MATERIAL AND METHODS

The subjects in this study were the patients attending the out patient department of Ophthalmology and also those who were admitted to Ophthalmology wards of M.L.B. Medical College and Hospital, Jhansi between May, 1982 to March, 1983. This study was undertaken on a series of 60 subjects to see the relationship of various ocular parameters in early diagnosis of chronic simple glaucoma. A subject was considered in study if he/she was falling in one of the following groups :-

* Group I
* Group II

GROUP I :

A person on routine examination showing intracocular pressure of 21 mm of mercury or more by Goldman applanation tonometer (Sitting).
GROUP II:

Follow eyes of the patients suffering from
unilateral chronic simple glaucoma.

A series of sixty patients, belonging to
above chosen groups, was examined on the following
lines.

HISTORY:

detailed history of ocular complaints
alongwith family history and also regarding various
systemic diseases like diabetes, hypertension,
cardiovascular disorders and use of any medication
was recorded on a preset proforma.

EXAMINATION:

1. Systemic examination: A general examination of
   various systems was done and any positive finding,
   if found, was noted in the proforma.

2. Local examination: It was done with the help of
   different illumination, focal illumination and slit
   lamp examination. The state of the anterior segment
   of the eye was noted and special attention was
   given to exclude any recent or past sign of
   inflammation and to record the depth of anterior
   chamber and if sign of any ocular disease was found.
that case was excluded from the study.

Besides these investigations, various other examinations were also undertaken, which are listed below:

(a) Visual acuity.
(b) Papillary examination.
(c) Intracocular pressure recording.
(d) Gonioscopy.
(e) Fundus examination.
(f) Pachymetry.
(g) Specimetry.

Visual acuity of every patient was recorded initially and in subsequent follow-up. The distinct visual acuity was recorded with the help of Snellen's distant chart (Snellen, 1853) and near vision was recorded by standard reading test types as recommended by British Faculty of Ophthalmologists (Lam, 1983). After doing the retinoscopy (static & dynamic) corrected visual acuity for near and distant was also noted.
(b) **EXAMINATION OF PUPIL**:

Pupils of both eyes were seen for:

1. Pupillary reaction.
2. Size of pupil.

1. **Pupillary reaction**: Direct and consensual pupillary reactions were seen with the help of slit light. Reaction to accommodation was also noted. Special attention was paid to presence of cycloplegia.

2. **Size of pupil**: This was measured by the ocular of telescope attached to Goldmann's periphere. After placing patient on the Goldmann's periphere skin and head pack allowed required background immobility of ophtoma (11.5 cm) was obtained by adjustable device. Now the patient's eye was central and focused and diameter of pupil was noted in millimeters by reticle scale. The other eye was also subjected to the same procedure.

(c) **MEASUREMENT OF INTRACRANIAL PRESSURE**:

The intracranial pressure or tension was measured with the help of Goldmann's application tonometer attached to a Haag-Streit-900 slit lamp.
Intersacral pressure was recorded at various hours of day and highest reproducible reading was taken.

An application transducer is not in routine use at various institutes, a brief description of the instrument will not be out of scope of this study.

SIDDLE'S APPLICATION TRANSDUCER

It is the most commonly used transducer in clinical research and works on Inert-Stick law by this force necessary to flatten a known area of ecmes is mounted. It consists of a plexiglass plate, 7.0 cm in diameter, at one end of a cylinder, which is used to applyate an area of ecmes 2.08 cm in diameter. The plate is made to press on the ecmes by a casted spring and lever system of very great stability. The force employed over the casted spring is controlled by a dial calibrated directly in cm. This gives a force that may vary between 0 and 7 cm. This whole instrument is mounted on a long stout-800 slit loop. The constant area flattened is observed with right angle of microscope. The measurement of the flattened
Surface is made directly on the cornea, between the plate and the observer there is a pair of prisms so as to divide the circular field into two halves and displace them 2.06 mm apart. A force of 1 gm placed on a surface of \( F = 7,365 \text{ mm}^2 \), its diameter being 3.06 mm, corresponds to a pressure of 10 mm of mercury.

**Method of measuring tension:**

1. **Preparing the patient:**

   - Both eyes of the patient were anesthetized with 2-3 drops of 0.5% topical tetracaine within 30-40 seconds.

   - A sterile fluorescein paper strip (here Hang Snell 1.0, sterile fluorescein strips were used) was placed near the outer canthus in the lower conjunctival sac in the same manner as for the Schimler test. After five seconds, when the lacrimal fluid was sufficiently retained, the paper strip was removed.

   - Now the patient was asked to put his/her hand on the skin and beneath most of the skin.**
(2) Preparing the slit lamp and thermometer:

- Pressure cone with the prism was then swung into the beam of the light of the slit lamp along the axis of right microscope.

- After opening the slit aperture fully, the blue filter was brought into light beam of slit lamp. The angle between microscope and illuminating device was set at $60^\circ$. The switch was set at 6 volts or more if needed.

- Right microscope was focused on the front surface of the prism so that the measuring ring could be seen distinctly.

- Now the measuring cone was set at 1 gr.

