بسم الله الرحمن الرحيم

Sudan University of Sciences and Technology

College of Graduate Studies

Study of Renal Calculi using Computed Tomography

دراسة حصى الكلي باستخدام الأشعة المقطعية

A Thesis submitted in partial fulfillment for the requirement

The M.Sc Degree in diagnostic Radiological technology.

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August 2016

بسم الله الرحمن الرحيم

الآية الكريمة

(قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ)

سوره البقره الآية 32

Dedication

To soul of Dr. Abdalkreem Altayb

To soul of my father

To my mother

To my sister

To my freinds

Acknowledgment

First I would like and grateful to my supervisor Dr abdalkreem for this supervision great help, valuable support, a device, great support and learning. This humble effort is also dedicated to everybody who has sincerely participated of this thesis. My thank extended to every one who assisted to bring this study to the light.

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List of Abbreviation

CT	Computed tomography
KUB	Kidneys ureters and bladder
HU	Hounsfield unit
PH	Plasma hydrogen
ESRD	End stage renal disease
UTIs	Urinary tract infections
CAT	Computed axial tomography
ID	Identification data
T12	Number(12) of thoracic vertebrae
MM	millimeter
CM	centimeter
IVP	Intra venous pylography
3D	Three dimension

List Contents

Abstract

The objective of this study is to evaluate renal calculi using non-contrast computed tomography kidney, ureter and bladder (KUB).

A prospective cross-sectional study was executed and data were collected On October 2015 from Alamal hospital, included fifty subject,45 identified renal stone the included subjects were diagnosed to have < 2mm nephrolithiasis with non-contrast helical CT scan and KUB X-ray, which were carried out on the same day.

Nephrolithiasis characteristics such as stone location, stone size, CT attenuation value,number of slice thickness, CT-scout film and KUB radiograph appearance were recorded independently.

The cases were included. 25 out of 27 CT-scout film detected nephrolithiasis were identified on plain radiograph and determined as radio-opaque with sensitivity 92%. The determined value of HU utilized for prediction of radiographic characteristics was 617 HU at which urinary calculi were not seen at CT-scout film and were KUB X-ray radio-opaque

According to graph (4:1) and equation demonstrated that the

density increased by 11 density/mm of stone thickness starting from 617HU

مستخلص الدراسة

الهدف من تلك الدراسة هو تقييم الاشعه المقطعيه الحلزونية بدون وسيط تباين لمرضي حصى الكلي.

لقد تم جمع 50 مريض من مستشفي الامل في اكتوبر 2015

وتم لهم اجراء فحص بالاشعه المقطعيه والاشعه العادية وت تشخيصهم بوجود حصى في اللكلي لعدد من المرضي بحجم 2سم او اقل

في كل المرضي تم تحديد مكان الحصى بالكلي حجم الحصى وكثافاتها وكيفيه ظهورها في الاشعه المقطعيه والاشعه العادية.

اعلى كثافه تم تسجيلها بحوض الكليه وكانت قيمتها947.33

كل كثافات الحصى التي تم ظهورها في الفيلم الكشفي للاشعه المقطعيه, تم ظهورهم في الاشعه العاديه.

تم ظهور 27 من الحصى في الاشعه العادية 25 منهم تم ظهورهم في الفيلم الكشفي للأشعة المقطعيه وتم ضبط الحساسية بقيمه 92%.

قيمه الكثافة المتوقع ظهورها في الأشعة العادية دون الفيلم الكشفي الأولي للأشعة المقطعيه هي 617

تزداد كثافه الحصى بزياده سمك الشريحه ابتداء من قيمه الكثافه 617

1-1.Introduction

Renal calculus remains to be a common presentation in the hospital. It is the third most common urological problem after urinary tract infection and prostate disease with life time prevalence of nephrolithiasis at 10-15%. The prevalence has risen over a 20-year period from the mid 1970's to the mid 1990's. The diagnosis of nephrolithiasis is largely dependent on analyzing the clinical presentation and physical examination. Suspicion is confirmed with radiologic tests, particularly the non-contrast enhanced computed tomography (CT) scan. The advent of non-enhanced CT has not only provided detection and confirmation of calculi, but also accurate detection of its size and location. Non-contrast helical CT scan provides several advantages over the KUB radiograph such as detection of radiolucent calculi, sensitivity for small stones, identification of other causes of flank pain as well as avoidance of any preparation prior to the procedure. Non-contrast helical CT scan has long replaced the plain abdominal radiograph as the gold standard in the diagnosis of nephrolithiasis. However, a KUB radiograph has remained part of the protocol for most clinicians even after a non-contrast helical CT scan is carried out because of its impact in clinical decision making prior to treatment. Due to the higher radiation dose with CT, conventional or digital radiography is being used to monitor the passage of stones if radiographic follow-up is believed to be indicated. (David Sutton 1987)

1-2. Research problem:-

The renal stones are common and most of Sudanese people suffer from.

1-3. objectives:-

1-3-1. general objective:-

To determined the value of non contrast spiral CT in evaluation of suspected renal calculi

1-3-2. Specific objectives:-

To determine utility computed tomography scout film.

To determine an optimal non-contrast helical CT scan Hounsfield unit (HU) in predicting the appearance of urinary calculus in the plain (KUB)-radiograph.

1-4 Significance of the study:-

This study will provide rich information about computed tomography (CT) of the kidney in detecting renal calculi.

1-5 Over view of the study:-

Chapter one deal with Introduction, Chapter two deal with Theoretical background (anatomy, physiology, pathology and Equipments) and previous study, Chapter three deal with Material and method, Chapter four deal with results, Chapter five deal with discussion, conclusion, recommendation, references and appendices.

Literature reviews

2-1. Theoretical background

2-1-1.Anatomy:-

2-1-1-1. Kidneys:-

2-1-1-1-1.Kidney location:-

The kidneys are a pair of organs found along the posterior muscular wall of the abdominal cavity. The left kidney is located slightly more superior than the right kidney due to the larger size of the liver on the right side of the body. Unlike the other abdominal organs, the kidneys lie behind the peritoneum that lines the abdominal cavity and are thus considered to be retroperitoneal organs. The ribs and muscles of the back protect the kidneys from external damage. Adipose tissue known as per renal fat surrounds the kidneys and acts as protective padding. (JACK STERN, et al 1997)

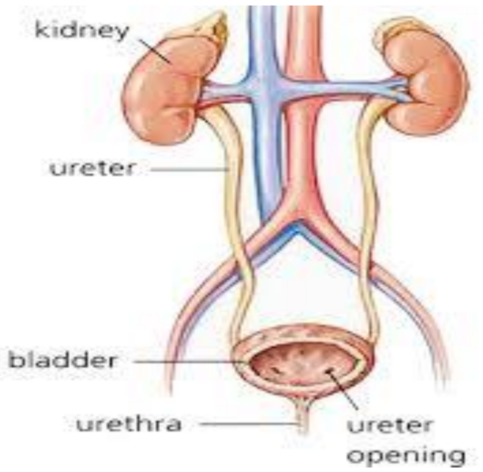

Figure (2-1) shows urinary system structure

2-1-1-1-2.Kidneyes Structures:-

The kidneys are bean-shaped with the convex side of each organ located laterally and the concave side medial. The indentation on the concave side of the kidney, known as the renal hilus, provides a space for the renal artery, renal vein, and ureter to enter the kidney.Ref (Richard s. Snell et. al 1995)

