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## **The Role of Multi-section CT Scan in Examining the Shoulder Joint with Opaque Medium in Saudi Arabia**

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### **Abstract**

The shoulder joint is considered one of the most active joints in the human body. Degenerative changes in various shoulder tissues (ligaments and rotator cuff), or trauma and excessive repetitive use will lead to injury to the patient's shoulder joint and surrounding tissues, which will have a serious impact on the patient's life and work. In the diagnosis of shoulder injury, combined multi-section CT examination can obtain a more accurate diagnosis rate and optimal effect. This research aims to understand the role of multi-section CT scan in examining the shoulder joint in the dark environment in the Kingdom of Saudi Arabia. In this research, the descriptive methodology was used by using previous studies that discuss the topic of the current research. The current research also adopted a set of recommendations, which are: Providing medical centers and radiology departments with multi-segment CT scan machines. Preparing training courses for radiology specialists to enhance their skills in using CT scan devices and knowing the extent of its harm to the patient's body. In addition to providing the educational curricula of medical



radiology departments in Saudi universities with educational materials that work to educate the patient and the specialist about everything related to CT scans. Finally, the researcher recommended the necessity of conducting an applied laboratory study on the current research topic in Saudi Arabia, and this study will be the researcher's future study.

**Keywords:** (Multi-section CT scan, shoulder joint, dark media, X-ray)

### الملخص

يعتبر مفصل الكتف من أكثر مفاصل جسم الإنسان نشاطاً. التغيرات التنكسية في أنسجة الكتف المختلفة (الأربطة والكفة المدورة)، أو الصدمات والاستخدام المتكرر المفرط ستؤدي إلى إصابة مفصل كتف المريض والأنسجة المحيطة به، مما سيكون له تأثير خطير على حياة المريض وعمله. في تشخيص إصابة الكتف، يمكن للفحص المشترك للتصوير المقطعي متعدد المقاطع الحصول على معدل تشخيص ادق وتأثير مثالي. يهدف ها البحث لفهم دور الأشعة المقطعية متعددة المقاطع في فحص مفصل الكتف في الوسط المعتم في المملكة العربية السعودية. تم في هذا البحث استخدام المنهجية الوصفة من خلال الاستعانة بالدراسات السابقة التي تناقش موضوع البحث الحالي. كما تبنى البحث الحالي مجموعة من التوصيات وهي: تزويد المراكز الطبي واقسام الاشعة باجهزة الاشعة المقطعية متعددة المقاطع. و اعداد دورات تدريبية لمختصي الاشعة لتعزيز مهاراتهم في استخدام اجهزة الاشعة المقطعية ومعرفة مدى اضراره على جسم المريض. اضافة الى تزويد المناهج التعليمية لاقسام الاشعة الطبية في الجامعات السعودية بمواد تعليمية تعمل على توعية المريض والمختص بكل ما يتعلق بالاشعة المقطعية. واخيرا فقد اوصى الباحث بضرورة اجراء دراسة مخبرية تطبيقية حول موضوع البحث الحالي في السعودية وهذه الدراسة ستكون الدراسة المستقبلية للباحث.

**الكلمات المفتاحية:** الأشعة المقطعية متعددة المقاطع، مفصل الكتف، وسط معتم، الأشعة السينية



## 1. Introduction

Among the joints in the human body with the highest activity level is the shoulder joint (Hershkovich, 2014). The patient's life and career may be severely impacted by injuries to the shoulder joint and surrounding tissues caused by trauma, changes in the patient's shoulder tissues, or excessive repetitive use. It is likely to cause numerous major complications if it is not identified and treated in a timely manner. Several examination techniques are employed in the clinical diagnosis and treatment plan to ascertain the presence or absence of a shoulder joint injury. Computed tomography (CT) and standard X-rays are the most often utilized (Xiao Li, 2022).

A multi-section CT scan can prevent trauma and the dangers associated with surgery, but it also carries the risk of major tissue problems, including the development of certain illnesses and malignancies (Xiao Li, 2022). Conventional radiography is the primary method used to evaluate shoulder injuries; computed tomography (CT) is likely to be used in addition to radiography to help determine the exact shape of the fracture. When it comes to detecting fracture patterns, computed tomography outperforms radiography, particularly in complicated anatomical regions like the shoulder joints (Almohiy, 2020).

