Sudan University of Science and Technology

College of Graduate Studies

Assessment of abdominal CT examination request form

تقييم طلب فحص الاشعة المقطعية المحوسبة للبطن

A thesis submitted in partial fulfillment for the Requirements of the M.SC Degree in Diagnostic Radiologic Technology

By:

Marwa Saeed Gumaa

Supervisor:

Dr. Ahmed Mostafa Abukonna

January 2016

بسم الله الرحمن الرحيم

الأيه

قال تعالى:

(الله لا إله إلا هو الحي القيوم لا تأخذه سنة ولا نوم له ما فى السموات وما فى الأرض من ذا الذى يشفع عنده إلا بإذنه يعلم ما بين ايديهم و ما خلفهم ولا يحيطون بشئ من علمه إلا بما شاء وسع كرسيه السموات والأرض ولا يئوده حفظهما وهو العلي العظيم)

الآية 255 من سورة البقرة

Dedication

To the candle that burn to light my way, my lovely parents.

Whom made all the cheap and precious for the sake of my arrival to this Stage

To my dear brother

&

My Sweet sisters

For their patients & endless support

To my friends & my colleagues

To the kids & children around the world

To all whom I do love & respect

I dedicate this work for you

Acknowledgement

Grateful thanks & grace to ALLAH for guiding & helping me start & finish this research.

I would also to express sincere thanks & deep gratitude to my faithful supervisor, ***Dr: Ahmed Mustafa Abukonna*** *for his useful advice, encouragement & wise guidance through this thesis & sharing his knowledge through all the lectures during the course.*

My thanks extend to royal scan diagnostic center staff for their helps.

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

.

List of abbreviation

Abbreviation	The term
CT	Computed tomography
CAT	Axial Computed tomography
ACR	American College of Radiology
SPR	Society for Pediatric Radiology
SCBT-MR	Society of Computed Body Tomography and Magnetic Resonance
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
MDRD	Modification of Diet in Renal Disease
ICM	Iodinated Contrast Media

List of tables:

List of figures:

Table of contents:

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 in khartoum state to reduce the complications which can occur due to insufficient information about patient's condition.

A total number of 70 CT Abdomen forms referred from various hospitals in Khartoum state were evaluated. The result of the study revealed that patient name, exam date, physician name, age and clinical data were included in the request form. Height, allergy to medications and contrast media, anesthesia, and renal function test (GFR) were not existed. Phone number was found in 94,3 %, furthermore weight was found in 22.9% of request form. Diabetes was found in 5.7% of request form. Creatinin was found in 15.7% and Sedation was found in 8.9%.

In spite of the importance of the information included in an ideal request form, radiological departments don't imply them in their procedures.

المستخلص

طلب فحص الاشعة هو وسيلة لجمع المعلومات عن المرضى الذين سيخضعون لاجراء فحص الاشعة المقطعيه او فحوصات اشعه اخرى.في دراسة تقييم طلب فحص الاشعة المقطعية للبطن تم استخدام طلب فحص الاشعة المقطعية للبطن المعياري وتمت مقارنته بواسطة الطلبات التي تم جمعها من عدة مستشفيات داخل ولاية الخرطوم.

وقد كان الهدف الرئيسي من هذه الدراسة هو تقييم طلب فحص الاشعة المقطعية للبطن في مختلف اقسام الاشعة المقطعية لمعرفة ما اذا كان طلب فحص الاشعة المقطعية مثاليا ام لا وذلك لتقليل المضاعفات التي قد تحدث نتيجة لعدم وجود معلومات كافية عن حالة المريض. بنيت الدراسة على 70 طلب فحص الاشعة المقطعية للبطن بالمستشفيات المختلفة داخل ولاية الخرطوم ووجد من خلال البحث ان اسم المريض ، تاريخ الفحص ، اسم الطبيب ، العمر والبيانات الطبيه موجود بنسبة 100% والطول ، الحساسية للعقاقير و صبغة التصوير ، التخدير و وظائف الكلى ، غير موجودة بنسبة 100%. اما رقم الهاتف وجد بنسبة 94.3% ، والوزن بنسبة 22.9% ، ومرض السكري بنسبة 5.7 % و المهدئات بنسبة % 8.9. على الرغم من اهمية المعلومات المذكورة في طلب فحص الاشعة المعياري , الا ان اقسام الاشعة لا تقوم بتطبيقه عند اجراء فحص الاشعة المقطعية للبطن.

