ANALYSIS OF CRANIUM RADIOGRAPHY RESULTS WITH COMPARISON OF GRID RATIO 8:1 AND RATIO GRID 6:1 TO GET GOOD DENSITY VALUES

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ABSTRACT

Grid has several types of ratios, where each ratio is influenced by the plate, the thickness of the plate, the width of the insulating material or interspace and the absorption of radiation. This can affect the density of the resulting radiograph. Based on the observations, the grid used in the Cranium examination, where the grid ratios that are often found are 8:1 and 6:1 grid ratios. Therefore, the purpose of this study is to determine which grid ratio produces good density and can produce good quality cranium radiographs. This type of research is quantitative with experimental studies. It was carried out at the Radiology Installation of the Siti Rahmah Islamic Hospital, Padang. In May 2022. This research uses the ratio grid, Phantom Cranium and stepwadge. The results of the radiograph are then measured for the density value using a densitometer and displayed in the form of a table and the graph obtained is displayed in the form of tables and graphs. The results showed that the radiographic density value of the Cranium Ap grid ratio of 8:1 was 0.69 and the 6:1 grid ratio was 0.75. The radiographic density value of the Cranium Lateral grid ratio of 8:1 is 0.67 and the 6:1 grid ratio is 0.88. From the density value, it can be concluded that the result of using the grid ratio on Cranium examination is good, namely the grid ratio of 8:1.

Keyword : Phantom Cranium, Grid Ratio, Density

BACKGROUND

In the medical world, it is necessary to carry out supporting fields of examination to help establish the diagnosis of a disease, one of which is the field of radiology which helps establish the diagnosis of a disease by utilizing X-rays whose results are in the form of radiographs. Therefore we need a radiograph that can provide as much information as possible, without having to repeat photos which can increase the dose received by the patient.(Carroll, 2019) Decline in the quality of radiographic images is caused by various factors, one of which is scattering radiation(Faiz M. Khan, 2014). Because of that, efforts need to be made to suppress the factors that can reduce the quality of radiographs. In order to reduce the scattered X-ray radiation reaching the film, several inspection aids have been made for this purpose.(Utami, 2016) One such tool is the grid. The grid is a tool to reduce or eliminate scattered radiation so that it does not reach the x-ray film. (Rasad, 2005)The main function of the grid is to prevent scatter radiation from reaching the film and as much as possible to transmit as much primary radiation as possible to the film or other image-forming detectors.(Dewilza, Yudha and Alfareza, 2022) With reduced scatter radiation, the radiographic image formed is sharper and the contrast between objects is expected to increase.(Rahman, 2009)

The grid ratio determines the grid's ability to absorb scattered radiation, the higher the grid ratio, the higher its ability to absorb scatter radiation and the radiographic contrast will also increase. Several types of grid ratios are 5:1, 6:1, 8:1, 10:1, 12:1. The grid ratio is affected by the height of the slab, the thickness of the slab and the width of the insulating material or interspace. The higher the grid frequency, the thinner and denser the material insulation, the grid ratio is even higher(Fauber, 2000). Another factor that determines the quality of radiography is the exposure factor. Exposure factors are factors that influence and determine the quality and quantity of X-ray irradiation required in making radiographic images.(Rasad, 2005) Exposure factors consist of tube voltage (kV), tube current (mA), and exposure time (s). Exposure factor settings Proper radiographic contrast can produce optimal radiograph contrast, which is able to show clear differences in the degree of blackness between organs that have different densities. The radiographic examination used is conventional radiography in its utilization using mobile X-rays and computed radiography (CR) to obtain the desired image results in the form of digital radiographs. (Sparzinanda, 2017)

Among the parts of the body that are relatively thick and cause a lot of scattering of radiation on radiological examination, one of them is the cranium(Yudha, 2023). Therefore, in examining the cranium, a grid is needed to reduce the scattered radiation) (Akhadi, 2020) resulting in an increase in the radiation dose received by the patient. Based on standard head examinations, the average voltage setting for an adult head examination on the Antero-Posterior (AP) projection is in the range of 70-80 kV with current-time in the range of 20-25 mAs, and in the lateral projection (LAT) using a voltage of 65-75 kV with a time-current of 20-25 mAs. The higher the grid ratio requires the higher the exposure factor (Priyono, Anam and Wahyu Setia Budi, 2020)

Based on observations, it was found that at Siti Rahmah Padang Islamic Hospital there are grids with various types of grid ratios. However, in general, the most easily found grid ratios are grids with a grid ratio of 8:1 and a grid ratio of 6:1. Which is the ratio grid It can also affect the quality of the radiographic images, one of which is the examination of the cranium. Some radiographers even set a high exposure factor but do not use a grid when examining the cranium, so that the results of the images are not good or not optimal.

