MATERIAL AND METHOD
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This present study was undertaken in eyes of the individuals attending Ophthalmology department of M.L.B. Medical College and Hospital, Jhansi during the period September, 1989 to September, 1990. The subjects were collected from the 'Glaucoma Clinic' and 'General Eye C.P.D.' Only those patients were selected whose media of the eye were clear i.e. whose fundus can be clearly visualized and have previous history of glaucoma and some findings of chronic raised tension like cupping of the optic disc or visual field changes were present.

The intra-ocular pressure of the eyes were within normal limit at the time of fluorescein angiography. Gonioscopically, it was confirmed that angle of the anterior chamber was wide and there was no risk of the precipitation of acute attack of the glaucoma.

The patients were divided into two groups.

1) **Group - I**: Normal eyes.

   Those patients, who were having media clear and without any clinical abnormality.

2) **Group - II**: Those patients, who were having some previous history of the raised intra-ocular tension and also having either cupping of the optic disc or some visual field defects.
The biodata of the patients were recorded in the form of name, age, sex, present and past history of glaucoma and findings were recorded in detail according to the proforma.

1. Clinical history -
   A detailed history suggestive of glaucoma was enquired in each individual.

2. Clinical examination -
   The external examination of each eye was done to exclude any pathology in the conjunctiva, cornea, and lens and detailed examination of anterior chamber and pupil was undertaken.

3. Tonometry -
   Intra-ocular tension of both the eyes were recorded in different sittings by digitally and by Tonometer. In the cases of raised intra-ocular pressure, the patients were treated accordingly to control the intra-ocular pressure within normal limits by appropriate drugs.

4. Slit lamp examination -
   It was done in detailed for abnormality of the anterior chamber and, lenticular opacity and vitreous opacity.

5. Gonioscopy -
   It was done for the examination of angle of the anterior chamber. Detailed study about the angle of the anterior
chamber was done to know the type of glaucoma and to know the cause of raised intra-ocular pressure.

6. **Fundus examination** -

   The fundus examination was done by indirect ophthalmoscopy and by direct ophthalmoscopy to know any pathology in the fundus. Main impression was done on the examination of the optic disc specially the cupping of the disc, circum-papillary region, blood vessels, centrocaecal area and macular area. The status of the chroidal vessels and the retinal pigmentary epithelium was also seen. The equatorial region of the retina was also visualized.

7. **Visual field examination** -

   The central and peripheral visual fields were recorded in each individual to know any field defects due to chronic elevation of the intra-ocular pressure and to see, the effects of raised intra-ocular pressure upon the optic disc and its cupping.

**EQUIPMENT** :

For present study of fluorescein angiography, the carl-zeiss fundus camera and fluorescein angiography unit was used. Negative films, Black & white rolls of 35 mm. CRWC 400 ASA were used for photography.
The instrument consists of following things -

(1) High speed, high power, flash generator;
(2) Automatic camera system;
(3) Pulse generator;
(4) Data recording system; and
(5) Filters.

The instrument was used as per manufacturer's instructions.

(1) **High speed, high power, flash generator:**

This generator has 4 different steps for flashes of 120 watts/sec., 240 watts/sec., 480 watt/sec., 720 watts/sec. The firing sequence varies from 0.5 seconds at 120 watts/sec. - 240 watts/sec. to 1.2 sec. to 720 watts/sec. The flash generator mainly consists of a power supply unit with cut outs and selector switches, control unit with filament lamp and a pulse generator.

(2) **Automatic camera system:**

Automatic camera system is a special purpose Asahi pentax camera with a built in tripping magnet driven by an electric motor. This is attached with a standard zeiss fundus camera.

The high speed mirror in the eye piece head is attached by a rotatory magnet. Automatic photography is initiated by pressing a pedal switch.
The camera is ready for the next exposure after a minimum of 0.5 seconds. The power supply unit for the automatic camera system is incorporated in the flash generator. To study the fine details in a small field a 1.5 x auxiliary objective can be inserted in the eye piece.

(3) **Pulse generator**:

It is very difficult to take the series of exposures manually at time interval of 1-2 seconds, a special automatic timer is attached, which triggers the automatic camera system at present intervals as long as the pedal switch is pressed. Automatic timer has three different settings for sequential photography: 0.5 seconds to 3.5 seconds at flash step 60/120/240 watts/sec., from 0.7 seconds to 3.7 seconds at flash step 420 watts/sec., 1.2 to 4.2 seconds at flash step 720 watts/sec.