According to previous studies, the application of conventional CT scans for systematic diagnosis is limited due to its high dose for patients with orthopedic injuries. Clinical research has shown a growing proficiency in the use of low-dose CT scans for diagnosis and surgical procedures. The technical benefit of CT scans



is their ability to identify intricate anatomical structures (Lei, 2022; Sulieman, 2018)

CT is one of the most important and effective radiological tools available. Using CT scanning, illnesses and other medical conditions can be found and assessed, laying the groundwork for a diagnosis and course of treatment. The speed, accuracy, adaptability, and non-invasiveness of this approach have made it more popular for use in medical diagnosis (Almohiy, 2020). Regarding this, the current research aims to investigate the role of multi-section CT scan in examining the shoulder joint in opaque media in the Kingdom of Saudi Arabia.

## **2. Research Problem and Questions**

According to Yang (2021), the value of CT scanning and its potential benefits for diagnosing illnesses, fractures, and other medical conditions, some people especially small children may experience negative effects from it because of their small bodies. Children who undergo CT scanning have a higher lifetime risk of developing cancer because, compared to adults, their developing tissues and organs are more susceptible to the damaging effects of cell deterioration. Currently, around 40% -50% of medical exposure to radiation comes from CT scans (Almohiy, 2020).

There are worries that greater use of CT could have unfavorable effects down the road because it exposes users to ionizing radiation. Early-life CT exposure has been associated with a small rise in the number of cases of leukemia and brain



cancer, according to the findings of multiple prior studies (Jana Vasković, 2023). Although the exact cause of the lifelong risk for cancer associated with low-dose radiation exposure (less than 100 mSv) is unknown, it is estimated that the risk for pediatric patients is two to five times higher than that of adult patients (Almohiy, 2020).

Previous studies reveal that there is a lack of laboratory studies that discuss the current research topic in Saudi Arabia (Al-Othman, 2022; Qurashi, 2014). Regarding this, the research seeks to answer the following main question; **“What is the role of multi-section CT scan in examining the shoulder joint in opaque media in the Kingdom of Saudi Arabia?”** In addition, investigating the following sub-questions:

- What is the effect of using opaque media when performing a multi-section CT scan to examine the shoulder joint in Saudi medical centers?
- What is the importance of using multi-section CT scan to examine the shoulder joint for Saudi patients?

### **3. Research Importance**

Multi-section CT scan contributes significantly to identifying problems and diseases affecting joints and cartilage. Given the lack of strategic research and studies focusing on the topic of the role of multi-section CT scan in examining the shoulder joint in opaque medium in the Kingdom of Saudi Arabia, the current



research is of great importance to researchers and specialists in this field (Qurashi, 2014).

This research will demonstrate the role played by multi-section CT scans in examining the shoulder joint in opaque medium and identifying its problems. This research will also contribute to a greater understanding of the role of multi-section CT scanning in the screening of adhesive capsulitis, rotator cuff disorders, and acromioclavicular (AC) joint disease.

#### **4. Research Methodology**

The approach of the current research adopts a descriptive methodology by reviewing the previous studies that examine the role of multi-section CT scans in examining the shoulder joint in an opaque medium in the Kingdom of Saudi Arabia.

#### **5. Literature Review**

##### **5.1 Multi-section CT scan**

With the advent of more sophisticated CT and interventional techniques, diagnostic and interventional radiological procedures are becoming more and more important in the global management of patients (Al-Othman, 2022). The drive to satisfy growing clinical needs has led to a rapid advancement in medical equipment technology. The need for more flexible X-ray tubes and significantly more effective digital detection capacity than was previously possible, enabling better data acquisition rates when needed (Sulieman, 2018).



Medical X-ray technology is undoubtedly under more stringent regulation now that facilities are required to follow quality assurance and practice standards, in addition to training, which are just two of many crucial measures. However, as a result of the quick advancements in imaging technology, there are now more patients and medical who are exposed to ionizing radiation (Sulieman, 2018).

A different method of imaging technique that is non-invasive is computed tomography (CT). X-rays can also be used for a CT scan, but the technology is more sophisticated. The idea is to use a stationary subject to create several cross-sectional pictures that can be combined to create a three-dimensional image (Buckwalter, 2001). This provides us with a slice of the chosen body part in a cross-section. The image is also dependent on tissue density because CT uses X-rays. Hounsfield units are used to express density (HUs). Every bodily tissue has a typical density of its own. Basic tomographic terms such as hyper density, hypo density, or iso density when compared to another structure are used to express changes in density (Jana Vasković, 2023).

Buckwalter (2001) asserted that compared to X-ray radiography, CT has the benefit of offering a three-dimensional view of the body, which results in an improved visualization of the area that has to be imaged. There are various CT methods, including spiral CT, multi-slice CT, and single-slice CT (SSCT) (MSCT). The radiation dose and slice thickness used to create the image in these techniques vary from one another.

