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RADIOGRAPHY OF OS HUMERUS SINISTRA WITH SUSPENSION MULTIPLE FRACTURES OF THE MIDDLE 1/3 OF THE HUMERUS AT THE Drs. H. AMRI TAMBUNAN LUBUK PAKAM REGIONAL HOSPITAL

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ABSTRACT

The humerus is the longest and largest bone in the upper extremity. This bone articulates proximally with the scapula and distally with the elbow or forearm. This study was conducted to produce optimal radiographic images of the left humerus with suspected multiple fractures in the middle third of the humerus, so that the results could be used as accurate findings for further treatment. This study was conducted at the Radiology Unit of Drs. H. Amri Tambunan Regional General Hospital in April 2025, using interview and direct observation methods. The results of the study showed that the examination of the left humerus with suspected multiple fractures in the middle third of the humerus was performed using antero-posterior and lateral projections. The conclusion of this study states that in this examination, the author used a general X-ray unit, with the image recording process using digital radiography (DR).

Keywords: Os Humerus, Multiple Fractures, Digital radiography (DR)

INTRODUCTION

The humerus (arm bone) is the longest and largest bone in the upper extremity. It articulates proximally with the scapula and distally with the elbow or antebrachium. The proximal end of the humerus has a rounded head (caput humeri) that articulates with the glenoid cavity of the scapula to form the glenohumeral joint. Distal to the humeral head is the anatomical neck, which appears as an oblique groove [1]. Distal to the anatomical neck is the greater tubercle. The greater tubercle is the most palpable lateral landmark of the humerus in the shoulder region. Between the greater tubercle and the lesser tubercle is a groove called the intertubercular sulcus [2]. The chirurgical neck is a narrowing of the humerus distal to the two tubercles, where the humeral head gradually transforms into the humeral body. This area is called the chirurgical neck because fractures frequently occur in this area [3].

The humerus is the long bone in the upper arm that connects the shoulder to the forearm [4]. It is the single bone in the upper arm and plays a vital role in various arm movements, including flexion, extension, abduction, adduction, and rotation. The humerus also articulates with the scapula (shoulder blade) at the shoulder and with the radius and ulna at the elbow [5].

A fracture is a complete or partial break or rupture of bone or cartilage, or a discontinuity in the bone caused by a force exceeding the bone's elasticity. In some cases, fractures affect not only the bone structure but also surrounding tissues such as muscle, nerves, and blood vessels [6]. Fractures generally occur due to trauma, but some types of fractures occur secondary to, or what are called pathological fractures, and are caused by, disease processes such as osteoporosis [7].

A multiple fracture is a fracture that occurs in more than one line due to pressure. Therefore, it can be concluded that a multiple fracture is a condition where there is a loss of continuity of bone tissue in more than one line due to external pressure, characterized by pain, swelling, deformity, and disturbance in the fracture area [8].

Fractures are usually caused by trauma, which can be substantial, as in the case of a hip fracture following a traffic accident, or mild and repetitive, as seen in metatarsal fractures in ballerinas or long-distance athletes. Pathological fractures occur due to underlying diseases such as Paget's disease, osteoporosis, osteomalacia, or tumors that weaken the bone [9].

A radiological examination is a supporting examination that uses X-rays to help diagnose a disease in a body organ. Radiography is defined as a method of recording, displaying, and obtaining information on film using X-rays [10].

In practice, radiographic examination of the humerus can be performed with several routine projections, including AP (anterior-posterior) projections and lateral rotation. In radiographic examination of the humerus, if clinically suspected fracture and dislocation, it is recommended not to attempt to rotate the arm during the procedure [11].

Based on this, the author would like to further examine the radiography of the Os Humerus Sinistra with suspected Multiple Fractures of the Middle 1/3 of the Humerus in the form of a scientific paper entitled "Radiography of the Os Humerus Sinistra with Suspected Multiple Fractures of the Middle 1/3 of the Humerus at Drs. H. Amri Tambunan Lubuk Pakam Regional General Hospital"

Understanding the Concept

Definition of Examination

A radiological examination is a supporting examination that uses X-rays to help diagnose a disease in a body organ [12]. Radiography is defined as a method of recording, displaying, and obtaining information on film using X-rays [13].

