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Study of comparison of retinal imaging using smart phone and Indirect ophthalmoscopy in emergency wards.

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Introduction: Ophthalmoscopy is required to be done in various emergency and non-emergency settings[1]. It is a useful clinical tool in emergency room to rule out certain life threatening conditions like features of raised intra cranial pressure in the form of papilledema. Retinal and disc imaging has been important part of assessment of other medical emergencies like trauma, hypertensive emergencies, optic neuritis, hemorrhagic disorders, high altitude retinopathy etc. In non-emergency settings diabetic retinopathy, hypertensive retinopathy, ocular tuberculosis, vasculitis and vascular occlusions are main indications of ophthalmoscopy. In addition it also forms an integral part of examination of children under anesthesia in operation theatres for tumors like retinoblastoma.

Various methods of ophthalmoscopy are in vogue. Conventionally it is done with ophthalmoscopes (direct or indirect) which are portable but have a limitation of inability of image storage[2]. In addition requirement of a trained examiner cannot be overlooked.

Retinal imaging systems are excellent tools for use in ophthalmology clinics. Integrated with the angiography, some of the current systems are also able to image the retinal periphery. These table top and expensive devices can store images for detailed analysis or tele ophthalmology but are neither portable and nor widely available. Consequently they have limitations for use in emergency rooms and field conditions. Smart phones are widely available with improved screens and cameras[3].

This study was done to compare the utility of smart phone ophthalmoscopy with conventional indirect ophthalmoscopy in emergency room and wards.

Material and methods:

Design: Clinical, Prospective, single masked, comparative non interventional study

This study was done in emergency rooms and acute care wards of tertiary care hospital. Total 100 cases (as referred by primary care physician for emergency ophthalmoscopy) were enrolled in the study after taking consent. Comprehensive ophthalmic evaluation was done. Pupils were dilated with tropicamide drops put twice at a gap of 30 min. Indirect Ophthalmoscopy was done using this smart phone (Screen resolution 1136X640 pixels and more than 330 pixel per inch (ppi) with 8 MP camera and 64 GB memory) and 20 D lens where video camera of smart phone with flash light continuous on mode acted as source of light and also a capturing device. The video captured and still images retrieved and stored in data bank with patient identification numbers. Conventional ophthalmoscopy was done with 20 D lens and findings noted with patient identification numbers. The images were analyzed by masked examiner who was not be aware of patients' diagnosis.

Results: Descriptive statistics were used for data on demographics. Agreement between two methods was analyzed using kappa values. Sensitivity and specificity were also calculated.

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The mean age of patients was 62.6 years. 56% of patients were males and 44% were females. The average length of hospital stay was 2.4 days. Out of 100 patients normal findings were recorded in 68%. 15% had disc edema. 10% had hypertensive retinopathy and 7 % had retinal haemorrhages of various etiologies like diabetic retinopathy, trauma or platelet disorders. The average time taken for smart phone ophthalmoscopy was 123 sec and conventional ophthalmoscopy was 106 sec. The sensitivity and specificity for smart phone were 82 and 88 percent when compared with indirect ophthalmoscopy. Kappa values were 0.76 (CI 0.71-0.8)

Conclusion:

In this study good correlation was found in both the methods.

The images were acquired in reasonable time available in the clinic. The quality of images were realistic for analysis. The results showed good correlation between the two methods which was clinically and statistically significant. This method seems to have immense potential to be used in community setting. Easy availability, low cost, wide applicability, portability and potential of data transfer with mobile network are the strengths of this procedure.

It is now estimated that almost 50% physicians use smart phone. This device has versatile camera and excellent screen resolution[4]. The addition of ophthalmic 20 D lens which is readily available in the eye department makes this procedure

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inexpensive in contrast to retinal imaging cameras which are available for Appx 20 Lakh rupees. Technically the procedure is not very demanding and can be learnt without any specific training[5]. This method has extended utility of being used by technicians in community setting. The ever expanding mobile network and use of data clouds make this procedure more lucrative with regards to tele ophthalmology[6]. Similar approach of retinal imaging can be used by medical personnel in remote locations in certain life threatening conditions like papilledema, high altitude cerebral edema. In such situations the images can be sent to ophthalmologist for opinion.

The intensity of light of smart phone flash has been found to be safe in human and animal eyes[5]. The quality of images acquired is limited by quality of camera and also screen resolution. This can be overcome using newer phone models with a higher camera resolution and better screens[3].

The limitations of this study is requirement of patients with clear media only which was essential to compare both imaging modalities under standard conditions. Further studies are required to study imaging capabilities of smart phone ophthalmoscopy in hazy media also, but in those situations even conventional ophthalmoscopy would not be possible.

The smart phone can be used to store these photos or videos for future reference. The technique is inexpensive and user friendly hence making it appropriate for use by technicians. The two methods had significant level of correlation.This precise and objective way of retinal assessment can be helpful in early diagnosis and treatment of medical emergencies[8]. The wide availability, acceptability and feasibility of this method will make it popular and make it cost effective.

The requirement for development of smartphone app for data storage was felt during the study. The provision for entry of clinical details will be added advantage. This study would act as a pilot study for development of protocols for further epidemiological studies in the community which is a felt need in developing countries.

In this study clinically and statistically significant correlation was found between smart phone ophthalmoscopy and conventional ophthalmoscopy in retinal assessment of medical emergencies. Smart phone ophthalmoscopy seems to have immense potential to be used in community setting. Easy availability, low cost, wide applicability,portability and potential of data transfer with mobile network are the strengths of this procedure.

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