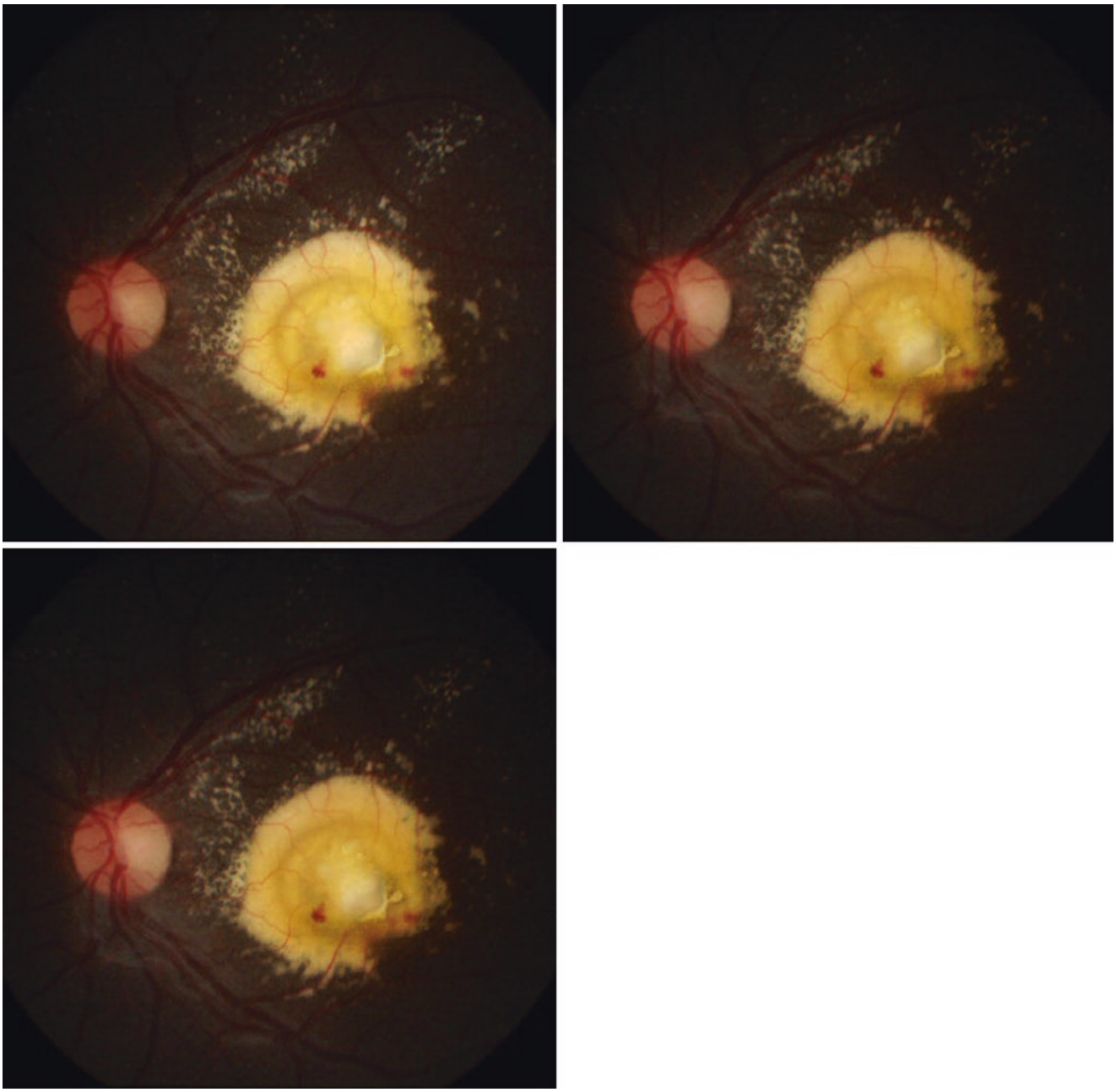

Fig. 3.35 Adult Coats' disease
I. The lesion was elevated like three layers of cake
II. The blood supply of the retinal artery was insufficient than the other retinal branches
III. Suspected abnormal vessels

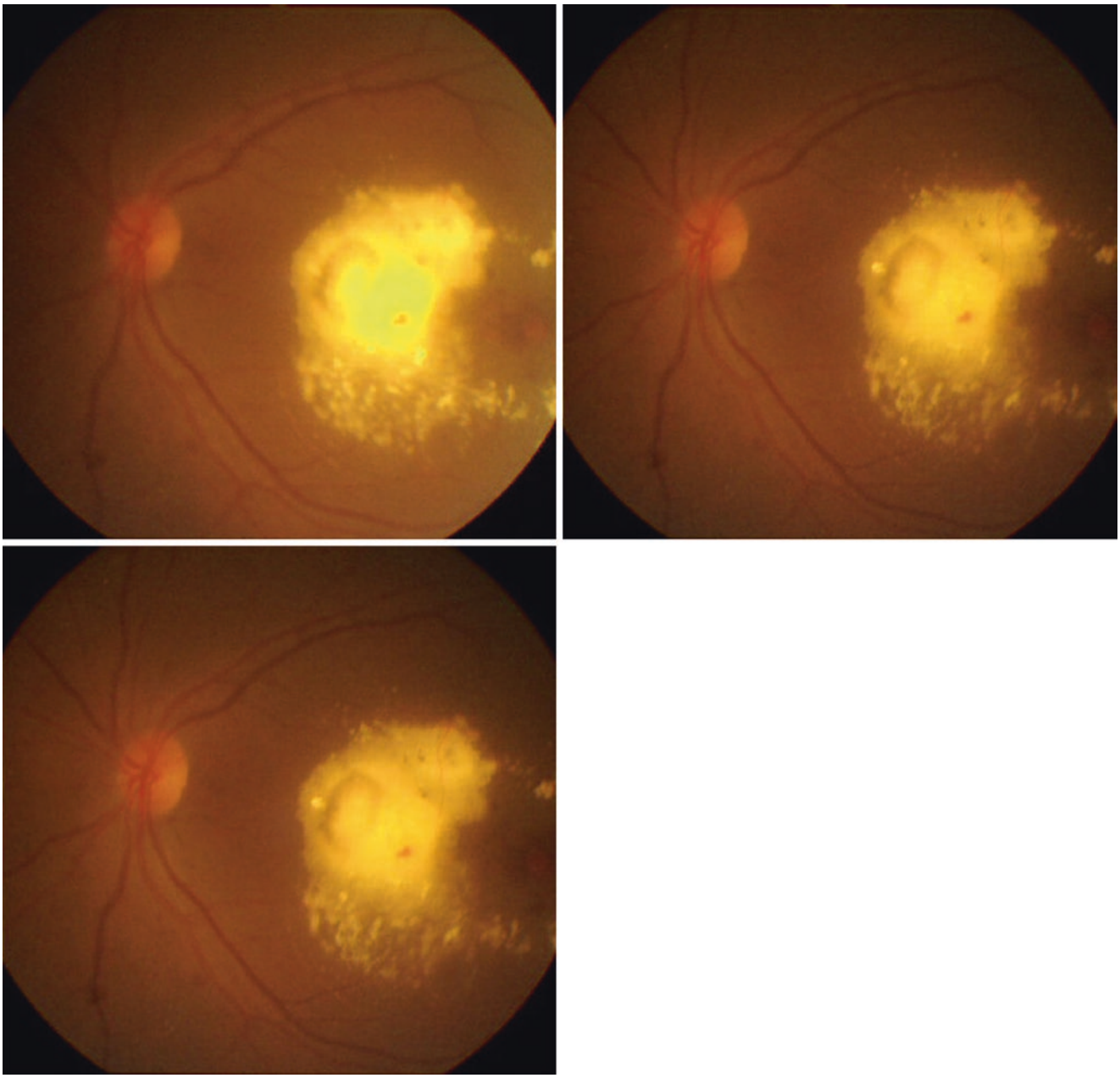

Fig. 3.36 Adult Coats' disease of the macula
I. Superficial retinal exudates
II. Large amount of yellow-white exudates and crystal in the deep retina
III. Deep retinal hemorrhage