Anatomy

Anatomy comes from the Greek words "Ana" meaning part, and "Tomi" meaning slice or cut. Anatomy is the science that studies the overall structure and relationships of body parts [14]. Anatomy encompasses the structure of the human body, from the smallest details to explaining how each part interacts to form a functional unit [15].

The humerus or upper arm bone is the longest bone of the upper limb. The humerus bone consists of 3 parts, namely [16]:

Upper end of the humerus

The upper third of the tip of the humerus consists of a head, which articulates with the glenoid cavity of the scapula and is part of the structure of the shoulder joint. Immediately below the neck is a slightly narrower portion called the anatomical neck. On the outside of the upper end below the anatomical neck is a bump, the greater tuberosity, and in front of it is a smaller bump, the lesser tuberosity [17]. Between these two tuberosities is a gap, the bicipital fissure or intertubercular sulcus, which contains the tendon of the biceps muscle. The bone becomes narrower below the tuberosities, and this area is called the cirurgical neck, because it is easily fractured there [18].

Humerus shaft

The upper side is rounded, but becomes flatter as it goes down. A tubercle on the lateral side of the shaft, just above the middle, is called the deltoid tuberosity. This

tuberosity receives the insertion or attachment of the deltoid muscle. A gap runs obliquely across the back of the shaft, from the medial to the lateral side. Because it provides passage for the radial nerve, or musculospiral nerve, it is called the spiral gap or radial gap [19].

Lower end of the humerus

Wide and somewhat flat. At the very bottom there is a joint surface formed by the bones of the forearm. The trochlea, which is located on the inner side, is spindle-shaped where it articulates with the ulna, and on the outer side there is the capitulum which articulates with the radius. On both sides of the joint at the lower end of the humerus there are two epicondylus, namely the lateral epicondyle on the outside and the medial epicondyle on the inside [20].

Pathology

Pathology is the study of disease, both in terms of structural and functional changes at the cellular and organ levels in the human body or other living organisms. It involves the study of the causes, mechanisms, development, and consequences of disease in the body. Pathology also encompasses the diagnosis of disease based on the examination of tissues or body fluids under a microscope or using various other techniques [21].

In this scientific work, the author will discuss one of the pathologies of bone, namely multiple fractures in the humerus bone.

X-ray tube

The X-ray tube is the part of the X-ray unit that houses the X-ray source and protects the tube insert from impacts and shocks [22].

The x-ray tube consists of:

Tube housing (outer x-ray tube)

It is a cylindrical container made of metal and coated with lead (Pb). It serves as a place for the tube insert to protect it from impacts and shocks and to prevent X-rays from escaping through the window. Furthermore, this wall functions to suppress unnecessary radiation [23]. The tube housing is also equipped with a high-voltage cable connection, namely HTT cable.

HTT (High Tension Transformer)

A High Tension Transformer (HTT) is a device used to increase and decrease electrical voltage. A high-voltage transformer consists of two coils: a primary coil and a secondary coil [24]. High-voltage transformers are used to increase or decrease electrical voltage, and there are high-voltage transformers (step-up transformers) used to increase the voltage from a few volts to several kilovolts and quickly move electrons through an X-ray tube. There are low-voltage transformers (step-down transformers) used to decrease the electrical voltage and provide current to the filament [25].

Control Table

The control table is a diagram of the X-ray machine unit which is used to control the amount of X-ray output needed to control each exposure. In general, the control table is placed behind a shield so that the officer is protected from radiation during the examination [26].

