RADIOGRAPHY OF THE LUMBAL VERTEBRAE COLUMNA WITH SUSPECTED SCOLIOSIS AT BHAYANGKARA HOSPITAL
2nd Grade Medan

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ABSTRACT

The spine is the main bone that supports the body, including the head, upper limbs, and chest cavity. One disorder of the thoracolumbar spine is scoliosis. Scoliosis is an excessive lateral curvature of the spine at the vertebrae. The purpose of this study on radiation protection is to prevent harmful deterministic effects and minimize the occurrence of stochastic effects. Scoliosis examination is performed using several projections, namely Anteroposterior (AP) for patients lying down or Posteroanterior (PA) for patients standing (more recommended), Lateral with a standing position, and (AP) bending to the right and left. This examination was conducted at Bhayangkara TK II Medan in May 2025 through observation and interviews, using image processing with Computer Radiography (CR). The X-ray machine used for lumbar spine radiography with suspected scoliosis has a capacity of 500 mA; however, the researchers chose a large focus of 200 mA to achieve optimal image sharpness. Since the object being examined is relatively large, it is recommended to use a grid for image contrast (200 mA).

Keywords: Lumbar Vertebrae Column, Scoliosis, Computed Radiography (CR)

INTRODUCTION

The vertebral column is the main pillar of the body's bones, supporting the head, upper extremities, and chest cavity. It functions to transfer body weight to the lower extremities and acts as a channel that protects the spinal nerves and envelops the meninges. The vertebral column is divided into five regions: the cervical vertebral column, thoracic vertebral column, lumbar vertebral column, sacral vertebral column, and coccygeal vertebral column [1].

Scoliosis is a disorder of the lumbar vertebral column. Scoliosis is an excessive lateral curvature of the spine. It often affects children aged 10-14, especially girls. Scoliosis can cause complications or malfunctions in the heart and respiratory system. The effects of scoliosis are most apparent when the disease affects the lumbar region, causing a tilted pelvis, which affects the lower extremities, causing limps or difficulty balancing when walking [2].

In the scoliosis series examination, the Postero-Anterior (PA) projection is more recommended than the Antero-Posterior (AP) projection because it can reduce the radiation dose to radiation-sensitive organs such as the breast and thyroid gland. Scoliosis generally requires re-examination every few years, especially in children [3]. The lumbar vertebrae consist of 5 vertebrae (L1-L5) located at the bottom of the spine, tasked with supporting body weight, providing stability, and allowing movements such as flexion, extension, and rotation [4].

Scoliosis is a deformity of the spine where the spine bends to the left or right [5]. Scoliosis is a deformity in adolescent girls caused by spinal lesions, such as infections,

tumors, trauma, light therapy, muscle weakness in the back, abnormal development of the spine and ribs, and weakness in the trunk muscles. Scoliosis also occurs due to differences in leg length [6]

To obtain a clear diagnosis, a radiological examination using X-rays was performed. With the help of these X-rays, the location of scoliosis in the lumbar vertebrae, changes in its structure, and its effects on surrounding organs can be determined [7]. The author presents this in the form of a scientific paper entitled "Radiography of the Lumbar Vertebrae Column with Suspected Scoliosis at Bhayangkara Hospital Level II Medan."

Understanding Radiography Techniques

Radiography technique is a procedure for taking photographs using X-rays to obtain radiographic images to help establish a diagnosis [8].

The lumbar vertebrae are the largest, consisting of five segments. They are the strongest part of the vertebral column, increasing in size as they move downward [9].

Anatomy

Anatomy of the Vertebral Column

Anatomy is the study of the structure and relationships between the body parts of living organisms. This field of science examines the external and internal appearance and features of living organisms. In short, anatomy is the study of the form and parts of an organism [10].

The vertebral column, or spine, forms the main axis of the body's skeleton and is located in the midsagittal plane at the posterior (back) of the body. The spine has many functions: it protects and encloses the spinal cord, supports the upper body, supports the skull at the top, and provides attachment points for the deep muscles of the back and the ribs at the sides [11].

Physiology

Physiology is the study of human body function. In other words, the mechanisms by which various organs and tissues carry out specific activities. Emphasis is often placed on the processes that control and regulate these functions. For the body to function optimally, conditions within the body, known as the internal environment, must be carefully regulated. Therefore, many important variables, such as body temperature, blood pressure, blood sugar, oxygen and carbon dioxide levels in the blood, and electrolyte balance, are important [12].