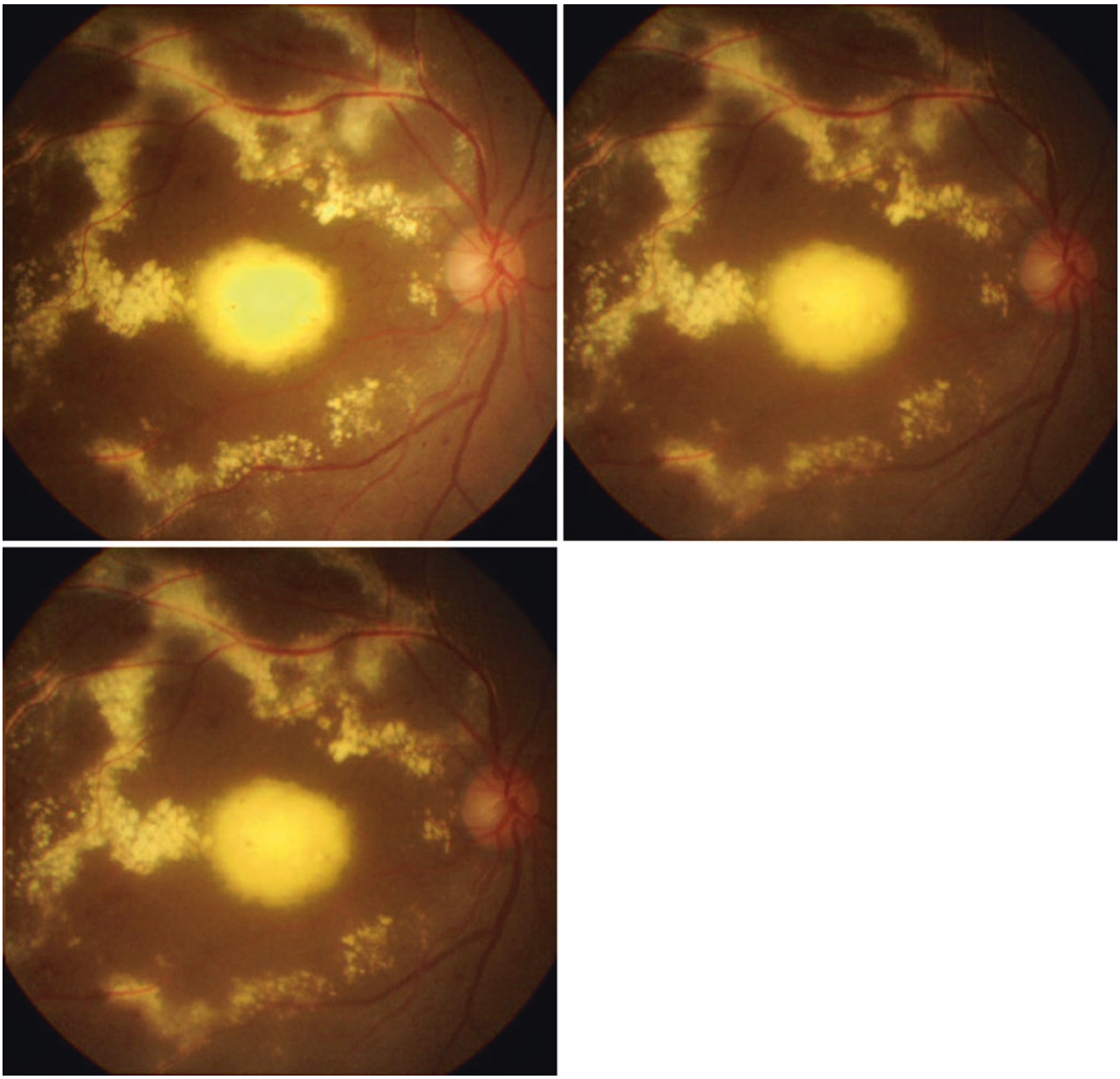

Fig. 3.37 Coats' disease
I. Yellow-whitish sub-retinal exudates
II. Exudates of the retinal artery
III. Irregular diameter and exudates of retinal veins
IV. The end of the retinal vessels was dilated

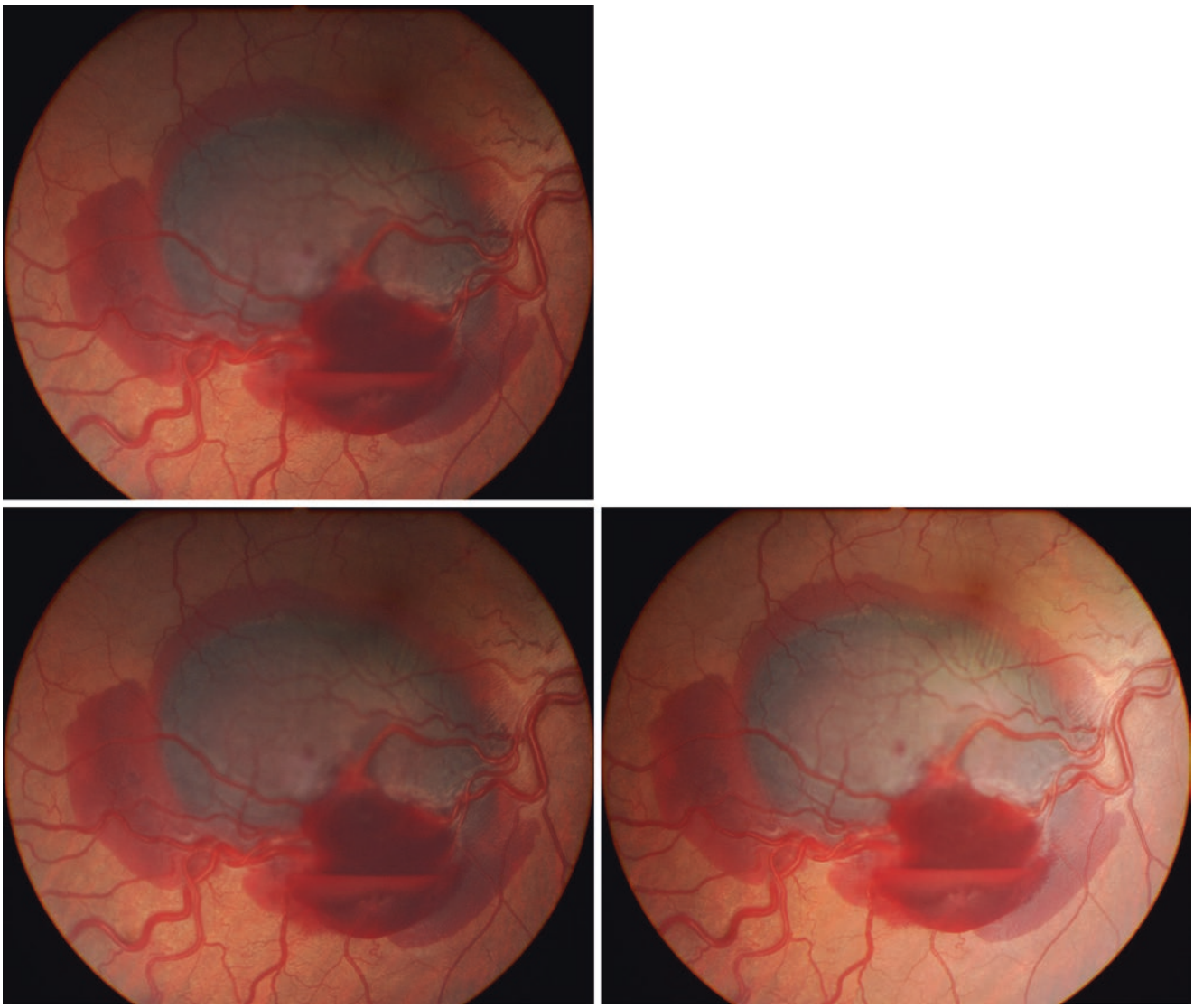

Fig. 3.38 Macular hemorrhage in various layers
I. Pre-retinal hemorrhage looked alike a boat
II. Sub-retinal hemorrhage
III. Sub-RPE hemorrhage
IV. The retinal vessels were distorted and dilated