Radiography Equipment

Understanding Digital Radiography

Digital radiography (DR) is a medical imaging technology that uses digital detectors to capture radiographic images directly, without the need for conventional film. The system consists of a flat-panel detector connected to a computer to produce

images instantly. Its advantages include time efficiency, reduced radiation dose, and improved digital processing and storage capabilities [27].

Then there is Digital Radiography with film that includes a faster dynamic range for upper and lower exposures as well as the ability to apply special image processing techniques that improve the overall appearance of the image.

Conventional radiography uses a cassette, film, and a screen. Computed radiography uses only an imaging plate. While it physically appears to use the same screen as conventional radiography, the imaging plate has a very different function. This is because the imaging plate only functions to store signals in a Photostimulable Phosphor (PSP) and then transmit image information in digital form [28].

Meanwhile, in Digital Radiography, an FPD (Flat Panel Detector) is used to take radiographic images. This is because the FPD (Flat Panel Detector) functions to convert the radiographic image into a digital format.

Main Components of Digital Radiography

X-ray source

To change conventional radiography to DR (Digital Radiography) does not replace the X-ray machine, DR (Digital Radiography) only needs to replace the image capture system which has become digital FPD (Flat Panel Detector) by replacing the position of the film as the latent shadow capture [29].

RESEARCH METHODS

Types of research

study, which examined radiography *of the left humerus* with suspected *multiple fractures of the middle third of the humerus,* used descriptive qualitative research. Data collection techniques were based on interviews, documentation, and literature review.

Qualitative research is an approach that is also called investigation because usually the research collects data by meeting directly face to face and interacting with people at the research location.

Descriptive research is a method of research that describes and interprets an object according to its reality without exaggeration **. (Sugiyono, 2020)**

Time and Place of Research

1. Research Period. The research period was March 25 – June 2025.
2. Research Location. The research location was conducted at the radiology installation of Drs. H. Amri Tambunan Regional General Hospital, Lubuk Pakam.

Data Collection Techniques

To obtain correct and accurate data in compiling this paper, the author uses several methods as below: Interview The author conducted interviews with patients, the patient's family concerned with the disease they are suffering from and related parties. The author also consulted with radiologists, radiographers and supervising lecturers related to the examination and writing of this scientific paper. To obtain accurate data, the author studied research based on the theories read, then compared normal clinical or those with abnormalities, especially fractures [30]. To obtain theoretical support for the chosen research problem, the author read a lot of literature books, both in the form of texts (theories), the results of other people's research, journals, as well as directions from the supervising lecturer who helped the author in compiling this scientific paper on radiography of *the Os Humerus Sinistra* with suspected *Multiple Fractures of the Middle 1/3 of the Humerus* .

Analysis of Results

Data analysis is the most important and decisive stage in a research. The data obtained is then analyzed with the aim of processing the data into information, so that the characteristics or properties of the data can be easily understood and are useful for answering problems related to the research.

The data obtained in this study is qualitative. This is evident from the categories and nature of the variables. The data collected consists of sentences, statements, and descriptions. The collected data is then processed and linked to hypotheses to produce conclusions [31].

RESULTS AND DISCUSSION

Results

In conducting an examination, it is necessary to know the patient's identity clearly which is useful for identifying one patient with another so that no errors occur. In this chapter, the author will describe the patient's identification after conducting a radiographic examination of *the Os Humerus Sinistra* with suspected *Multiple Fractures of the Middle 1/3 of the Humerus* at Drs. H. Amri Tambunan Lubuk Pakam Regional General Hospital with the following patient data:

Patient Identity

Name : Mr. J
Age : 20 Years
Gender : Male Medical Record No.: 45****
Date of Examination: March 24, 2025 Examination : Os Humerus Sinistra
Diagnosis : Fracture of Shaft of Humerus
Referring Doctor : Dr. Rudy Tanudin, M.Ked(surg),Sp.OT
Reading Doctor : Dr. Duma Ratna Sari Nasution, M. Ked (Rad), Sp. Rad

Examination Procedure

Radiographic examination procedure *of Os Humerus Sinistra* with suspicion *Multiple Fractures of the Middle 1/3 of the Humerus* [32].