METHODE

TYPE OF RESEARCH

This type of research used is a qualitative experimental study method. This study analyzed the radiographs of the cranium with a grid ratio of 8:1 and a grid ratio of 6:1 to obtain a good density value. The population in this study is Phantom. the research sample used purposive sampling or judgmental sampling.

SUBJECTS OF RESEARCH

Subjects of research is cranium phantom.

Design Of Research

The type of research used is a quantitative experimental study method. This study analyzed the results of skull radiographs with a grid ratio of 8:1 and a grid ratio of 6:1 to obtain a good density value. The population in this study is Phantom. the research sample used purposive sampling or judgmental sampling. (Notoadmojo, 2010) In this study, the researcher used the population as a sample, in which the characteristics or characteristics of the population were previously known or determined from the entire population, namely Phantom Cranium.(Sugiyono, 2019)

STAGES OF RESEARCH

1. Using Grid Ratio 8:1

   Setting up an X-ray machine and preparing tools and materials. Make radiographs of the cranial Ap and lateral with true Ap and true lateral radiographic techniques.(Bontranger, 2016) This is done using a 24 x 30 cm cassette, then the grid is placed on top of the cassette. The grid used is a grid ratio of 8:1. Stepwedge was placed beside the cassette beside the phantom cranium. Center the collimator light in the middle of the stepwedge with an FFD of 100 cm,(Balingger, 2019) with the direction of the vertical beam perpendicular. Set the collimation as needed, do the exposure with an exposure factor of 70 kV, 100 Ma and 0.20 s. Film processing is done by automatic processing with computed radiography. After data collection, the density values of the 10 steps were measured using a densitometer.

2. Using Grid Ratio 6:1

   Setting up an X-ray machine and preparing tools and materials. Make radiographs of the cranial Ap and lateral with true Ap and true lateral radiographic techniques. This is done using 24 x 30 cm tapes, then the grid is placed on top of the tapes. The grid used is a grid ratio of 6:1. Stepwedge was placed beside the cassette beside the phantom cranium. Center the collimator light in the middle of the stepwedge with an FFD of 100 cm, with the direction of the vertical beam perpendicular. Set the collimation as needed, do the exposure with an exposure factor of 70 kV, 100 Ma and 0.20 s. Film processing is done by automatic processing with computed radiography. After data collection, the density values of 10 stepwadges were measured using a densitometer

After obtaining the results of the picture, measure the density using a densitometer. How to measure it:

1. The film is placed between the light source and the sensor.
2. Then the film is pressed so that the film sticks between the light source and the sensor.
3. The light source is turned on so the light will turn on.
4. Light passing through the film will be captured by an electric photo sensor. The darker the film being measured, the less light will be received by the sensor, this means the density value will be higher.
5. After the light passes through the film and is captured by the electric photo sensor, it will produce a density value from the densitometer.

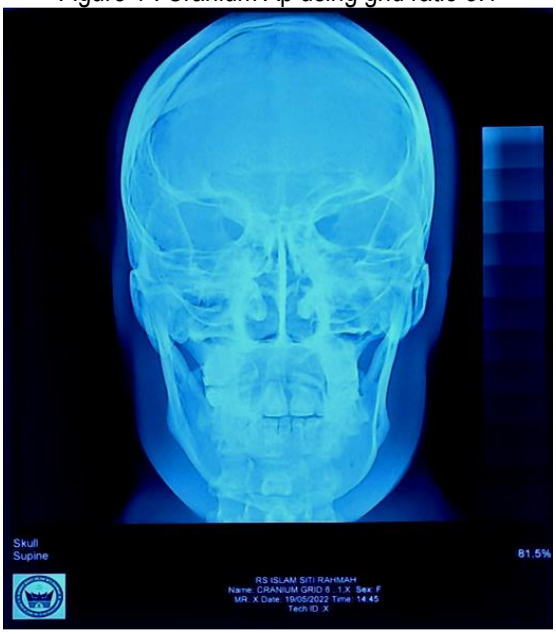
6. To measure the density value on the radiograph there is a stepwedge image with ten levels, the first level is measured at 3 points, namely the left edge, the middle and the right edge. The underlying rules for processing or measuring at three points (left edge, middle and right edge) are so that the results obtained from measurements are more accurate and can be assessed as a whole in several areas where the density value is calculated.
7. Then the results of the three parts are totaled and divided by three. This applies to the second, third, up to the tenth level.

