Education and Training

It is time for more colors!

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Retinal drawing with a color-coding system brings uniformity in representation of fundus findings so that clinician can decipher various lesions on a two-dimensional drawing. Existing color coding addresses most of the common retinal pathologies including preretinal, intraretinal, and subretinal lesions. However, with the advent of various imaging modalities there is deeper understanding of microanatomy of retina and associated pathologies. With this, there appears further need of newer set of color coding to include the minute details of fundus findings clinically. Through this article, we discuss few common pathologies at different levels of retina layers with color-coding dilemma which calls for a better preciseness in its clinical representations.

Key words: Color coding, digital drawing, retinal drawing

Pictorial Representation of fundus findings started way back in 1928 where Amsler and Dubois used fundus chart to depict retinal detachment with its extent and causative break.[1] Later in 1947 with the advent of head mount indirect ophthalmoscopy (IDO) by Charles Schepens which was modified version of earlier handheld IDO by Giraud Teulon, it became much easier to map down various retinal findings.[2‑4] Since then fundus drawing and color coding has evolved, helping retina surgeons worldwide to understand and represent IDO findings on paper.

Color coding brings uniformity in representation of fundus findings so that one can decipher various lesions depicted on a 2D drawing. Existing color coding addresses most of the common retinal pathologies including preretinal, intraretinal, and subretinal lesions.[5] However, with the advent of various imaging modalities like multicolor fundus imaging, wide angle fundus photography, infrared imaging Fundus autofluorescence, optical coherent tomography, optical coherent tomography angiography, there is deeper understanding of microanatomy of retina and detailed clinical description of retinal pathologies. For example, in eyes with parafoveal telagectasia, early clinical signs like retinal graying lacks appropriate color-coding illustration. With this, there appears further need of newer set of color coding for easy understanding and detailed representation. Through this article, we discuss few common pathologies at different levels of retina and choroid with color-coding dilemma which needs more detailed clinical representation.

Is color coding relevant in the present time?

Even in the present era of electronic medical record (EMR) documentation of fundus finding using digital drawing system, depiction of clinical findings can be seriously compromised without appropriate color coding for various retinal pathologies. The alternative could be to attach a wide field fundus photograph in the EMR, but it may not always be the appropriate solution considering facts like the false color, which is seen on most wide field photographs, availability of such equipment, and also all the lesions which are visible on IDO may not be picked up with the photography. Though color coding is probably more relevant in a paper-based drawing, it is highly useful to clinician in deciphering and conveying the accurate clinical findings in all modes of documentation. This emphasizes the need for more precise depiction of color coding even in present time. Fig. I helps us to understand how clinical representation differs in a documented fundus photo from an EMR representation and a hand drawing illustration.

Color-coding dilemma in common retinal pathologies

Preretinal pathologies

All preretinal lesions are conventionally denoted by green color, which includes opacities in the media, vitreous hemorrhage, vitreous membranes, hyaloid ring, intraocular foreign body, asteroid hyalosis, frosting or snowflakes on cystoid degenerations, retinoschisis or lattice degeneration outline of elevated neovascularization (NV).[5‑6] Though this

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coding simplifies the differentiation, most of the details can be compromised. For instance, vitreous hemorrhage; there is less clarity on coding for changes in its color along the course of time from red (fresh) to yellowish then to white membranes (old). An incomplete posterior vitreous detachment with active traction over macula becomes worth documenting with precise depiction, an epiretinal membrane all of which are labeled in green, which alone may not be adequate representation [Figs. 1 and 2].

**Intraretinal pathologies**

Retinal vascular structures and pathologies including arteries, arterioles, hemorrhages at various level of retina, NV, vascular anomalies, and tumors are denoted by red color. Subtle ischemic lesions like paracentral acute middle maculopathy which can be clinically appreciated as a grayish intraretinal lesion adjacent to fovea require precise representation. Drawing of microvascular lesions including retinal angiomatosus proliferation, initial clinical stages of parafoveal telangiectasia needs clarity for better understanding during follow up visits. Hard exudate, cotton wool spots, drusen, and different types of drusen have all been grouped under same color coding of yellow, where differentiation of each of this lesion at different levels is of extreme clinical importance especially when more than one of these are present in the same location [Fig. 2].

**Subretinal and sub retinal pigment epithelium (RPE) pathologies**

Pigment epithelial detachment (PED), choroidal lesions like malignant melanomas, choroidal detachment, and outer layer of posterior staphyloma are denoted by brown. Different types of PED have less clarity in representation depending upon the content. Subretinal hemorrhage and sub RPE hemorrhage with both coding red need distinction in their depiction [Fig. 2]. Polypoidal choroidal vasculopathy can create dilemma in its depiction as it is subretinal (code yellow) and also a vascular lesion (code red) [Fig. 2].

**Color-coding dilemma in common intraocular tumors**

Endophytic and exophytic types of retinoblastoma need better differentiation on color documentation as each grows in a different direction with different types of progression. Calcific residue, fish flesh, active part of tumor, and inactive tumor all grouped under yellow need clarity in differentiation while documentation. Regression results in a fibrous type of tumor; redundant retinal fold that can at times be seen in regressed tumor is difficult to convey through existing color coding. There is need of more accuracy in color coding in choroidal lesions including malignant melanoma and a benign nevus, which are represented by same color (brown) so as in choroidal...
vascular tumors like hemangioma and retinal tumors like angiomas (common color red).

Other important set of pathologies including myopic traction maculopathy and its components and optic nerve pathologies (Disc pit, disc edema, disc drusen, disc pallor) has very less clarity on color coding depiction. Also, color coding in documenting retinal surgeries with various implants and tamponades (Silicone oil, perfluoro liquids) used needs to be addressed with clarity.

Can color-coded drawings be replaced?
True color ultra-wide-angle photographs have made it possible for easy and accurate documentation of fundus findings to a certain extent. This may not be feasible in patients with media opacities. Practical issues including affordability of these equipment and electronic medical recording technologies, which are outside the purview of most ophthalmologists, make color code-based drawings indispensable. While it may appear that a color-coded drawing may be less relevant in this era of EMR, the rudimentary drawing and representational skills offered by the electronic drawing tools make it impossible to mirror the drawing capabilities offered by color pencils on paper where one can use their drawing skills on paper to realistically represent the fundus changes, thereby making it apparent to the viewer of the pathology, such representation is not really possible with the electronic drawing aids.

To conclude, it is now time to extend the existing spectrum of the color-coding system for retinal drawings to make sure it is inclusive of subtle clinical fundus details and to be updated with scientific advancement in various retinal pathologies.

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