1. The patient brought a photo request letter to the radiology room.
2. The radiographer read the photo request letter.
3. Identify the patient, then provide direction to the patient regarding the examination to be carried out.
4. The radiographer prepares the equipment used in the radiographic examination *of the Os Humerus Sinistra* with suspected *Multiple Fractures of the Middle 1/3 of the Humerus*
5. Conducting a radiographic examination *of the Os Humerus Sinistra* with suspected *Multiple Fractures of the Middle 1/3 of the Humerus* using *Antero-Posterior projections* and *Lateral projections*
6. Film processing is carried out, during which time the patient waits until the film has finished being processed.

Patient Preparation

In the examination *of the Os Humerus Sinistra* with suspected *Multiple Fractures of the Middle 1/3 of the Humerus,* the patient does not require special preparation, but in this examination the radiographer provides an explanation of the procedure to be

carried out [33]. If necessary, invite cooperation with the patient's family or the nurse present to adjust the patient's position, if the patient is not cooperative [34].

Preparation of examination tools

The X-ray machine used in the radiography of *the Os Humerus Sinistra* with suspected *Multiple Fractures of the Middle 1/3 of the Humerus* at the Drs. H. Amri Tambunan Lubuk Pakam Regional General Hospital with the following data:

Aircraft Type : PHF153NE2
Aircraft Brand : HITACHI
Number of Tubes : 1 Tube
Maximum kV : 150 kV
Maximum mA : 500 mA
Serial No : KC17909102
Aircraft Services : Radiography

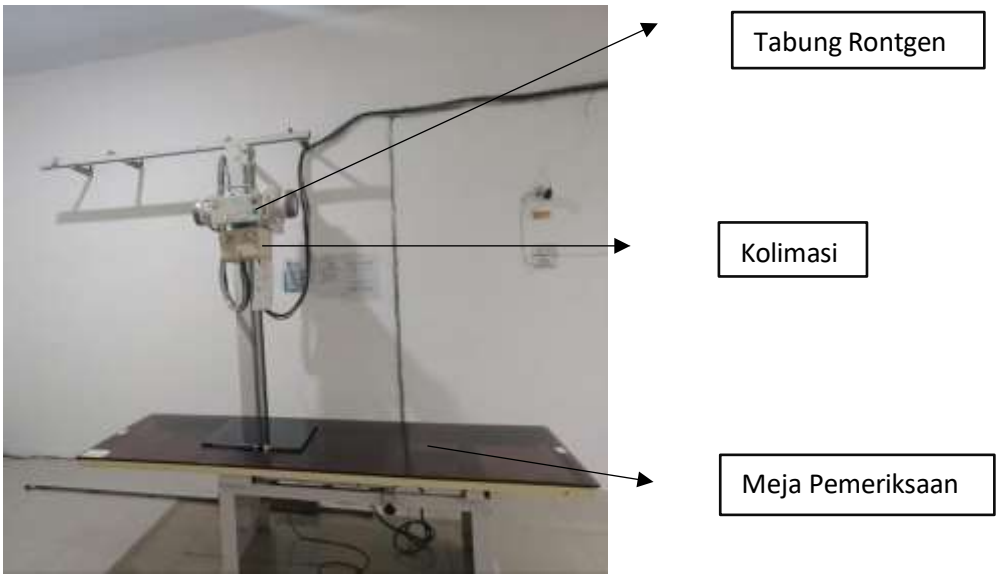

Figure 1. Digital Radiography Plane

Figure 2. Control Table Unit

Figure 3. Radiography Detector Unit

a.Inspection Equipment

Examination Techniques

The projections performed in the examination of *the Os Humerus Sinistra* with suspected *Multiple Fractures of the Middle 1/3 of the Humerus* before and after surgery were the Antero Posterior (AP) projection and the Lateral projection.

Anterior Posterior (AP) Projection [35].

