Journal of Public Health Science (JoPHS)
Volume 2, No 4 – Desember 2025
e-ISSN : 3047-3632

ADIOGRAPHY OF THE RIGHT ELBOW JOINT WITH SUSPENSION ARTHRITIS AT MEDAN HAJI GENERAL HOSPITAL

Justinus Tambunan[1], Juliana Lasniar Sidauruk[2*]
[1,2,] Akademi Teknik Radiodiagnostik Dan Radioterapi, Yayasan Sinar Amal Bhakti Medan, Indonesia
[1] Julianasidauruk75@gmail.com*

Received: 02-12-2025	Revised: 15-12-2025	Approved: 27-12-2025

ABSTRACT

The elbow joint is the joint that connects the radius-ulna bone to the humerus bone. Elbow joint examination techniques are radiological examinations to detect clinical conditions or diseases around the elbow joint. In clinical practice, there is a disease called arthritis, which is inflammation of the joints, especially the elbow joints. The purpose of this study was to determine the elbow joint examination technique and the results of elbow joint radiography in patients with clinical arthritis at the Radiology Department of Haji Medan General Hospital in May 2025, using an X-ray machine with a capacity of 500 mA, but the author only used 100 mA to obtain optimal image sharpness. This study used a qualitative method, with data collection conducted through observation techniques, consultation with radiology specialists, and discussions with radiology technicians, as well as documentation and library studies. The collected data was then analyzed to draw conclusions. The results of the study showed that the technique for examining the elbow joint in clinical arthritis used two projections, namely antero-posterior and lateral, through image processing using Computer Radiography (CR). In the lateral projection, the position of the object was incorrect due to the patient's stiffness. However, the resulting radiographs showed a fairly clear anatomical image, which could assist in establishing a diagnosis.

Keywords: Elbow joint, Arthritis, Computer Radiography (CR).

INTRODUCTION

The elbow joint is a synovial joint that plays a vital role in the movement of the upper and lower arms, thus significantly determining the function of the upper extremities in daily activities [1]. Arthritis of the elbow joint, or elbow joint arthritis, is an inflammatory condition that affects the structure of the joint, causing pain, limited movement, and a reduced quality of life. Although arthritis is more common in the knee and hip joints, elbow joint involvement is not uncommon, especially in patients with rheumatoid or post-traumatic arthritis [2].

Arthritis is defined as acute or chronic inflammation of a joint, often accompanied by pain and structural damage [3]. Arthritis is not the same as arthralgia, which refers to pain localized to a joint, regardless of the origin of the pain, which may or may not be due to joint inflammation [4].

Radiological procedures to show arthritis use the Anterior Posterior (AP) and Lateral projection Elbow Joint examination technique. Using a general X-ray machine with a capacity of 500mA, but the author uses a small focus of 100mA. Therefore, the author chose to use the examination technique, namely Anterior-Posterior and Lateral, with image recording using Computed Radiography (CR) [5].

Therefore, the author conducted research aimed to determine the radiographic examination technique for the elbow joint in cases of arthritis and the role of each radiographic projection. The purpose of this elbow joint radiography was to optimally visualize and confirm a diagnosis of the elbow joint in cases of suspected arthritis [6].

The elbow joint is a complex joint consisting of three bones, three ligaments, two joints, and one capsule. This joint is the joint between the humerus and radioulna. The elbow joint is a type of hinge joint that only allows flexion and extension movements. However, this joint is important because of its location and frequency of use in daily activities and sports that involve this joint [7].

Antero Posterior (AP) Projection. To evaluate the bone structure of the elbow joint and to assess the integrity of the distal humerus, proximal ulna, and proximal radius, detect fractures or dislocations, and also to assess degenerative or inflammatory disorders that can occur in the elbow joint.

Lateral projection. The purpose of this projection is to assess the relationship of the elbow bone articulation laterally, detect fractures or dislocations that are not visible in the Anteroposterior (AP) projection, evaluate the results of internal fixation, implant placement, or recovery, to see signs of inflammation, infection, or bone tumors that affect the lateral part of the elbow joint [8]. The patient is positioned sitting beside the examination table [9].