Chapter one

Chapter one

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. [Brancatelli G2001] 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 galls tones, 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.

1.2 The Problems of study:

The abdomen is the most part that affected by pathological condition as well as some other disease has it is manifestation in the abdomen while the organs were remote, therefore most of the time the requested examination does not associated with the real condition.

1.3 Objectives of study:

1.3.1 General objective of the study:

The main objective of this study is to assess the indications of abdominal computed tomography (CT) examination (Initial diagnosis) in order to relate the condition to the request.

1.3.2 Specific objectives:

- To evaluate the requested CT scan for abdomen and relate the request to the associated symptoms.

- To highlight the importance of CT scan in diagnosis of some abdominal disorders.

1.4 overview of the study:

This study was consisted of five chapters; chapter one an introduction, which introduce this thesis briefly and it was contain general introduction, problem of study, study objectives, significant of the study and overview of the study. Chapter two contains the theoretical background and literature review. Chapter three contains material and method. Chapter four contains the results. Chapter five was including discussion, conclusion, recommendation in addition to the reference and appendices.

Chapter two

Chapter two

2. Literature Review

2.1. 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 help 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 improve.

2.2. 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]

2.3. 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, oesophagus, 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. . [Poeppel TD et.al., 2014]

2.4. Indications and Contraindications for abdominal CT:

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

- Evaluation of renal and adrenal masses and with CT urography.[Caoili 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,AJR2008]

- 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. 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.
- Pre- and post-transplant assessment.
- Noninvasive angiography of the aorta and its branches and noninvasive venography.

2.4.2. 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]

2.5. Standard techniques for CT abdomen:

A. 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. [ACR Resolution 35, adopted in 2006]

B. 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.

C. 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. [Liao EA et. al 2011]. [Cohen MD.AJR2009]

D. 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 nonabsorbable agent, or a negative agent such as air or carbon dioxide.

E. 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. [Gruden JFet.al 2002, Kawel N et.al 2009].

F. 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. [McMahon MAet.al2014].

G. 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.

-Radiation dose report.

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.

-Detector configuration.

-Table increment and pitch.

-Slice thickness.

-Reconstruction interval.

-Reconstruction kernel (algorithm) .

-kVp and mAs per slice or range (minimum and maximum mAs for multidetector CT) as appropriate for adult or pediatric patients.

-Noise index (for multi detector CT).

-Superior and inferior extent of the region of interest to be imaged.

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.

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]

2.6. Equipment specifications:

A. 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. [Marshall GBet.al2014].

B. 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. [Marshall GBet.al2014].

C. 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].

2.7. 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}

2.9. 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)

2.10. 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. .[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.

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. Delayed Contrast Reactions 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%. 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.

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, a shaving 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 µmoles/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, nu-metformin, 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].

2.8. 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 adult's. These advocacy and awareness campaigns provide free educational materials for

Chapter three

Chapter Three

3. Material and Methods

3.1. Material:

The material used for data collection was 70 copies of a preset standard CT abdominal request form**.**

3.2. Methods:

This study was aimed to evaluate the CT abdomen request form using standardized request formula to assess the general requirement for this investigation that must be written or considered before the CT abdomen examination in Khartoum state hospitals, the data were collected from November to January 2015, all patient data and technical data was included in the CT request formula and then the assessment was done through questioner prepared from the standardized one to assess the presence of these variable or not then the data were analyzed in order to exclude presence of these requirement or not.

3.2.1. Study area:

The data has been collected from Al-Ribat hospital teaching, Royal scan center, and guided from Sudan University of sciences and technology, collage of medical radiological sciences.

3.2.2. Study duration:

The research was conducted from September to December 2015.

3.2.3. The study population:

This study was included AL-Ribat hospital teaching and including all age and gender cases requested to perform CT Abdomen examination.

3.2.4. Study sample:

This study was performed in 70 patients having CT Abdomen request form selected randomly from the hospital under study.