RESULT AND DISCUSSION

RESULT

After the researchers conducted research on the analysis of cranial radiograph results with a grid ratio of 8:1 and a grid ratio of 6:1 to obtain a good density value from the results of Ap Projection Cranium radiographs as follows:

Figure 1 : Cranium Ap using grid ratio 8:1



Figue 2 : Cranium AP using grid ratio 6:1

Figures 1 and 2 show in general that the density values in the two radiographic images of the Ap cranium with a grid ratio of 8:1 are different from a grid ratio of 6:1. This is shown from the table below:

Table 1 Comparison of AP Cranium Density Values with Grid Ratio 8:1 and Grid Ratio 6:1

Stepwadge	Density values from radiographs AP Cranium with 8:1 grid ratio	Density values from radiographs AP Cranium with 6:1 grid ratio	Difference Density Value (Increase Difference)
1	0,41	0,52	0,11
2	0,44	0,55	0,11
3	0,49	0,64	0,15
4	0,53	0,68	0,15
5	0,59	0,71	0,12
6	0,68	0,86	0,18
7	0,75	0,89	0,14
8	0,89	0,96	0,07
9	1,03	1,09	0,06
10	1,18	1,19	0,01
Total	6,99	7,57	1,10
Mean	0,70	0,76	0,11

The results of table 1 above compare the grid density values of 8:1 and 6:1 grid ratio on examination of the AP Cranium, which can be seen in Figure 3.

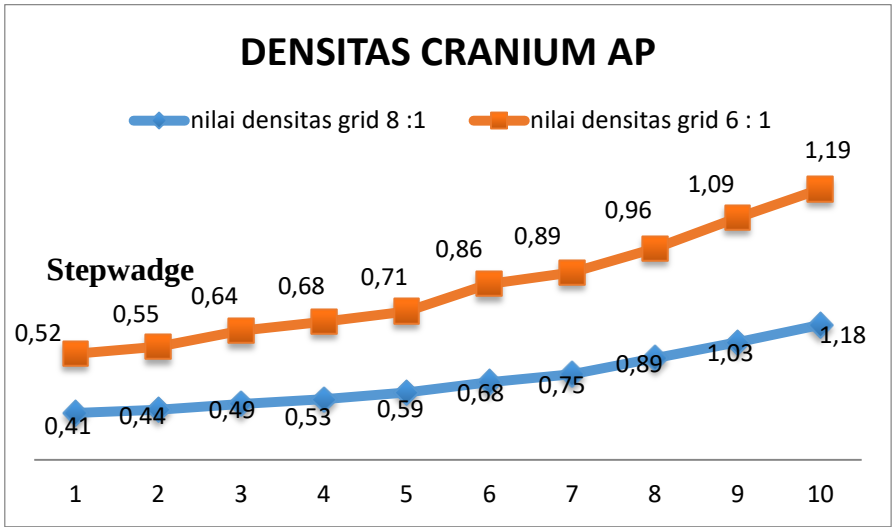


Figure 3. Grid Ratio Graphics 8:1 and Grid Ratio 6:1 of the AP Cranium

From the graph (figure 3) it can be seen that the density values of both the grid ratio of 8:1 and the grid ratio of 6:1 both have increased of each step from step one to step ten. Based on the research that has been done on the analysis of the radiographic results of cranial examination with a grid ratio of 8:1 and a grid ratio of 6:1 to get a good density value from the results of Lateral Projection Cranium radiographs as follows:

