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Assessment of Abdominal CT Examination Request Form in Khartoum State

تقويم طلب فحص الأشعة المقطعية المحوسبة للبطن في ولاية الخرطوم

**A Thesis Submitted in Partial Fulfillment for the Requirements of M.SC
Degree in Diagnostic Radiologic Technology**

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الآية

بسم الله الرحمن الرحيم

قال تعالى (الله لا إله إلا هو الحي القيوم لا تأخذه سنة ولا نوم له ما في السموات وما في الأرض من ذا الذي يشفع عنده إلا بإذنه يعلم ما بين أيديهم وما خلفهم ولا يحيطون بشيء من علمه إلا بما شاء وسع كرسيه السموات والأرض ولا يؤوده حفظهما وهو العلي العظيم).
صدق الله العظيم

الآية 255 من سورة البقره

Dedication

To the candles that burn to light my way, my lovely parents.
Who made all the cheap and precious for the sake of my arrival
to
this Stage

To my dear brother
For their patience and endless support
To my friends and my colleagues
To the kids & children around the world
To all whom I do love and respect
I dedicate this work for them.

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Finally, I would like to sincerely thank my family for their consistent support.

List of abbreviations

CT	Computed tomography.
CAT	Axial Computed tomography.
ACR	American College of Radiology.
SPR	Society for Pediatric Radiology.
PACS	Picture archiving and communication system.
MIPs	Maximum-intensity projections.
DFOV	Display field of view.
ALARA	As low as reasonably achievable.
GFR	Glomerular filtration rate.
LMP	Last menstrual period.
MDRD	Modification of Diet in Renal Disease.
ICM	Iodinated Contrast Media.
SCBT-MR	Society of Computed Body Tomography and Magnetic Resonance.

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Abstract

The request form is a way to gather information about the patients who undergo CT or any other radiological procedure. The aim of this study was to assess CT Abdomen request form using an ideal request form and compared it to the request forms collected from different hospitals and diagnostic centers in Khartoum state to reduce the complications which can occur due to insufficient information about patient's condition.

A total number of 80 CT Abdomen forms referred from various hospitals and diagnostic centers in Khartoum state were evaluated.

As for the information in the forms collected from the hospital under study (80 CT Abdomen request forms), the patient name, gender, age, clinical data, exam date and physician name were included in the request forms. Height, allergy to medications and contrast media, anesthesia, renal function test (GFR) and LMP were not existed. Phone number was found in 95.0 %, furthermore weight was found in 22.5% of request form. Diabetes was found in 11.3% of request form. Creatinine was found in 20.0% and Sedation was found in 7.5%.

Recommended CT departments should issue one standard CT Abdominal request form that should be applied by all the hospitals, in order to enhance the CT procedures for better diagnosis and for care of patient. All doctors should follow the standard CT request carefully before referring the patients to the CT department. Finally, I recommend that all departments should not accept patients with incomplete CT Abdominal request form.

المستخلص

طلب فحص الأشعة هو وسيلة لجمع المعلومات عن المرضى الذين سيخضعون لإجراء فحص الأشعة المقطعية أو فحوصات أشعة أخرى.

في دراسة تقويم طلب فحص الأشعة المقطعية للبطن في ولاية الخرطوم تم استخدام طلب فحص الأشعة المقطعية المعياري للبطن وتمت مقارنته بواسطة الطلبات التي تم جمعها من عدة مستشفيات ومراكز تشخيصيه داخل ولاية الخرطوم.

الهدف الرئيسي من هذه الدراسة هو تقييم طلب فحص الأشعة المقطعية للبطن في مختلف أقسام الأشعة المقطعية بولاية الخرطوم لمعرفة ما إذا كان طلب فحص الأشعة المقطعية مثاليا أم لا وذلك لتقليل المشاكل التي قد تحدث نتيجة لعدم وجود معلومات كافية عن حالة المريض.

اشتملت الدراسة على 80 طالبا لفحص الأشعة المقطعية للبطن بالمستشفيات المختلفه داخل ولاية الخرطوم ووجد من خلال البحث أن إسم المريض والعمر و الجنس و تاريخ الفحص و إسم الطبيب والبيانات الطبيه موجوده بنسبه 100%. الطول والحساسيه للعقاقير وصبغة التصوير والتخدير ووظائف الكلى و اخر دوره شهرية للإناث فهي غير موجوده بنسبه 100%. أما بخصوص رقم الهاتف وجد بنسبة 95.0% والوزن بنسبة 22.5% والمهدئات بنسبة 7.5% ومرض السكري بنسبه 11.3% والكرياتينين في الدم بنسبة 20.0%.

اوصت هذه الدراسة على وجوب تطبيق طلب فحص الاشعة المقطعية المعياري للبطن في جميع المستشفيات والمراكز التشخيصيه وذلك لضمان جوده الفحص والتشخيص واوصت ايضا ان على جميع الاطباء متابعه طلب فحص الاشعة المقطعية المعياري للبطن بعنايه قبل تحويل المريض لقسم الاشعة المقطعية كما اوصت ايضا هذه الدراسه ان على جميع اقسام الاشعة المقطعية عدم استقبال اي مريض يحمل طلب فحص للاشعة المقطعية للبطن غير مكتمل.

Chapter One

Introduction

1.1 Introduction:

A CT scan is a type of x-ray that uses a computer to make pictures of the inside of the body. Images of the abdomen are taken to study the organs and tissue in the abdomen and to look for signs of: Injury, Tumors, Infections and other diseases. Many conditions and diseases can be diagnosed with an abdominal CT. Tumors and cysts, spread of cancer from another location (metastases), Aortic aneurysm, Gall bladder disease, including gallstones, Pancreatitis, Abscess, Kidney stones, Kidney disease, bleeding in the abdomen and Liver disease. The standard request for abdominal CT must consist patient age, gender, weight, initial diagnosis and interest area, the physician recommend an abdominal CT the patient have the following symptoms: Abdominal pain, Bowel changes, Blood in the urine or stool, Urinary difficulties, Jaundice (yellow skin), Weight loss, unexplained fever abdominal injury and Fluid buildup in the abdomen. [Brancatelli G2001].

1.2 The Problem of study:

The requested examination for CT abdomen in Khartoum State is not similar with standard request form.

1.3 Objectives of study:

1.3.1 General objective:

The general objective of this study was to assess CT abdomen examination request forms in Khartoum State to match them with the standard request form for CT abdomen examination.

1.3.2 Specific objectives:

- To assess the requested CT forms for abdomen in different hospitals and diagnostic centers in Khartoum State.
- To identify the most sufficient information in CT abdomen request forms.
- To compare the information in the request forms according to the observation of the researcher.