A thin layer of fibrous connective tissue forms the renal capsule surrounding each kidney. The renal capsule provides a stiff outer shell to maintain the shape of the soft inner tissues. Deep to the renal capsule is the soft, dense, vascular renal cortex. Seven cone-shaped renal pyramids form the renal medulla deep to the renal cortex. The renal pyramids are aligned with their bases facing outward toward the renal cortex and their apexes point inward toward the center of the kidney. Each apex connects to a minor calyx, a small hollow tube that collects urine. The minor calyces merge to form 3 larger major calyces, which further merge to form the hollow renal pelvis at the center of the kidney. The renal pelvis exits the kidney at the renal hilus, where urine drains into the ureter. Ref (Richard s. Snell et. al 1995)

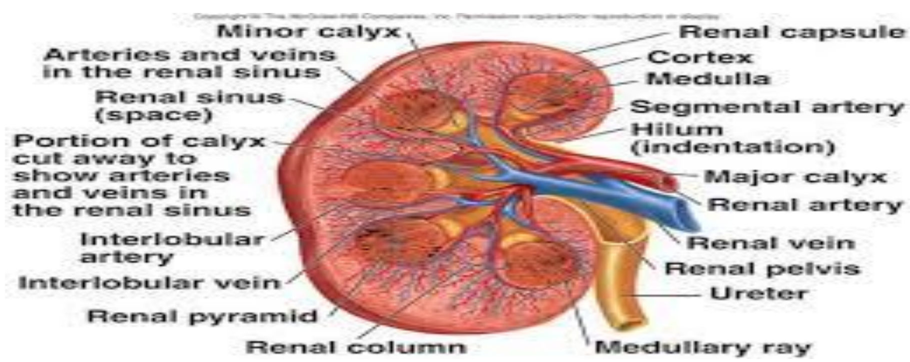

Figure 2:2 shows kidney structure

2-1-1-1-3. blood supply:-

The renal arteries branch directly from the abdominal aorta and enter the kidneys through the renal hilus. Inside our kidneys, the renal arteries diverge into the smaller afferent arterioles of the kidneys each afferent arteriole carries blood into the renal cortex, where it separates into a bundle of capillaries known as a glomerulus. From the glomerulus, the blood recollects into smaller efferent arterioles that descend into the renal medulla. The efferent arterioles separate into the peritubular Capillaries that surround the renal tubules. Next, the peritubular capillaries merge to form veins that merge again to form the large renal vein. Finally, the renal vein exits the kidney and joins with the inferior vena cava which carries blood back to the heart. (JACK STERN, et al 1997)

2-1-1-1-4.The Nephron:-

Each kidney contains around 1 million individual nephrons, the kidneys' microscopic functional units that filter blood to produce urine. The nephron is made of 2 main parts: the renal corpuscle and the renal tubule (Richard s. Snell et. al 1995)

Responsible for filtering the blood, our renal corpuscle is formed by the capillaries of the glomerulus and the glomerular capsule (also known as Bowman's capsule). The glomerulus is a bundled network of capillaries that increases the surface area of blood in contact the blood vessel walls. Surrounding the glomerulus is the glomerular capsule, a cup-shaped double layer of simple squamous epithelium with a hollow space between the layers. Special epithelial cells known as podocytes form the layer of the glomerular capsule surrounding the capillaries of the glomerulus. Podocytes work with the endothelium of the capillaries to form a thin filter to separate urine from blood passing through the glomerulus. The outer layer of the glomerular capsule holds the urine separated from the blood within the capsule. At the far end of the glomerular capsule, opposite the glomerulus, is the mouth of the renal tubule (Richard s. snell et . al 1995)

A series of tubes called the renal tubule concentrate urine and recover non-waste solutes from the urine. The renal tubule carries urine from the glomerular capsule to the renal pelvis. The curvy first section of the renal tubule is known as the proximal convoluted tubule. The tubule cells that line the proximal convoluted tubule reabsorb much of the water and nutrients initially filtered into the urine,. Urine next passes through the loop of Henle, a long straight tubule that carries urine into the renal medulla before making a hairpin turn and returning to the renal cortex. Following the loop of Henle is the distal convoluted tubule. Finally, urine from the distal convoluted tubules of several nephrons enters the collecting duct, which carries the concentrated urine through the renal medulla and into the renal pelvis. Finally, urine from the distal convoluted tubules of several nephrons enters the collecting duct, which carries the concentrated urine through the renal medulla and into the renal pelvis. (Richard s. snell et . al 1995)

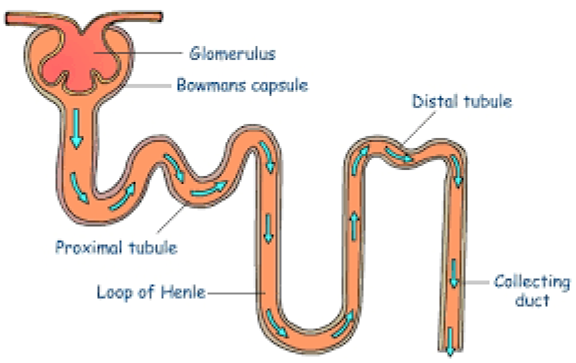

Figure (2-3) shows nephron

2-1-1-2.The ureters:-

The ureter is retroperitoneal, distensible muscular tube that connects the kidney with bladder. In position the upper half is abdominal, the lower half pelvic. The ureter supplied by nearly arteries (renal, gonadal, and vesicle) and from adjacent nervous plexuses (renal and hypo gastric (JACK STERN, et al 1997)

2-1-1-3. Urinary bladder:-

The bladder (vasicca; hence the adjective vesicle) varies in size, shape and position with amount of contained urine. The main part of bladder is

termed its body. The lowest part termed a neck a bladder. (JACK STERN, et al 1997)

2-1-1-4. The urethra:-

The urethra is extended from the neck of the bladder to
the exterior at the external urethra orifice. The length differs in male and in the female. The male urethra is associated with urinary and reproductive systemThe female urethra is approximately 4cm long The walls of the urethra are in closed apposition have 3 layers, the muscle layer, the sub mucosal layer, the mucosal layer (JACK STERN, et al 1997)

2-1-2. physiology of the Urinary System:-

One of the major functions of the Urinary system is the process of excretion. Excretion is the process of eliminating, from an organism, waste products of metabolism and other materials that are of no use. The urinary system maintains an appropriate fluid volume by regulating the amount of water that is excreted in the urine. Other aspects of its function include regulating the concentrations of various electrolytes in the body fluids and maintaining normal pH of the blood. Several body organs carry out excretion, but the kidneys are the most important excretory organ. The primary function of the kidneys is to maintain a stable internal environment (homeostasis) for optimal cell and tissue metabolism. They do this by separating urea, mineral salts, toxins, and other waste products from the blood. They also do the job of conserving water, salts, and electrolytes. (M. Y. Sukar, et al 2000)

2-1-2-2.Function of the kidney:-

Regulation of plasma ionic composition. Ions such as sodium, Potassium, calcium, magnesium, chloride, bicarbonate, and phosphates are regulated by the amount that the kidney excretes.