(4) **Data recording**:

The study of serial photographs is considerably facilitated by recording the data together with each exposure. The data including the patients identification number (PID) and the exposure time in seconds or minutes is recorded on the films. This all is done by dataphot system attached to the back of the camera.
(5) _Filters and films:_

The selection of a proper combination of excitor and barrier filters is extremely important for the best results. Satisfactory results will only be obtained, if the different spectrum distribution factors like an emission flash tube, transmittance of the excitor and barrier filters, activation spectrum, fluorescence spectrum of the fluorescein in the blood plasma, reflectivity of the retina and film speed are favourably balanced. The excitor filter is ideal which removes all the wavelengths from the incident light except in the range of 590 - 510 nm. wavelengths, which is the absorption peak of fluorescein excitation. An ideal barrier filter should cut off all the wavelength except those in the range of 500 - 530 nm., which is the fluorescent or emitted peak of fluorescein. The suitable flash intensity and the proper use of the films is also necessary to have good results.

The filters used in this apparatus were L.F. 520 barrier filter, inserted in the funnel stop and held in front of the camera and a Med 485 excitor filter. The excitor filter is present in the diaphragm turnet of the fundus camera. The funnel stop containing the barrier filter can be introduced in the camera body by a simple manipulation. ORWO, 400 ASA, 35 mm. film was used in this present study. Pictures were taken with the above filter
combinations utilizing a flash step at 240 watts/sec. Unfortunately during the period of this study, the automatic motorized film advancement system and dataphot were not working properly, so the series of photographs were taken some time automatically and some time manually by film advancement by quick action, locking lever and with the release of auxiliary and sutter, by auxiliary release knob and sutter release knob respectively.

Procedure:

Before doing the fluorescein angiography the patient were explained about the procedure and the patient was prepared psychologically and mentally. The pupil of the patient was fully dilated by using the drosyn 10% eye drops and cyclopentolate drops, instilling 1-2 drops every ten minutes for 5-6 times or more till the patients have fully dilated pupil. In the patients having the treatment for the controlling the intra-ocular pressure the dilatation of the pupil was very slow and was not upto mark, so this is the main drawback of fluorescein angiography in glaucoma cases. There was also a risk of precipitation of the acute attack of the glaucoma.

The patients were subjected to sensitivity test by injecting the small 0.1 - 0.2 ml. fluorescein dye subcutaneously before starting the actual procedure.
If the patient was not sensitive to dye then the patient was seated on an adjustable stool placed next to the camera and his chin and forehead were adjusted on the frame. The proper focusing of the central fundus was done. The apparatus was made ready for operation after all the necessary & finer adjustments.

A fundus photograph of posterior pole of the eye was taken in the same focus with both excitor as well as barrier filters in position using flash intensity of 480 watts.

After the instrument was ready for operation 5 ml. of 10% fluorescein dye was injected intravenously in the antecubital vein in majority of cases and in the veins of dorsum of the hands in patients of fatty vasculature. The dye was injected very rapidly as a bolus through the 19 guage needle.

The photographs were taken after 5 second of dye injection for every seconds, up to 20 seconds till the filling of the retinal vessels. After that the photographs were taken after 1 minute, 3 minute, 5 minute, 10 minute, 15 minute and after 30 minutes.

The focusing of the fundus image was frequently checked in between the exposures as patients are often inco-operative or blink the eyes consequently to high speed flash.
Any unpleasant side effects or reaction to the dye was recorded. Whole procedure lasted for about 30 minutes and in the end, the patient was asked to take rest in supine position. No case in this present study develop serious complications except slight nausea, in few patients.

An emergency tray containing medicines and equipment to deal with any adverse reactions to the fluorescein dye was kept in the fluorescein angiography room.

The patients were explained about yellowish green discolouration of urine for 24 to 36 hours. Yellowish skin staining for 12-24 hours and yellow or blue purple hue of visual fields for 3 to 6 hours.

After the completion of the procedure the, apparatus was switched off and the film was sent for processing immediately. Positive prints were made and these fluorescein angiograms were studied.

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CARL ZEISS FUNDUS CAMERA WITH AUTOMATIC CONTROL SYSTEM, HIGH POWER, HIGH SPEED FLASH GENERATOR & PULSE GENERATOR.