(3) Instruction to patient:

- Patient was asked to press head firmly against the chin and forehead rest (for thin, if necessary head rest head was also used).
- He or she was asked to blink immediately before taking the measurement to get some moist by lacrimal fluid with fluorescein.

- Patient was asked to look straight ahead if necessary fixation lamp was also used.

- Now the patient was asked to keep his/her eye wide open. If necessary it was held open without putting any pressure over the eye ball.

(4) Measurement:

- Slit lamp was moved forward to bring the patient into contact of cornea on pupillary area. As soon as the light was lighted up, slit lamp’s forward movement was stopped.

- Now the two astigmatic were looked through the right ocular of microscope, so as to steady the position of two fluorescein astigmatics of equal size in the middle of the field of view (Fig 3). If it was not like this adjustment was done with the help of height control and joy sticks.
(a) - Pressure is low
(b) - Pressure is high
(c) - Correct final position

FIG. 3: CORRECT AND INCORRECT POSITION OF FLUORESCEIN RINGS.
- The pressure on the eye was increased by turning the measuring drum on the tonometer until the inner border of the two sphenocular rings just touched each other (Fig 3). The width of the sphenocular band around the point of contact should be about 0.3 mm.

- Pressure applied by the measuring drum was noted. This multiplied by 10 was the intracocular pressure in mm of mercury.

- This first reading was taken as trial and subsequently 3 readings were taken and if they remained within a range of ± 0.5 mm, they were considered correct.

NOTE: In case of spherical corneal curvature, measurement was made in any position preferably in 0 position while in case of flattening of more than 30° diameter measurement was made in a direction of 45° to least power.

(c) CILIARY

Binocular examination of anterior ciliary muscle was performed with the help of
Goldman's 3 mirror gonioscope. The method used was as follows:—

- The conjunctival sac of the patient's internal eye was anaesthetised with 4
topical proparacain.

- Now the gonioscope holder was filled
  with re-disp.

- While the patient was looking up, the inferior angle of the gonioscope was
  placed into the lower cul-de-sac and
  then, slowly, it was placed over the eye ball.

- Patient was seated on the slit lamp.

- By fascinating the slit and rotating the
  gonioscope all the four quadrants were
  examined.

- Opening of the anterior chamber angle
  was done according to Miller and
(a) **FUNDUS EXAMINATION:**

Fundus examination of the both eyes was done with the help of direct ophthalmoscope. If pupils were small they were dilated by instilling 10% Phospholine (BLOGUE), preceding to this angle was examined with vernier scope. The state of cup and disc along with vessels was seen in detail. This was done on the chart based on Stedman and associates method (1975). A brief description of that is as follows:

In this two circles representing the outside diameter of each disc were divided into squares of 0.2 disc diameter each, the cup/disc ratio was then expressed in tenth of disc diameter (Fig 6).

In diagnosing the disc an inner circle was drawn representing cup's best estimate of intensity between neurons and the lacera outflow as identified by the picture to yellow circle. A solid line was used to represent vertical or undetermined edge of cup while a dotted line for sloping edge.

A second peripheral circle inside the disc circle was used to show where nerve fibers
(a) C/D ratio 0.2, small cup with sloping border, lamina cribrosa not exposed.

(b) C/D ratio 0.3, deeper cup exposing lamina cribrosa. Nerve fibre reaching up to periphery of disc.

(c) C/D ratio 0.4 with an upward slope to the retinal level near the edge of disc. On one side slope steepens abruptly as shown by short concentric line.

(d) C/D ratio 0.8 with exposed lamina cribrosa with loss of nerve fibre at 5 O'clock.

FIG 4 SFAFFER AND COWORKER'S METHOD OF DISC DIAGRAMMING
reach the approximate level of surrounding objects. The steepness of the slope was shown by the several radial lines between the inner and outer circles. Areas of increased slope were shown by concentric dashes to radial lines and if leaning cellulose was exposed it was shown by tiny circles (Fig 4). These were needed because photographs were taken with the help of大學 Faculty cameras.

(a) PERIPHERAL FIELD (Kinetic quantitative polling)