Regulation of plasma osmolarity; the kidneys regulate osmolarity because they have direct control over water a person excretes.

Regulation of plasma volume; Kidneys are so important they have an effect on blood pressure. The kidneys control plasma volume by controlling how much water a person excretes. The plasma volume has a direct effect on the total blood volume, which has a direct effect on your blood pressure. Salt (NaCl) will cause osmosis to happen; the diffusion of water into the blood.

Regulation of plasma hydrogen ion concentration (pH); the kidneys partner up with the lungs and they together control the pH. The kidneys have a major role because they control the amount of bicarbonate excreted or held onto. The kidneys help maintain the blood Ph mainly by excreting hydrogen ions and reabsorbing bicarbonate ions as needed.

Removal of metabolic waste products and foreign substances from the plasma; One of the most important things the kidneys excrete is nitrogenous waste. As the liver breaks down amino acids it also releases ammonia. The liver then quickly combines that ammonia with carbon dioxide, creating urea which is the primary nitrogenous end product of metabolism in humans. The liver turns the ammonia into urea because it is much less toxic. We can also excrete some ammonia, creatinine and uric acid. The creatinine comes from the metabolic breakdown of creatine phospate (a high-energy phosphate in muscles). Uric acid comes from the breakdown of nucleotides. Uric acid is insoluble and too much uric acid in the blood will build up and form crystals that can collect in the joints and cause gout.

Secretion of Hormones; the endocrine system has assistance from the kidneys when releasing hormones. Renin is released by the kidneys. Renin leads to the secretion of aldosterone which is released from the adrenal cortex. Aldosterone promotes the kidneys to reabsorb the sodium (Na^+) ions. The kidneys also secrete erythropoietin when the blood doesn't have the capacity to carry oxygen. Erythropoietin stimulates red blood cell production. The Vitamin D from the skin is also activated with help from the kidneys. Calcium (Ca^+) absorption from the digestive tract is promoted by vitamin

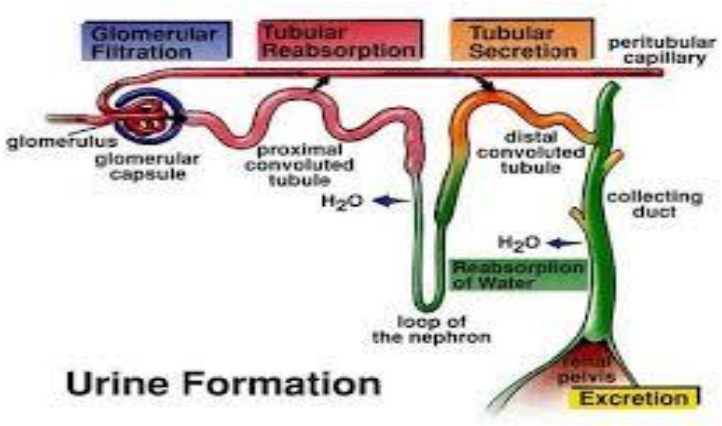

Figure (2-4) shows physiology of urinary system

2-1-3. Pathology:-

2-1-3-1.Kidney condition:-

Pyelonephritis (infection of kidney pelvis): Bacteria may infect the kidney, usually causing back pain and fever. A spread of bacteria from an untreated bladder infection is the most common cause of pyelonephritis.

Glomerulonephritis: An overactive immune system may attack the kidney, causing inflammation and some damage. Blood and protein in the urine are common problems that occur with glomerulonephritis. It can also result in kidney failure.

Kidney stones (nephrolithiasis): Minerals in urine form crystals (stones), which may grow large enough to block urine flow. It's considered one of the most painful conditions. Most kidney stones pass on their own but some are too large and need to be treated.

Nephrotic syndrome: Damage to the kidneys causes them to spill large amounts of protein into the urine. Leg swelling (edema) may be a symptom.

Polycystic kidney disease: A genetic condition resulting in large cysts in both kidneys that impair their function.

Acute renal failure (kidney failure): A sudden worsening in Kidney function. Dehydration, a blockage in the urinary tract, or kidney damage can cause acute renal failure, which may be reversible.

Chronic renal failure: A permanent partial loss of kidney functions. Diabetes and high blood pressure are the most common causes.

End stage renal disease (ESRD): Complete loss of kidney function, usually due to progressive chronic kidney disease. People with ESRD require regular dialysis for survival.

Papillary necrosis: Severe damage to the kidneys can cause chunks of kidney tissue to break off internally and clog the kidneys. If untreated, the resulting damage can lead to total kidney failure.

Diabetic nephropathy: High blood sugar from diabetes progressively damages the kidneys, eventually causing chronic.

2-1-3-2. Kidney disease:-

Hypertensive nephropathy: Kidney damage caused by high blood pressure. Chronic renal failure may eventually result.

Kidney cancer: Renal cell carcinoma is the most common cancer affecting the kidney. Smoking is the most common cause of kidney cancer.

Interstitial nephritis: Inflammation of the connective tissue inside the kidney, often causes acute renal failure. Allergic reactions and drug side effects are the usual causes.

Minimal change disease: A form of nephrotic syndrome in which kidney cells look almost normal under the microscope. The disease can cause significant leg swelling (edema). Steroids are used to treat minimal change disease.

Nephrogenic diabetes insipidus: The kidneys lose the ability to Concentrate the urine, usually due to a drug reaction. Although it's rarely dangerous, diabetes insipidus causes constant thirst and frequent urination.

2-1-3-3. Types of kidney stones:-

2-1-3-3-1. Calcium stones:-

Most kidney stones are made of calcium compounds, especially calcium oxalate. Calcium phosphate and other minerals also may be present. Conditions that cause high calcium levels in the body, such as hyperparathyroidism, increase the risk of calcium stones. High levels of oxalate also increase the risk for calcium stones.

2-1-3-2. Uric acid stones:-

Some kidney stones are made of uric acid, a waste product normally passed out of the body in the urine. You are more likely to have uric acid stones if you have:

- Low urine output.
- A diet high in animal protein, such as red meat.
- An increase in how much alcohol you drink.
- Gout.

2-1-3-3.Struvite stones:-

Some kidney stones are struvite stones. They can also be called infection stones if they occur with kidney or urinary tract infections (UTIs). These types of kidney stones sometimes are also called stag horn calculi if they grow large enough. Struvite stones can be serious, because they are often large stones and may occur with an infection. Medical treatment, including antibiotics and removal of the stone, is usually needed for struvite stones. Women are affected more than men because of their higher risk of urinary tract infections.