Some abnormalities or pathologies in the elbow joint are fractures, joint dislocations, subluxations, and other degenerative disorders such as osteoarthritis, rheumatoid arthritis, congenital abnormalities, osteochondroma, and osteosarcoma, in other conditions olecranon bursitis (inflammation of the bursa at the tip of the elbow) [10].

Therefore, the preparation of the scientific paper formulates the problem as follows "What efforts are made to obtain an optimal radiographic image of the Elbow Joint with suspected Arthritis? Based on this, the author wants to further examine the radiography of the Elbow Joint with suspected Arthritis in the form of a scientific paper with the title: "Elbow Joint Radiography with Suspected Arthritis at Haji General Hospital Medan"

Understanding the Concept

Definition of Examination

Radiological examination is a supporting examination that uses X-rays to help confirm the diagnosis of a disease in a body organ [11]. Radiography is defined as a method of recording, displaying, and obtaining information in the form of film sheets using X-rays [12].

Anatomy

The word anatomy comes from the Greek, meaning "to open a piece." Anatomy is the study of the structure of the human body and the physical relationships of the body systems involved [13]. For example, studying the heart and its location within the human body. Anatomy is a series of scientific studies about the structure and parts of the body that form a functional system under normal conditions. Knowledge of everything that is normal is an important tool for studying the abnormal (pathological) changes in body structure [14].

The elbow joint is a complex synovial joint that allows significant movement and function, primarily in the form of extension and flexion. However, it also facilitates movements in the hand in the form of supination and pronation of the forearm [15]. The primary stability of the elbow joint results from the articulation of the trochlea of the humerus and the olecranon of the ulnar bone. The olecranon resembles a spoon or wrench in that a landmark, called the trochlear notch, fits around the trochlea of the humerus and serves as the primary pivot point during flexion and extension of the

elbow joint. The trochlear notch wraps around the humerus almost 180 degrees, while the trochlea of the humerus is wide with a central groove, allowing for a tight fit between the two bones. adding stability. After the articulation of the humerus and ulna (ulnohumeral articulation), the main components of elbow joint stability come from two strong ligaments: the medial collateral ligament (MCL) and the lateral collateral ligament (LCL). Both the LCL and MCL form the joint capsule to provide further stability [16].

Physiology

Physiology studies the function or workings of the human body under normal conditions. This science is closely related to the knowledge of all living things covered in biology [17]. Furthermore, this science is closely related to the work of cytologists, who study the details of cell structure, and biochemists, who deal with the chemical changes and activities of cells and investigate the complex chemical processes of living organisms. It is also closely related to the natural sciences, which study the physical reactions and movements that occur in the body [18].

Pathology

Pathology is the science that studies 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 includes disease diagnosis [19].

So arthritis is an acute inflammation of the joints or which is often accompanied by pain and structural damage, Arthy is not the same as arthralgia, which refers to pain localized to the joints, regardless of the origin of the pain (which may or may not be caused by joint inflammation) [20].

X-ray Machine Technique

X-ray machine technique is a procedure/management of using an X-ray machine to generate X-rays in examinations with good image results. An X-ray machine is one of the radiology installation equipment that has an important role to be able to produce X-rays and can provide an image of an object on an X-ray film after going through a chemical process in a film processing room or dark room. Where in the medical field it is used as a tool to diagnose a disease [21]. One X-ray machine unit consists of four components, namely:

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 functions to protect the tube insert from impacts and shocks [22]. In general, the X-ray tube consists of:

Tube housing (Outer X-ray Tube) Tube Housing is a cylindrical container made of metal and coated with lead (Pb). Functions as a place for the tube insert to avoid impacts and shocks and as a barrier for x-rays to exit only through the window. In addition, the function of this wall is to suppress unnecessary radiation. The tube housing is also equipped with a high-voltage cable connection, namely a cable from HTT.

High Voltage Transformer

High Tension Transformer (HTT) or high voltage transformer is a tool to increase and decrease the magnitude of the electric voltage. High voltage transformers consist of two coils, namely the primary coil and the secondary coil. High voltage transformers function to increase or decrease the electric voltage and there is a high voltage transformer (step up transformer) which is used to increase the voltage of

several volts to several kilovolts and quickly move electrons through the X-ray tube. There is a low voltage transformer (step down transformer) used to reduce the electric voltage and provide current to the filament [23].