3.2.5. Inclusion criteria:

All patients with indication for CT Abdominal examination

3.2.6. Statistical analysis:

The data was analyzed using Microsoft excel program and SPSS

3.2.7. Method of data collection:

The data were collected by the researcher during examination, and designing data table content

3.2.8. Variables of the study:

Exam date, patent name,

3.2.9. Standard CT Abdomen request form: CT Request form checklist:

Exam date …… ☐

Patient name: …… ☐

Age …… ☐

Height …… ☐

Weight ……... ☐

Phone Number: …… ☐

Clinical data: …… ☐

Allergy to medication ☐ or Contrast Media ☐

Sedation …… ☐

Anesthesia …… ☐

Kidney dysfunction: (GFR) ……... ☐ ☐

(Serum Creatinine) ☐

Diabetes Mellitus: ……. ☐

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 was kept in personal computer with personal password

Chapter four

Chapter four

4-Results

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

Patient data	Frequency		Percent
Exam Date	Yes	70	100.0
Patient name	Yes	70	100.0
Age	Yes	70	100.0
Height	NO	70	100.0
Clinical Data	Yes	70	91.7
Allergy to Medication	NO	70	100
Allergy to Contrast	No	70	70
Anesthesia	No	70	100
GFR	NO	70	100

Table 4-2:showed the frequency distribution of phone N0 with its percentages

Phone No

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	4	5.7	5.7	5.7
	Yes	66	94.3	94.3	100.0
	Total	70	100.0	100.0	

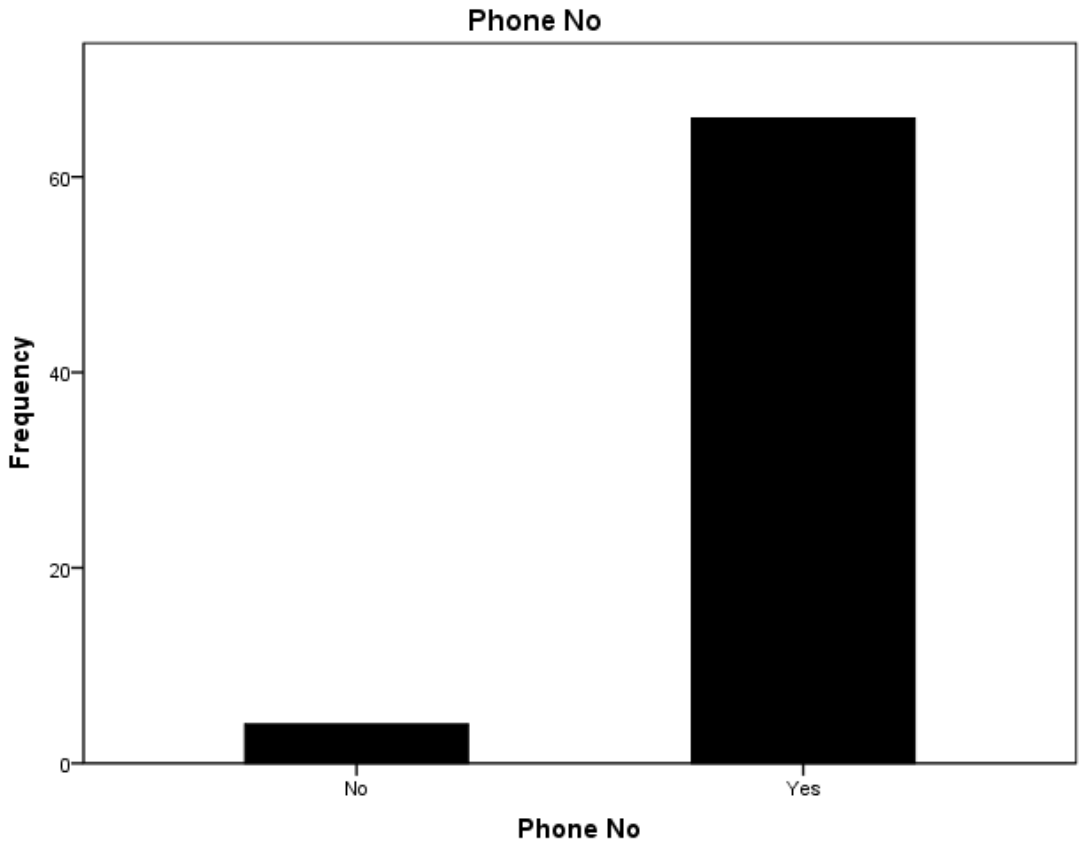

Figure 4-1: bar charts demonstrate the frequency of patient phone No.