2-1-4-4. Cyctin stone:-

Less common are kidney stones made of a chemical called cystine. Cystine stones are more likely to occur in people whose families have a condition that results in too much cystine in the urine (cystinuria).

2-1-4. Equipment:-

2-1-4-1. historical back ground:-

Computed Tomography (CT) imaging is also known as "CAT scanning" (Computed Axial Tomography). Tomography is from the Greek word *"tomos"* meaning "slice" or "section" and *"graphia"* meaning "describing".(Robert ciemiac 2011)

CT was invented in 1972 by British engineer Godfrey Hounsfield of EMI Laboratories, England and by South Africa-born physicist Allan Cormack Tufts University, Massachusetts. Hounsfield and Cormack were later awarded the Nobel Peace Prize for their contributions to medicine and science. The first clinical CT scanners were installed between 1974 and 1976. The original systems were dedicated to head imaging only, but "whole body" systems with larger patient openings became available in 1976. CT became widely available by about 1980. There are now about 6,000 CT scanners installed in the U.S. and about 30,000 installed worldwide. The first CT scanner developed by Hounsfield in his lab at EMI took several hours to acquire the raw data for a single scan or "slice" and took days to reconstruct a single image from this raw data. The latest multi-slice CT systems can collect up to 4 slices of data in about 350 ms and reconstruct a 512 x 512-matrix image from millions of data points in less than a second. An entire chest (forty 8 mm slices) can be scanned in five to ten seconds using the most advanced multi-slice CT system. (Robert ciemiac 2011)

During its 25-year history, CT has made great improvements in speed, patient comfort, and resolution. As CT scan times have gotten faster, more anatomy can be scanned in less time. Faster scanning helps to eliminate artifacts from patient motion such as breathing or peristalsis. CT exams are now quicker and more patient-friendly than ever before. Tremendous research and development has been made to provide excellent image quality for diagnostic confidence at the lowest possible x.ray dose. Original axial CT image from the dedicated Siretom CT scanner circa 1975. This image is a coarse 128 x 128 matrix; however, in 1975 physicians were fascinated by the ability to see the soft tissue structures of the brain, including the black ventricles for the first time (enlarged in this patiieen t (Robert ciemiac 2011)

2-1-4-2.Spiral CT:-

is a Helical (or spiral) cone beam computed tomography type of Three-dimensional computed tomography (CT) in which the source (usually of X-rays) describes a helical trajectory relative to the object while a two-dimensional array of detectors measures the transmitted radiation on part of a cone of rays emanating from the source. (Avinash c. 2001)

In practical helical cone beam X-ray CT machines, the source and array of detectors are mounted on a rotating gantry while the patient is moved axially at a uniform rate. Earlier X-ray CT scanners imaged one slice at a time by rotating source and one-dimensional array of detectors while the patient remained static. The helical scan method reduces the X-ray dose to the patient required for a given resolution while scanning more quickly. This is however at the cost of greater mathematical complexity in the reconstruction of the image from the measurements. (Avinash c.2001)

2-2. Previous study:-

In study by Yap (2012), it has been shown the abdominal radiography is more sensitive than CT scout film in revealing renal calculi; however there were still some calculi revealed on unenhanced CT scout film, which cannot be seen on either abdominal K.U.B or CT scout radiography

Another study done by hung (2009) demonstrated urolithiases Identified on CT scout film were also seen radiopaque on KUB Radiography, and optimal cut-off value of 630HU are also likely radiopaque.

Another study in 2000 by Assi and et al utilizes a technique of measuring the Hounsfield (HU) value of stone, value below 200HU it will not be Visible on CT-KUB, if it is between 200-300HU, it may be visible, and if the stone is greater than 300HU then it will definitely be visible on KUB.

Another study Johnston (2005), where in stones were seen on 47%(51/108) of the CT scout films and 63% (68/108) of the KUB x.ray finding of this study was that all stones seen on CT scout were also seen on KUB.

Material and Methods

3-1. Materials:-

3-1-1. Equipments:-

CT spiral machine in alamal hospital CT Toshiba 64 slices model aquilion.KV 135, MA 500

3:1:2- Area and duration of the study:-

This study was done in Khartoum state, Alamal National Hospital between January to July 2016.

3-1-3- Study population:-

50 patients who undergone non-contrast helical computed tomography (CT) and abdominal x ray kidney ureter and bladder (KUB) which were carried out on the same day. And their ages between 20-70 years.

3-2.Methods:-

3-2-2. Data collection:-

Was collected by work sheets which contains gender, ages, sizes of stone in kidneys, densities of stone, stone location and number of slice thickness in the kidneys

3-2-3 Data analysis:-

The data analyzed by excel.

3-2-4. Technique:-

CT KUB, patient fasting four hours before exam full ID of patient written and then patient laying supine on ct cutch feet first and his hands above head, move the cutch up until the center of axillary line and then enter the cutch from the top of the kidneys usually aboveT12 to the base of the bladder (symphsis pubis), then scout view or plain done and axial cut with 5mm slice thickness.

The reconstruction of CT KUB with 5mm or less through a limited region with interval 5mm or less. There was in axial, coronal and sagittle view to visualize the kidneys and anatomical structures and pathology like stone.

Plain KUB, patient take euocarbon and castor oil before exam, patient lying supine on x ray table and the image include kidneys, ureters and bladder.

