



# Procedure of Thoracolumbal Radiographic Examination with Scoliosis Case at Radiology Department of Yogyakarta Regional Public Hospital

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**Abstract.** Various radiographic projections are used to produce radiographic images of thoracolumbar vertebrae with scoliosis cases. In theory, the procedure for thoracolumbar radiographic examination with scoliosis cases uses PA (Postero-Anterior) or AP (Antero-Posterior) projections, lateral, Ferguson method, right and left bending projections. However, the Radiology Department of Yogyakarta Regional Public Hospital uses AP projection, lateral, and bending positions. This research aimed to determine the difference between thoracolumbar radiographic examination with scoliosis cases in theory and at the Radiology Department of Yogyakarta Regional Public Hospital and the reasons for the projection. This study is a qualitative descriptive conducted from December 2018 to May 2019 at the Radiology Department in Yogyakarta Regional Public Hospital. The research subjects were three radiographers and one patient with indications of scoliosis. The results showed that thoracolumbar radiographic examination with scoliosis cases in the Radiology Installation of Yogyakarta Regional Public Hospital used AP, lateral, right bending, and left bending projection in the upright position. The Ferguson method is not used because the SOP (Standard Operational Procedure) of scoliosis cases in this hospital only uses those projections. The four projections are appropriate with the radiology request form from the orthopedic physician and sufficient to provide diagnostic information.

**Keywords:** projection · scoliosis · thoracolumbar

## 1 Introduction

The vertebral column is a series of bones that form the spinal system. The vertebral column is located in the MSP (Mid Sagittal Plane), forming the posterior or dorsal side of the human body. It comprises five parts: cervical, thoracic, lumbar, sacrum, and coccygeal vertebrae [1].

Scoliosis is a spinal curvature. Scoliosis can result from an actual structural deformity of the vertebral column at birth (congenital) or neuromuscular disease such as muscular

dystrophy. Scoliosis causes deformity and sometimes pain. If this situation cannot be handled, respiratory and lung function can disrupt [2].

The radiographic examination technique of the thoracolumbar spine in scoliosis cases uses PA (Postero-Anterior) projection in an upright position or AP (Antero-Posterior) projection in a supine position and a lateral projection in upright or supine position [3].

Additional projections in scoliosis cases are the Ferguson method. This method consists of two examinations with AP or PA projections. The first examination is performed in an upright or sitting position without using a block, then performed with a block on the leg or hip (if sitting position) on one side of the convex. The other projection is right and left bending. This projection uses an AP supine or a PA projection in an upright position [3]. The purpose of Ferguson method is to assess or measure the curvature of the spine caused by scoliosis. It produces the curve's measurement, affecting the subsequent examination.

Based on initial observations at the Radiology Department of the Yogyakarta Regional Public Hospital, the radiographic examination technique of the thoracolumbar with scoliosis cases uses AP or PA projections, lateral, and bending positions without Ferguson method. This research aimed to determine the difference between thoracolumbar radiographic examination with scoliosis cases in theory and at the Radiology Department of Yogyakarta Regional Public Hospital and the reasons for the projection.

## 2 Method

The research method is qualitative descriptive, which aims to determine the difference between thoracolumbar radiographic examination with scoliosis cases in theory and at the Radiology Department of Yogyakarta Regional Public Hospital and the reasons for the projection.

The study was conducted at the Radiology Department of Yogyakarta Regional Public Hospital from December 2018 to May 2019. The research subjects were three radiographers at the RSU Kota Yogyakarta, and the object of this study was one scoliosis patient.

Data collection equipment were observation and interview transcripts, stationery, recording equipment, and cameras. The data were processed and analyzed in several stages: data collection (interview), data reduction, data presentation, discussion, and conclusion.

## 3 Result

The scoliosis series is conducted on a female patient (19 years old) who indicates scoliosis. The patient felt back pain, and one side of the body is heavy. The patient went to the hospital with his family for further examination. After being examined at the orthopedic clinic, the patient was referred for radiological examination of the scoliosis series.

The thoracolumbar radiographic examination consists of patient preparation, equipment preparation, and radiographic techniques. That are:

### 3.1 Patient Preparation

The patient preparation before the thoracolumbar radiographic examination is only general preparation (Fig. 1). The radiographer explained the examination to the patient. Then, the patient changed the clothes to the patient gown and removed metal objects to avoid artifacts in radiographic images (Fig. 2).