The vertebrae function to support the body and maintain balance. The vertebrae also support the head and arms, as well as providing anchorage for muscles, ribs, and several other organs. The spine has several curves that support body weight and enable the body to perform various movements and positions, such as standing, sitting, or running [13].

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 [14].

Scoliosis is a lateral curvature of the lumbar vertebrae with associated rotation of the vertebral bodies within the curve. This condition can be caused by disease,

surgery, or trauma, but is often idiopathic. Scoliosis is generally detected in the teenage years. If left undetected and untreated, it can progress to the point of debilitation [15]
Etiology

Etiology is the study of the causes of disease and/or injury. The causes of disease can be divided into two categories: endogenous (from within the body) and exogenous (from outside the body). Although the cause of a disease must be known by medical professionals, some diseases have unknown causes, such as idiopathic diseases. Furthermore, certain clinical conditions are caused by the effects of specific disease treatments, known as iatrogenic [16].

The exact cause of scoliosis is unknown, but it is thought to be influenced by osteoporotic conditions such as fractures, bone disease, arthritis, and infections. Scoliosis isn't solely caused by poor sitting posture.

X-ray Machine Technique

An X-ray machine is a piece of radiology equipment that plays an important role in producing X-rays and providing an image of an object on X-ray film after undergoing a chemical process in the film processing room or dark room.

An X-ray machine is one of the most important pieces of equipment in conducting radiodiagnostic examinations. The quality of the X-ray results cannot be separated from how the radiographer uses the machine.

X-ray technique is the procedure for using an X-ray machine to ensure a smooth examination and optimal radiographic results. Broadly speaking, the components of an X-ray machine can be divided into several parts [17]:

X-ray Machine Tube

The X-ray tube is part of the X-ray unit, which is the container where the X-rays occur and serves to protect the tube insert from impacts and shocks [18].. In general, the X-ray tube consists of:

Tube Housing (Outer X-ray Tube)

The tube housing is a cylindrical container made of metal and coated with lead. Its function is to house the tube insert and protect it from impacts and shocks. The components of the tube housing are:

1) The window is equipped with a diaphragm box and collimator lamp.
2) The filter functions to filter X-rays to make them homogeneous.
3) made of aluminum with a certain thickness.
4) Cooling oil that functions as an insulating and cooling material.

Radiation Protection

Radiation protection is a branch of science or engineering that studies human and environmental health issues and is related to providing protection to an individual or group of individuals or their offspring against the possibility of harm to health due to radiation exposure. The goal of radiation protection is to prevent the occurrence of harmful deterministic effects and reduce the occurrence of stochastic effects as low as possible [19].

RESEARCH METHODS

Types of research

This study uses a qualitative research method. Qualitative descriptive is a method in examining the status of a group of people, an object with the aim of creating a systematic, factual and accurate description, picture or painting of the facts or

phenomena being investigated. Data collection techniques are based on observation, interviews, literature reviews, and documentation [20].

Time and Place of Research

Research Location   : This examination was conducted at the Radiology Installation of Bhayangkara Hospital Class II Medan

Research Time   : This examination was conducted in May 2025

Data collection technique

To obtain valid and optimal data, the author will use several methods to collect data. These methods include:

1. Observation

Direct observation conducted by the researcher can be realized by recording information related to the radiology installation room of Bhayangkara Hospital Class II Medan, also observing how the radiographic examination technique of the Lumbalis Columna Vertebrae with suspected Scoliosis. For this reason, the researcher can conduct direct observation on the implementation of Lumbalis Columna Vertebrae radiography with suspected Scoliosis in the radiology department of Bhayangkara Hospital Class II Medan to obtain accurate information or data related to the research object [21].

2. Documentation

According to the Big Indonesian Dictionary (KBBI), "Documentation" means the collection, selection, processing, and storage of information in a field of knowledge, as well as the provision or collection of evidence and information such as images and other reference materials [22].

By collecting photos and studying the results of radiographs of the lumbar vertebrae column found during scientific research, both normal and abnormal, especially scoliosis [23].

3. Interview

In data collection, researchers conducted interviews with patients and their families. This was done with the aim of obtaining comprehensive and comprehensive data based on the patient's current condition.