1.4 Overview of the study:

This study was consisted in five chapters; chapter one was an introduction, which introduced this thesis briefly and it was contain general introduction, problem of the study, study objectives and overview of the study. Chapter two contained the theoretical background and literature review. Chapter three contained materials and methods. Chapter four contained the results. Chapter five included discussion, conclusion, recommendations in addition to the references and appendices.

Chapter Two

Literature review

2.1 Theoretical background

2.1.1 Request form:

The important of request form is being familiar with the patient's clinical problem or question and consistent with the state's scope of practice requirements. And it helps in protected the patient from harmful radiation exposure if 'Justification' and 'Optimization. [ACR Resolution 35, adopted in 2006].

The goal of this study is to prospectively evaluate Abdomen CT request forms to assess how the Abdomen CT request could be improving.

2.1.2 CT Abdomen:

Computed tomography (CT) is a radiologic modality that utilizes ionizing radiation to obtain cross-sectional images (nonhelical CT) or volumetric data sets (helical CT). The acquired images may also be reprocessed to produce images in many anatomic planes or in three dimensions to view entire anatomic volumes. Optimal performance of CT requires knowledge of anatomy and pathophysiology, familiarity with the basic physics and techniques of CT, and knowledge of radiation safety. This practice parameter outlines the principles for performing high-quality diagnostic abdominal CT. [Timins et al., 2008].

2.1.3 Abdomen anatomy and physiology:

The major system assessed in the abdominal examination is the GI or digestive system. The digestive system is responsible for the ingestion and digestion of food, absorption of nutrients, and elimination of waste products. The primary structures of the digestive system include the mouth, pharynx, esophagus, stomach, small

intestines (duodenum, jejunum, and ileum), large intestines (cecum, colon [ascending, transverse, descending, and sigmoid], and rectum. [Hong X 2006]

These main structures of the digestive system form a hollow tube that is actually outside the internal environment of the body even though it is located inside the body. This tube, referred to as the alimentary canal or the gastrointestinal tract, begins at the mouth and ends at the anus. [Hong X 2006].

The digestive system also contains accessory organs that aid in the digestion of food. The accessory organs of the digestive system include the salivary glands (parotid, submandibular, and sublingual), liver, gallbladder, and pancreas. [Poepfel TD et.al, 2014].

2.1.4 Indications and Contraindications for abdominal CT:

2.1.4.1 Indications for abdominal CT examinations include, but are not limited to:

- Evaluation of renal and adrenal masses and with CT urography. [Caoli EM, 2002].
- Evaluation of known or suspected abdominal masses or fluid collections. [Kawamoto S, 1999].
- Evaluation of primary or metastatic malignancies, including lesion characterization, e.g., focal liver lesion. [Brancatelli G, 2001].
- Evaluation of diffuse liver disease (e.g. steatosis, iron deposition disease, cirrhosis) and biliary system, including CT cholangiography. [Wang ZJ, 2005].
- Assessment for recurrence of tumors following surgical resection. [Kim KW, 2002, Pannu HK, 2003].

- Detection of complications following abdominal surgery, e.g. abscess, lymphocele, radiation change, and fistula/sinus tract formation. [Pickhardt PJ, 2002].
- Evaluation of abdominal inflammatory processes, including inflammatory bowel disease, infectious bowel disease and its complications. [Hara AK, AJR 2008].
- Assessment of abnormalities of abdominal vascular structures. [Turkvatan A, 2009].
- Evaluation of abdominal trauma. [Atri M, 2008].
- Clarification of findings from other imaging studies or laboratory abnormalities. [Atri M, 2008].
- Evaluation of known or suspected congenital abnormalities of abdominal organs. [Suzuki K, 2007].
- Evaluation for small bowel or large bowel obstruction. [Zeitoun D, 2004].
- Screening for colonic polyps and cancers with CT colonography. [Zeitoun D, 2004].
- Pre- and post-transplant assessment. [Zeitoun D, 2004].
- Noninvasive angiography of the aorta and its branches and noninvasive venography. [Atri M, 2008].

2.1.4.2 Contraindications:

There are no absolute contraindications to abdominal CT examinations. As with all procedures, the relative benefits and risks of the procedure should be evaluated before performing abdominal CT, with and/or without the administration of intravenous iodinated contrast. Appropriate precautions should be taken to minimize patient risks, including radiation exposure. [ACR–SPR Practice Parameter].

2.1.5 Standard techniques for CT abdomen:

In general, a CT examination of the abdomen includes transaxial images from just above the dome of the diaphragm to the upper margin of the sacroiliac joints with 5 mm or less slice thickness. Often, depending on the clinical indication for the study, the abdomen may be examined concurrently. In certain cases, it may be appropriate to limit the area exposed and focus only on the area or organs of concern in order to limit the radiation dose. This is especially advised in patients with multiple CT studies and follow-up examinations. An adequate study may be performed with single detector helical technique, but multi detector (including wide detector) scanners are now preferred. Beam pitch should not routinely exceed 2:1 for helical scanners. In addition to axial images, images in coronal, sagittal, or other more complex oblique planes may be constructed from the source-image data to answer specific clinical questions, to aid in disease visualization, or to assist in planning for interventional or surgical procedures. Additionally, the imaging information may be displayed to demonstrate specific structures such as in CT angiography, CT urography, CT cystography, CT colonography, CT enterography, CT cholangiography, and/or other applications deemed necessary. Such applications are best performed based on data acquired with multidetector CT. Some abdominal CT examinations performed with multiple acquisitions. All acquisitions are best obtained in the same suspended state of respiration if possible. In general, the fewest number of acquisitions needed to answer the clinical question should be obtained. This is particularly important when imaging children and adolescents. For radiation treatment planning, examinations should be obtained during normal respiration. Scans should be obtained through the entire area of interest. The scan field of view should be optimized for each patient. Exposure parameters should be optimized for each acquisition to minimize radiation dose while providing the necessary

information. Scanner specific dose modulation programs may be helpful for this purpose. Radiation dose reduction is particularly important in the pediatric population and young adults. An intraluminal gastrointestinal contrast agent may be administered orally, rectally, or by nasogastric or other tube to provide adequate visualization of the gastrointestinal tract unless medically contraindicated or unnecessary for the clinical indication. This may be a positive contrast agent such as dilute barium or a water-soluble iodinated solution, a neutral contrast agent such as water or a non-absorbable agent, or a negative agent such as air or carbon dioxide. Abdominal examinations may be performed during and/or after administering intravenous (IV) contrast medium, using appropriate injection techniques. For specific indications, it may be necessary to perform a non-IV contrast enhanced study first. may require further evaluation with contrast enhancement or an alternative imaging study if contrast medium is contraindicated. Appropriate window width and level settings should be used to view the visceral organs, the intra-abdominal fat and muscles, the pulmonary parenchyma at the lung bases, and the osseous structures. Although many of the operations of a CT scanner are automated, a number of technical parameters remain operator-dependent. [Marshall GBet.al2014].