Table 4-3:showed the frequency distribution of the patient weight with its percentages

Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	54	77.1	77.1	77.1
	Yes	16	22.9	22.9	100.0
	Total	70	100.0	100.0	

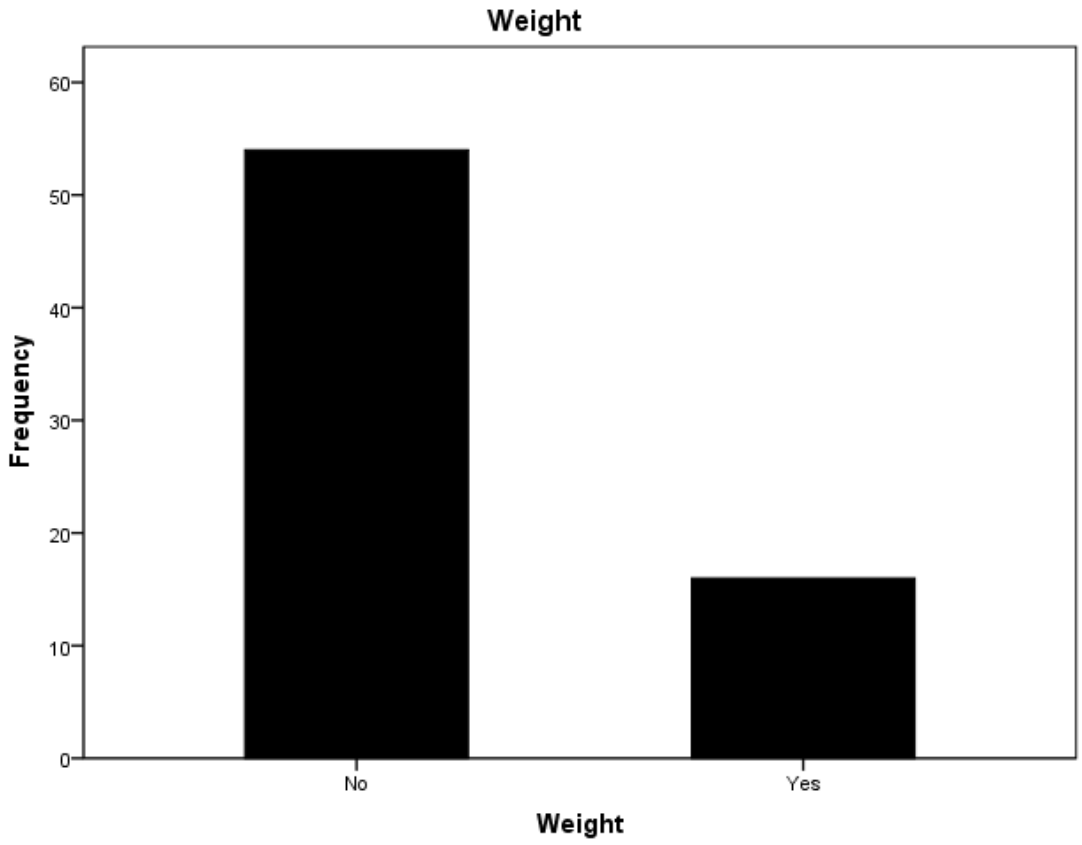

Figure 4-2: bar charts demonstrate the frequency of patient Weight.

Table 4-4:showed the frequency distribution of Diabetes with its percentages

Diabetes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	66	94.3	94.3	94.3
	Yes	4	5.7	5.7	100.0
	Total	70	100.0	100.0	