Results

Table 4:1 demonstrate site of stones

	Lower	*Pelvis*	*Mid*	*Upper*
Area	***15***	***12***	***10***	***8***

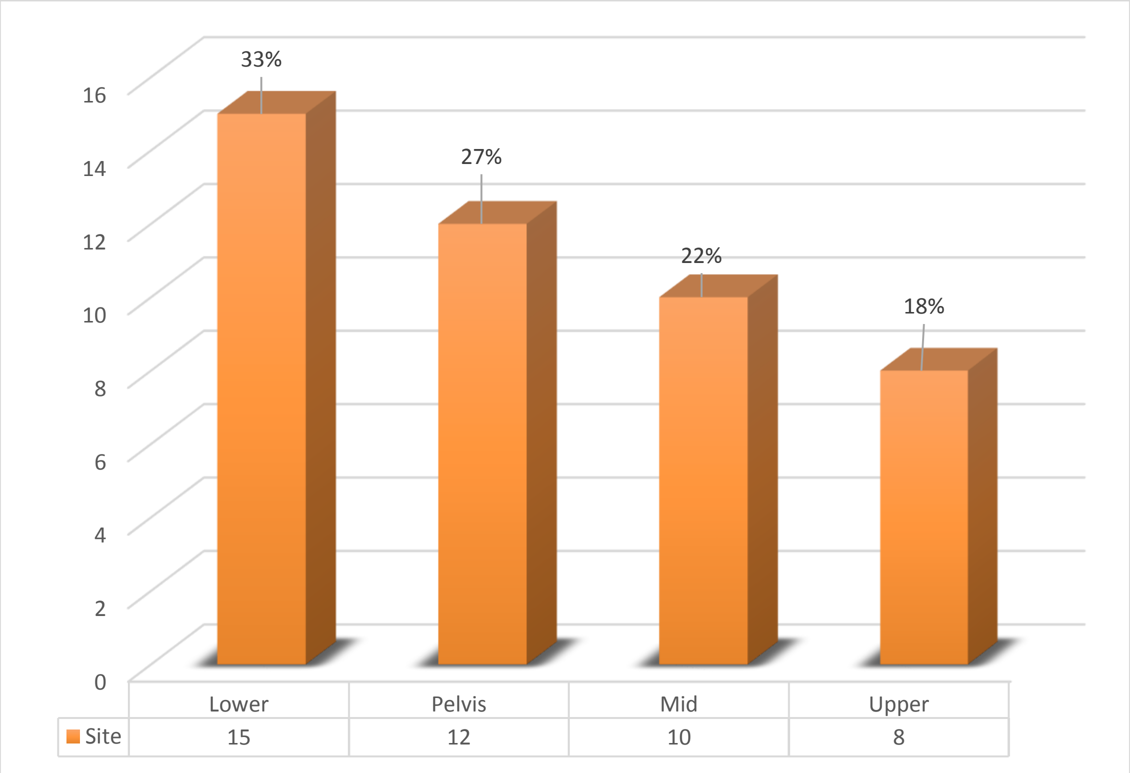

Figure (4.1) shows site of stones in the kidneys

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Table (4:2) demonstrate mean stones density

	Lower	*Pelvis*	*Mid*	*Upper*
Density	***660.7±399.5*** ***(1450 – 220)***	***947.33±364.9*** ***(1541 – 420)***	***720.9±278.5*** ***(1170 - 325)***	***804.62±347.5*** ***(1222 – 303)***

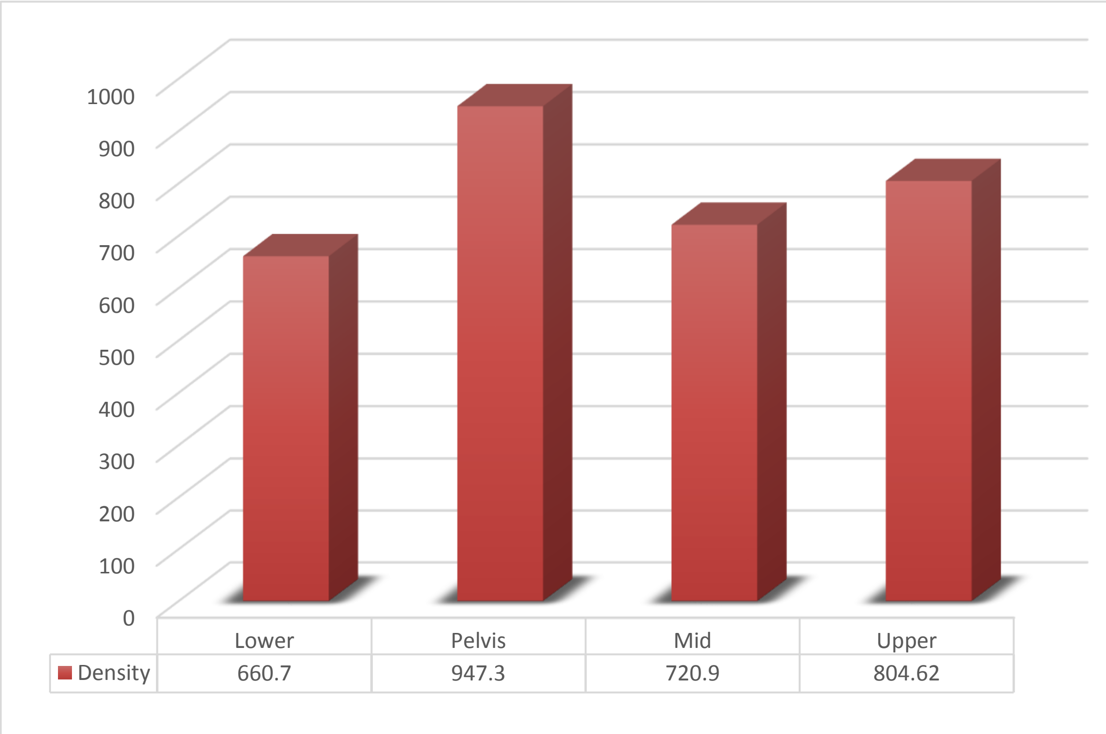


Figure 4-2 shows mean densities

Table (4:3) demonstrates stones size

	Lower	*Pelvis*	*Mid*	*Upper*
Size of stone *mm*	***3.6±1.6 (12 - 3)***	***13.6±1.0 (20 - 5)***	***10.5±1.0 (20 - 4)***	***10.6±0.9 (20- 5)***