Radiodiagnostic Physics and Radiation Protection

Radiodiagnostic Physics

Diagnostic radiology is the study of symptoms using X-rays produced by an X-ray tube to establish a diagnosis. Radiography of the elbow joint in cases of suspected arthritis requires high precision [24].

A radiographic image is said to be sharp if the image can show the clear boundaries of the part of the object to be photographed so that the organ structure is clearly visible.

RESEARCH METHODS

Types of research

study on *elbow joint radiography* with suspected *arthritis* used qualitative research. Data collection techniques were based on observations, study materials, and interviews. Qualitative research is an approach also called investigation because it typically involves collecting data through face-to-face meetings and interactions with people at the research site [25].

Time and Place of research

1. Research Time. The research was conducted on April 8 - May 8, 2025.
2. Research Site. The research location was at the Radiology Installation of Haji General Hospital, Medan.

Data collection technique

The procedure for collecting data in the implementation of *Elbow J Radiography is as follows:* with suspected *arthritis* are as follows: Direct observation conducted by the researcher can be realized by recording information related to the radiology installation room at Medan Haji General Hospital, also observing how the radiographic examination technique *for Elbow Joints* with Suspected *Arthritis* is carried out. For this reason, the researcher can conduct direct observation on the implementation of *Elbow Joint radiography* with Suspected *Arthritis* in the radiology department of Medan Haji General Hospital to obtain accurate information or data related to the research object [26].

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 [27].To obtain theoretical support for the chosen research problem, the author read a lot of literature, both in the form of texts (theory), 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.Patient documentation can be seen from the patient's medical record and expertise in radiographic examination *of the Elbow Joint* with suspected *Arthritis* at the Haji General Hospital, Medan [28].

Data analysis

Data analysis is the process of systematically searching for and compiling data obtained from interviews, field notes, and documentation, by organizing the 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 [29].

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 [30].

RESULTS AND DISCUSSION

In 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 it is easier to carry out an examination and also to prevent errors in patient data between one patient and another [31].

The patient's identity during the *Elbow Joint radiography* with suspected *Arthritis* at Haji General Hospital, Medan, is as follows:

Name : Mrs. C

Age : 35 Years Date of Birth: September 4, 1990 Gender: Female Time of Examination: May 9, 2025

Type of Examination : *Antero Posterior (AP) Lateral Elbow Joint* Radiography

Diagnosis : *Arthritis Elbow Joint dextra*

Examination Procedure

Elbow Joint radiographic examination procedure with suspected *Arthritis:*

a. Nurses or independent patients register patients for radiology by bringing a request letter for examination photos from the referring doctor.
b. The nurse brought the patient and brought a letter requesting a photo of the radiology room [32].
c. The radiographer read the letter requesting the photo, and told the nurse to wait in front of the radiology room.
d. Radiographer prepares equipment used in radiographic examination of Elbow Joint with suspected Arthritis.
e. The radiographer calls the patient's name and matches the patient's identity with the photo request letter.
f. The radiographer informs the patient of the procedure to be performed.
g. Performing a radiographic examination of the Elbow Joint with suspected Arthritis using the Antero-Posterior projection and Lateral projection.
h. Editing is done, during which time the patient waits until the film is finished on the Output Device.
i. After completion, the radiologist will read the radiographs and the patient will leave the radiology room. If necessary, the patient will take the radiographs with them on a CD or wet film.

Patient Preparation

When performing Elbow Joint radiography with suspected Arthritis, the patient does not require special preparation, however, objects that can produce artifacts around the object are removed [33].

Preparation of Examination Tools

X-ray machine

The X-ray machine used in the implementation of *Elbow Joint radiography* with suspected Arthritis at the Radiology Installation of Haji Medan Hospital with the following data:

Aircraft type : OPTITTOP 150/40/80HC-100 Aircraft brand: SIEMENS
Input voltage : 230 V
Max kV : 150 kV
Max mA : 399 mA
Frequenc : 50-60 Hz

Figure 1. X-ray machine of Medan Haji General Hospital

Radiography Equipment:

1). Cassette size 18 cm × 24 cm
2). Types of Computed Radiography films
3). The R marker is used to identify the anatomical location of the patient's identity.