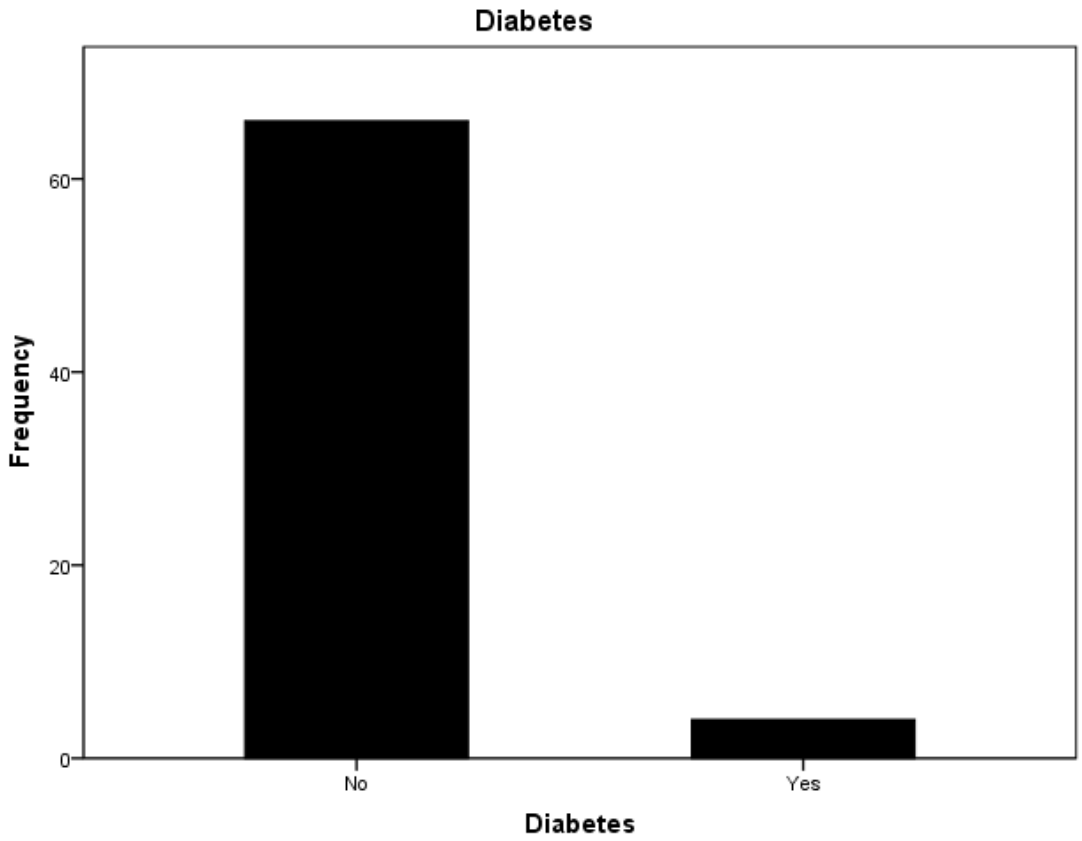

Figure 4-3: bar charts demonstrate the frequency of Diabetes patients.

Table 4-5:showed the frequency distribution of Creatinin Level with its percentages

Creatinine Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	59	84.3	84.3	84.3
	Yes	11	15.7	15.7	100.0
	Total	70	100.0	100.0	

