THE VISUAL FIELD

The visual field is that portion of space in which objects are simultaneously visible to the steady fixating eye. It is somewhat more than one half of a hollow sphere situated before and around each eye of the observer within which objects are perceived while the eye is fixating a stationary point on its inner surface.

The boundaries of the field of vision measured in degrees from the fixating point are approximately:

60° above, 75° below, 60° nasal and 100° temporal.

Field of Vision of the Right and Left Eyes:

The fields of view of the two eyes overlap in human beings and in most recreatives. In man; there is an area of overlap of 120°, while there is an area to the extreme temporal of about 30° when objects are seen only by one eye, right or left (uniocular field). The binocular field of both eyes is larger than each eye alone and extends about 180°-190° horizontally and 130° vertically.

The Island of Traquair (Traquair Hill):

The single most important concept ill understanding the visual field is defined by the Island of Traquair; this island is a "hill of vision" surrounded by a "sea of darkness or blindness". The island has a sharp central peak (fovea) with best sensitivity and sloping sides. There is a small oval area of darkness near the peak, corresponding to the blind spot. Every point in the visual field has a certain visual threshold defined as the weakest stimulus that is visible in that location. Visual field testing / consists of determining the visual threshold, or the inverse of sensitivity, at selected points through the field of vision, as well as determining the outside boundary of the visual field.

Important Terminology

• **The central field:** Is that portion of visual field within 30° of fixation.

• **The peripheral field:** Is that portion of visual field from 30° of fixation to the far periphery.

• **Static perimetry:** A stationary test stimulus in a given location is intensified (or enlarged) until it is seen, thereby determining the visibility threshold at that location.

• **Kinetic perimetry:** The selected test stimulus is moved until it is perceived by the eye (crosses its isopter).

• **Isopter:** Is the outline of an area of the field capable of perceiving a given stimulus. The results are most often recorded in kinetic perimetry as isopters representing a contour map of the "hill of vision" or in static perimetry as a graph or profile representing a slice through the "hill of vision".

• **Colour fields:** Using objects of the same size, the field for green is the smallest, larger for red and largest for blue. The scotopic peripheral retina is many times more sensitive to blue than to red or white. Conversely, the scotopic fovea is most sensitive to red and white. There is a physiological central scotoma for blue which may be clinically demonstrated in the normal eye with a very small stimulus about 1/8°.

• **The blind spot:** Is the projection in the field of the optic papilla. It is vertically oval in shape and its center is situated 15" temporal to the fixating point and is 1.5° below the horizontal meridian.

This area is totally blind (absolute scotoma). It is not detected in our usual life due to: overlap of the 2 fields, it is away from the visual axis and the eye is never steady.

Examination of the Visual Field

A- Perimetry without special instruments:

1. Confrontation method (kinetic perimetry) especially for hemianopias and altitudinal defects.

2. Amsler grid: for macular lesions, to test the inner 10° of the central field of vision. It is performed at a distance of 30 cm, each square represents I ° of the field.

3. Bed side perimetry.

B- Perimetry with special instruments:

1. Tangent screen "Campimetry" for testing the cenral 25-30°. The most commonly used screen is 1 m x 1 m grey or black in color, is held at a distance of 1 m from the patient. The usual size of the object varies from 1\2 mm to 10 mm and may be used in different colors. The patient will inform the points of appearance and disappearance of the object. It is highly valuable in testing the central field and can detect a small and early defect due to a central retinal lesion.

2. Kinetic perimetry: In kinetic perimetry we plot isopters kinetically. The most famous machine is the Goldman apparatus.

3. Static perimetry: Automated perimeters test fields by static method. Missed targets reflects areas of visual field sensitivity loss. The most famous machines are Octopus, Humphery and Fieldmaster perimeters.

C- Other tcchniques of perimetry:

• Angioscotometry: especially useful in glaucoma.

• Critical fusion frequency "CFF" perimetry which may be used in presence of media opacities like cataract.

Pathological Affection in the Field of Vision

A- Depression: or decreased sensitivity. In static perimetry, inability to detect objects of low intensity while in kinetic perimetry, it is inability

to see smaller objects.

B- Contraction: means complete total blindness to all stimuli, in the effected area, whatever the intensity (in static perimetry) or size (in kinetic perimetry).

c- Scotoma: is a defect within the visual field. It may be relative or absolute (like the blind spot). It may be -ve when the patient does not feel or +ve if the patient feels its presence in the visual field.

Sometimes it is relative to certain colors like in papillitis.

methods of Conducting Perimetry

A) Suprathreshold screening procedures:

These tests present stimuli that are greater than threshold, and thereby readily visible to a normal individual.

The simplest form is the confrontation test. This test is simple and easy but not suited or detecting mild sensitivity loss

B) Threshold estimation procedures:

- Kinetic perimetry.
- Static perimety.
- Swedish interactive threshold algorithm (SITA).

Kinetic Perimetry:

Becoming less common now but has certain advantages

- Flexible and interactive.
- Evaluates the full peripheral field upto 90° (most static perimetry techniques stop at 30°).

Disadvantages

- Results depend on skill of operator.
- Limited information available on normal population characteristics.

Procedure: The basic procedure is moving a target of a specific size and

luminance to map out the boundaries of seeing (isopters) and non-seeing (scotoma) areas.

Standard Automated Perimetry

Procedure:

Initial threshold estimation by presenting an initial target. If the target is seen, the stimulus luminance is reduced in steps until the target is no longer seen. Then the luminance is increased in the same steps until it is once again seen. This is called "staircase" or "bracketing" strategy. If the initial target is not seen, the reverse is applied i.e., increasing first then reducing luminance.

Most procedures present stimuli at fixed locations in the central field, in a pseudorandom fashion.

Fixation stability is monitored visually or automatically by eye tracking.

Advantages:

• Test strategies are standardized.

• Normative database to compare results to age corrected normal values.

• Can be stored and retrieved.

• Monitors fixation and patient reliability.

Disadvantages

• Time consuming.

• Affected by learning, fatigue, attention lapses and *response* errors.

Most procedures take 12-20 minutes to perform for each eye.

SITA:

Uses information obtained during the test to determine the luminance of the next stimulus. This reduces time of test to about one half.

New Perimetric Test Procedures

1) Short wavelength automated perimetry SWAP

2- Frequency Doubling Technology Perimentry:

3) Motion Automated Perimetry and Displacement Perimetry

4) Flicker perimetry

5) High-pass Resolution Perimetry: (HRP)