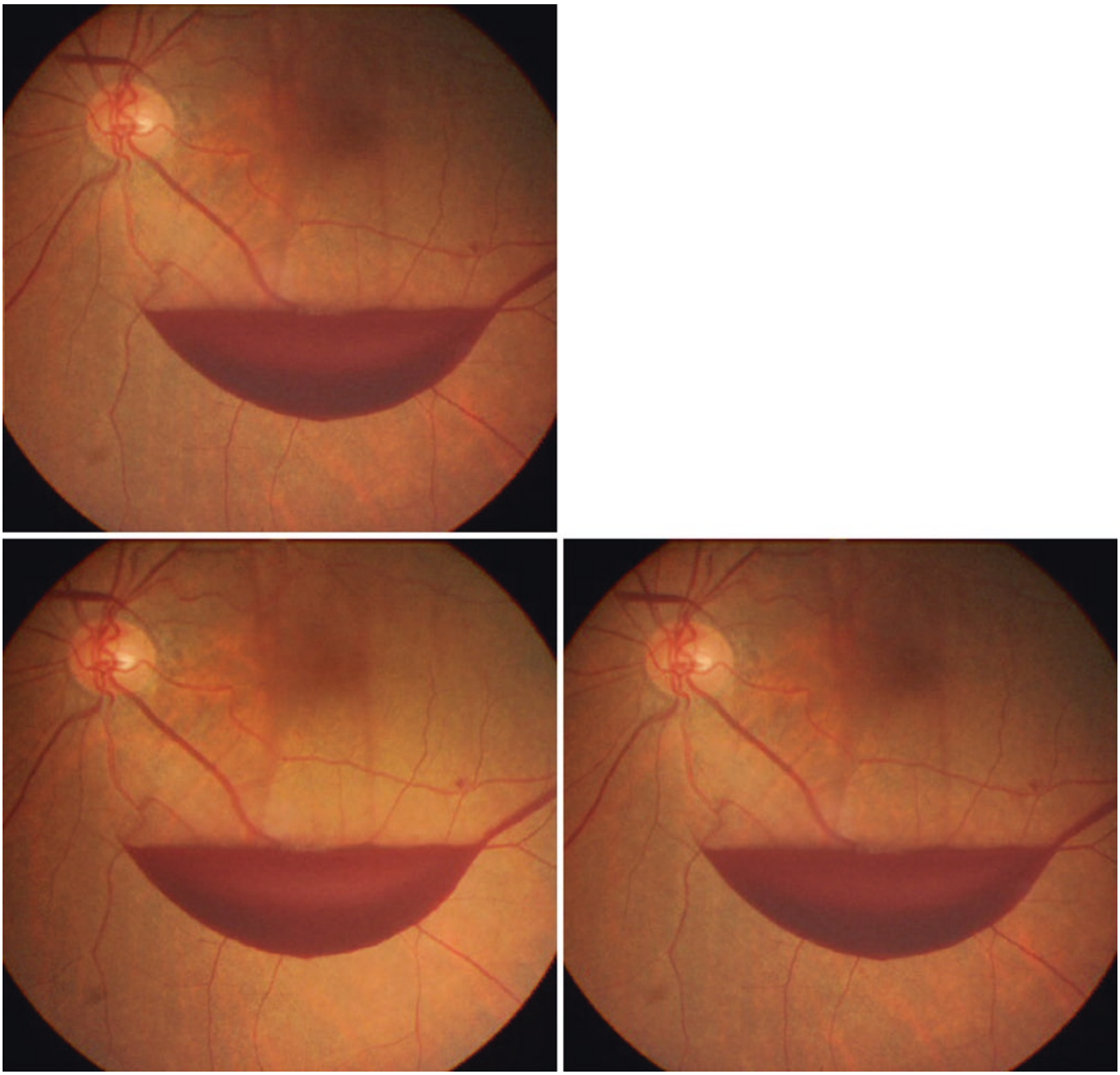

Fig. 3.39 Boat-like epiretinal hemorrhage
I. The serum
II. The platelets
III. The white blood cells
IV. The deoxygenated hemoglobin
V. The oxygenated red blood cells