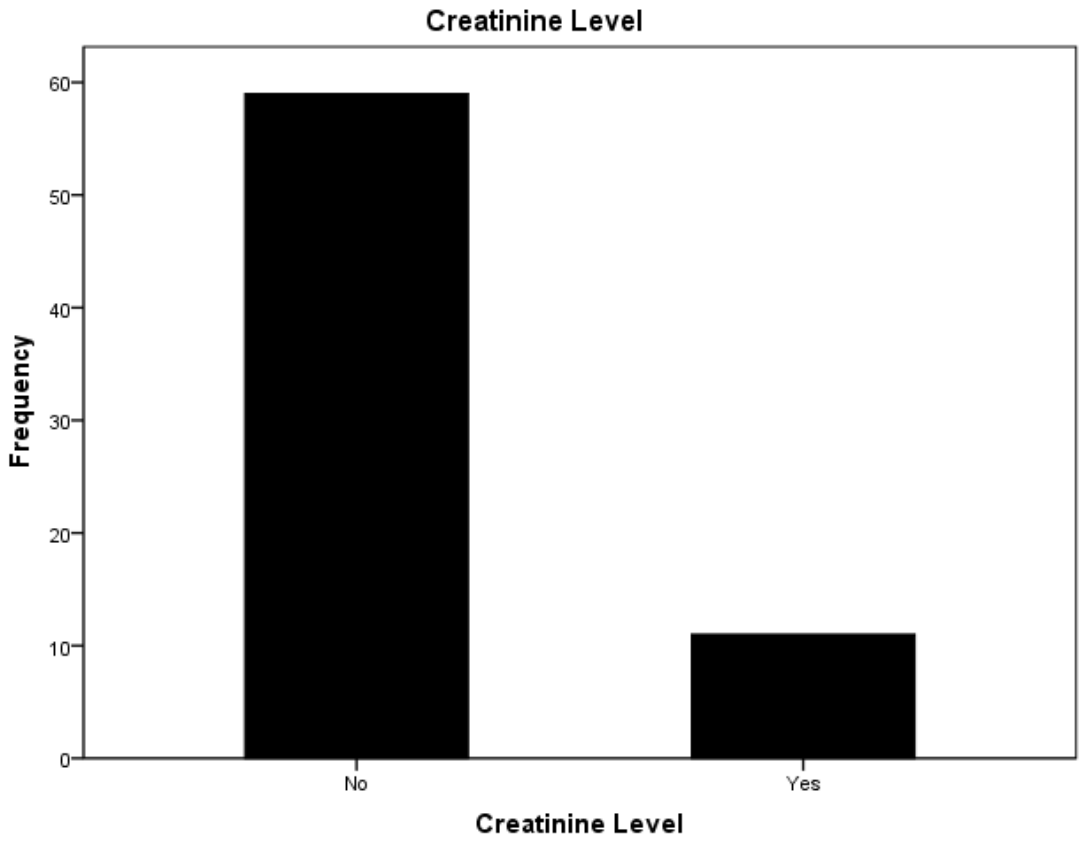

Figure 4-4: bar charts demonstrate the frequency of patient Creatinin level.

Table 4-6:showed the frequency distribution of Sedation with its percentages

Sedation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	64	91.4	91.4	91.4
	Yes	6	8.6	8.6	100.0
	Total	70	100.0	100.0	