### 3.2 Equipment Preparation

#### 1) Stationary x-ray

It is Siemens Ysio Max with a bucky stand and examination table with the following specification:

- a) Type: Optitop 150/40/80 HC
- b) Serial Number: 805321552



**Fig. 1.** Conventional X-Ray and examination table at Radiology Department of Yogyakarta Regional Public Hospital



**Fig. 2.** Bucky Stand at Radiology Department of Yogyakarta Regional Public Hospital

- 2) Detector
- 3) Computer
- 4) Digital Processing Equipment

### 3.3 Radiographic Techniques

The technique of thoracolumbar radiographic examination in scoliosis patients at the Radiology Department of the Yogyakarta Regional Public Hospital: (Fig. 3).

#### 1) *AP Projection*

- a) Patient position: The patient stands upright facing the tube x-ray with both arms alongside the body.
- b) Position of the object: MSP of the body at the mid-bucky stand. The upper border is at the C1 (the first cervical) level, and the lower is symphysis pubis.
- c) CR (Central Ray): Horizontal and perpendicular to the cassette.
- d) CP (Central Point): The central point is the xiphoid process and towards the center of the cassette.
- e) FFD (Focus Film Distance): 180 cm
- f) Exposure factor: 70 kV, 50 mAs
- g) Exposure: Hold breath to limit the patient moving.

#### 2) *Lateral Projection*

- a) Patient position: The patient stands upright with a left lateral position and arms alongside the body.
- b) Position of the object: MCP (Mid Coronal Plane) of the body at the mid-bucky stand. The upper border is at the C1 (the first cervical) level, and the lower is symphysis pubis.
- c) CR (Central Ray): Horizontal and perpendicular to the cassette.
- d) CP (Central Point): The central point is at the level of vertebrae thoracal IX and towards the center of the cassette.



**Fig. 3.** Thoracolumbar AP Projection Image at Radiology Department of Yogyakarta Regional Public Hospital



**Fig. 4.** Thoracolumbar Lateral Projection Image at Radiology Department of Yogyakarta Regional Public Hospital

e) FFD (Focus Film Distance): 180 cm

f) Exposure factor: 70 kV, 50 mAs

g) Exposure: Hold breath to limit the patient moving.

### 3) Right Bending Projection

a) Patient position: The patient stands upright facing the tube x-ray with both arms alongside the body.

b) Position of the object: MSP of the patient at the mid-bucky stand. The upper border is at the C1 level, and the lower is symphysis pubis. The patient leans directly right lateral as far as possible by pulling the right hand down. The patient is asked to hold this position so as not to fall.

c) CR (Central Ray): Horizontal and perpendicular to the cassette.

d) CP (Central Point): The central point is the xiphoid process and towards the center of the cassette.

e) FFD (Focus Film Distance): 180 cm

f) Exposure factor: 70 kV, 50 mAs

g) Exposure: Hold breath to limit the patient moving.

### 4) Left Bending Projection

a) Patient position: The patient stands upright facing the tube x-ray with both arms alongside the body.

b) Position of the object: MSP of the patient at the mid-bucky stand. MSP of the patient at the mid-bucky stand. The upper border is at the level, and the lower is symphysis pubis. The patient leans directly left lateral as far as possible by pulling the left hand down. The patient is asked to hold this position so as not to fall.

c) CR (Central Ray): Horizontal and perpendicular to the cassette.

d) CP (Central Point): The central point is the xiphoid process and towards the center of the cassette.

e) FFD (Focus Film Distance): 180 cm



**Fig. 5.** Thoracolumbar Right Bending Projection Image at Radiology Department of Yogyakarta Regional Public Hospital

- f) Exposure factor: 70 kV, 50 mAs
- g) Exposure: Hold breath to limit the patient moving.

The result from the interview is the thoracolumbar vertebrae examination procedure with scoliosis cases at the Radiology Department of the Yogyakarta Regional Public Hospital only using AP or PA projections, lateral and bending positions without Ferguson method (Fig. 4). The four projections can establish a diagnosis from the results of interviews that the author had conducted with several radiographers. It is also the SOP for thoracolumbar vertebrae examination in scoliosis cases in this hospital, and it is appropriate with the radiology request form from the orthopedic physician (Fig. 5)

It is possible that if the doctor wants additional projections, so that the projections will be made. However, only these four projections have been used in examining the thoracolumbar vertebrae with scoliosis cases at the Radiology Department of the Yogyakarta Regional Public Hospital (Fig. 6).



