KARNATAKA RADIOLOGY EDUCATION PROGRAM
GRIDS

The radiographic grid consists of a series of lead foil strips separated by X ray transparent spacers.
It was invented by DR.GUSTAVE BUCKY in 1913.
Grid is still the most effective way of removing the scatter radiation from large radiographic fields.

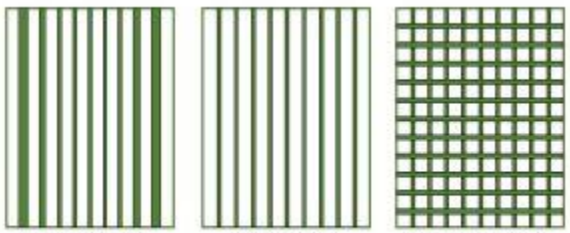
Primary radiation is oriented in the same axis as the lead strips and passes between them .
Scatter radiation arises from many points within the patient and most of it is absorbed by the lead strips

The interspaces of the grids are filled either with aluminium or some organic compound.
The main purpose of the interspace material is to support the thin lead foil strips.

GRID RATIO
Is defined as the ratio between the height of the lead strips and the distance between them.

The lead strips are approximately 0.05 mm thick (lead foil). The interspaces are much thicker.
Grid ratios are usually expressed as two numbers, such as 20:1
Ratios usually range from 4:1 to 16:1, the Higher the ratio, the better the grid functions.

Grid pattern
Is the orientation of the lead strips in their longitudinal axis.



The two basic grid patterns are :
Linear and
Crossed.

Linear grid
They allow us to angle the x-ray tube along the length of the grid .

Crossed grids : A crossed grid is made up of two superimposed linear grids that have the same focussing distance
The grid ratio of crossed grids is equal to the sum of the ratios of the two linear grids.
A crossed grid made up of two 5:1 linear grids has a ratio of 10:1.
Crossed grids cannot be used with oblique techniques requiring angulation of the X-ray tube

Focussed grid
Is a grid made up of lead strips that are angled slightly so that they focus in space.
A focussed grid may be either linear or crossed.
Linear focused grids converge at a line in space called the convergent line.
Crossed grids converge at a point in space called the convergent point.
The focal distance is the perpendicular distance between the grid and the convergent line or point.

Focussing range
Indicates the distance within which the grid can be used without significant loss of primary radiation
It is fairly wide for a low-ratio grid and narrow for a high ratio grid.
A 5:1 grid focused at 40 inches has a focusing range of approximately 28 to 72 inches.
While a 16:1 grid focused at 40inches has a range of only 38 to 42inches.

Parallel grid
A parallel grid is one in which the lead strips are parallel
They are focused at infinity.
can only be used with either very small X ray fields or long-target grid distances.
They are frequently used in fluoroscopic spot film devices.

Lines per inch Is the number of lead strips per inch of the grid.
Lines per inch = 25.4/D+d
D= thickness of the interspaces
d=thickness of the lead strips(both in millimeters)

Grid cassette
Usually used for portable radiography , with a grid built in to the front of the cassette.
Are focussed and Have a grid ratio of 4:1 to 8:1

Evaluation of grid performance
The three methods of evaluating grid performance:
1.Primary transmission(Tp)

2.Bucky factor (B)
3.Contrast improvement factor(K)

Primary transmission
Is the percentage of primary radiation transmitted through the grid.
Ideally , a grid should transmit 100% of the primary radiation.
The first measurement is made with the grid in place
The second measurement is made after removal of the grid

Bucky factor
Is the ratio of the incident radiation falling on the grid to the transmitted radiation passing through the grid.
It indicates how much we must increase exposure factors when we change from a non grid to a grid technique.
The Bucky factor indicates the absorption of both primary and secondary radiation.
It is determined with a large X-ray field and a thick phantom.

The contrast improvement factor(K) is the ratio of the contrast with a grid to the contrast without a grid.

$$K = \frac{\text{contrast with a grid}}{\text{contrast without a grid}}$$

Is the ultimate test of grid performance.
The contrast improvement factor is dependent on kVp,field size and phantom thickness.
These three factors determine the amount of scatter radiation
The larger the amount of scatter radiation, the poorer the contrast, and the lower the contrast improvement factor.
It is more closely related to the lead content of the grid than any other factor.
Generally, the higher the grid ratio,the higher the contrast improvement factor.

Grid cut off
Grid cut off is the loss of primary radiation that occurs when the images of the lead strips are projected wider than they would be with ordinary magnification
It is the result of a poor geometric relation ship between the primary beam and the lead foil strips .
The resultant radiograph will be light in the area in which the cutoff occurs.
With linear grids there may be uniform lightening of the whole film, one edge of the film ,or both edges of the film,depending on how the cutoff is produced.

There are 4 situations that produce grid cutt off
The amount of cutt off is always greatest with high ratio grids and short grid focus distance
There are 4 situations that produce grid cutt off
Focussed grids used upside down
Lateral decentering

Focussed grid distance decentering
Combined lateral and focus grid distance decentering

Three factors affect the magnitude of cutoff :
Grid ratio
Focal distance and
Amount of decentering

Moving grids
Grids are moved to blur out the shadows cast by the lead strips.
Most grids are reciprocating,which means they continuously move 1 to 3 cms back and forth through out the exposure.
They start moving when the Xray tube anode begins to rotate.
They eliminate grid lines from the film

Moving grids precautions
The grid must move fast enough to blur its lead strips
The transverse motion of the grid should be synchronous with the pulses of the Xray generator

Disadvantages They are costly Subject to failure
May vibrate the Xray table
Put a limit on the minimum exposure time because they move slowly
increase the patient's radiation dose

Grid selection
Usually 8:1 grid will give adequate results below 90kVp.
Above 90kVp,12:1 grids are preferred.
There is little decrease in transmitted scatter beyond an 8:1 ratio grid,
And almost no change between 12:1 and 16:1
For this reason12:1 grids are preferable to 16:1 grids for routine radiography.

Air gap technique
Scattered radiation arising in a patient from comption reactions is dispersed in all directions.
With an air gap the concentration of scatterd radiation decreases because scatters photons fail to reach the film

Used in 2 clinical situations
Magnification radiology
Chest radiology
With magnification techniques the object -film distance is optimised for the screen focal spot combination and the air gap technique reduces the scatter radiation
In chest radiography the focal film distance is usually lengthened from 6-10 ft to restore sharpness

Exposure factors with air gaps
X-ray tube exposure must be increased for the air gap technique because of larger focal film distance
Patients exposures are usually less with air gap technique
The air gap loses less primary radiation, so the patient's exposure is less

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