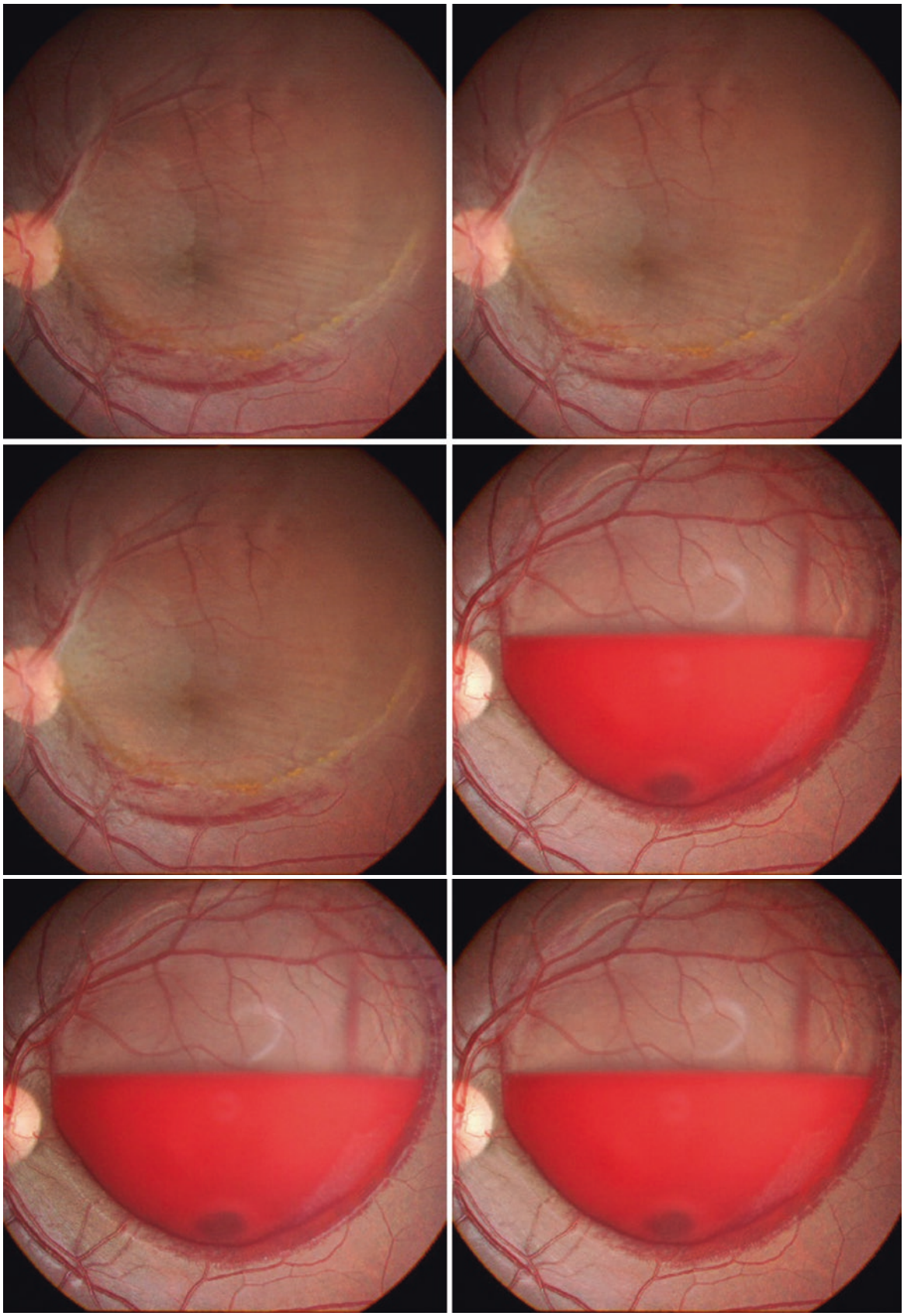

Fig. 3.40 Epiretinal hemorrhage
I. The boat-like epiretinal hemorrhage like a dome
II. After dissection of posterior limiting membrane by Nd:YAG laser, the hemorrhage was disseminated and absorbed
III. Thickened posterior hyaloids and folds

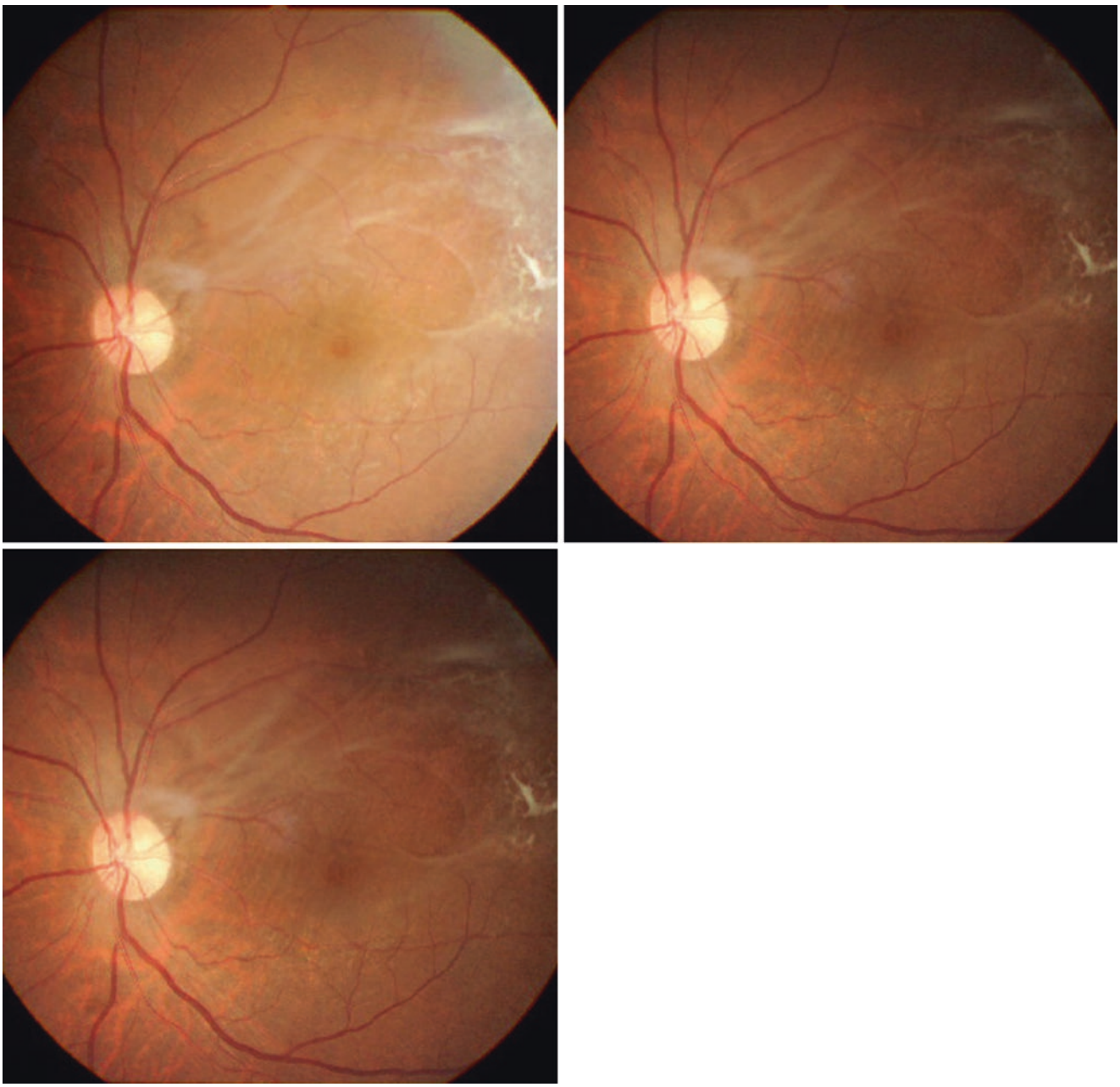

Fig. 3.41 Proliferative vitreoretinopathy
I. Proliferative membrane and streaks
II. Pseudo hole
III. Atherosclerosis of superior temporal retinal artery

Fig. 3.42 Epi-retinal membrane
I. Epi-retinal membrane extended from the optic disc to the periphery
II. Distorted retinal veins
III. Irregular diameter of the retinal vein

