

Smartphone wide-field fundus photography in retinoblastoma with a nasal endoscope

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Key words: Endoscope, fundus imaging, retinoblastoma, smartphone

The documentation of retinoblastoma is traditionally done with retinal drawings. The introduction of wide-field photography with Retcam in 1997 changed the way tumors could be documented and followed up. However, the high cost of the Retcam makes it beyond the reach for most of the ophthalmologists treating retinoblastoma in the developing countries. The search for alternative affordable technology has taken different approaches. One such promising technique is the use of a nasal endoscope for fundus photography. One of the authors (S.D.) has been using a nasal endoscope attached to a high definition imaging stack for retinoblastoma fundus photography. The high-definition endoscopic camera unit is expensive. Therefore, to make the imaging cost-effective, we wanted to explore the feasibility of using a smartphone camera attached to a nasal endoscope to acquire images without the use of conventional video tower of an endoscope.

Technique

An android smartphone (OnePlus 6T) was mated to a 0-degree 4-mm nasal endoscope using an off the shelf universal smartphone adapter [Fig. 1a]. A conventional light source (K-CAM LED- II) was connected to the nasal endoscope to provide trans pupillary illumination. The endoscope was placed in front of the cornea by the examiner and pictures were taken with the smartphone camera using the manual focus mode by a second observer [Fig. 1b]. Clear photographs of tumors, subretinal seeds as well as vitreous seeds, and of the peripheral retina could be obtained by tilting the endoscope in

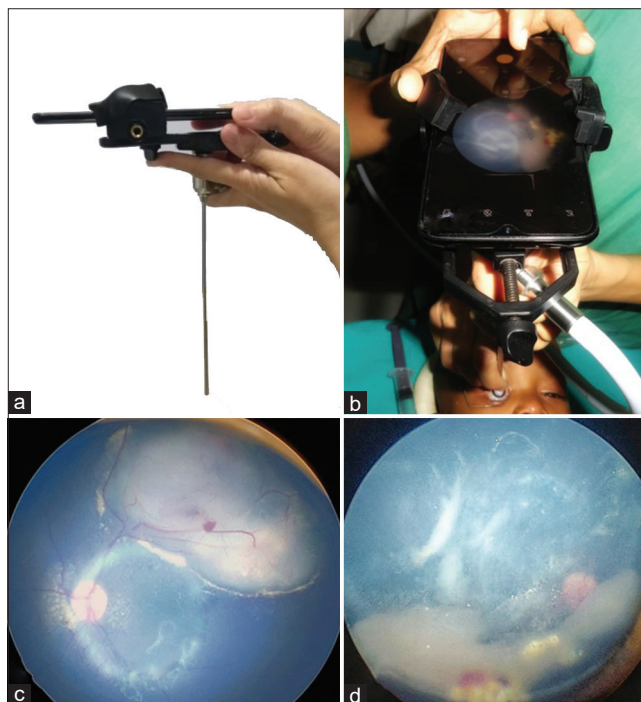


Figure 1: Smart phone-based fundus photography using a conventional nasal endoscope. The nasal endoscope is mated to the smartphone using a universal smartphone adapter (a). Fundus photographs are taken during examination under anesthesia of a child with retinoblastoma by placing the endoscope just in front of the cornea while the assistant uses the manual focus of the smartphone camera to capture the photographs (b). Retinal tumors (c) as well as vitreous seeds (d) can be imaged by tilting the endoscope in various directions

various directions [Fig. 1c and d]. The field of view obtained in a single image was approximately 60°.

Discussion

The use of Retcam imaging for retinoblastoma documentation is well established. Alternative technologies for acquiring wide-field fundus images include smartphone-based indirect ophthalmoscopy and endoscopes and otoscope connected with a digital SLR camera.^[1-3] Shanmugam *et al.* first demonstrated fundus photography using a nasal endoscope.^[4] Ali *et al.* studied the use of different nasal endoscopes and light sources and established their safety.^[5] Both these groups used the conventional video camera and tower that are available with endoscope systems. Smartphones have been

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used with an endoscope for imaging the ear and nasal cavity.^[6] This particular work demonstrates the feasibility of using a smartphone to photograph retinal tumors with a nasal endoscope. The use of a smartphone would further reduce the cost of image acquisition and also allow quick sharing of images for cross consultations. However, there are some limitations to this technique. There is an artifactual ring reflex due to reflections from the light source. This technique also requires two persons, one to stabilize the endoscope on the patient's eye and another to adjust illumination, focus, and capture the images on the smartphone. At present, there is no application for the labelling, orientation, and archiving of the images obtained. These images are used as a supplement to the retinal drawings for counseling, documentation, and follow-up.

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Conflicts of interest

There are no conflicts of interest.

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