Because these parameters can significantly affect the diagnostic quality of a CT examination, the supervising physician must become familiar with the following: Radiation exposure factors, collimation, table increment or pitch, field of view, window settings, reconstruction algorithm, detector configuration for multidetector systems, display slice width for multidetector systems, tube current dose modulation setting and additional dose report. [McMahon MAet.al2014].

Protocols may be prepared by region of interest and medical indication. Techniques should be selected that provide image quality consistent with the diagnostic needs

of the examination at acceptable radiation dose levels. For each area of interest or indication, the protocol indicates the following: the volume and type of gastrointestinal contrast media to be administered, the route of administration (oral, rectal, or via nasogastric or other tube), and the time intervals during which it should be delivered, if intravenous contrast material is used, the type, volume, rate of administration, and time delay between administration and scan initiation. Bolus tracking should be used whenever indicated to optimize results. [McMahon MAet.al2014].

Protocols for sending images to PACS (Picture Archiving and Communication System) (e.g., scans in original slice thickness and/or reformations in axial plane at larger slice thickness in the coronal, sagittal, and other oblique planes), and MIPS (Medical Image Processing System) as needed. 3D reconstructions where needed. [Marshall GBet.al2014].

For every CT examination, the information in the radiation dose report (CTDI and Dose Length Product) should be retained in the radiological record (sent to PACS) for future reference. [Marshall GBet.al2014].

2.1.6 Equipment specifications:

Performance Guidelines to achieve acceptable clinical Abdomen CT scans, a CT scanner should meet or exceed the following capabilities: Multi row detector acquisition with a pitch between 1 and 2, Scan rotation time ≤ 1 sec, minimum slice thickness ≤ 2 mm, limiting spatial resolution ≥ 8 lp/cm for ≥ 32 -cm, display field of view (DFOV) and ≥ 10 lp/cm for < 24 cm. Appropriate emergency equipment and medications must be immediately available to treat adverse reactions associated with administered medications. The equipment and medications should be monitored for inventory and drug expiration dates on a regular basis. The equipment, medications,

and other emergency support must also be appropriate for the range of ages and sizes in the patient population. Images should be available on a PACS workstation for review by the radiologist. Remote viewing of images should also be available to authorized health care providers. Equipment should be capable of providing a digital means of conveying the dataset. [Marshall GBet.al2014].

2.1.7 Equipment quality control:

The quality control program for CT equipment should be designed to minimize patient, personal, and public radiation risks and to maximize the quality of the diagnostic information. The program should be supervised by a Qualified Medical Physicist. Each imaging facility should have documented policies and procedures that include: A list of tests to be performed and the frequency of performance, A list identifying which individual or group will perform the tests, A written description of the procedure that will be used for each test, including the technique factors to be employed, the equipment to be used for testing, the acceptability limits of each test, and sample records from each test, Periodic tests for CT all stakeholders involved in imaging (patients, technologists, referring providers, medical physicists, and radiologists), Radiation exposures or other dose indices should be measured and patient radiation dose estimated for representative examinations and types of patients by a Qualified Medical Physicist in accordance with the applicable ACR technical standards. Regular auditing of patient dose indices should be performed by comparing the facility's dose information with national benchmarks, such as the ACR Dose Index Registry, the NCRP Report No. 172, Reference Levels and Achievable Doses in Medical and Dental Imaging: Recommendations for the United States or the Conference of Radiation Control Program Director's National Evaluation of X-ray Trends A Qualified Medical Physicist and radiologist together should verify that any dose reduction devices or utilities maintain acceptable image

quality while actually reducing radiation dose. Dose estimates for typical examinations should be compared to reference levels described in the ACR–AAPM Practice Parameter for Diagnostic Reference Levels in Medical X-Ray Imaging. [ACR Resolution 17 adopted in 2006].

2.1.8 Quality control and improvement:

Policies and procedures related to quality, patient education, infection control, and safety should be developed and implemented in accordance with the ACR Policy on Quality Control and Improvement, Safety, Infection Control, and Patient Education appearing under the heading Position Statement on QC & Improvement, Safety, Infection Control, and Patient Education on the ACR website (<http://www.acr.org/guidelines>).

For specific issues regarding CT quality control, see the ACR Practice Parameter for Performing and Interpreting Computed Tomography (CT). Equipment performance monitoring should be in accordance with the ACR–AAPM Technical Standard for Diagnostic Medical Physics Performance Monitoring of Computed Tomography (CT) Equipment. (<http://www.acr.org/guidelines>)

2.1.9 The ideal CT Abdomen request form contains:

Patient data: Exam date, Patient name and patient age; is not an important factor in and of itself. However, it should be remembered that significant illness is common among the elderly. Additionally, they may have decreased reserve that makes them less able to tolerate an adverse reaction. Also the presence of the gender considered an effective factor that must be written by the physician especially for the female with CT abdomen request and for all radiation procedure because the operator must apply the 10-day rule; if patient is female to be surer there is no pregnancy. [B. Robbins et.al 2010]

Radiation exposure for any patient is varies for ranges of Kvp and mAs which is strongly related to the patient thickness in case of Kvp in direct relationship so the presence of patient weight is consider as an important factor for CT examination in order to predict which factor can be used for the scan therefore improving the image quality and scan result. The diagnostic radiological centers tend to request the patient phone number from the patient or from the very close relative in order to call the patient for previously mentioned reasons. [Keyzer C AJR 2009].

Technical data: Clinical Data; to evaluate the patient indication for these investigation, and furthermore the assessing the requirement for IV iodinated contrast injection; decision should be taken upon. Also Allergy to medication and Contrast agents are indispensable in the practice of radiology. Nonetheless, risks associated with contrast agents have not been eliminated, and adverse reactions of varying degree continue to occur. Consequently, it is imperative for anybody administering contrast agents to be intimately familiar with the characteristics, indications, and potential side effects of these agents; severity: The American College of Radiology has divided adverse reactions to contrast agents into the following categories: Mild: Signs and symptoms appear self-limited without evidence of progression: Nausea, vomiting Altered taste Sweats, Cough Itching Rash, hives, Warmth (heat) Pallor Nasal stuffiness, Headache Flushing Swelling: eyes, face ,Dizziness Chills Anxiety ,Shaking . Treatment: Observation and reassurance. Usually no intervention or medication is required; however, these reactions may progress into a more severe category. Moderate: Reactions which require treatment but are not immediately life-threatening: Tachycardia bradycardia, Hypotension, Bronchospasm, wheezing, Hypertension Dyspnea Laryngeal edema, Pronounced cutaneous Pulmonary edema reaction. Treatment: Prompt treatment with close observation. Severe: Life-threatening with more severe signs or

symptoms including: Laryngeal edema, profound hypotension, Unresponsiveness (severe or progressive), Convulsions, Cardiopulmonary arrest, clinically manifests arrhythmias. Treatment: Immediate treatment. Usually requires hospitalization. Fortunately, most reactions are classified as mild. Within this category, itching, flushing, hives, nasal congestion, and swelling about the eyes and face are common. Nausea and vomiting have become less common with the use of low osmolar and iso-osmolar agents. Among the moderate reactions, bronchospasm and laryngeal edema are encountered most frequently; patients must also be monitored carefully for changes in cardiac rate and blood pressure. Severe reactions, while infrequent, can rapidly escalate to a life-threatening situation. [Keyzer C AJR 2009].