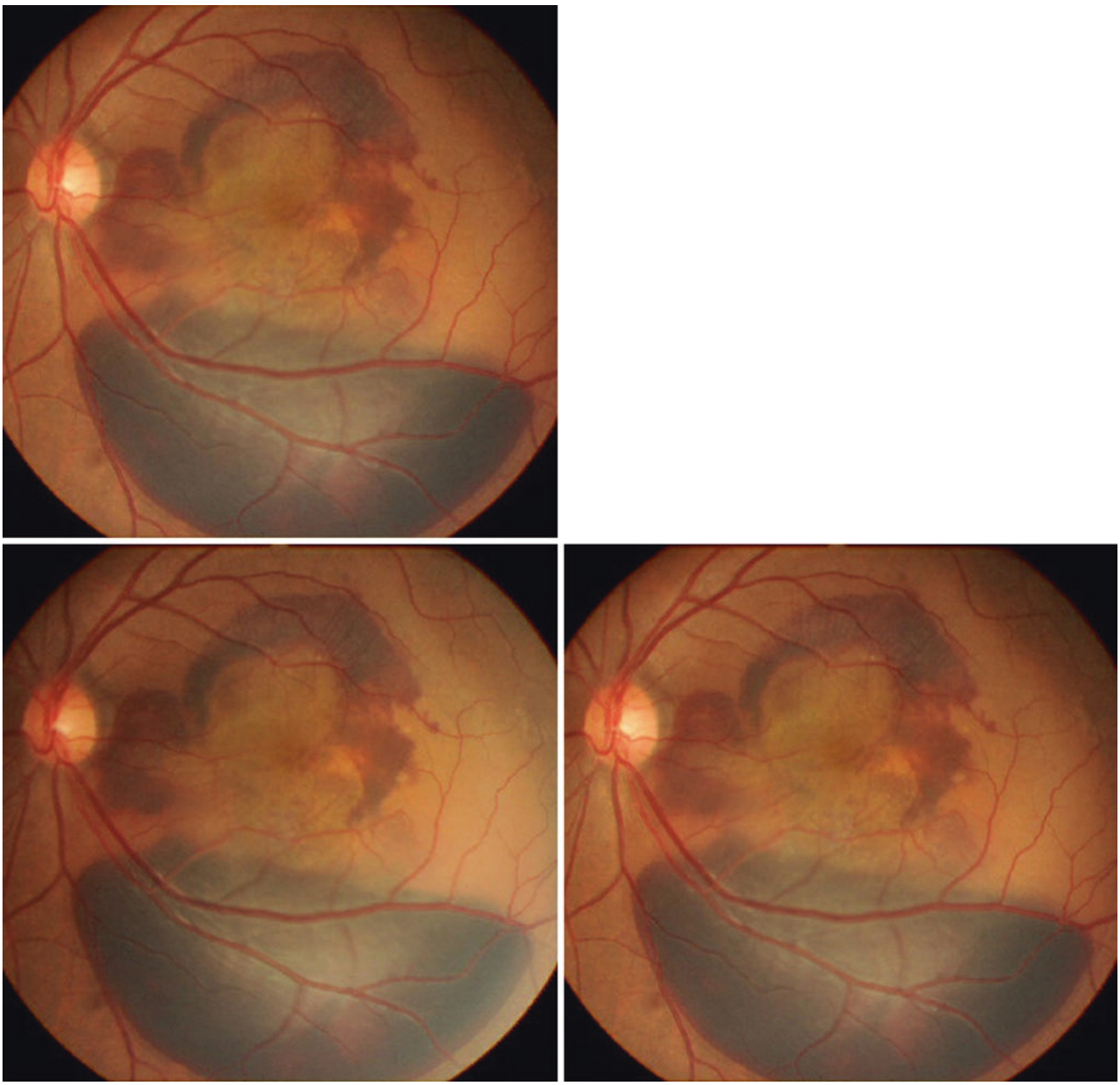

Fig. 3.43 Retinal hemorrhage of different retinal layers
I. Sub-RPE hemorrhage, the lesion was highly elevated
II. Deep retinal hemorrhage
III. Sub-retinal hemorrhage
IV. The central reflex was lost

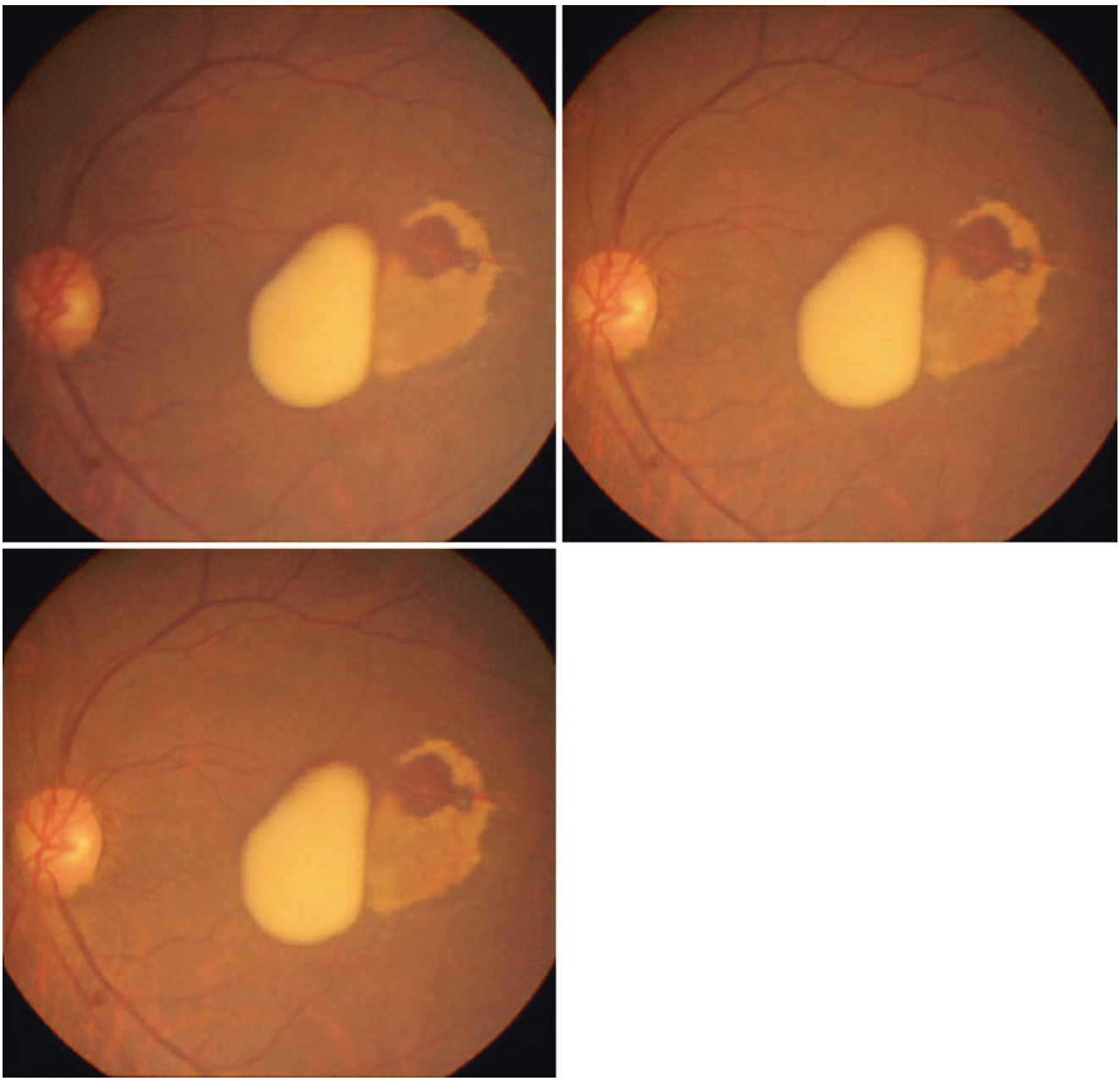

Fig. 3.44 Chronic retinal hemorrhage
I. Pre-retinal hemorrhage
II. Suspected location of retinal macroaneurysm
III. Intermediate retinal hemorrhage
IV. Artery-Vein nicking (Salus Sign)