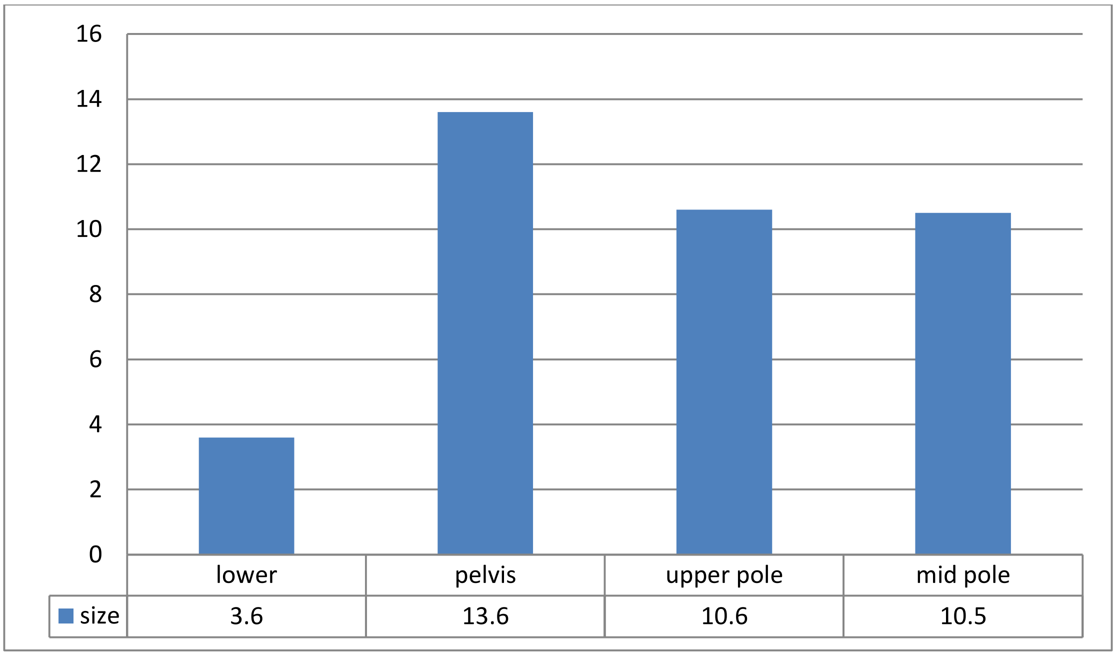


Figure (4-3) shows mean size of stone

Table (4:4) demonstrate mean ages

	Male	*Female*
Age	***44.09±15*** ***(69 - 20)***	***49.3±16.2*** ***(70 - 24)***

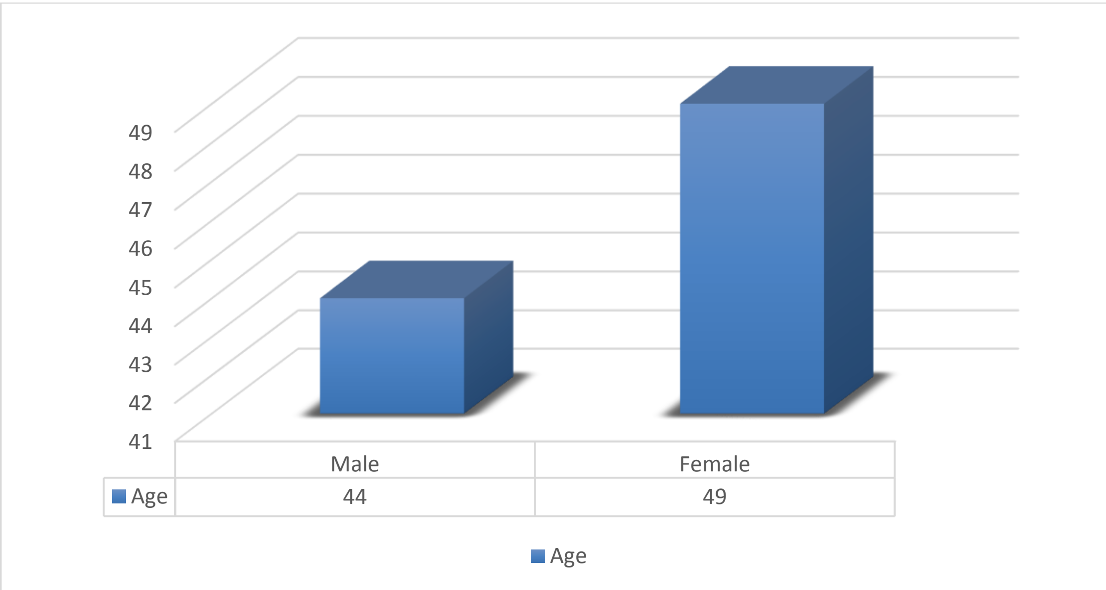


Figure 4:4 shows mean ages

Table (4:5) demonstrate mean stone density in male and female

	Male	*Female*
Density *HU*	***770.37±281.1*** ***(1267 - 420)***	***879.82±375*** ***(1450 - 233)***