Compared to other diagnostic techniques, computed tomography (CT) technology and its clinical applications have proven incredibly resilient, and they



are currently more powerful than ever. Facilitated by technological advancement that offer high-power x-ray tubes, enormous processing capacity, multi-channel detectors for wider scan coverage in sub-millimeter slices, and quicker rotation times one rotation taking only 0.3 seconds (Rehani, 2018).

Another non-invasive imaging technique is computed tomography (CT), formerly known as computed axial tomography (CAT). Although CT uses X-rays as well, its apparatus is more sophisticated. It revolves around a stationary subject, producing a series of cross-sectional pictures that can be processed to produce a three-dimensional picture. This provides us with a cross-sectional view of that particular body part (Vasković, 2023).

Since CT makes use of X-rays, tissue density also affects the image. Hounsfield units (HUs), which range from +1000 for bright bones (gray), to -1000 for dark air (black), are used to express mass. Radiologists are familiar with the normal density of every tissue in the body. If there is a change in mass, we describe it using simple CT terms: hyper dense, hypo dense, or isodense about another structure (Vasković, 2023).

Previous studies asserted that the Kingdom of Saudi Arabia is witnessing clear progress in the emergence of modern X-ray technology widely in its medical sector. Over the past few decades, the Kingdom of Saudi Arabia's health sector has experienced significant growth. The World Health Organization placed Saudi Arabia's healthcare system as the twenty-sixth best in the world in 2000 (Suliman, 2018; Al-Othman, 2022; AL NAKSHABANDI, 2015)





This translates roughly to a very high number of X-ray examinations and their associated frequencies occurring per procedure in the context of the current interest in X-ray imaging. There are not many patient dose studies done in Saudi Arabia when it comes to CT exams, especially when it is considered how frequently these procedures are performed (Sulieman, 2018).

## **5.2 Examining the Shoulder Joints through Opaque Medium**

With indicated incidence rates ranging more than 20%, shoulder pain and weakness rank among the most common musculoskeletal complaints, potentially making it difficult to perform activities of daily living (Yang, 2021). There are several common shoulder conditions, including adhesive capsulitis, rotator cuff disorders, and acromio-clavicular (AC) joint disease. With so many structures involved in shoulder function, it can be difficult to pinpoint specific shoulder pathology (Shihr, 2019). Oberholzer employed shoulder arthrography for the first time in 1933 while researching capsular distortion brought on by shoulder dislocation (PAUL, 1968).

Ultrasound appears to have become competitive as one of the first-line tests for the diagnosis of shoulder pain due to its increased availability in recent years. Shoulder ultrasounds are frequently conducted without X-rays. Magnetic resonance imaging (MR) and MR tomography are becoming more popular as a first-line diagnostic modality for shoulder pain, coinciding with the growing use of ultrasound as a test for diagnosing shoulder pain (Hershkovich, 2014).



To replicate the symptoms and indicators that would aid medical professionals in determining the pathology of the shoulder issue, specific tests are employed (Yang, 2021). A detailed and thorough image of the patient's signs and symptoms is a requirement for any treatment in the shoulder area. The shoulder is challenging to evaluate due to its numerous structures (the majority of which are concentrated in a small area), numerous movements, and numerous lesions that can develop inside or outside the joints (Shihr, 2019).

In order to gather crucial diagnostic hints, the physical examination of the shoulder starts with taking a history, performing inspections, testing muscle strength, and performing physical examination tests (Vasković, 2023). Taking a thorough history is the first step in the diagnostic process, and it can help you with the additional testing required to identify the pathology of any shoulder issue. It is crucial to take a history to rule out external causes of shoulder pain, which are typically difficult-to-localize pains that are unaffected by both positive and negative CDs. Fractures or dislocations are more likely to be associated with a history of trauma (AL NAKSHABANDI, 2015).

To evaluate the features of shoulder pain, common questions to ask are about radiation, quality, time frame, aggravating as well as mitigating factors, and related symptoms. While evaluating the patient's shoulder condition, it's also critical to consider their age; young people are more likely to experience trauma to the shoulder, while the elderly are more likely to develop rotator cuff disorders and adhesive capsulitis (Yang, 2021).



The examination, which entails a front and back examination, is the next crucial stage. The imbalance between the afflicted and healthy shoulder sides should be looked for by the examiner. It is important to take note of any atrophy, deformity, bruising, swelling, wounds, scarring, and skin redness (Hershkovich, 2014). The top of the humerus may be observed as a prior swell within the shoulder in cases of large rotator cuff tears. It is important to compare any anomalies observed on the afflicted side with the opposite side (Yang, 2021).