Purpose of Examination: To show radiographic images *of the os*

left humerus with suspected *multiple fractures of the middle 1/3 of the humerus* from an *anterior posterior position*

Patient Position : The patient lies on his back on the examination table.

Object Position : Upper and lower arms straight, slightly

abduction (away from the body) and set supine. The upper arm is extended in the middle of the detector, with *the elbow* included in the detector and set true *antero posterior* where the medial and *lateral epicondyles* are equidistant from the detector, the detector is horizontal on the examination table.

FDD : 90 cm

Central Ray : Vertical and perpendicular to the detector Central Point: Middle of the Humerus

Exposure Factor : 50kV, 100mA Cassette Size: 35 x 43 cm

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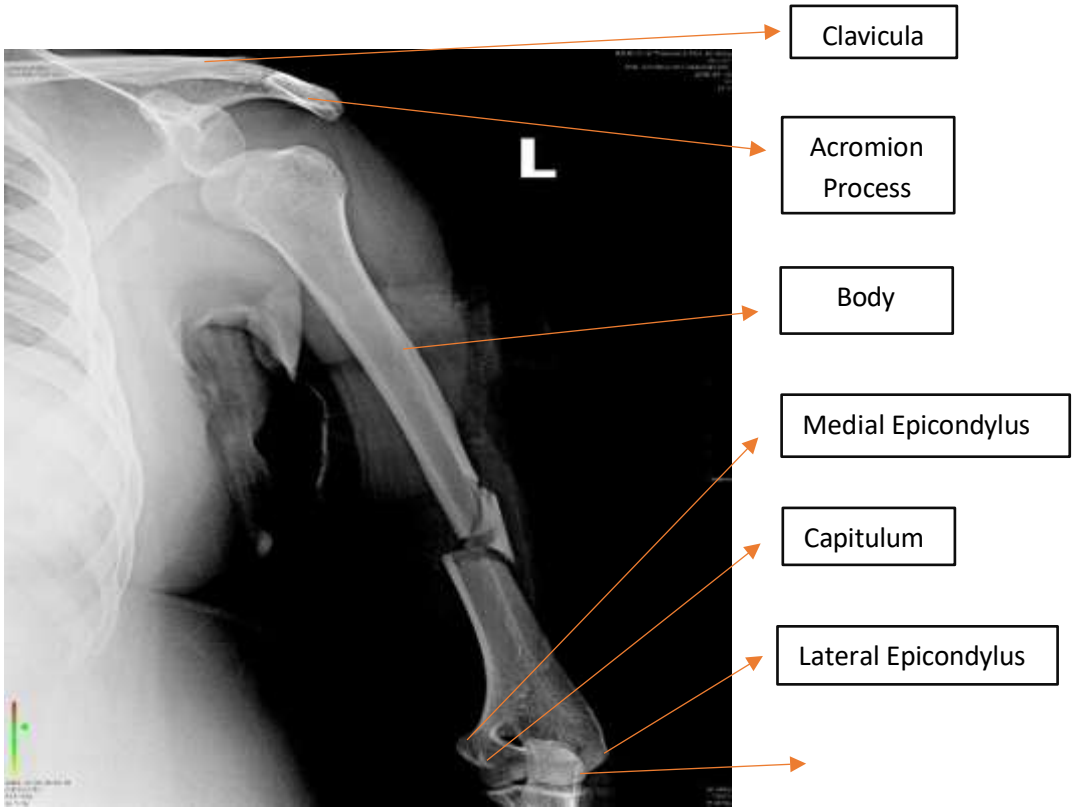

Figure 4. Humerus Anterior Posterior

Elbow Joint and *Shoulder Joint* visible ,

The medial epicondylus and *lateral epicondylus* are parallel, *the fracture* is visible , *the clavicle* and *acromion process are visible.*

Lateral Projection

Purpose of Examination: To show radiographic images

os humerus sinistra with suspected *multiple fractures of the middle 1/3 of the humerus* from the lateral side

Patient Position : Patient is supine on the examination table.