Figure 2. *Control Table* at Haji General Hospital Medan

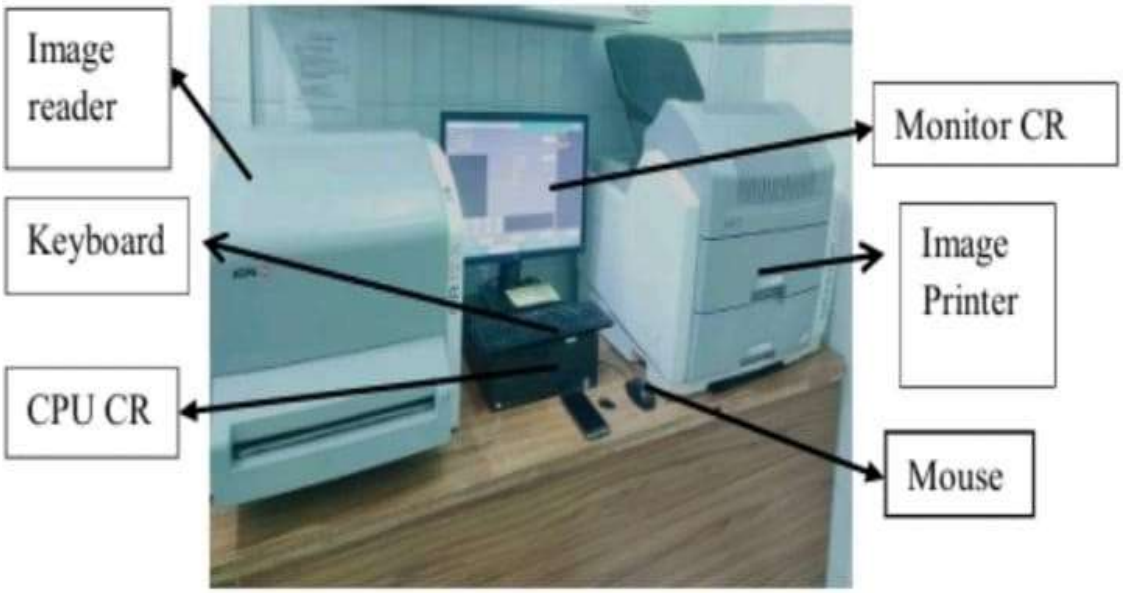

Figure 3. Computer Radiography, Image Reader and Image Printer at Haji General Hospital, Medan

Figure 4. Computer Radiography (CR) cassette at Haji General Hospital, Medan

Inspection Technique

As for the projections carried out in the Elbow Joint Radiographic examination with suspected Arthritis, the author only carried out *Anterior Posterior projections* and *Lateral Projections* .

Antero-Posterior Projection

Purpose of Examination : To show any anatomical abnormalities in Elbow Joint from Antero Posterior position

Patient Position : Patient sits beside the examination table, arms at extend and palm facing up Object Position : Ask the patient to extend the elbow, with the hand

supine, and center the center of the cassette on the elbow joint, adjust the cassette to be parallel to the object. Ask the patient to straighten the elbow until *the epicondyles* of the humerus and the anterior surface of the elbow are parallel to the plane of the cassette. Supine the hand to prevent rotation of the forearm bone, and then instruct the patient not to move [34].

Focus Distance to Film : 100 cm
Beam Direction(CR) : Vertical perpendicular to the cassette
Center point(CP) : 3 inches proximal and distal to *the elbow joint*
Cassette : 18 cm × 24 cm
Exposure Factor : Kv: 55, mAs: 8

Anterior Posterior **Projection** ***Elbow Joint*** **Radiograph at Haji General Hospital Medan**

Lateral Projection

Patient Position : The patient sits sideways on the examination table.

With the affected side close to the examination table, adjust the sitting height so that the arm can be placed comfortably on the examination table.

Object Position : Flex the arm as comfortable as possible for the patient to avoid the patient

Position the patient on the examination table and position the elbow directly in the center of the imaging field. Position the arm perpendicularly above the cassette on the ulnar side. Place the thumb on top and against the palm, ensuring a true lateral position. Position the hand and arm in a straight line. Position the two humeral *epicondyles* superimposed on each other. Position the forearm and upper arm on a flat surface. Instruct the patient to relax to avoid movement. For fixation, a soft bag/sandbag can be used for the underside of the hand.