Figure 4 Cranium Lateral Grid Ratio 8:1

Figure 5 Cranium Lateral Grid Ratio 6:1

From Figure 4 and 5 it can be seen in general that the density values in the two images of the Lateral cranium radiography with a grid ratio of 8:1 have a difference with a grid ratio of 6:1. This is shown from the table below:

Table 2 Comparison of Lateral Cranium Density Values with a Grid Ratio of 8:1 and a Grid Ratio of 6:1

Stepwadge	Density values from radiographs Lateral Cranium with 8:1 grid ratio	Density values from radiographs Lateral Cranium with 6:1 grid ratio	difference Density Value (Increase Difference)
1	0,41	0,52	0,11
2	0,43	0,56	0,13
3	0,45	0,69	0,24
4	0,57	0,71	0,14
5	0,49	0,82	0,33
6	0,52	0,91	0,39
7	0,69	0,98	0,29
8	0,78	1,09	0,31
9	1,18	1,21	0,03
10	1,34	1,40	0,06
Total	6,76	8,89	2,03
Mean	0,68	0,89	0,203

From the results of the table 2, a comparison graph of the 8:1 grid ratio and 6:1 grid ratio is obtained on examination of the lateral cranium which can be seen in Figure 6.

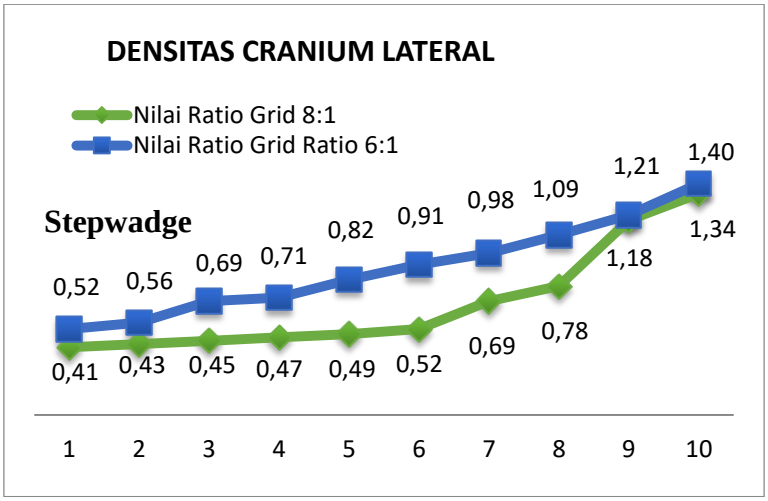


Figure 6. Grid Ratio Graphics 8:1 and Grid Ratio 6:1 of the Lateral Cranium

From the graph (figure 6) it can be seen that the density values for both the 8:1 grid ratio and the 6:1 grid ratio both have increased each step from step one to step ten.

DISCUSSION

The radiographic results of Cranium AP from step one to step ten can be seen that the grid ratio of 8:1 has a lower density value than the value of the grid ratio of 6:1,(Perbankara, 2007) where the value of each step, namely step one to step ten, does not exceed the predetermined density value where the susceptibility is that varies from 0.2 in the transparent area to 4 in the darkest part. Useful density values range from 0.25-2(Rahman, 2009). From graphic (figure 3) of the Cranium AP radiography results, both the grid ratio of 8:1 and the grid ratio of 6:1, it can be seen that there is an increase in the density value of each step, namely from step one (transparent area or minimum value) to step ten (darkest area or maximum area).). From step one to step ten it can also be seen that the darker the film being measured, the less light will be received by the sensor, this means that the density value will be higher (in the darkest areas). From table 1, the radiographic data of Cranium Ap with a grid ratio ratio of 8:1 have a minimum value (step one) in the transparent area a density value (D1) of 0.41 and a maximum value (step ten) in the darkest area the density value (D10) of 1.18. While the results of Cranium AP radiography with a grid

ratio of 6:1 have a density value, namely the minimum value (step one) in the transparent area the density value (D1) is 0.52 and the maximum value (step ten) in the darkest area is the density value (D10).) of 1.19.