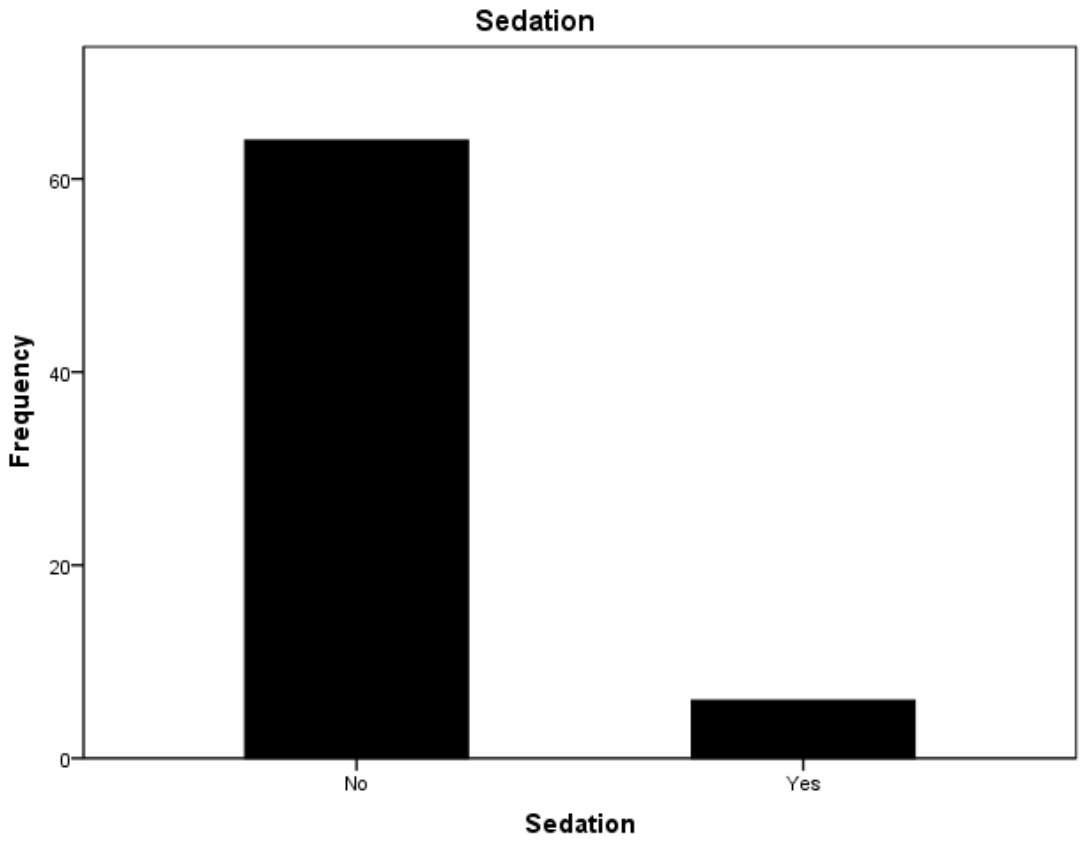

Figure 4-5: bar charts demonstrate the frequency of patient Sedation.

Chapter five

Chapter five

5. Discussion, Conclusion and Recommendations

5.1 Discussion:

The purpose of this research was to evaluate 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 at Khartoum state diagnostic centers and hospitals. The ideal request form should include the following: Exam date, Patient name, Age, 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 patient, the more accurate the diagnosis will be. 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% (70patients) included the patient name their CT Abdomen request. In addition age is also important in CT Abdomen request to determine the amount of contrast media and to adjust the exposure parameters. In this study 100% (70 request forms) identified patient age. Height is important to determine patient dose and amount of contrast media that will be administered. In this study 100% (70 request forms) did not include height. Patients Phone number is important to able to reach him for follow up. In this study 94.3 %(66 request forms) was included the patient phone number. Patient clinical data is important to be written in all CT 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 %(70 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% (70 request forms) have not mentioned patient's allergy to medications and contrast media in their request for CT Abdomen. Sedation and anesthesia it's important to be written in all CT chest requests for pediatrics and anxious patients .In this study 100 % have no sedation and anesthesia information in their request for CT Abdomen. Sedation is important to be written in all CT Abdomen requests for pediatrics and anxious patient's .In this study 8, 6 % (6 request forms) was included the Sedation. Kidney dysfunction GFR and the serum creatinine lab tests in addition to diabetes mellitus are important because patient with high creatinine level may have renal failure. And patients with insufficient kidneys will not be able to excrete the contrast media from their bodies. In this study GFR is 100 % (70 request forms), serum Creatinine is 15, 7 (11 request forms) and diabetes mellitus results is 5, 7 % (4 request forms).

5.2. Conclusion:

The study found that exam date, patient name, clinical data, age, and physician name were included in all the request forms. Most of the request forms included the phone number and weight. On the other hand Diabetes, Creatinin and sedation were rarely found in the request forms. High, GFR, anesthesia, sedation, allergy to medication, and allergy to contrast media were never found in the request forms.

5.3. Recommendations:

- CT departments should issue one standard CT Abdominal request 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 must follow the standard CT request carefully before referring the patient to the CT department.
- Finally I recommend that all departments should not accept patients with incomplete CT Abdominal request form.

References:

ACR–SPR Practice Parameter for the Use of Intravascular Contrast Media

ACR Manual on Contrast Media.

Aguirre DA, Santosa AC, Casola G, Sirlin CB. Abdominal wall hernias: imaging features, complications, and diagnostic pitfalls at multi-detector row CT. *Radiographics* 2005;25: 1501-1520.

Blachar A, Federle MP, Pealer KM, Ikramuddin S, Schauer PR. Gastrointestinal complications of laparoscopic Roux-en-Y gastric bypass surgery: clinical and imaging findings. *Radiology* 2002;223: 625-632.

Bendeck SE, Nino-Murcia M, Berry GJ, Jeffrey RB, Jr. Imaging for suspected appendicitis: negative appendectomy and perforation rates. *Radiology* 2002;225:131-136.

Brancatelli G, Federle MP, Grazioli L, Blachar A, Peterson MS, Thaete L. Focal nodular hyperplasia: CT findings with emphasis on multiphasic helical CT in 78 patients. *Radiology* 2001;219:61-68.

Caoili EM, Cohan RH, Korobkin M, et al. Urinary tract abnormalities: initial experience with multi-detector row CT urography. *Radiology* 2002;222:353-360.

Dyer R, DiSantis DJ, McClennan BL. Simplified imaging approach for evaluation of the solid renal mass in adults. *Radiology* 2008;247:331-343.