4. Literature Review

To obtain theoretical support for the chosen research problem, the author read a lot of literature, both in the form of texts (theories), other people's research results, journals, as well as direction from the supervising lecturer who helped the author in compiling this scientific paper on radiography of the Lumbar Vertebrae Column with suspected Scoliosis [24].

Data analysis

Data analysis is the process of systematically searching for and compiling data obtained from interviews, field notes, and documentation, by organizing data into categories, breaking it down into units, synthesizing it, arranging it into patterns, selecting what is important and what will be studied, and drawing conclusions so that it is easy for oneself and others to understand [25]..

This research method uses an inductive qualitative method, namely an analysis based on the data obtained, then developed into a hypothesis based on the hypothesis formulated from the data, then the data is searched for again repeatedly and then it can be concluded whether the hypothesis is accepted or rejected based on the data collected, if the hypothesis is accepted, then the hypothesis develops into a theory

[26].

This qualitative analysis begins with direct observation of the radiographic examination of the lumbar vertebrae column with suspected Scoliosis at the Radiology Installation of Bhayangkara Hospital Class II Medan with Antero-Posterior and lateral projections, obtaining a decent and good image to read in establishing a diagnosis, because in this study the image recording process uses Computer Radiography so that the image can be adjusted according to needs and can produce an image with optimal sharpness and detail [15].

RESULTS AND DISCUSSION

Results

1. Patient Identity

When carrying out an examination, it is necessary to know the patient's identity clearly, which is useful for identifying one patient from another so that misunderstandings do not occur.

On this occasion, the author conducted a lumbar vertebral column examination with suspected scoliosis at the Radiology Institute of Hermina Hospital Medan with patients including [27]:

Name　　: Mrs. MK

Age　　　: 59 Years Gender: Female

Diagnosis　　: Spondylosis and Lumbar Scoliosis Date: 02-May-2025

2. Examination Procedure

By reading the photo request letter, especially for a temporary diagnosis from the doctor who requested a photo of the Lumbar Vertebrae Column.

Lumbar vertebral column radiography for suspected scoliosis does not require any special preparation; the patient should cooperate with the examination. This also applies to metal objects that will be subject to radiological imaging [28].

3. Patient Preparation

The procedure for examining the Lumbar Vertebrae Columna Radiograph with suspected Scoliosis which is carried out at the Radiology Installation of Bhayangkara Hospital Class II Medan is as follows:

a. The patient's family and the patient come to the Radiology Installation and register at the Radiology counter.

b. The patient's family came to radiology with the request letter and then gave it to the radiology officer.

c. The radiologist read the introductory letter and then gave directions to the patient's family to follow a lumbar vertebra examination procedure with antero-posterior (AP) and lateral projections.

4. Preparation of Inspection Equipment

a. X-ray machine

Before conducting the examination, the X-ray machine is first turned on. The X-ray machine used at the Class II Bhayangkara House in Medan has the following data:
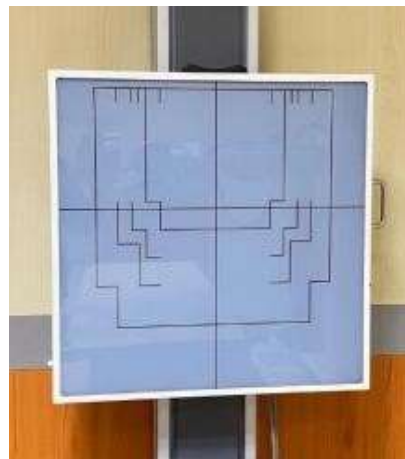
Aircraft brand: DK

Max kVp　　　: 90 kVp Maximum Current: 500 mA Aircraft service: Radiography

Figure 1. General X-Ray DK at Bhayangkara Hospital Class II Medan
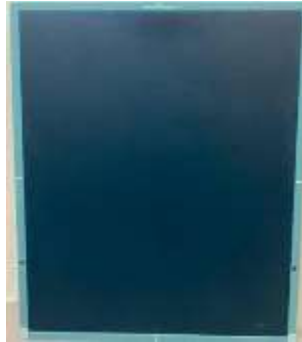
a. Bucky Stand

Figure 2. Bucky Stand at Bhayangkara Hospital Class II Medan

Control Table

Figure 3. Control Table at Bhayangkara Hospital Class II Medan

Computed Radiography Cassette

Figure 4. CR cassette at Bhayangkara Hospital Class II Medan

Image Reader Computed Radiography (CR)

Figure 5. *Image Reader* CR at Bhayangkara Hospital Class II Medan

Image Console Computed Radiography (CR)

Figure 6. Image Console CR at Bhayangkara Hospital Class II Medan
Computed Radiography Printer

Figure 7. CR Printer at Bhayangkara Hospital Class II

Examination Techniques

The projections that will be carried out here are in accordance with the examination that the author carried out on the patient, namely the Antero-Posterior and Lateral projections.