Object Position : From *anterior to posterior position* then

The arm is endorotated so that the palm is in a prone position. The upper arm extends along the center line of the detector with *the elbow joint* entering the detector, the detector is horizontal on the examination table.

FFD : 90 cm

Central Ray : Vertical perpendicular to the detector Central Point: Middle of the humerus

Exposure Factor : 50kV, 100mA

Cassette Size : 35 x 43 cm

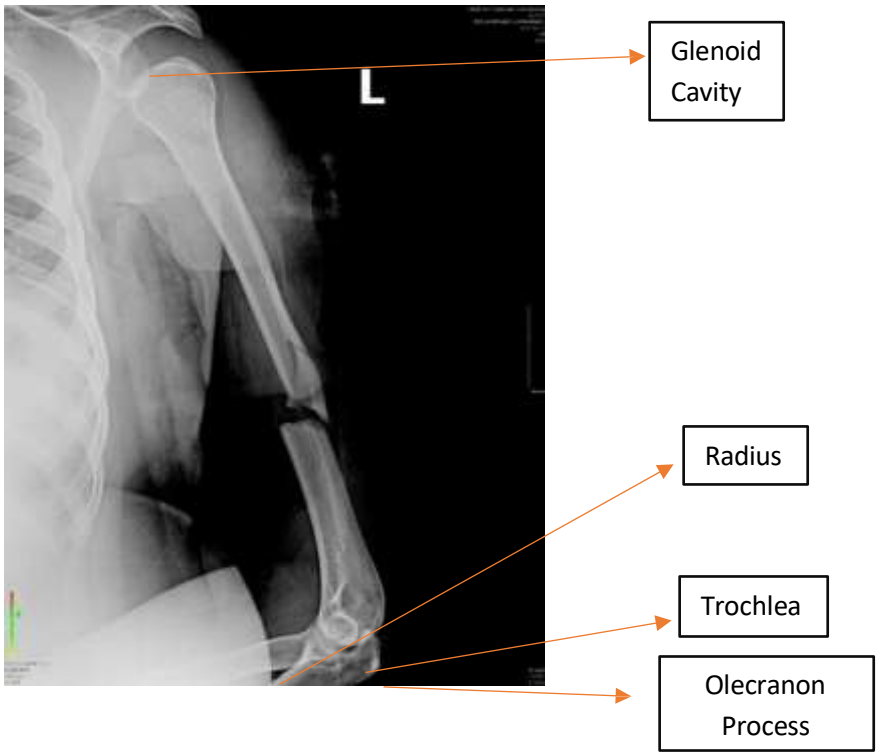

Figure 5. Lateral Humerus

Image Criteria: *Elbow joint* and *shoulder joint visible* , *medial epicondylus* and *lateral epicondylus* overlapping , fracture visible ,

Discussion

Formulation of the problem

By paying attention to the background and scope of the problem above, the author formulates the problems that arise in radiography *of the left humerus* with suspected multiple *fractures of the middle 1/3 of the humerus* as follows:

"What efforts are made to obtain a radiographic image of *the Os Humerus Sinistra* with suspected Multiple *Fractures of the Middle 1/3 of the Humerus* with good Sharpness and Detail"? [36].

Cause of the Problem

The causes of problems from the radiographic examination *of the Os Humerus Sinistra* with the suspicion of *Multiple Fractures of the Middle 1/3 of the Humerus* are:

a. The patient was in pain when the officer directed the patient's position according to the projection to be carried out.
b. The patient was uncooperative during the examination, due to the pain he was suffering.

Efforts made

The steps that must be taken when there is a problem in conducting a radiographic examination *of the Os Humerus Sinistra* with suspected *Multiple Fractures of the Middle 1/3 of the Humerus* are:

c. Provide immobilization equipment to patients so that the pain suffered by the patient can be reduced and the patient feels more comfortable.

d. It is best to provide an explanation of the examination that will be carried out first to ensure the examination runs smoothly.