Palpation is an additional crucial step. For instance, pain in specific locations could be an indication of rotator cuff issues, biceps tendinitis, or acromioclavicular arthritis. A rotator cuff tear or supraspinatus tendonitis may be present when the deltoid muscle feels deeply palpated inferiorly lateral to the acromion process. Although certain shoulder structures can cause pain when the affected shoulder is palpated, it is generally advised to palpate both shoulders (Yang, 2021).

Provocative and muscular strength tests are two types of physical examination tests used to diagnose shoulder problems. Typically, a strength test compares the shoulder muscles on the affected and contralateral sides. A variety of shoulder diseases are diagnosed through physical examination tests (Yang, 2021).

Chemical combinations of elements with high atomic numbers compose opaque contrast media. By blocking the path of X-rays, they serve as a diagnostic tool in radiology by releasing X-rays that are visible in hard tissues (bones) but can pass through soft tissues in the body (Saha, 2011).



The radiation creates a compound with silver bromide, which results in a black spot on the photographic plate. The X-ray observing object forms a bright spot where these rays do not form a similar-shaped bright point. Certain inorganic substances, like barium salts or iodine, can absorb soft tissue and enable it to absorb X-rays, functioning as a contrast medium (JOWETT, 1949).

Both (JOWETT, 1949; Saha, 2011) claimed that there are situations in which radiography of the joints helps evaluate the efficacy of treatment as well as help with diagnosis in cases that are difficult to understand. Air arthrography is valuable when treating meniscal lesions because it serves the same purpose. However, opaque arthrography is thought to have a wider application because it can provide valuable information sometimes more precisely than any other method about the condition of the articular cartilages, the synovial membrane, the presence of non-opaque bodies within the joint, and the relationship between an opaque body and the synovial cavity.

### **5.3 Diagnosis of the Shoulder Joint through Multi-section CT scan in Saudi Arabia**

The acromioclavicular joint, glenohumeral joint, scapular thoracic joint, and sternoclavicular joint are all compound joints, and the shoulder joint is one of them. It can carry out numerous daily bodily functions and engages in a great deal of movement. Anatomistically speaking, the rotator cuff is made up of numerous tendons and has a complex structure. It is attached to the upper portion of the humeral head. As a result, the shoulder joint's stability can be preserved (Li, 2022).



Acute trauma, degenerative changes, anatomical factors, and excessive use are the main causes of injury. Shoulder soft tissue injuries, shoulder fractures, and other conditions are characterized by obvious persistent shoulder pain, inconvenient joint movement, and a significant decline in muscle strength (Li, 2022). Its impact on the patient's regular life and work will be severe if it is not identified and treated promptly. Patients experience less discomfort and the examination can be repeated with more sophisticated imaging tools (Hershkovich, 2014).

Comparing computed tomography (CT) to other medical modalities like plain radiography, numerous studies claimed that CT is one of the main sources of medical radiation. Multi-section CT (MSCT) is becoming a very valuable diagnostic imaging modality due to ongoing technological advancements. Patients may be exposed to radiation as a result of improper clinical application, which is made more likely by this widespread use (Qurashi, 2014).

Imaging of the bones and joints has advanced significantly thanks to multi-slice CT. With a 0.5-mm slice width, a volumetric image set with isotropic properties can be obtained in a single acquisition. Using thin slices, multi-section CT enables extended anatomic coverage (Buckwalter, 2001).

Higher sensitivity multi-section CT may reveal the physiological and anatomical structure of the shoulder joint and precisely show the type of joint fracture, dislocation, internal fragments, and associated issues. This diagnostic technique can correctly diagnose rotator cuff injuries and exhibits high sensitivity for patients with occult fractures (Xiao Li, 2022). Successful integrated use is used



in shoulder joint injury analysis to examine the soft tissue injury and adjacent relationship, prevent misdiagnosis, and offer a reliable foundation for clinical treatment (Buckwalter, 2001).

Previous studies cleared that, multi-section CT has several benefits, including the ability to utilize thin slice width and long anatomic coverage at low-pitch settings. It is possible to achieve isotropic viewing with the thin-slice method. A list of standard imaging parameters for different joints (Buckwalter, 2001; PAUL, 1968; Xiao Li, 2022)

According to previous studies, Saudi Arabia's healthcare system has grown significantly over the last 20 years, and it is currently ranked 26th out of the world's best healthcare systems. The Kingdom of Saudi Arabia has focused on radiological imaging, including CT single- and multi-section scans as well as X-rays (AL NAKSHABANDI, 2015; Sulieman, 2018).