Gruden JF, Ouanounou S, Tigges S, Norris SD, Klausner TS. Incremental benefit of maximum-intensity-projection images revealed by multidetector CT. AJR 2002;179:149-157.

Hanbidge AE, Buckler PM, O'Malley ME, Wilson SR. From the RSNA refresher courses: imaging evaluation for acute pain in the right upper quadrant. *Radiographics* 2004;24:1117-1135.

Hong X, Choi H, Loyer EM, Benjamin RS, Trent JC, Charnsangavej C. Gastrointestinal stromal tumor: role of CT in diagnosis and in response evaluation and surveillance after treatment with imatinib. *Radiographics* 2006;26:481-495.

Ichikawa T, Federle MP, Grazioli L, Nalesnik M. Hepatocellular adenoma: multiphasic CT and histopathologic findings in 25 patients. *Radiology* 2000;214:861-868.

Iannaccone R, Laghi A, Catalano C, et al. Hepatocellular carcinoma: role of unenhanced and delayed phase multi-detector row helical CT in patients with cirrhosis. *Radiology* 2005;234:460-467.

Keyzer C, Cullus P, Tack D, De Maertelaer V, Bohy P, Gevenois PA. MDCT for suspected acute appendicitis in adults: impact of oral and IV contrast media at standard-dose and simulated low-dose techniques. *AJR* 2009;193:1272-1281.

Kawamoto S, Urban BA, Fishman EK. CT of epithelial ovarian tumors. *Radiographics* 1999;19 Spec No:S85-102; quiz S263-104.

Kamel IR, Choti MA, Horton KM, et al. Surgically staged focal liver lesions: accuracy and reproducibility of dual-phase helical CT for detection and characterization. *Radiology* 2003;227:752-757.

Kim KW, Choi BI, Han JK, et al. Postoperative anatomic and pathologic findings at CT following gastrectomy. *Radiographics* 2002;22:323-336.

Liao EA, Quint LE, Goodsitt MM, Francis IR, Khalatbari S, Myles JD. Extra Z-axis coverage at CT imaging resulting in excess radiation dose: frequency, degree, and contributory factors. J Comput Assist Tomogr2011;35:50-56.

Marshall GB, Farnquist BA, MacGregor JH, Burrowes PW. Signs in thoracic imaging. 2006;21:76-90.

Miller WJ, Baron RL, Dodd GD, 3rd, Federle MP. Malignancies in patients with cirrhosis: CT sensitivity and specificity in 200 consecutive transplant patients. *Radiology* 1994;193:645-650.

Ohtomo K, Baron RL, Dodd GD, 3rd, et al. Confluent hepatic fibrosis in advanced cirrhosis: appearance at CT. *Radiology* 1993;188:31-35.

Pannu HK, Bristow RE, Montz FJ, Fishman EK. Multidetector CT of peritoneal carcinomatosis from ovarian cancer. *Radiographics* 2003;23:687-701.

Pickhardt PJ, Bhalla S, Balfe DM. Acquired gastrointestinal fistulas: classification, etiologies, and imaging evaluation. *Radiology* 2002; 224:9-23.

Pannu HK, Corl FM, Fishman EK. CT evaluation of cervical cancer: spectrum of disease. *Radiographics* 2001;21:1155-1168.

Yu J, Turner MA, Cho SR, et al. Normal anatomy

Sadow CA, Silverman SG, O'Leary MP, Signorovitch JE. Bladder cancer detection with CT urography in an Academic Medical Center. *Radiology* 2008;249:195-202.

Silverman SG, Leyendecker JR, Amis ES, Jr. What is the current role of CT urography and MR urography in the evaluation of the urinary tract? *Radiology* 2009;250:309-323.

Tublin ME, Murphy ME, Delong DM, Tessler FN, Kliewer MA. Conspicuity of renal calculi at unenhanced CT: effects of calculus composition and size and CT technique. *Radiology* 2002;225:91-96.

Wang ZJ, Yeh BM, Roberts JP, Breiman RS, Qayyum A, Coakley FV. Living donor candidates for right hepatic lobe transplantation: evaluation at CT cholangiography--initial experience. *Radiology* 2005;235:899-904.

5.4. Appendices:

DEPARTMENT OF RADIODIAGNOSIS & 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