Central ray : Set the center ray perpendicular to *the elbow joint* . Central Point : in the middle of the marker mark.

FFD : 100 cm

Exposure factor : Kv: 60, mAs: 8

Figure 6. Radiography *of the right elbow joint, lateral* projection at the Haji General Hospital, Medan

Evaluation Criteria:

a) the elbow joint is shown.
b) The humerus, ulna, radius and *olecranon bones are* clearly visible.
c) Superimposed humeral *epycondylus*
d) *Arthritis elbow joint dextra* appears

Evaluation of Elbow Joint Radiographic Images

After completing the radiographic examination of the Elbow Joint with suspected arthritis, the author then carried out an evaluation of the results of the radiographic image:

j. The projections used are Anteroposterior and Lateral
k. Using 18 cm × 24 cm film, and the required cassette corresponds to the film used without a grid.
l. Sharpness : Sufficient
m. Details : Sufficient
n. Density : Sufficient
o. Contrast : Sufficient

Discussion

Formulation of the problem

After observing the examination of the right elbow joint with suspected arthritis, the author formulated the problem "efforts made to show the radiographic image of the right elbow joint with suspected arthritis and can provide optimal diagnostic information" [35]..

Discussion of Problem Formulation

p. When performing an *elbow joint radiograph* for suspected *arthritis* , cooperation between the radiographer and the patient is essential to ensure a smooth examination. Therefore, the patient should be informed about the procedures to be performed prior to the radiograph.

q. The projections used in *Elbow Joint Radiography* with suspected *Arthritis are Anterior Posterior (AP) and Lateral projections. With these two projections, the anatomy and abnormalities of the elbow joint, especially arthritis,* can be seen from two aspects.

r. In carrying out radiographic examination *of the Elbow Joint* with suspected *Arthritis* , a general X-Ray machine with a capacity of 500mA was used, but the author used a small focus (100mA), because the object being examined was relatively small.

s. The process of recording images in the implementation of *Elbow Joint Right radiography* with suspected *Arthritis arthritis,* the author uses computer radiography (CR) in accordance with the facilities available at the Radiology Installation of Haji General Hospital Medan [36]. In setting the exposure factor, it is best not to be too high (overexposure) and not too low (underexposure) in the sense that it is still within the permissible tolerance for editing or reconstructing images on the monitor [37].

Cause of the Problem

a. The patient is a little difficult to position in the *Lateral projection.*

b. The patient felt pain in *the elbow joint* that spread to the shoulder and was difficult to move.

Efforts made to overcome the problem

To overcome the difficulty of lateral projection in patients, the radiographer should use an immobilization device such as a sponge to obtain a suitable lateral projection [38]. To reduce pain in patients performing radiography *of the right elbow joint* with suspected *arthritis* , the radiographer should shorten the exposure time by increasing the mA to 200 mA.

CONCLUSION

From the research results that have been described in this paper with the title "Radiographic Examination of the Elbow Joint with Suspected Arthritis", the following conclusions can be drawn:

1. To avoid repeating photos or examinations, before carrying out a radiographic examination, the radiographer informs the patient about the examination procedure.
2. Radiographic examination of the elbow joint with suspected arthritis is carried out using two projections, namely the Anterior Posterior (AP) projection and the Lateral projection.
3. In accordance with the facilities provided at the Radiology Installation of Medan Haji General Hospital as well as to improve the quality of X-ray photos and work efficiency, the imaging process is carried out using Computed Radiography.

Suggestion

1. To ensure the examination runs smoothly, when conveying information

about the examination procedure, it is best to use language that is easy for the patient to understand.

2. In providing exposure factors on right elbow joint radiographs with suspected arthritis, it is best to use exposure factors that are appropriate to the thickness of the object.
3. To show a normal elbow joint and an elbow joint that has abnormalities, especially arthritis, a comparative photo is taken.

BIBLIOGRAPHY

[1] S. Reuter, C. Moser, En M. Baack, "Respiratory Distress In The Newborn", *Pediatr. Rev.*, Vol 35, No 10, Bll 417–428, 2014, Doi: 10.1542/Pir.35-10-417.