The fields were taken by using caliper perimeter – 340 Heng Fazit A.C. It is a spherical projection perimeter with a recording device. It consists essentially of a hollow hemispherical circumscritted bowl which is of 300 cm radius. Inner surface of this is painted white. A standing illuminates the inner of the bowl. This is shaded from the rest of the hemispheres by a hood. A portion of light is sent by a condenser through a hollow lens and containing the projection system for the perimeter target. By this means, slight variations in the brightness of the lamp affect background and target luminosity equally.
1. Socket with cable for main bulb
2. Left-hand socket for central scotoma device
3. Projector
4. Lightmeter
5. Handle for photometer screen
6. Bulb for illumination of the lightmeter scale
7. Push-button contact for 6
8. Knurled knob for chart plate
9. Handle
10. Push-contact with cable for buzzer signal
11. Resistance for main bulb
12. Resistance for chart illumination
13. Spirit level
14. Foot screws
15. Slide in front of bulbs for chart illumination
16. Knurled knob for lateral movement of the headrest
17. Knurled knob for vertical movement of the chin-rest
18. Plug device for holder of correcting lenses
19. Handle of pantograph
20. Pantograph coupling
21. Chart plate
22. Tightening screw for telescope
23. Handle for large fixation point
24. Table for filter combinations on 940-K7
25. Telescope
26. Checking aperture
27. Lever for diaphragms
28. Handle for normal grey filters 940-K7
29. Handle for grey filters 940-ST
30. Handle for additional grey filters 940-K7
31. Centring socket
32. Centring pin
the amount of the projection can be produced by a pantograph controlled by a handle which slides on a vertical plate of opal glass illuminated from behind, intensity of which can be adjusted by a resistance. On the back of the pantograph, this plate has a place for recording chart, which is secured in place by four pressure clips. Each position of handle corresponds exactly with the position of the spot of light on the hemisphare. By slow movement of the handle across the surface of chart the visual field may be examined for 90° on each side of fixation. A telescope through the back of the hemisphare allows for constant observation and control of patient eye fixation. It has two light, variable aimed, fixation points. The back side of the opal glass has a four sets of lenses aimed for controlling the size of target and intensity. Those projected targets are ellipses of varying sizes from 1/16 cm² to 61 cm² while ranges of intensity 0.0001 minute photometric sensation to the luminosity of target from 100 to 1,040,000,000 to 1,040,000,000. Usually basic luminosity of the target has been fixed at 25 times that of background. This is adjusted by high-intensity photometer. This whole latter system is mounted on a platform which can be moved up and
done by a device. On patient's side there lies a
chin and forehead rest with head band. This can be
moved up and down and side to side with help of
two lehrs. It also has a button signal for immediate
response. This whole instrument is mounted in a dark
and quiet room.

NOTE:

(A) Adjusting the projecting: The instrument was
levelled by turning both first screws in 14 until
spirit level lies 13 almost correct position.

Chart was inserted over the chart plate
by turning the handle and was positioned
in such a manner that line 'y' on its bottom edge
was in the V notch of the frame and the lateral 'y'
mark with level of two lateral V notch (Fig 6).

Induction of patient was done previously
and optimum connection was given for a distance of
20 cm. If patient was in systolic group (usually
present), addition to distance connection was done
as follows ->
25-30 years old + 1.0 D sph.
30-35 years old + 1.5 D sph.
35-50 years old + 2.0 D sph.
50-65 years old + 2.5 D sph.
65-80 years old + 3.0 D sph.
Over 80 years + 3.5 D sph.

After switching on the power supply of the perimeter patient was placed in front of the perimeter in a perfectly comfortable position.

The other eye of the patient was covered with a patch, centimeter and slide and flashlight mask was adjusted after placing the patient and he/she was told about the whole procedure in detail.

Perimeter was played first with the Lightmeter, then with the photometer after in the following sequence.

The index at the end of the photograph was pulled to the little circle at 70° on the right hand side of the chart. (Point b in Fig 6) Centering pin 58 was pressed to lock the photograph. Now by using the longest and brightest target (between 57 to 58 towards the extreme right position)
normal luminosity of 1000 cad or 1439 lux was obtained by main mirror 11. To obtain 51.5 cad luminosity of ambient, handle 5 was pulled downwards, putting the white photometer screen in the light path of lamp. and gray filter 0.9235 was interposed by using lever 25. Now looking through the telescopic aperture and by moving sliding diaphragm up or down, ambient brightness was adjusted to that of photometer screen.

After closing the patient's eye
looking through the telescope, patient was asked to maintain fixation and to use humor if he or she was able to see the target coming from periphery to center.

Now sitting on the other side with eye at the level of telescope width of the pupil was measured by millimeter scale of telescope and was inserted on chart.

Then the examination was done by target side 1 and intensity 4 (1/4x) subsequently with 1/2x, 1/4x. Special attention was given to recall slip or presence of any asthen.
Blind spot was then plotted with 1/2 or 1/3 using shutter control 30.

Perimetric contours were examined by means of masking with 1/2 or 0/2.

 Entire field was examined on basis of Amal's method for gliomatous defects (Amal, 1973).

(c) *Galaxyry (central field checking with Bjerre's tangent screen):*

After the peripheral field had been investigated the central area of field (30° diametrical point) was examined by a Bjerre tangent screen.

It consists of square matt black cloth of 92 cm square. At the centre of it like a matt white disc of about 10 cm diameter to be used as fixation point. The screen is calibrated by an obviously visible black silk marking in mid-position every 15° and in concentric circles every 5°. It was illuminated with the help of day light lamps.
Patient was seated in front of the target screen at distance of 2 meters in such a manner that eye to be examined was exactly opposite the fixation mark. Patient with shunt on hand in the above position, the other eye being occluded, was asked to maintain fixation. Now the entire 30° of central field was examined by Tangany’s target. Starting with 2 an object if needed bigger object was used. Special care was given to localize the blind spot or any anomaly.
Fig. 1 APPLANATION TONOMETER
Fig. 2. APLANATION TONOMETER IN USE