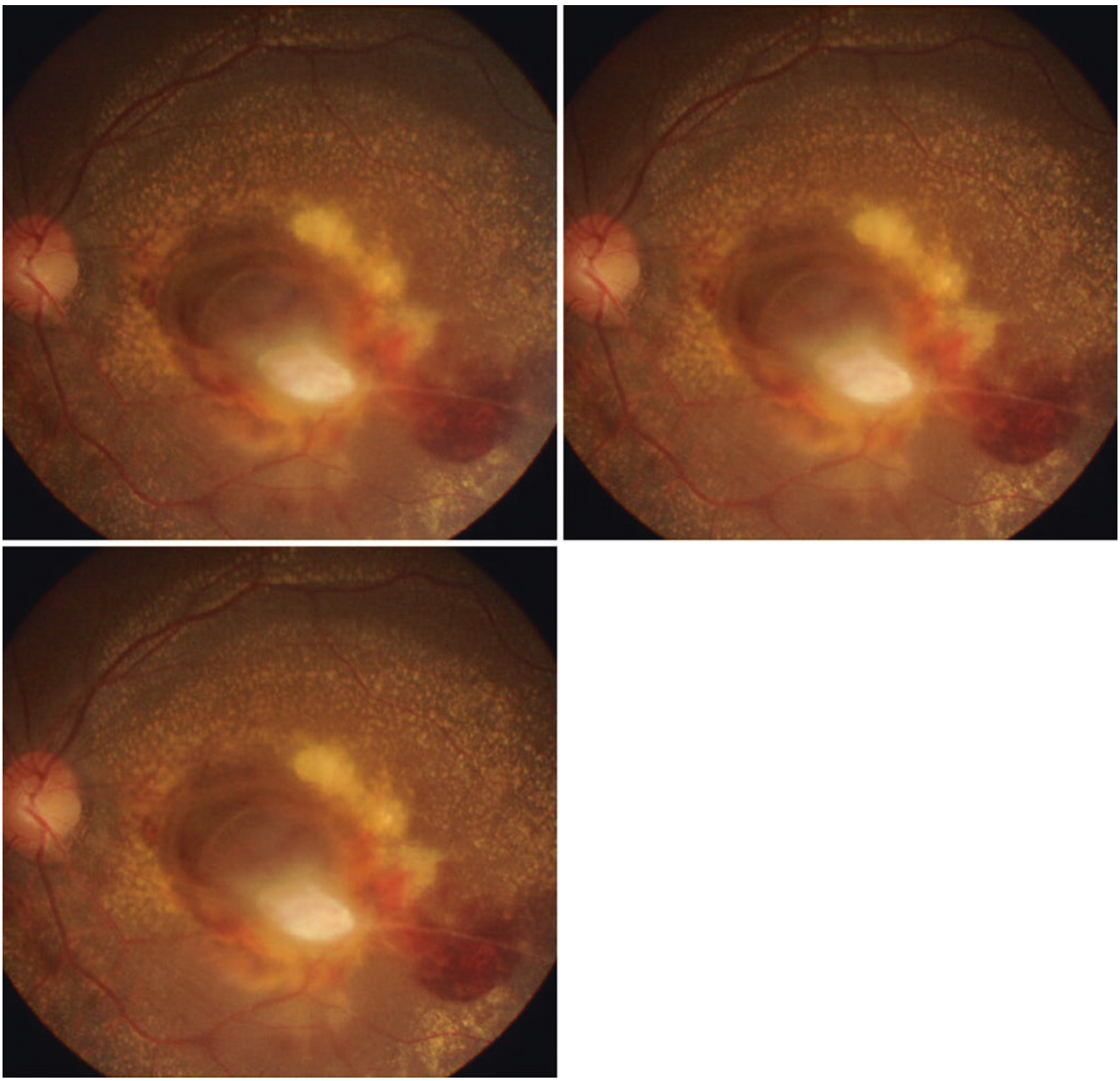

Fig. 3.45 Sub-retinal parasitic infection
I. Suspected scolex of the parasite
II. Intra-retinal reaction of multiple retinal layers
III. Exudative retinal detachment
IV. Dotted yellow-whitish exudates
V. Ghost vessel of retinal vein

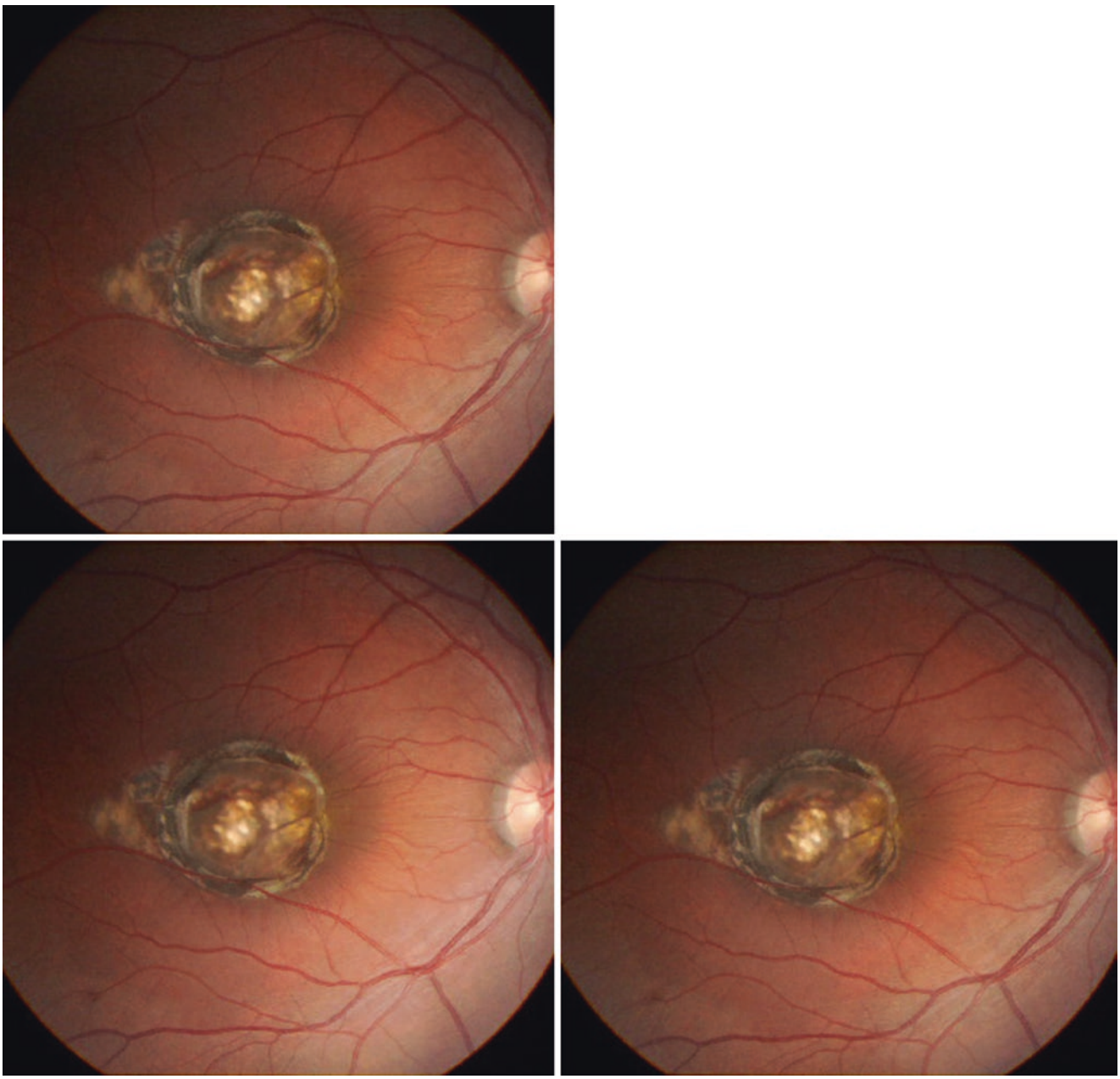

Fig. 3.46 Coloboma of macula
I. Exposed sclera
II. Choroidal vessels
III. Boundary of coloboma
IV. Impending retinal vessels