Problem Discussion

A radiographic image *of the Humerus* that shows optimal image sharpness and detail is an image that can show the clinical features of the object being examined as well as possible, so that it can show the anatomical abnormalities of the object.

To show an optimal radiographic image *of the left humerus, especially in cases of multiple fractures of the middle 1/3 of the humerus* , namely:

Proper projection settings

To show an optimal radiographic image *of the Os Humerus Sinistra* with suspected *Multiple Fractures of the Middle 1/3 of the Humerus, try to use a basic projection that is in accordance with the theory, namely:*

Anteroposterior Projection

The aim is to obtain a radiographic image *of the Os Humerus Sinistra* with the suspicion of *Multiple Fractures of the Middle 1/3 of the Humerus* as a whole and to see the abnormalities, especially the shape and location *of Multiple Fractures of the Middle 1/3 of the Humerus* in *the Os Humerus from the anteroposterior* position . In the *anteroposterior* projection, it is already true AP where the medial and lateral *epicondyles* are equidistant and are already visible in the film [37].

Lateral Projection

The aim is to obtain a radiographic image of *the Os Humerus Sinistra* with the suspicion of *Multiple Fractures of the Middle 1/3 of the Humerus* as a whole and to see the abnormalities, especially the shape and location of *the Multiple Fractures of the Middle 1/3 of the Humerus* in *the Os Humerus* from a lateral position .

True lateral imaging results, even if the patient is uncooperative and experiencing pain, can be positioned in a way that doesn't alter the resulting image, resulting in greater comfort and reduced pain. Immobilization devices such as sandbags can also be used to reduce movement or facilitate the examination.

1. The appropriate distance setting is the Focus Image Receptor Distance. The Focus Image Receptor Distance used for radiographic examination *of the Humerus* is generally 90 cm for cases *of Multiple Fractures of the Middle 1/3 of the Humerus .*
2. Adjusting the radiation field width and shooting conditions to suit the appropriate conditions. The radiographic radiation field width *of the humerus* must be adjusted to the width and size of the object to avoid scatter radiation effects on the patient and radiologist.

produces a better image. And the exposure factor used when examining *the Os Humerus Sinistra* with suspected *Multiple Fractures of the Middle 1/3 of the Humerus* must be adjusted to the thickness of the object being photographed so that it can show high sharpness and detail. The exposure factor of the humerus with the AP and lateral positions is the same because the thickness of the object is not much different [38].

In the examination of *the Humerus Os* with suspected *Multiple Fractures of the Middle 1/3 of the Humerus* , the radiation field was too wide and did not fit the object. The radiation field could still be reduced so that the radiation exposure received by the patient was not large.

In addition, the author also formulated the problem "What are the reasons for using digital radiography for the imaging process?"

Using digital radiography for image processing improves contrast, sharpness, and detail. Furthermore, digital radiography can reduce excess film usage because the images can be previewed before printing.

CONCLUSION

After the author conducted a radiographic examination *of the Os Humerus Sinistra* with the suspicion of *Multiple Fractures of the Middle 1/3 of the Humerus* at the Drs. H. Amri Tambuan Regional General Hospital, Lubuk Pakam and based on the results of the discussion of the problem that has been presented in the form of this scientific paper, the following conclusions can be drawn.

1. The irradiation field setting is too wide so that it does not meet the examination requirements.
2. Inconsistency in positioning the patient with existing theory will change the image results to be less than optimal, however the patient's uncooperative condition must also be a consideration for officers, for this reason the use of immobilization equipment will make it easier for officers to position the patient.

Suggestion

1. It is best to use an effective radiation field when conducting an examination so that the radiation dose received by the patient can be limited and more optimal images can be obtained.
2. It is best, in addition to using immobilization equipment to reduce movement that results in a lack of sharpness, to ensure that the patient does not hold the position for too long, therefore the officer must work as optimally and as quickly as possible.

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