Delayed contrast reactions can occur anywhere from 3 hours to 7 days following the administration of contrast. Since patients are generally discharged from the radiology department within 30 minutes of contrast administration, these reactions are rarely observed by the radiologist supervising the contrast administration. These events are often not brought to the attention of the radiologist since the delayed event may not be ascribed to the contrast media and these events are often self-limited. Regardless, it is important for anyone administering intravenous contrast media to be aware of delayed reactions. [Keyzer C AJR 2009]

With the exception of contrast-induced nephropathy, the more common reactions include a cutaneous xanthium, pruritis without urticaria, nausea, vomiting, drowsiness, and headache. While cardiopulmonary arrest has been reported, it is probably not related to newer contrast agents. Cutaneous reactions are the most frequent form of delayed contrast reaction with a reported incidence of 0.5-9%. [Keyzer C AJR 2009].

Cutaneous reactions vary in size and presentation but are usually pruritic. For the most part, these reactions are self-limited and symptoms can be treated with

corticosteroid creams. Rare cases may progress to become severe, some resembling Stevens-Johnson syndrome or a coetaneous vasculitis. Consultation with a dermatologist is appropriate for delayed coetaneous reactions. Delayed coetaneous reactions are more common in patients who have had a previous contrast reaction and in those who have been treated within the past 2 years, or are currently being treated with interleukin-2 (IL-2). Due to this association, the University of Wisconsin Hospitals and Clinics screens patients for a history of IL-2 therapy. While the exact mechanism of the delayed reaction is unknown, they can recur if the same contrast medium is administered again. Therefore, it is possible that these delayed reactions are T-cell mediated. As such, prophylaxis with oral corticosteroids may not be useful. [B.Robbins et. al 2010].

Sedation and anesthesia: Imaging studies require patients to remain still while images are acquired; in order to obtain diagnostic-quality images, some children require deep sedation or general anesthesia, Fast scanning methods, combined with behavior distraction techniques, can often help children undergo imaging studies without sedation or general anesthesia Neither sedation nor general anesthesia is necessary for most children < 12 > 4 years for CT; exceptions include those with certain neurological conditions or significant developmental delay that impair their ability to lie still. [B.Robbins et. al 2010].

Kidney function test (GFR): In most clinical settings, renal function is monitored by serum creatinine, which is not a sensitive marker. Creatinine is a product of muscle metabolism and is therefore proportional to muscle mass. The Glomerular filtration rate (GFR) must decline by about 50 percent, to 60 mL/min, before the serum creatinine rises above 1.5 mg/dL. Thus, by the time the serum creatinine becomes abnormal, significant renal dysfunction may already be present. There is no universal agreement regarding what value of serum creatinine. Indicates significant

renal insufficiency. However, a level of 1.5 mg/dL is a widely accepted figure. A cut-off below 1.5 mg/dL may classify individuals with normal renal function, but large muscle mass, as having renal insufficiency. A cut-off greater than 1.5 mg/dL may exclude individuals who actually have renal insufficiency. A serum creatinine of greater than 1.5 mg/dL indicates renal insufficiency. GFR is a more sensitive indicator of renal function than serum creatinine alone. Because creatinine clearance, as derived from 24-hour urine collection, is a cumbersome test and has been shown to overestimate the true GFR by as much as 20% and alternative predictor of GFR is ideal. The estimated GFR (eGFR) is significantly easier to obtain as it is calculated from serum creatinine, age, gender, and ethnicity using the MDRD (Modification of Diet in Renal Disease) calculation. Additionally, eGFR has been shown to be a more accurate predictor of GFR than serum creatinine alone. With respect to GFR, moderately decreased renal function is defined as GFR 30-59, severely decreased renal function is defined as GFR 15- 29 and renal failure is defined as GFR<15.[Silverman SG 2005].

Serum creatinine: An alteration of renal function can happen in the days following the injection of Iodinated Contrast Media (ICM). This is one of the risks patients must be informed of. ICM induced nephropathy is defined by an increase in serum creatinine by more than 42 μ moles/l and/or 25%. Induced renal failure is rare in the absence of risk factors, but it affects about 20% of patients with risk factors. It is then a cause of over morbidity. The signs are an elevation of creatinine aemia and a diminution of the clearance of creatinine in the 72hours following the injection of ICM. For high-risk patients, the serum creatinine level will be measured 48 to 72 hours after the administration of ICM. In case of oliguria or a rise of more than 30% in Creatinin aemia after the injection, specialist advice must be sought [A spelin P2003].

Diabetes mellitus: Patients must stop the following medication for 48 hours after the exam; medications are Glucophage, Glucophage XR, glucovance, glumetza, metformin, alti-metformin, apo-metformin, gen-metformin, novo-metformin, numetformin, pms-metformin, rho-metformin, rhoxal-metformin fc, avandamet, metaglib, riomet, glycon, byetta, janumet and fortamet. All other medication should not be stopped. Diabetes increases the risk of contrast-induced renal toxicity, even when serum Creatinin is normal. The effect is magnified, however, in those patients with both diabetes and renal disease. Additionally, insulin dependent diabetics are likely at higher risk than non-insulin-dependent diabetics. Therefore, we set a lower cutoff for the use of IV contrast in diabetics. [B.Robbins et. al 2010].

Physician data: Physician name should be included as a reference. Technologists to assure that they understand CT principles and are complying with dose reduction protocols for multi detector CT imaging. [Marshall GBet.al2014].