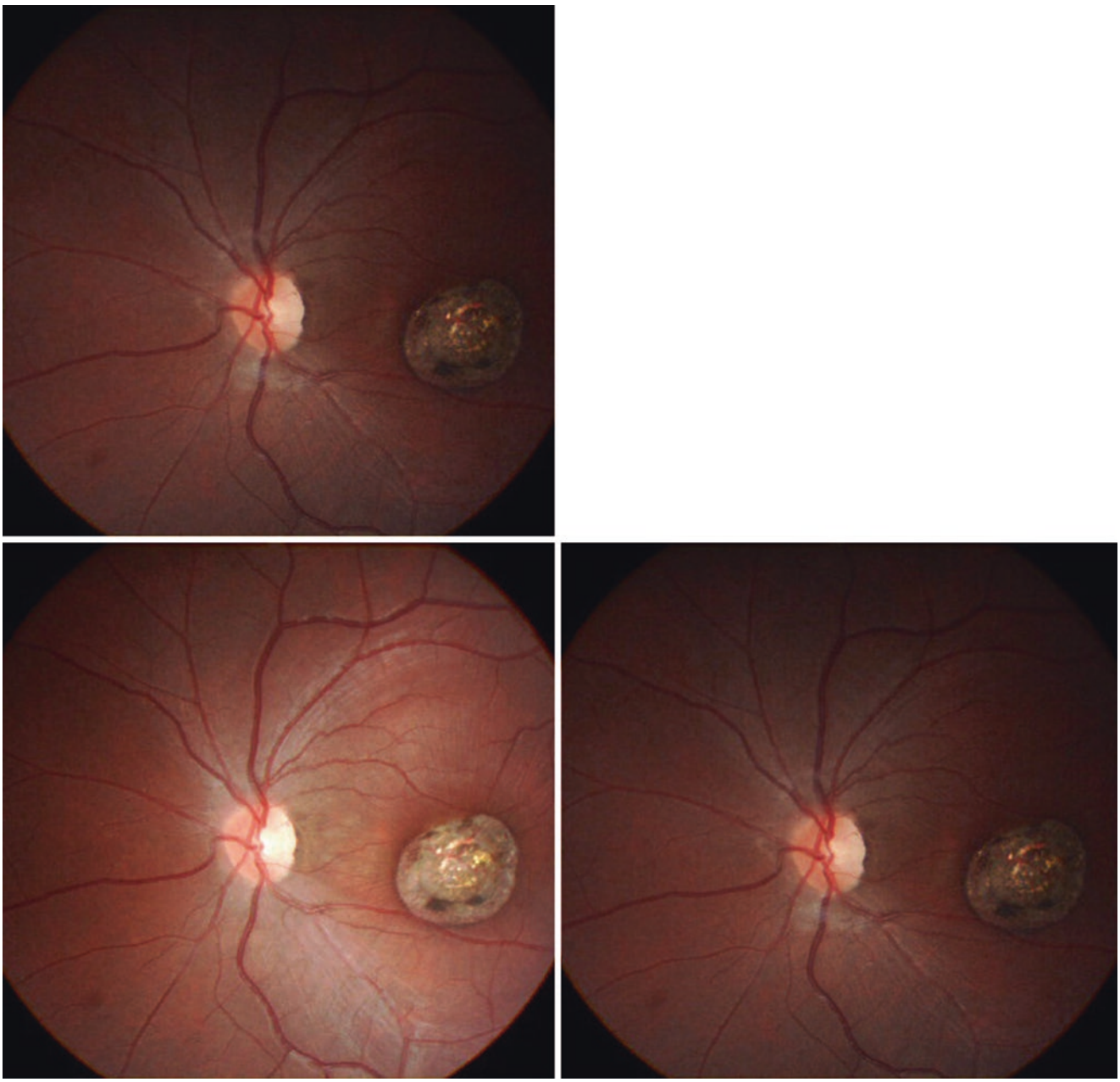

Fig. 3.47 Congenital coloboma of macula
I. The sclera was exposed in the area of coloboma
II. Suspending choroidal vessels
III. Mottled epithelial pigment proliferation
IV. The boundary of coloboma

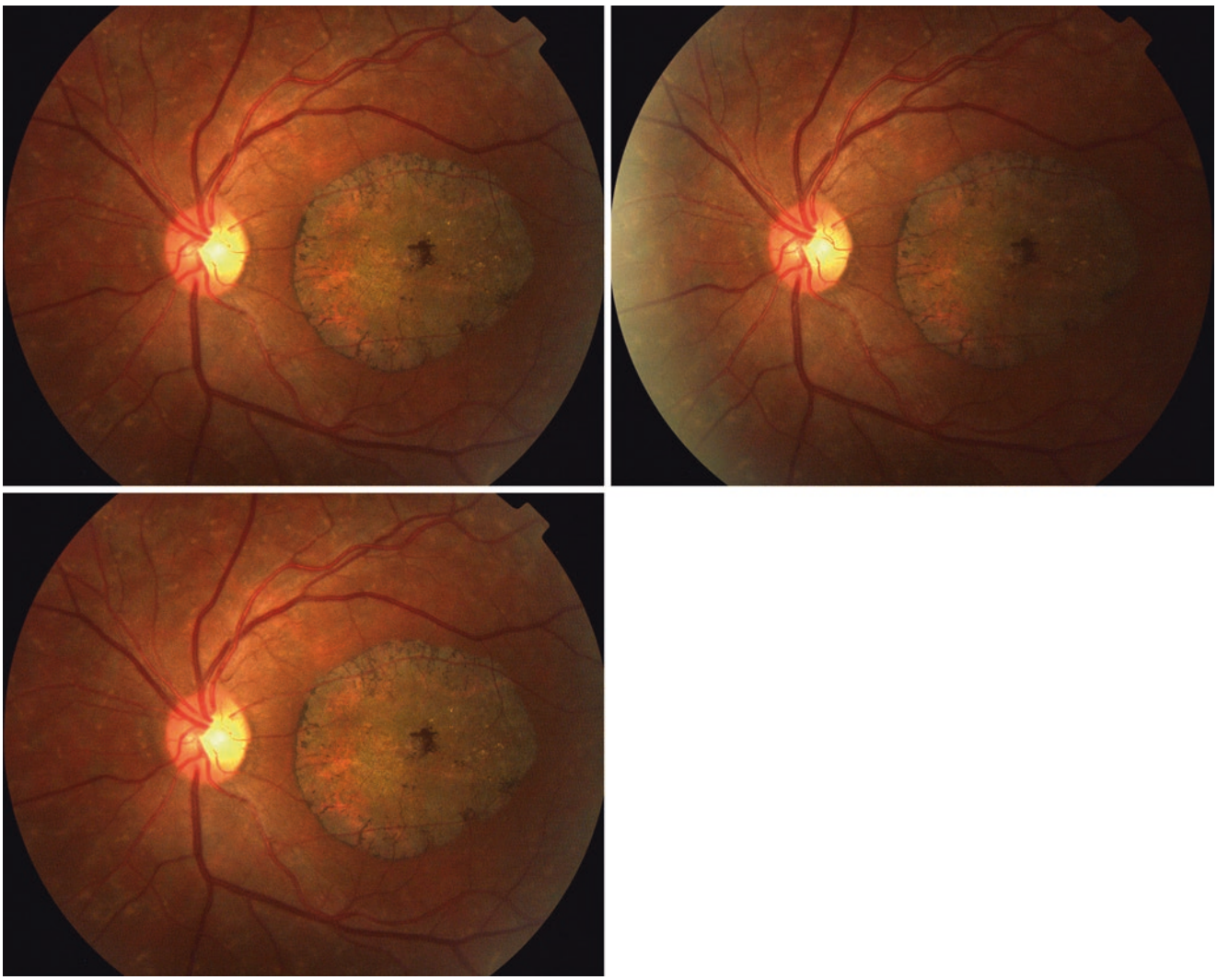

Fig. 3.48 Stargardt disease
I. Bull-eye shaped lesion, irregular with pigmentation
II. Retinal and choroidal atrophy like a basin
III. Retinal vessels that passed through the lesion went attenuated