[2] A. N. O. Sebayang, "Perawatan Diagnostik Dan Konservatif Hidropneumotorax Karena Tuberkulosis Pada Anak Laki-Laki Berusia 17 Tahun", *Scr. Score Sci. Med. J.*, Vol 2, No 1, Bll 58–63, Aug 2020, Doi: 10.32734/Scripta.V2i1.3527.

[3] T. Tsuboyama *Et Al.*, "Mri Of Borderline Epithelial Ovarian Tumors: Pathologic Correlation And Diagnostic Challenges", *Radiographics*, Vol 42, No 7, Bll 2095–2111, 2022, Doi: Https://Doi.Org/10.1148/Rg.220068.

[4] C. L. Hermansen En A. Mahajan, "Newborn Respiratory Distress", *Am. Fam. Physician*, Vol 92, No 11, Bll 994–1002, 2015, Doi: 10.1007/978-3-030-26044-6_157.

[5] R. Setiawati *Et Al.*, "Modified Chest X-Ray Scoring System In Evaluating Severity Of Covid-19 Patient In Dr. Soetomo General Hospital Surabaya, Indonesia", *Int. J. Gen. Med.*, Vol 14, Bll 2407–2412, 2021, Doi: 10.2147/Ijgm.S310577.

[6] R. Whelan, A. Shaffer, En J. E. Dohar, "Button Battery Versus Stacked Coin Ingestion: A Conundrum For Radiographic Diagnosis", *Int. J. Pediatr. Otorhinolaryngol.*, Vol 126, Bl 109627, Nov 2019, Doi: 10.1016/J.Ijporl.2019.109627.

[7] J. J. Crivelli *Et Al.*, "Clinical And Radiographic Outcomes Following Salvage Intervention For Ureteropelvic Junction Obstruction", *Int. Braz J Urol*, Vol 47, Bll 1209–1218, 2021.

[8] D. A. Rosenfield, N. F. Paretsis, P. R. Yanai, En C. S. Pizzutto, "Gross Osteology And Digital Radiography Of The Common Capybara (Hydrochoerus Hydrochaeris), Carl Linnaeus, 1766 For Scientific And Clinical Application", *Brazilian J. Vet. Res. Anim. Sci.*, Vol 57, No 4, Bll E172323–E172323, 2020.

[9] F. P. Machado, J. E. F. Dornelles, S. Rausch, R. J. Oliveira, P. R. Portela, En A. L. S. Valente, "Osteology Of The Pelvic Limb Of Nine-Banded-Armadillo, Dasypus Novemcinctus Linnaeus, 1758 Applied To Radiographic Interpretation", *Brazilian J. Dev.*, Vol 9, No 05, Bll 14686–14709, 2023.

[10] L. Meomartino, A. Greco, M. Di Giancamillo, A. Brunetti, En G. Gnudi, "Imaging Techniques In Veterinary Medicine. Part I: Radiography And Ultrasonography", *Eur. J. Radiol. Open*, Vol 8, Bl 100382, 2021, Doi: 10.1016/J.Ejro.2021.100382.

[11] E. K. Wati, "Penatalaksanaan Teknik Radiografi Abdomen 3 Posisi Pada Kasus Ileus Paralitik Dengan Modalitas Computed Radiography Di Instalasi

Radiologi", *J. Compr. Sci.*, Vol 2, No 9, Bll 1605–1622, 2023, Doi: Https://Doi.Org/10.59188/Jcs.V2i9.518.

[12] S. L. Purchase, "Point And Shoot: A Radiographic Analysis Of Mastoiditis In Archaeological Populations From England's North-East". University Of Sheffield, 2021.

[13] I. A. N. Liscyaningsih, M. Fa'ik, En V. V. Felleaningrum, "Difference In Radiograph Image Between Prints Directly On Cr Modality With Print Through Pacs", In *2022 'Aisyiyah International Conference On Health And Medical Sciences (A-Hms 2022)*, Atlantis Press, 2023, Bll 248–253.

[14] S. Sukegawa *Et Al.*, "Multi-Task Deep Learning Model For Classification Of Dental Implant Brand And Treatment Stage Using Dental Panoramic Radiograph Images", *Biomolecules*, Vol 11, No 6, Bl 815, Mei 2021, Doi: 10.3390/Biom11060815.