Antero-Posterior (AP) Projection

Purpose of Examination: To show the vertebrae in general lumbar from the antero-posterior side.

Patient Position   : Supine (lying on your back on the table) inspection)

Object Position   : Place the mid sagittal plane of the body exactly on the

The middle of the cassette, shoulder joint, hip joint, is set right in the middle of the examination table, both upper and lower arms are straight beside the body [29]. With the upper border of the XI thoracic vertebrae and the lower border of the ossacrum. The cassette is horizontal above the bucky [30].

Light Settings   : Focus Film Distance = 90 cm

Central Ray (CR): Vertical and perpendicular to the cassette. Central Point (CP): at lumbar III or Umbilicus

Exposure Factor   : 70 kV, 20 mAs

Figure 8. Results of antero-posterior (AP) radiographic projection

Lateral Projection

Purpose of examination: To show the image of the vertebrae

lumbar from the lateral (side) side

Patient position   : Supine (lying on the back on the examination table)

Object position: From the supine position, the patient is tilted to the side.

one side to the right. Place the mid-axillary plane of the body on the midline of the examination table, place the patient's hands above the head, and bend the knees for patient comfort. Place the lumbar in the middle of *the film* , the cassette is placed horizontally on the bucky.

Light settings: Focus *film* distance = 90 cm

Central Ray   : Vertical and perpendicular to the cassette.

Figure 9. Results of Lateral Projection Radiographic Images

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Central Ray (CR): Vertical and perpendicular to the cassette. Central Point (CP): at lumbar III or Umbilicus

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Light settings: Focus film distance = 90 cm
Central Ray   : Vertical and perpendicular to the cassette.

Problem Discussion

Formulation of the problem

Judging from the background and problem limitations, the author formulates the problem that arises in the radiographic examination *of the lumbar vertebrae* with suspected *Scoliosis* , namely: "What efforts are made to obtain an optimal radiographic image *of the lumbar vertebrae in Scoliosis* patients ?"

Cause of the Problem

The cause of the problem that arises in producing a radiographic image *of the lumbar vertebrae* with suspected *scoliosis* is the patient's condition which is in pain and less cooperative so that the patient's positioning must be done slowly.

Discussion of Problem Formulation

a) Radiography *of the lumbar spine* in suspected *scoliosis* uses *anteroposterior* (AP) and lateral projections. The beam direction used is vertical, preferably using the AP *oblique* and AP left and right bending projections.

b) To ensure the examination runs smoothly, the radiographer should explain the procedure to the patient so that the examination runs smoothly and there is no need to repeat the photos.

c) For patient comfort in this examination, it is very necessary because of the pain suffered when in the *supine position, in the antero-posterior* projection , a sponge should be placed under the patient's waist and *a sandbag under the patient's knees, and for the lateral* projection, only a sponge should be used under the patient's waist.

Image recording using Computed Radiography (CR) and selecting the correct exposure factor to avoid repeated images.

CONCLUSION

After conducting a vertebral radiography examination Lumbar with suspected *Scoliosis* , the conclusion of this scientific paper is:

a. In the radiographic examination *of the Lumbar Vertebrae* with suspected *Scoliosis* at Bhayangkara Hospital Class II Medan, *the Antero-Posterior* (AP) *Supine* and *Lateral projections were used* .

b. In the radiographic examination *of the Lumbar Vertebrae* with suspected *Scoliosis* using high kV.

c. In the examination *of the Lumbar Vertebrae,* what is required is good image sharpness and detail.

Suggestion

Based on the results of the Lumbar Vertebrae Radiographic examination with suspected *Scoliosis* , the suggestions from this study are:

1. To show the extent *of the Curvature Scoliosis* in *the Lumbar Vertebrae, it is best to use the left AP Bending* and Lateral projections .

2. To show good image sharpness and detail, it is best to use high kV

technique.

3. To reduce scattered radiation and get good results, it is best to use *the grid* and field area as optimally as possible.

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