## **6. Conclusion**

Finally, with the great technological development in all fields, especially the medical and radiological fields, the use of a multi-segment CT scan is considered one of the most accurate and clear means of diagnosing fractures and ruptures and examining the shoulder joint for healthy patients. Opaque media are used during diagnosis, which contain barium sulfate and some bismuth compounds, which are useful for diagnostic purposes. Shoulder pain is a common musculoskeletal problem that causes significant pain and sometimes disability. Therefore, the evaluation of shoulder pain can be complex and difficult, and it takes a long time



to perform all the imaging techniques on the patient. CT scanning is used to diagnose rotator cuff injury, labrum injury, and supraspinatus tendon rupture.

## **7. Recommendations**

- The researcher recommends that all medical centers and radiology departments should have multi-segment CT scan machines, as they provide more accurate and clear radiological images.
- The researcher recommends that medical educational curricula, specifically the curricula of colleges of radiology and nursing, should contain materials that explain CT scans of all types, their benefits, uses, effects, and broader role.
- The researcher suggests raising awareness about the effects of multi-segment CT scans on patients' bodies. Additionally, conducting training courses for radiology specialists on CT scans and ways to use them to enhance their professional competencies. Radiologists must be skilled and aware of this collective responsibility to support and actively participate in dose regulation efforts by adapting to data management software.
- However, it has been shown that there is a scarcity of previous studies discussing the use of multiple CT scans in examining the shoulder joint specifically in Saudi Arabia, and this necessitates conducting an applied laboratory study in this field in Saudi Arabia.



## 8. Future Research

Future research may focus on conducting an applied laboratory study on the use of multi-section CT scan to examine the shoulder joint in a dark environment in the Kingdom of Saudi Arabia.

## Bibliography

AL NAKSHABANDI, A. S. (2015). SAUDI BOARD DIAGNOSTIC RADIOLOGY CURRICULUM . *Saudi Commission for Health Specialties*, 1-154.

Almohiy, e. a. (2020). Radiologists' Knowledge and Attitudes towards CT Radiation Dose and Exposure in Saudi Arabia—A Survey Study. *MDPI*, 27(8), 1-13.

Al-Othman, e. a. (2022). Radiation Dose Optimization Based on Saudi National Diagnostic Reference Levels and Effective Dose Calculation for Computed Tomography Imaging: A Unicentral Cohort Study. *Applied Sciences* , 12(22).

Buckwalter, e. a. (2001). Musculoskeletal Imaging with Multislice CT. 979-987.





Hershkovich, e. a. (2014). Role of radiographs in shoulder pathology: a clinical review. *Reports in Medical Imaging*, 7(2014), 75-80.

Jana Vasković. (2023). Radiological anatomy and medical imaging. *KenHub*.

JOWETT. (1949). Opaque Arthrography of the Knee Joint. *BMJ*, 8(2), 149.

Lei. (2022). The clinical performance of ultra-low-dose shoulder CT scans: The assessment on image and physical 3D printing models. *National Library of Medicine*, 19(7).

Li, X. (2022). Analysis of CT and MRI in the Diagnosis of Shoulder Joint Injury. *Journal of Biosciences and Medicines*, 10(2022), 253-257.

PAUL, e. a. (1968). SHOULDER ARTHROGRAPHY. 1-11.

Qurashi, R. F. (2014). Establishment of diagnostic reference levels for CT trunk examinations in the western region of Saudi Arabia. *Radiation Protection Dosimetry*, 167(4), 1-7.

Rehani, K. M. (2018). Managing Patient Dose in Multi-Detector Computed Tomography (MDCT) . 6-86.



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Saha, H. J. (2011). Radiopharmaceuticals and Radio Opaque Contrast Media: Practice, Prospects and Potentials. *Asian J. Res. Pharm. Sci*, 1(1), 4-8.

Shihr, A. (2019). Shoulder examination. 433, 1-6.

Sulieman, e. a. (2018). CT examination effective doses in Saudi Arabia. *Applied Radiation and Isotopes*, 141(2018), 261-265.

Vasković. (2023). Radiological anatomy and medical imaging. *KenHub*.

Xiao Li, F. X. (2022). Analysis of CT and MRI in the Diagnosis of Shoulder Joint Injury. *Journal of Biosciences and Medicines*, 10(11), 253-257.

Yang, K. H. (2021). Understanding the physical examination of the shoulder: a narrative review. *Annals of Palliative Medicine*, 10(2), 1-30.