2.1.10 Radiation safety in imaging:

Radiologists, medical physicists, registered radiologist assistants, radiologic technologists, and all supervising physicians have a responsibility for safety in the workplace by keeping radiation exposure to staff, and to society as a whole, “as low as reasonably achievable” (ALARA) and to assure that radiation doses to individual patients are appropriate, taking into account the possible risk from radiation exposure and the diagnostic image quality necessary to achieve the clinical objective. All personnel that work with ionizing radiation must understand the key principles of occupational and public radiation protection (justification, optimization of protection and application of dose limits) and the principles of proper management of radiation dose to patients (justification, optimization and the use of dose reference levels), Nationally developed guidelines, such as the ACR’s Appropriateness Criteria, should be used to help choose the most appropriate

imaging procedures to prevent unwarranted radiation exposure. [ACR Resolution 17 adopted in 2006].

Facilities should have and adhere to policies and procedures that require varying ionizing radiation examination protocols (plain radiography, fluoroscopy, interventional radiology, CT) to take into account patient body habitus (such as patient dimensions, weight, or body mass index) to optimize the relationship between minimal radiation dose and adequate image quality. Automated dose reduction technologies available on imaging equipment should be used whenever appropriate. If such technology is not available, appropriate manual techniques should be used; Additional information regarding patient radiation safety in imaging is available at the Image Gently for children and Image Wisely for adults. [ACR Resolution 17 adopted in 2006].

- AS for previous studies, the researcher did not find any previous study in the text books, references and web sites which handled this topic.

Chapter Three

Materials and methods

3.1 Materials:

The material used for data collection was 80 copies of a preset standard CT abdominal request form in Khartoum state.

No machines, devices or equipment were needed for this study.

3.1.1 Study sample:

This study was performed in 80 CT Abdomen request forms selected randomly at the hospital under study.

3.1.2 Inclusion criteria:

All forms for CT Abdominal examination.

3.1.3 Exclusion criteria:

All other CT forms for example: chest, brain, neck and pelvis.

3.2 Methods:

This study was aimed to evaluate the CT abdomen request form using standardized request form to assess the general requirement for this investigation that must be written or considered before the CT abdomen examination in Khartoum state hospitals and diagnostic centers. All patient's data and technical data were included in the CT request form and then the assessment was done through comparing with the standardized forms and data were analyzed in order to exclude presence of these requirements or not.

3.2.1 Study area:

The data were collected from Al-Zaytona hospital, Royal Care hospital, Royal Scan Center.

3.2.2 Study duration:

The research was conducted from November 2016 to February 2017.

3.2.3 Methods of data analysis:

The data were analyzed using Microsoft excel program and SPSS.

3.2.4 Methods of data collection:

The data were collected by the researcher during study period. Other information were collected from references, Text book and Web sites.

3.2.5 Variables of the study:

Exam date, patient name, gender, LMP, age, height, weight, clinical data, allergy to medication, allergy to contrast, anesthesia, GFR, sedation, diabetes mellitus, serum creatinine and physician Name.

3.3 Ethical issues:

There was official written permission to Hospitals and centers in Khartoum State to take the data.

No patient data were published, also the data were kept in personal computer with personal password.

Chapter Four

Results

Table 4-1: showed the frequency distribution of patient data with their percentages

Patient Data	Present–Not present	Frequency	Percent %
Exam date	Yes	80	100
Patient name	Yes	80	100
Age	Yes	80	100
Gender	Yes	80	100
Height	No	80	100
Clinical data	Yes	80	100
LMP	No	80	100
Allergy to medication	No	80	100
Allergy to contrast	No	80	100
Anesthesia	No	80	100
GFR	No	80	100
Physician name	Yes	80	100

Table 4-2: Showed the frequency distribution of phone numbers with their percentages.

Phone No.	Frequency	Percent	Valid Percent	Cumulative Percent
No	4	5.0	5.0	5.0
Yes	76	95.0	95.0	100.0
Total	80	100.0	100.0	

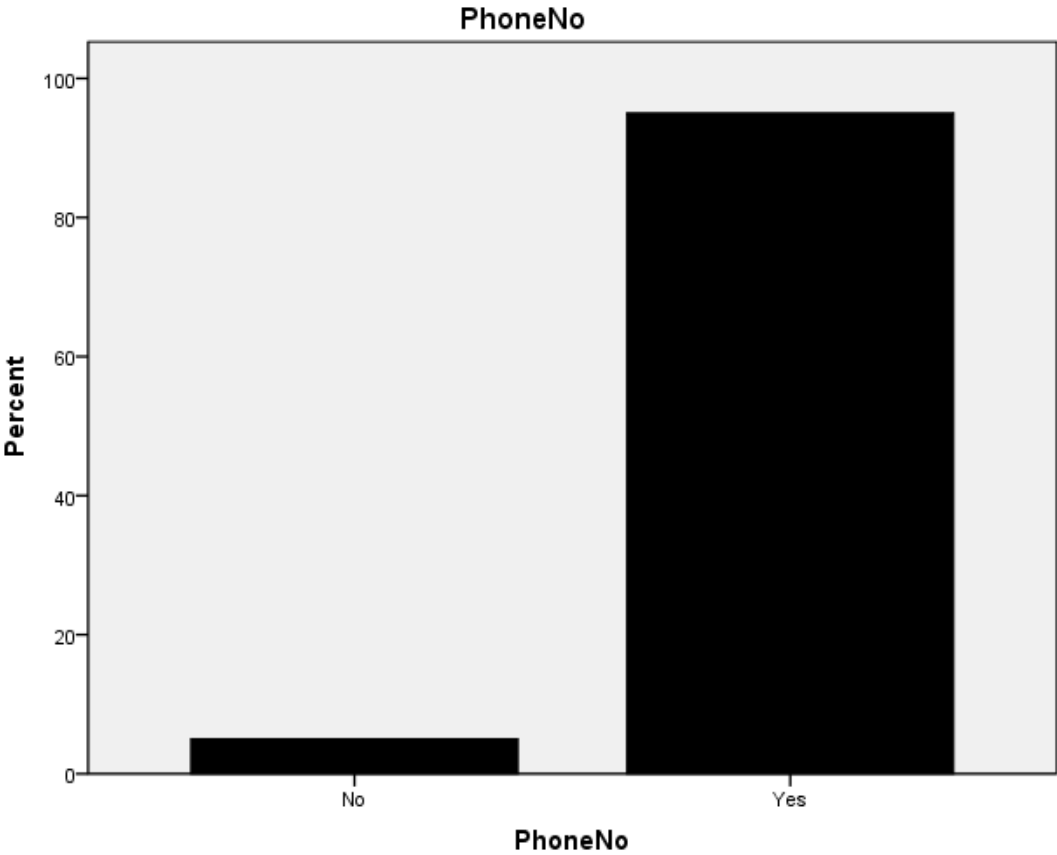


Figure 4-1: bar charts demonstrates the percentages of patient phone numbers.