[15] A. Pongkunakorn, C. Aksornthung, En N. Sritumpinit, "Accuracy Of A New Digital Templating Method For Total Hip Arthroplasty Using Picture Archiving And Communication System (Pacs) And Iphone Technology: Comparison With Acetate Templating On Digital Radiography", *J. Arthroplasty*, Vol 36, No 6, Bll 2204–2210, Jun 2021, Doi: 10.1016/J.Arth.2021.01.019.

[16] H. Alsleem *Et Al.*, "Evaluation Of Radiographers' Practices With Paediatric Digital Radiography Based On Pacs' Data", *Integr. J. Med. Sci.*, Vol 7, 2020, Doi: 10.15342/Ijms.7.216.

[17] W. Elshami, M. M. Abuzaid, En H. O. Tekin, "Effectiveness Of Breast And Eye Shielding During Cervical Spine Radiography: An Experimental Study", *Risk Manag. Healthc. Policy*, Bll 697–704, 2020.

[18] T. J. Meyer *Et Al.*, "Systematic Analysis Of Button Batteries', Euro Coins', And Disk Magnets' Radiographic Characteristics And The Implications For The Differential Diagnosis Of Round Radiopaque Foreign Bodies In The Esophagus", *Int. J. Pediatr. Otorhinolaryngol.*, Vol 132, Bl 109917, 2020.

[19] V. Sharma, K. Kumar, V. Kalia, En P. K. Soni, "Evaluation Of Femoral Neck-Shaft Angle In Subhimalayan Population Of North West India Using Digital Radiography And Dry Bone Measurements", *J. Sci. Soc.*, Vol 45, No 1, Bll 3–7, 2018.

[20] V. Torrecillas En J. D. Meier, "History And Radiographic Findings As Predictors For Esophageal Coins Versus Button Batteries", *Int. J. Pediatr. Otorhinolaryngol.*, Vol 137, Bl 110208, 2020.

[21] V. Torrecillas En J. D. Meier, "History And Radiographic Findings As Predictors For Esophageal Coins Versus Button Batteries", *Int. J. Pediatr. Otorhinolaryngol.*, Vol 137, No 5, Bl 110208, Okt 2020, Doi: 10.1016/J.Ijporl.2020.110208.

[22] A. Peiro, N. Chegeni, A. Danyaei, M. Tahmasbi, En J. Fatahiasl, "Pelvis Received Dose Measurement For Trauma Patients In Multi-Field Radiographic Examinations: A Tld Dosimetry Study", 2022.

[23] M. Shafiee *Et Al.*, "Knowledge And Skills Of Radiographers Concerning 'Digital Chest Radiography'", *J. Clin. Care Ski.*, Vol 3, No 4, Bll 197–202, Des

2022, Doi: 10.52547/Jccs.3.4.197.

[24] A. K. Prakash, S. G. Kotalwar, B. Datta, P. Chatterjee, S. Mittal, En A. Jaiswal, "To Evaluate The Inter And Intraobserver Agreement In The Initial Diagnosis By Digital Chest Radiograph Sent Via Whatsapp Messenger", In *Imaging*, Sep 2019, Bl Pa4820, Doi: 10.1183/13993003.Congress-2019.Pa4820.

[25] V. Sharma, K. Kumar, V. Kalia, En P. Soni, "Evaluation Of Femoral Neck-Shaft Angle In Subhimalayan Population Of North West India Using Digital Radiography And Dry Bone Measurements", *J. Sci. Soc.*, Vol 45, No 1, Bl 3, 2018, Doi: 10.4103/Jss.Jss_34_17.

[26] X. Chen, S. Sima, H. S. Sandhu, J. Kuan, En A. D. Diwan, "Radiographic Evaluation Of Lumbar Intervertebral Disc Height Index: An Intra And Inter-Rater Agreement And Reliability Study", *J. Clin. Neurosci.*, Vol 103, Bll 153–162, 2022, Doi: Https://Doi.Org/10.1016/J.Jocn.2022.07.018.

[27] P. D. Trobisch, R. Castelein, En S. Da Paz, "Radiographic Outcome After Vertebral Body Tethering Of The Lumbar Spine", *Eur. Spine J.*, Vol 32, No 6, Bll 1895–1900, 2023, Doi: Https://Doi.Org/10.1007/S00586-023-07740-2.