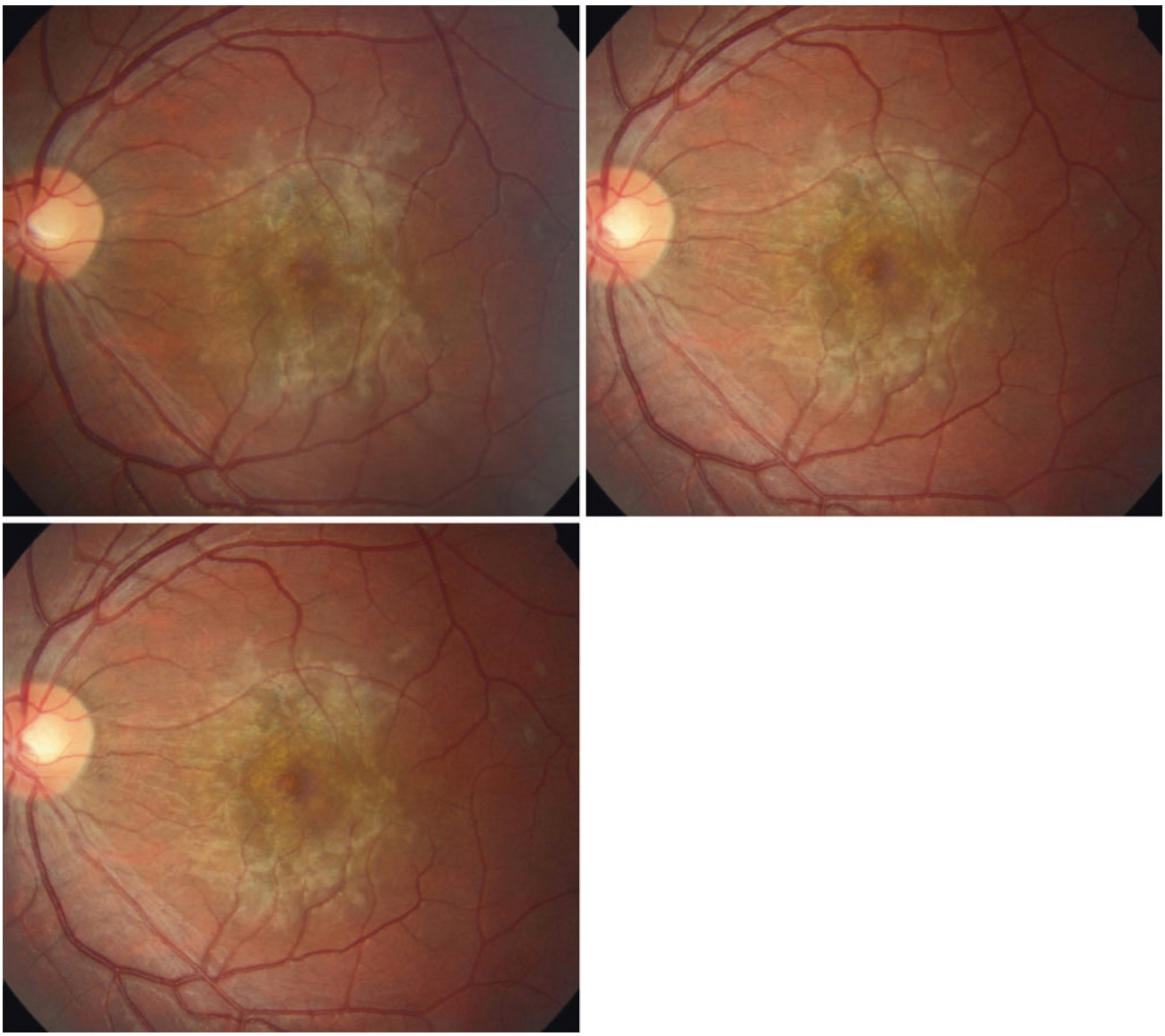

Fig. 3.49 Macular atrophy
I. Fovea
II. Irregular diameter of retinal veins
III. RPE atrophy

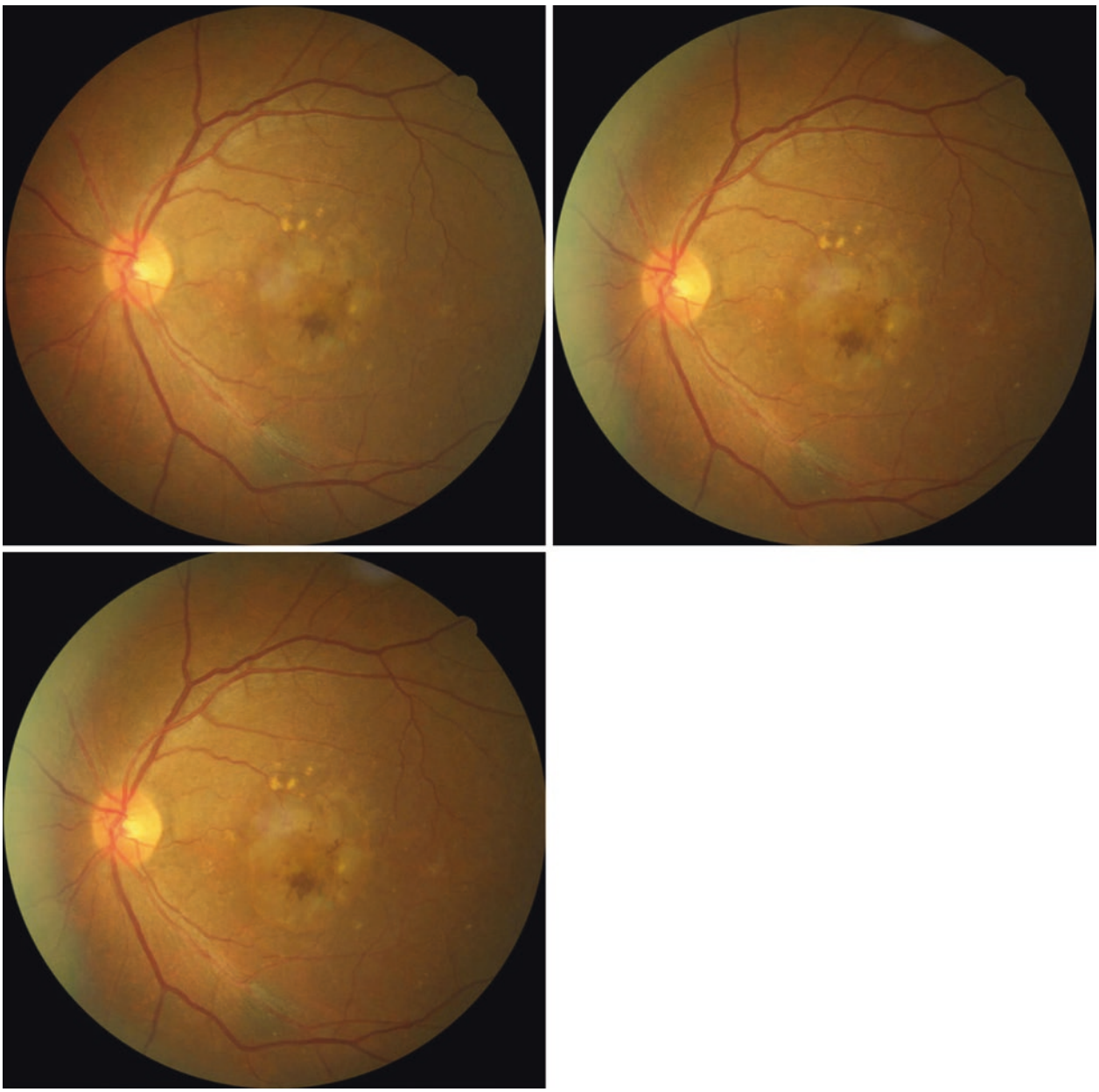

Fig. 3.50 Macular atrophy after branch retinal artery occlusion
I. Macular atrophy and thinning
II. Thinning of inferior temporal retinal artery
III. Pigment proliferation

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