Table 4-3: Showed the frequency distribution of the patient weight with their percentages

Weight	Frequency	Percent	Valid Percent	Cumulative Percent
No	62	77.5	77.5	77.5
Yes	18	22.5	22.5	100.0
Total	80	100.0	100.0	

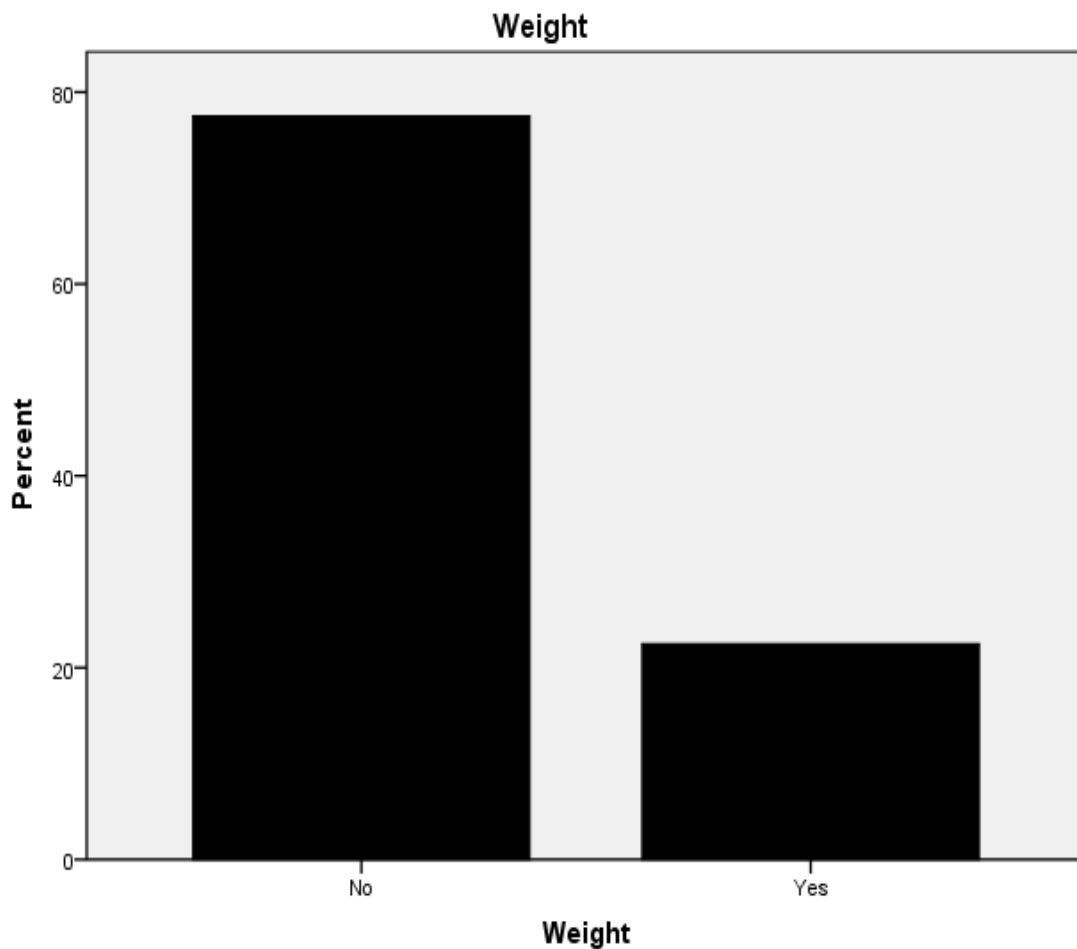


Figure 4-2: bar charts demonstrates the percentages of patient weight.

Table 4-4: Showed the frequency distribution of diabetes with their percentages

Diabetes	Frequency	Percent	Valid Percent	Cumulative Percent
No	71	88.8	88.8	88.8
Yes	9	11.3	11.3	100.0
Total	80	100.0	100.0	

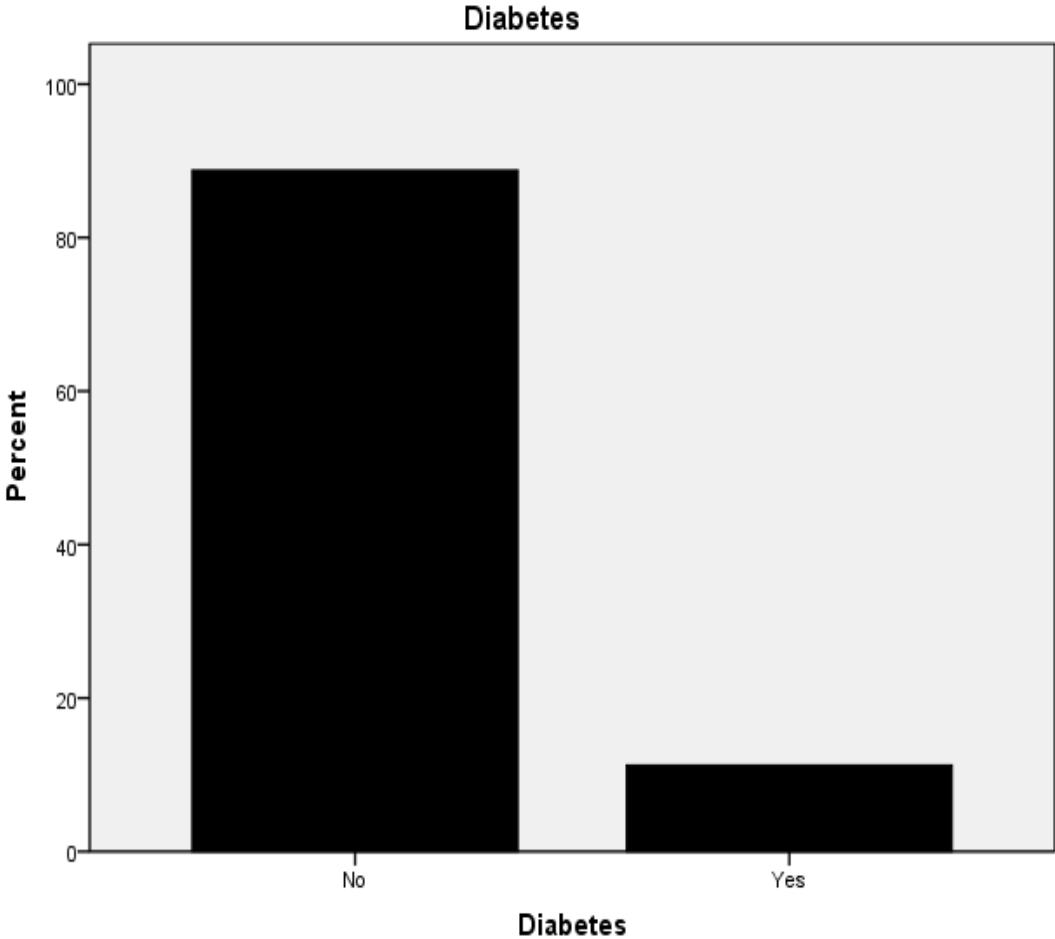


Figure 4-3: bar charts demonstrates the percentages of diabetes patients.