[28] A. Saremi, K. K. Goyal, E. C. Benzel, En R. D. Orr, "Evolution Of Lumbar Degenerative Spondylolisthesis With Key Radiographic Features", *Spine J.*, Vol 24, No 6, Bll 989–1000, 2024, Doi: Https://Doi.Org/10.1016/J.Spinee.2024.01.001.

[29] S. T. Willesen *Et Al.*, "Mri-Based Synthetic Ct: A New Method For Structural Damage Assessment In The Spine In Patients With Axial Spondyloarthritis–A Comparison With Low-Dose Ct And Radiography", *Ann. Rheum. Dis.*, Vol 83, No 6, Bll 807–815, 2024, Doi: Https://Doi.Org/10.1136/Ard-2023-225444.

[30] V. Logithasan, J. Wong, M. Reformat, En E. Lou, "Using Machine Learning To Automatically Measure Axial Vertebral Rotation On Radiographs In Adolescents With Idiopathic Scoliosis", *Med. Eng. Phys.*, Vol 107, Bl 103848, 2022, Doi: Https://Doi.Org/10.1016/J.Medengphy.2022.103848.

[31] A. Yu *Et Al.*, "Radiographic Assessment Of Successful Lumbar Spinal Fusion: A Systematic Review Of Fusion Criteria In Randomized Trials", *Glob. Spine J.*, Bl 21925682251384664, 2025, Doi: Https://Doi.Org/10.1177/21925682251384662.

[32] S. M. Ryu *Et Al.*, "Diagnosis Of Osteoporotic Vertebral Compression Fractures And Fracture Level Detection Using Multitask Learning With U-Net In Lumbar Spine Lateral Radiographs", *Comput. Struct. Biotechnol. J.*, Vol 21, Bll 3452–3458, 2023, Doi: Https://Doi.Org/10.1016/J.Csbj.2023.06.017.

[33] Y. Alashban, N. Shubayr, A. A. Alghamdi, S. A. Alghamdi, En S. Boughattas, "An Assessment Of Image Reject Rates For Digital Radiography In Saudi Arabia: A Cross-Sectional Study", *J. Radiat. Res. Appl. Sci.*, Vol 15, No 1, Bll 219–223, 2022, Doi: Https://Doi.Org/10.1016/J.Jrras.2022.01.023.

[34] P. Tavana, M. Akraminia, A. Koochari, En A. Bagherifard, "Classification Of Spinal Curvature Types Using Radiography Images: Deep Learning Versus Classical Methods", *Artif. Intell. Rev.*, Vol 56, No 11, Bll 13259–13291, 2023, Doi: Https://Doi.Org/10.1007/S10462-023-10480-W.

[35] L. Becker *Et Al.*, "Lumbosacral Transitional Vertebrae Alter The Distribution

Of Lumbar Mobility–Preliminary Results Of A Radiographic Evaluation", *Plos One*, Vol 17, No 9, Bl E0274581, 2022.

[36] Y.-T. Kim, T. S. Jeong, Y. J. Kim, W. S. Kim, K. G. Kim, En G. T. Yee, "Automatic Spine Segmentation And Parameter Measurement For Radiological Analysis Of Whole-Spine Lateral Radiographs Using Deep Learning And Computer Vision", *J. Digit. Imaging*, Vol 36, No 4, Bll 1447–1459, 2023, Doi: Https://Doi.Org/10.1007/S10278-023-00830-Z.

[37] J. A. Hipp, T. F. Grieco, P. Newman, En C. A. Reitman, "Definition Of Normal Vertebral Morphometry Using Nhanes Ii Radiographs", *J. Bone Miner. Res. Plus*, Vol 6, No 10, Bl E10677, 2022.

[38] A. Tabard-Fougère, C. De Bodman, A. Dhouib, A. Bonnefoy-Mazure, S. Armand, En R. Dayer, "Three-Dimensional Spinal Evaluation Using Rasterstereography In Patients With Adolescent Idiopathic Scoliosis: Is It Closer To Three-Dimensional Or Two-Dimensional Radiography?", *Diagnostics*, Vol 13, No 14, Bl 2431, 2023, Doi: Https://Doi.Org/10.3390/Diagnostics13142431.