Sudan University Of Science And Technology

College Of Graduate Studies

Detection of Renal Stones Using Ultrasonography Among Salha Population - Omdurman

الكشف عن الحصاوي الكلوية باستخدام التصوير بالموجات فوق الصوتية وسط سكان الصالحه – أم درمان

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الآية

بسم الله الرحمن الرحيم

قال تعالي:

(وَرَفَعَ أَبَوَيْهِ عَلَى الْعَرْشِ وَخَرُّوا لَهُ سُجَّدًا ۖ وَقَالَ يَا أَبَتِ هَٰذَا تَأْوِيلُ رُؤْيَايَ مِن قَبْلُ قَدْ جَعَلَهَا رَبِّي حَقًّا ۖ وَقَدْ أَحْسَنَ بِي إِذْ أَخْرَجَنِي مِنَ السِّجْنِ وَجَاءَ بِكُم مِّنَ الْبَدْوِ مِن بَعْدِ أَن نَّزَغَ الشَّيْطَانُ بَيْنِي وَبَيْنَ إِخْوَتِي ۚ إِنَّ رَبِّي لَطِيفٌ لِّمَا يَشَاءُ ۚ إِنَّهُ هُوَ الْعَلِيمُ الْحَكِيمُ).

صدق الله العظيم

سورة يوسف الآية (100)

Dedication

To my family

For their support and patience, for their love and understanding.

Acknowledgement

I would like to express my appreciation specially to Dr. Ekhlass Abdelasis Hassan Mohammed for supporting and guiding me to accomplish this work. In addition, I am thankful to all staff and doctors of College of Medical Radiological Sciences-Sudan University of Sciences and Technology.

Abstract

This is analytic study conducted in Albalsam medical center in period from September 2018 to February 2019, the problem of study is Renal stones are common complaint in people that lives in salha, many patients complaining loin pain has ultrasound finding of renal stones. This study was conducted to evaluate renal stones in salha. the data was collected from abdominal ultrasound scan Classified and analyzed by stood for statistical package for the social sciences application. The aim of study was study of renal stones in patients living in salha and complaining loin pain, by real-time ultrasonography.

The study found that 18 of 50 patients had positive renal stones which represent (36%), 10 patients ware males (55.6%) while 8 were females which is (44.4%), the renal stones affect males more than females. the most affected age group is (31-40 years) (27.8%), and there is four age group with same percentage (11.1%). Also there is no directional relation between time that patients staying in salha and stone formation the group with higher frequency is (6-10 years) which represent (38.9%). Percentage of Patients that diagnosed for first time were (66.7%) and (83.3%) of patients with negative family history.

In conclusion the study found that the percentage of renal stones in salha population is (36%), and there is no correlation between age or time of staying in salha and stone formation, while the percentages of first time diagnosed patients and negative family history were increased.

ملخص البحث

هذه دراسة تحليليه تمت في مركز البلسم الطبي في الفترة من سبتمبر 2018 الي فبراير 2019 وتكمن مشكلة البحث في ان حصاوي الكلي من الشكاوى الشائعة في منطقة صالحه ولوحظ ان الكثير من المرضي الذين يعانون من الم في الجانب لديهم حصاوي كلويه في فحص الموجات فوق الصوتية. وأجريت هذه الدراسة لتقييم حالات حصاوي الكلي في منطقة صالحه وجمعت البيانات من فحص البطن بالموجات فوق الصوتية تم تصنيف وتحليل البيانات باستخدام برنامج الحزمة الإحصائية للعلوم الاجتماعية وبرزت أهمية البحث في دراسة الحصاوي الكلوية في المرضي الذين يعانون من الم في الجانب ويقطنون في منطقة صالحه باستخدام الموجات فوق الصوتية.

وجدت الدراسة ان 18 مريض لديهم نتائج ايجابيه بالحصاوي الكلوية بنسبة (36%) 10 منهم رجال ويمثلون (55.6%) و8 منهم نساء بنسبة (44.4%) الحصاوي الكلوية تصيب الرجال أكثر من النساء. أكثر فئة عمريه مصابه هي (31-40سنة) بنسبة (27.8%) وهناك أربعة فئات عمريه بنفس النسبة (11.1%). أيضا ليس هناك أي ارتباط مباشر بين الزمن الذي يمكثه المريض في المنطقة وتكوين الحصاوي الكلوية الفئة التي تحمل أعلي تردد هي (6-10 سنين) التي تمثل نسبة (38.9%), نسبة المرضي الذين تم تشخيصهم لأول مرة (66.7%) و (83.3%) هي نسبة المرضي الذين ليس لديهم تاريخ حصاوي كلويه في الأسرة.