**Fig. 6.** Thoracolumbar Left Bending Projection Image at Radiology Department of Yogyakarta Regional Public Hospital

## 4 Discussion

### 4.1 The Procedure of Thoracolumbar Vertebrae Examination in Scoliosis Patient at the Radiology Department of the Yogyakarta Regional Public Hospital

The examination technique of the thoracolumbar vertebrae in patients with scoliosis at the Radiology Department of the Yogyakarta Regional Public Hospital showed a slight difference from the theory. However, the most important thing is that the information of the image can establish a diagnosis, and it can be used as a reference for clinicians to take the next examinations, such as therapy.

This examination begins with general preparation. The radiographer explains the examination and instructs the patient to change the clothes to the patient gown and remove metal objects to avoid artifacts on the image.

The difference in thoracolumbar vertebrae examination in patients with scoliosis between in theory and the Radiology Department of the Yogyakarta Regional Public Hospital are the projection used. The projections in theory used PA, lateral, PA right bending, PA left bending, and PA Ferguson method [3]. While at the Radiology department of Yogyakarta Regional Public Hospital using AP, lateral, AP right bending, and AP left bending. The AP projection is used because the object's position is closer to the cassette, so it will not provide a gap between the object and the patient compared to the PA projection. It will be no distortion or magnification on the image result.

In theory, the patient's position is supine or upright, but at Radiology Department of Yogyakarta Regional Public Hospital uses an upright position because it is easier, faster, and more comfortable for the patient. However, the upright position has a higher risk even though it can be prevented, such as the possibility of the patient falling.

### 4.2 The Reason for the Thoracolumbar Vertebrae Examination with Scoliosis Cases at the Radiology Department of Yogyakarta Regional Public Hospital Only Uses Ap or Pa, Lateral and Bending Position Projections Without Ferguson Method.

The radiographic examination of the thoracolumbar vertebrae in scoliosis cases using the AP, lateral, AP right bending, and AP left bending projections is sufficient to establish the diagnosis. It is in line with the purpose of the AP projection is to assess the degree of curvature of scoliosis, and the lateral projection aims to determine the type of abnormality, whether lordosis, kyphosis, or others [4].

The AP right and left bending projections aim to determine the major location of scoliosis. It can be used to determine the type of scoliosis so that the orthopedic physician can determine the next examination.

The Ferguson method aims to assess or measure the magnitude of the curve in the curvature that occurs in the spine [5]. It can produce the measurement of the curve, which will also affect the subsequent examination.

The AP, lateral, AP right bending, and AP left bending projections are used without PA Ferguson Method because the SOP for thoracolumbar examination in scoliosis at the Radiology Department of Yogyakarta Regional Public Hospital only uses those

projections. The four projections are appropriate with the radiology request form from the orthopedic physician and sufficient to provide diagnostic information to the patient.

According to the author, the radiographic examination of the thoracolumbar vertebrae in scoliosis cases at the Radiology department of the Yogyakarta Regional Public Hospital using the AP, lateral, AP right bending, and AP left bending projections can provide diagnostic information. The four projections are appropriate with the radiology request form from the orthopedic physician at the Yogyakarta Regional Public Hospital.

## 5 Conclusion

Research shows that the radiographic examination procedure of the thoracolumbar in scoliosis cases at the Radiology Department of the Yogyakarta Regional Public Hospital uses AP, lateral, right, and left bending projections in an upright position. The patient preparations are the patient wearing a patient gown and removing metal objects in the examination area. The central point is the xiphoid process by the upper border on the first cervical and the lower on the symphysis pubis. The central ray was horizontal and perpendicular to the cassette. The FFD is 180 cm and exposed when holding breath. The reason for using the AP, Lateral, AP Right Bending, and AP Left projections without PA Ferguson Method projection is because the SOP of thoracolumbar examination in scoliosis cases in this hospital only uses those projections. It is appropriate with the radiology request form from the orthopedic physician, and the four projections are sufficient to provide diagnostic information.

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