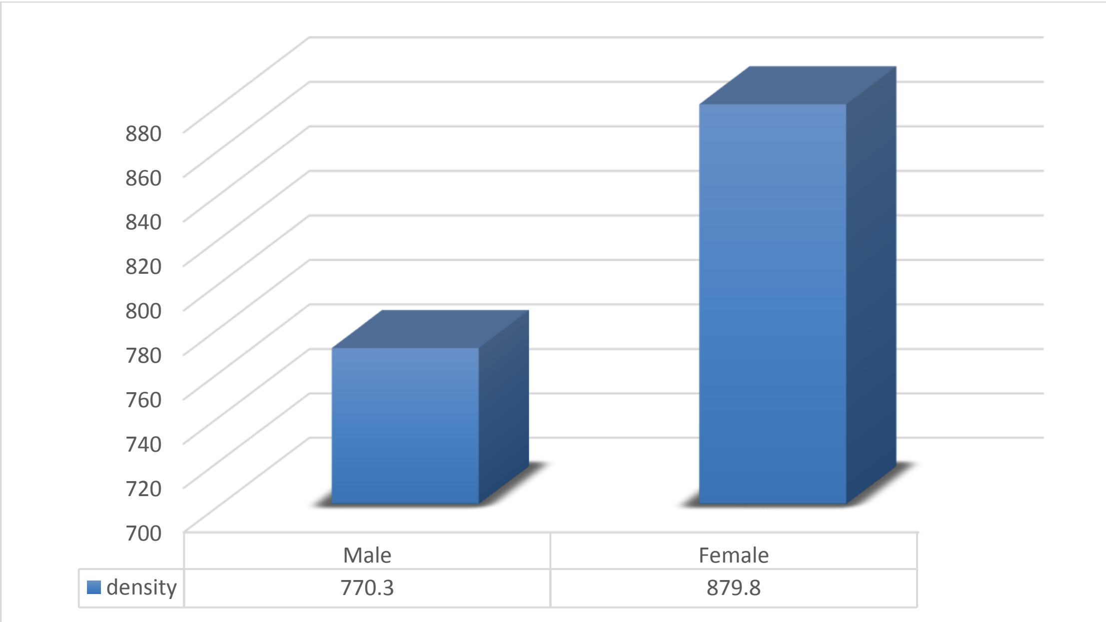


Figure (4:5) shows mean densities

Table (4-6) demonstrates stones frequencies in male and female

	Male	*Female*
	22	***23***

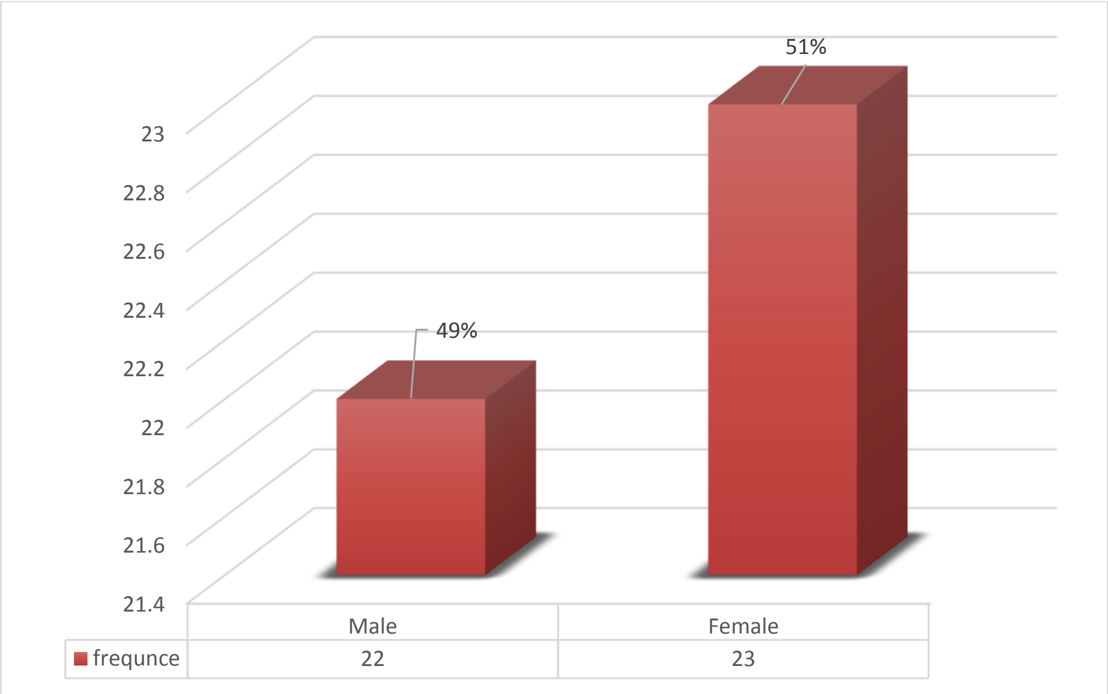


Figure (4-6) shows stone frequency

Table (4-7) demonstrate stone number versus ages

	10 ------29	*30 ------ 49*	*50 ------ 69*	*70 ------ 89*
Lower	***3***	***5***	***6***	***1***
Pelvis	***1***	***6***	***4***	***1***
Upper	***1***	***4***	***2***	***1***
Mid	***2***	***3***	***5***	***0***

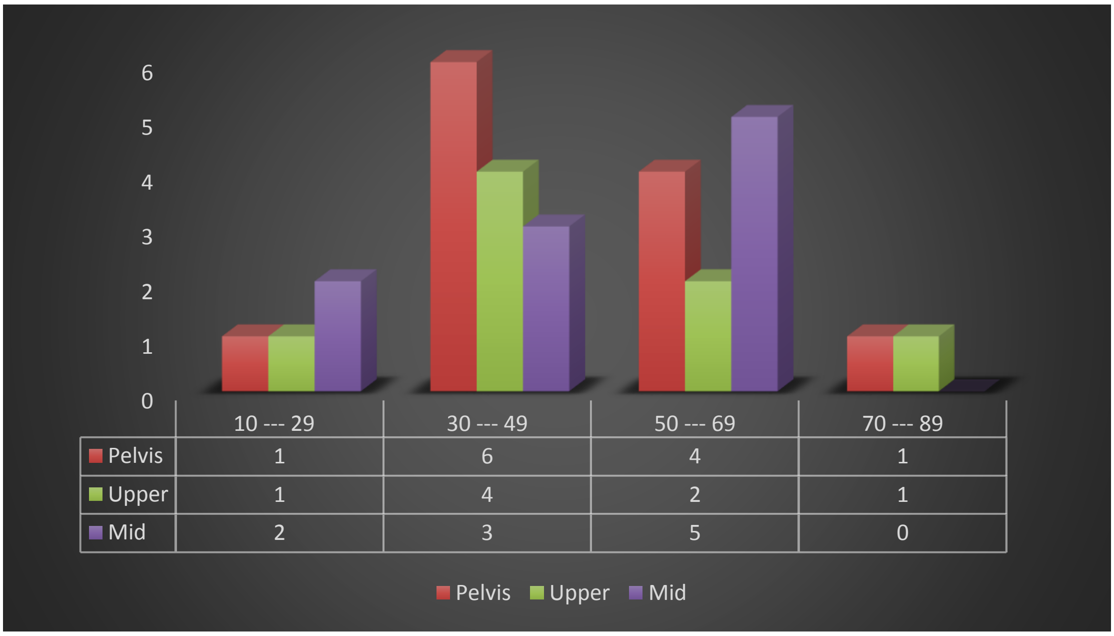


Figure (4-7) shows stone number versus ages

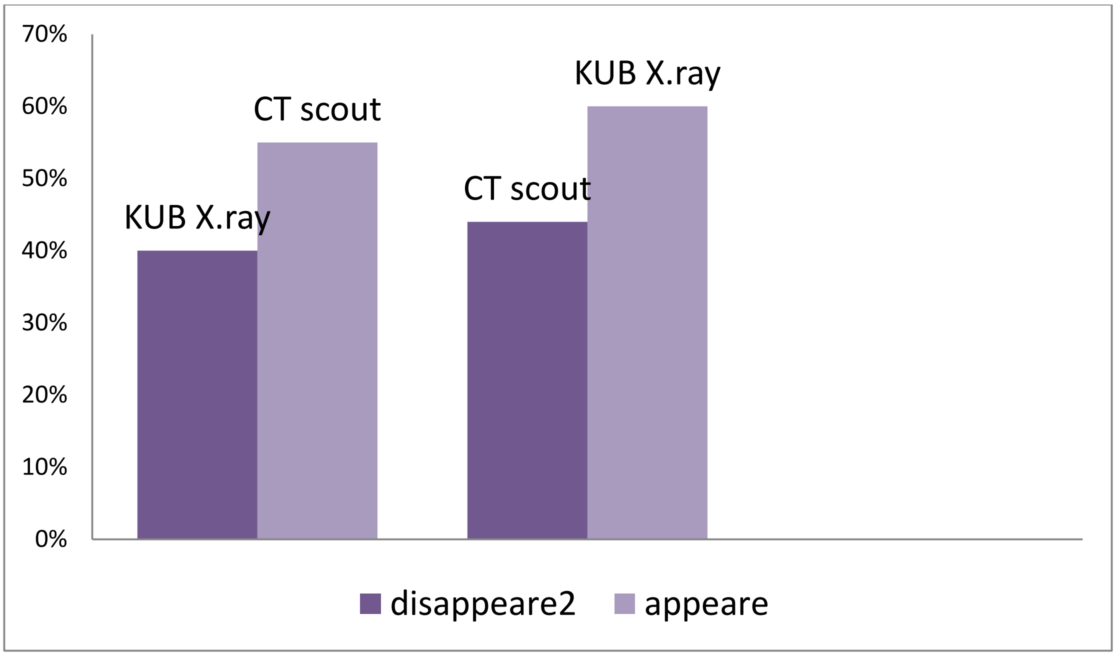
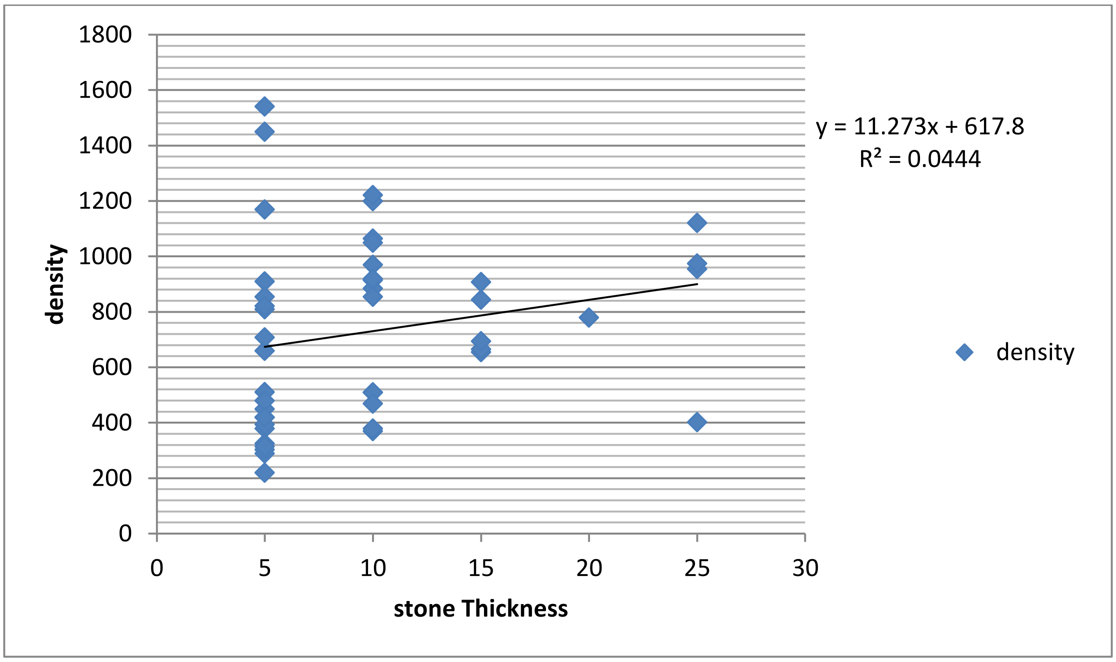