Table 4-5: Showed the frequency distribution of creatinine level with their percentages

Creatinine Level	Frequency	Percent	Valid Percent	Cumulative Percent
No	64	80.0	80.0	80.0
Yes	16	20.0	20.0	100.0
Total	80	100.0	100.0	

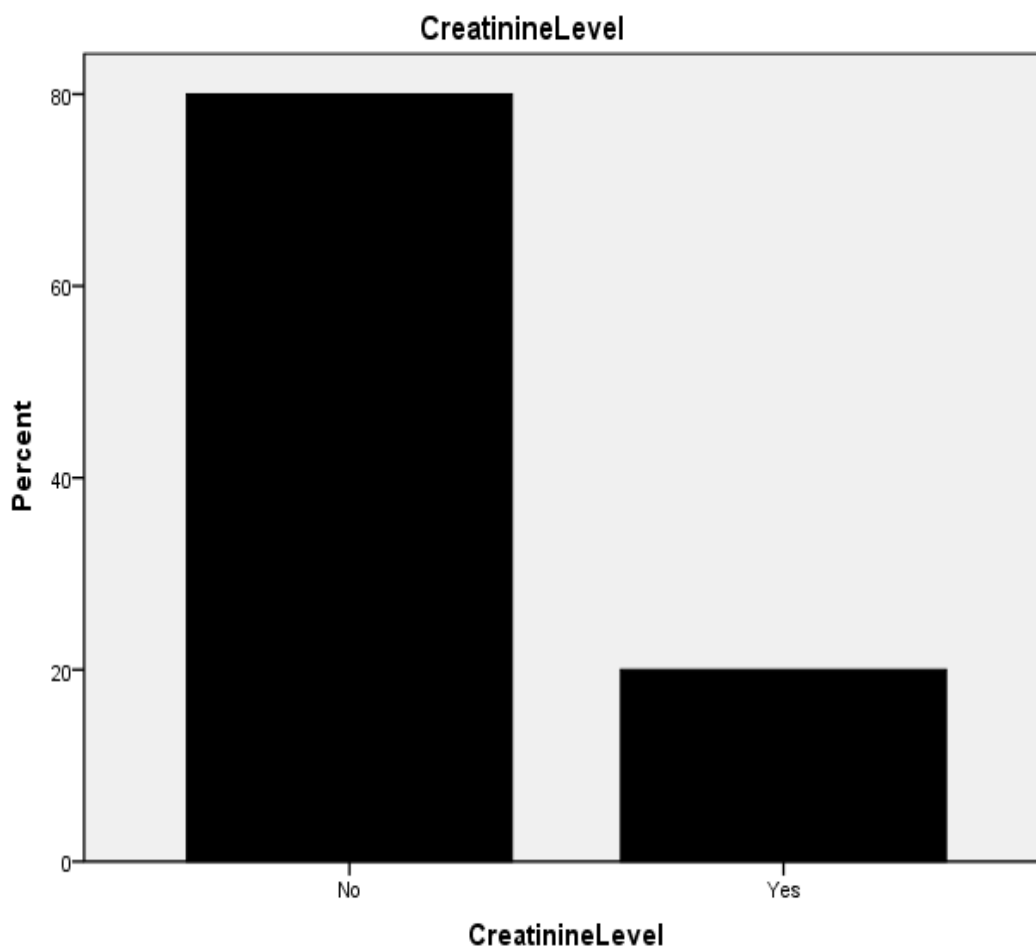


Figure 4-4: bar charts demonstrates the percentages of patients creatinine level.

Table 4-6: Showed the frequency distribution of sedation with their percentages

Sedation	Frequency	Percent	Valid Percent	Cumulative Percent
No	74	92.5	92.5	92.5
Yes	6	7.5	7.5	100.0
Total	80	100.0	100.0	

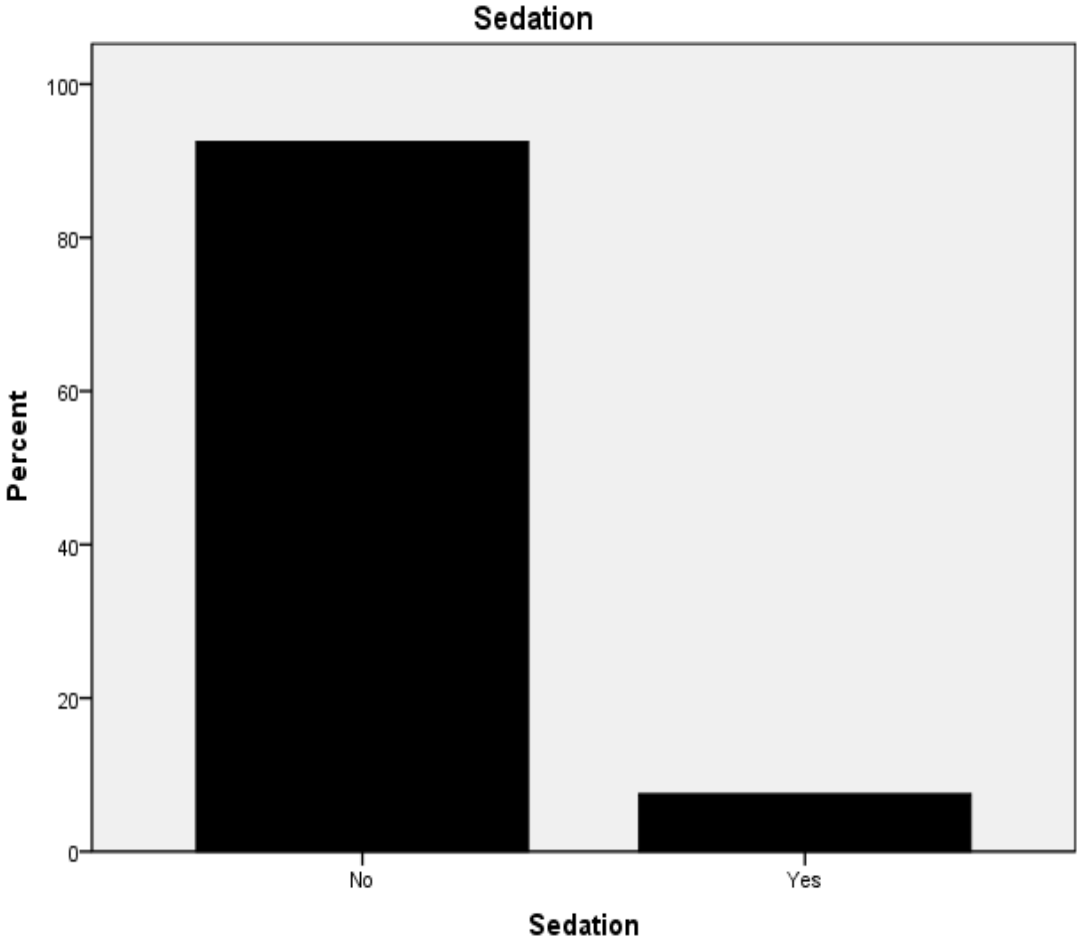


Figure 4-5: bar charts demonstrates the percentages of patient’s sedation.