Similar to the examination of the AP Cranium, the radiographic results of the Lateral Cranium from step one to step ten show that the grid ratio of 8:1 has a lower density value than the value of the grid ratio of 6:1, where the value from step one to step ten does not exceed the density value that has been determined. determined where the susceptibility varies from 0.2 in the transparent area to 4 in the darkest part. Useful density values range from 0.25-2 (Rahman, 2009). From graphic (figure 6) the results of the Lateral Cranium radiography, both the grid ratio of 8:1 and the grid ratio of 6:1, it can be seen that there is an increase in the density value of each step, namely from step one (transparent area or minimum value) to step ten (darkest area or maximum area)). From step one to step ten it can also be seen that the darker the film being measured, the less light will be received by the sensor, this means that the density value will be higher (in the darkest areas).

From table 2, the radiographic data obtained from lateral cranial radiographs with a grid ratio of 8:1 have a minimum value (step one) in the transparent area a density value (D1) of 0.41 and a maximum value (step ten) in the darkest area the density value (D10) of 1.34. While the results of Cranium AP radiography with a grid ratio of 6:1 have a density value, namely the minimum value (step one) in the transparent area the density value (D1) is 0.52 and the maximum value (step ten) in the darkest area is the density value (D10).) of 1.40. Therefore the use of an 8:1 grid ratio for examination of the cranium using a phantom, both AP and Lateral projections, requires increased absorption of scatter X-rays so that a higher exposure factor is required, namely in this study the exposure factor was used according to the cranium examination standards set by Setyo , et al. 2020, namely tube voltage of 70 kV, current strength of 100 mA, time of 0.20 s, and FFD of 100 cm which can affect the quantity of X-rays and also the intensity of X-rays. The intensity of the X-rays will be higher, the wavelength will be shorter, and the penetrating power will be greater, which can also affect the quality of the X-rays. According to Setyo, et al. 2020 with a high grid ratio, the density value will experience a decrease in the bright or white radiograph image, this is because the more X-rays that are blocked by the grid, the less number of X-rays that reach the film. According to Fauber, a high 2000 grid ratio can increase radiograph contrast because the high tube voltage and high X-ray intensity can blacken the film. The better the penetrating power of scatter radiation because the use of a larger grid ratio can increase the efficiency of absorption in scattering so that the radiation that hits the film is really only useful light (primary radiation). Because the 8:1 grid ratio has plates, the thickness of the plates and the width of the insulating material or interspace are getting tighter and thinner so they can absorb radiation properly. So that the quality of radiographs increases.

In contrast, the use of a 6:1 grid ratio for cranium examination using a phantom, both AP and Lateral projections, in this study used exposure factors according to cranium examination standards that had been set according to Setyo, et al. 2020, namely tube voltage of 70 kV, current strength of 100 mA, time of 0.20 s, and FFD of 100 cm which can affect the quantity of X-rays and also the intensity of X-rays. The intensity of the X-rays will be higher, the wavelength will be shorter, and the penetrating power will be greater, which can affect the quality of the X-rays. According to Setyo, et al. 2020 grid ratio, which has a low density value, will experience an increase in dark or black radiographic images, this is because the fewer X-rays that can be blocked by the grid, the less number of X-rays that reach the film. According to Fauber, 2000 scatter radiation has poor penetrating power because the use of a lower grid ratio can reduce the efficiency of absorption in scattering so that radiation hits the film. Because the 6:1 grid ratio has plates, the thickness of the plates and the width of the insulating material or interspace which is more tenuous means that a lot of radiation can escape and cannot be absorbed properly.(Sugiarti, Jatmiko and Plate, 2021)

CONCLUSIONS AND SUGGESTIONS

Based on the results of the data obtained and the discussion obtained, that analysis of the results of cranial radiographs with a ratio of 8:1 grid ratio and 6:1 grid ratio to obtain good density values can be concluded as follows:

From the results of the study it was found that the grid ratio of 8:1 increased the radiograph density value due to the good absorption of scatter radiation, while the 6:1 radiograph density ratio decreased due to the poor absorption of scattered radiation. From the results of the research that has been done, it proves that a good grid ratio for cranial and lateral examination is a grid with a grid ratio of 8:1.

With the Tam-Emboard tool, the authors hope in the future to add various functions so that the examination carried out is not only AP projection but also lateral examination.

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