Figure (4-8) appearance of stones on KUB and CT scout film



Graph (4-9) shows stone density versus thick

Discussion, Conclusion and Recommendations

5-1 Discussion:-

Total of 50 valid cases of radiographic studies were included in this Studies to determine the utility of CT non-contrast computed tomography and determination 0f best optimal HU for predication of renal calculi appearance in the KUB. Out of these number 45 cases identified renal stone, 49%(22/45) from the males and 51%(23/45) from females Table (4:6) and their ages between (69-20) from the males and (70-24) from the females Table (4:4). The mean stone density was 783.38HU±271 in all cases, 770.37±281 from the males and 897.82± 375 from the females table (4:5). The high density was indicated in pelvic of the kidney 947.33±36 table (4:2).

In the cases reviewed, nephrolithiases were noted with 33 %(15/45) on lower pole, 27 %(12/45) on pelvis, 22%(10/45) on mid pole and 18%(8/45) on upper pole. And these demonstrated on table (4:1).

In CT scout film stones were seen on 55 %(25/45) and 60 %(27/45) noted in plain KUB. This demonstrated on figure (4:8).

The largest size of the stone indicated in the pelvis of the kidney with high density. Table (4:2) (4:3).

Most of nephrolithiasis seen on CT scout film (25/27) were also seen as opaque on KUB radiograph with sensitivity 92%.

similar to our finding were those of Johnston (2005), where stones were seen 0n 47 %(51/108) 0f the CT scout film and 63 %(68/108) of KUB x.ray, of this study was that all stones on CT scout were also seen in KUB radiograph.

According to graph (4:1) and equation demonstrated that the density increased by 11 density/mm of stone thickness starting from

617HU.this proves that a KUB would need to be performed is if the stone had a range of density starting from 617H,this results were differ from previous study done by hung (2009) demonstrated nephrolithiases Identified on CT scout film were also seen radiopaque on KUB Radiography, and optimal cut-off value of 630HU are also likely radiopaque.

This proves that nephrolithiasis in which attenuation value more than 617HU, patient may be proceed with shock wave lithotripsy or Extracorporeal lithotripsy while those with less than this value, if with no indication for stone removal, Medical dissolution can be offered without need for additional KUB radiograph.

The radiographic records reviewed in this study involved patient with stone measuring 2cm or less because these are cases which can be managed medically depending on the degree radio-opacity of stone. And the thickness was determined by the number of slice thickness. Spiral CT scan detected stone less than 5mm according to mean size (3.6±1.6) mm table (4:3).

According to the figure (4:7) stone affected subjects age between 30 69 Years.

5-2 Conclusion:-

By definition, any stone visible on CT-scout film is likely to be radiopaque regard less of its location. The value at which urinary calculi not identified by CT Scout, but KUB radio graphically opaque is set at 617 HU according to graph4:1 and equation. The CT-scout film with an optimal HU value, when utilized together, can further aid clinicians in deciding the plan of management for patients with nephrolithiasis.

The commitment of technical instructions followed in using of computed tomography (CT) to be high diagnostic value to measure the density and the size of the stone

5:3- Recommendation:-

. The CT-scout film should be viewed before a decision to perform a subsequent KUB X-ray. For stones visible on the CT-scout film, requesting for a subsequent KUB X-ray can be omitted or used only for follow-up. With that, unnecessary radiation exposure can be avoided wherein the diagnosis of nephrolithiasis has already been established; hence, nearly half of the KUB.

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Image (1) Pain KUB and CT reconstruction axial cut demonstrated left renal stone.

Image (2) CT reconstruction coronal cut demonstrated bilateral renal stone

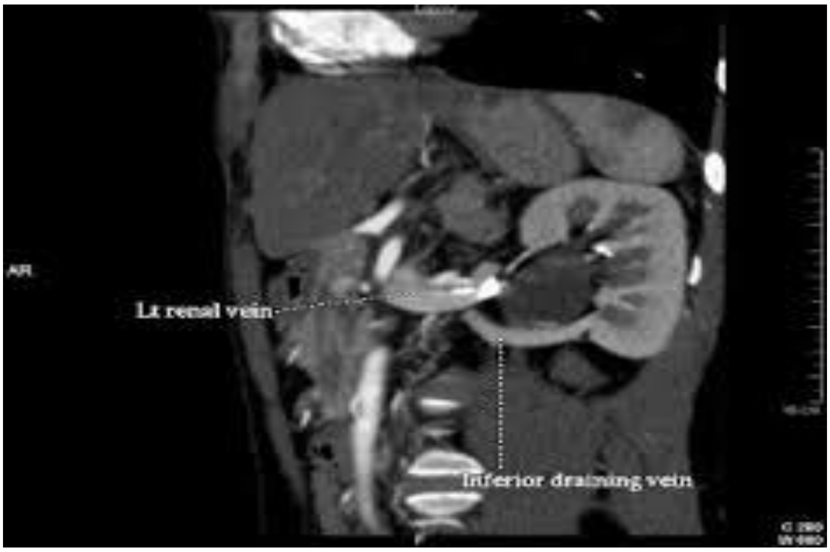

Image 3 CT reconstruction sagittle cut demonstrated renal pelvis stone

Data collection sheets

Gender	Age	Stone size mm	Stone density	Stone site	No of slice thickness