Chapter five

Discussion, conclusion and recommendations

5.1 Discussion:

The purpose of this research was to assess the CT Abdominal request form in Khartoum hospitals to determine if they meet the standard CT Abdominal request form or not. This study was conducted in Khartoum state at three CT diagnostic institutions.

The ideal request form should include the following: exam date, patient name, age, gender, LMP, height, weight, phone number, clinical data, allergy to medication or contrast media, sedation, anesthesia, kidney dysfunction (GFR) (serum creatinine), diabetes mellitus and physician name. This information is important because the more information about the patients and more accurate the diagnosis will be.

Table 4-1: showed the frequency distribution of patient data with percentages, exam date and patient name is important to be written in all CT Abdominal requests to be sure this is exact patient. In this study 100% (80 request forms) included the patient name in CT Abdomen request. Gender is important to be written in all CT abdomen requests. In this study 100 % (80 request forms) included gender. LMP check is important because it is a major contraindication due to the high radiation dose, the operator must apply the 10-day rule to make sure there is no pregnancy. In this study all CT abdomen request forms did not include statement about the LMP. In addition, age is also important in CT abdomen request forms to determine the amount of contrast media and to adjust the exposure parameters. In this study 100% (80 request forms) identified patients age. Height is important to determine patient dose and amount of contrast media that will be administered. In this study 100% (80 request forms) did not include the height. Patient clinical data is important to be written in all CT abdomen requests as general in order to evaluate the patient indication for

these investigations, and furthermore to assess the requirement for IV iodinated contrast injection; decision should be taken upon. In this study 100 % (80 request forms) was included the patient clinical data. Allergy to Medications and contrast media is important to prevent the reactions during the procedure. In this study 100% (80 request forms) have not mentioned patient's allergy to medications and contrast media in request for CT Abdomen. Anesthesia it's important to be written in all CT Abdomen requests for pediatrics and anxious patients. In this study 100 % (80 request forms) have no anesthesia information in CT abdomen request. GFR lab tests are important because patient with insufficient kidneys will not be able to excrete the contrast media from their bodies. In this study 100 % (80 request forms) was not included the GFR. Physician name should be included as a reference. In this study 100% (80 request forms) was included the physician name.

Table 4-2: Showed the frequency distribution of phone numbers with percentages, patients Phone number is important to able to reach him for follow up. In this study 95.0% (76 request forms) was included the patient phone number.

Table 4-3: Showed the frequency distribution of the weight with percentages, patients weight is important to determine patient dose and amount of contrast media that will be administered. In this study 22.5% (18 request forms) included the patients weight.

Table 4-4: Showed the frequency distribution of diabetes with percentages, diabetes increases the risk of contrast-induced renal toxicity, the operator must set a lower cutoff for the use of IV contrast in diabetics. In this study 11.3 % (9 request forms) was included the diabetes.

Table 4-5: Showed the frequency distribution of creatinine level with percentages, serum creatinine lab tests are important because patient with high creatinine level

may have renal failure and will not be able to excrete the contrast media from their bodies. In this study 20 % (16 request forms) was included the creatinine level.

Table 4-6: Showed the frequency distribution of sedation with percentages, sedation is important to be written in all CT Abdomen requests for pediatrics and anxious patients. In this study 7.5 % (6 request forms) was included the Sedation.

5.2 Conclusion:

This study was conducted at three CT diagnostic institutions at Khartoum state, during the period from November 2016 to February 2017. The main objective of this study was to assess CT abdomen examination request forms in Khartoum state to match them with the standard request form for CT abdomen examination. The study came out with many results included exam date, patient name, clinical data, age, gender and physician name were included in all the request forms. Most of the request forms included the phone number. On the other hand, Diabetes, creatinine level, weight and sedation were rarely found in the request forms under study. Height, GFR, anesthesia, allergy to medication and allergy to contrast media were never found in the request forms.

The study proposed some recommendations which could help in the improvement of the contents of the CT abdomen examinations request forms in Sudan.

Future studies on this topic which include other CT centers in Sudan, and done on greater numbers of forms may be more valuable.

5.3 Recommendations:

- CT departments should issue one standard CT Abdominal request form that should be applied by all hospitals, in order to enhance the CT procedures for better diagnosis and for care of patient.
- The request form should include all the necessary information which are usually present in the international request forms.
- All doctors should follow the standard CT request form carefully before referring the patients to the CT departments.
- All departments should not accept patients with incomplete CT Abdominal request form.
- Future studies on this topic which includes more request forms and at other places are greatly recommended.

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Appendices

Appendix (1)

DEPARTMENT OF RADIOLOGICAL DIAGNOSIS & IMAGING

Abdominal C.T. Scan Requisition Form

Name:..... Age:

Phone NO:

Height: Weight:

Clinical Data:

Diabetes:

Any Allergy to medication or Contrast Media:

Sedations: Anesthesia:

GFR: Serum Creatinine:

Date: Signature of referring physician:

(Name & Designation)

Contact No:

*Please note that forms which are incomplete in any respect shall not be accepted

**Please bring case file

Appendix (2)

1300

دكتور / فيصل جلال عبد العزيز

بكالوريوس طب وجراحة جامعة الخرطوم MBBS - زميل كلية الجراحين الملكية بريطانيا FRCS
زميل كلية أمراض النساء الملكية بريطانيا MRCOG - جراح وطبيب لامراض النساء والعم
استشاري جراحة الأورام النسائية - المستشفى العسكري ام درمان

الاسم: ~~.....~~

التاريخ: 10/07/2017

46 ♀ female

Δ Ca ovarum

for

CT pelvis & abdomen *

S.C. 05

د. فيصل

العيادة: مستشفى جمعية زارعي الكلى السودانية - غرب جامعة الزعيم الأزهري - جوار مركز العسكري