خلصت الدراسة الي ان نسبة حالات الحصاوي الكلوية في منطقة صالحه (36%) وليس هناك ارتباط بين العمر او الفترة التي يمكثها المريض في منطقة صالحه وبين تكوين الحصاوي، بينما هناك زيادة في نسبة المرضي الذين تم تشخيصهم لأول مره بالحصاوي الكلوية ونسبة الذين ليس لديهم تاريخ مرضي بالحصاوي الكلوية في الأسرة.

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Chapter one

Introduction

Kidney stone disease is a common clinical problem worldwide, it is basically the formation of stone in the kidney (nephrolithiasis) by the successive physicochemical events of super saturation, nucleation, and aggregation. The stone forms as a result of crystal deposition in the kidneys, and the crystal is formed of components like calcium oxalate, calcium phosphate, calcium carbonate, magnesium-ammonium phosphate, uric acid, and cysteine. (Mitra P, et al 2018).

Nephrolithiasis affects 5-15% of the population worldwide with a recurrence rate higher than 50%. It does not spare any geographical, cultural, or racial group. An increase in nephrolithiasis incidence and prevalence has been observed in the final quarter of the last century in both genders (Prezioso D, Strazzullo P, et al. 2015).

The Afro-Asian stone-forming belt stretches from Sudan, the Arab Republic of Egypt, Saudi Arabia, the United Arab Emirates, the Islamic Republic of Iran, Pakistan, India, Myanmar, Thailand, and Indonesia to the Philippines. The disease affects all age groups from less than 1-year-old to more than 70, with a male to female ratio of 2 to 1. (Hussain et al 1996).

1.2 problem

Renal stones are common complaint in people that lives in salha, many patients complaining loin pain has ultrasound finding of renal stones. This study was conducted to evaluate renal stones in salha.

1.3 Objectives

1.3.1 General objectives

To study renal stones in patients living in salha and complaining loin pain, by real-time ultrasonography.

1.3.2 Specific objectives

1. To assessment the frequency of renal stones in salha.
2. To correlate the age with renal stone formation.
3. To study the association between renal stone formation and time of staying in salha.
4. To evaluate the time of first diagnosis in patients with positive renal stones.
5. To study the effect of family history in patients with positive renal stone.

1.4 Overview of the study

The study divided into brief five chapters. First one contain a brief introduction about main subject of thesis, problems of the study and general and specific objectives. Chapter two hold all theoretical background and previous studies. Chapter three description the materials and methods were use during collecting the data. Then the result coming on chapter four and last chapter contain discussion, conclusion, some recommendations, references and appendices.

Chapter Two

2.1 Theoretical background

2.1.1 Anatomy of urinary system

The urinary system consists of kidneys, ureters, bladder and urethra.

2.1.1.1 Kidneys

The kidneys are situated on either side of the vertebral column, retroperitoneal between the 12th thoracic and 3rd lumbar vertebrae. The left kidney lies slightly superior to the right kidney and it is also slightly longer. The kidneys are bean-shaped, and approximately 10–12cm in length, 5–7cm wide and 2–5cm thick. The blood supply, nerves and lymphatic vessels enter and exit at the hilum. The superior surface of the kidney is capped by the adrenal gland. Each kidney is surrounded by three layers.

(1) Renal capsule: this is a layer of collagen fibres that covers the outer surface of the entire organ.

(2) Fat: this keeps the kidney in place and surrounds the renal capsule.

(3) Renal fascia: this is a dense fibrous outer layer that also secures the kidney to the posterior abdominal wall and to the surrounding structures (Ross et al. 2001).

The kidney itself is made up of two layers, the cortex and the medulla. The cortex is the outer layer and the medulla is the inner layer. Within the medulla there are 8–18 distinct conical or triangular structures called the renal pyramids. The base of each pyramid is turned towards the cortex and the tip of the pyramid is directed towards the renal sinus. The tips of the pyramids are referred to as the renal papillae. The pyramids are separated from each other by bands of cortical tissue called the renal columns. The renal cortex and the pyramids together make up the parenchyma. The parenchyma consists of approximately 1.25 million nephrons, which are the functional units of the kidney as they form urine and help regulate the composition of the blood (Raferty 2000; Tucker 2002; Martini 2004)

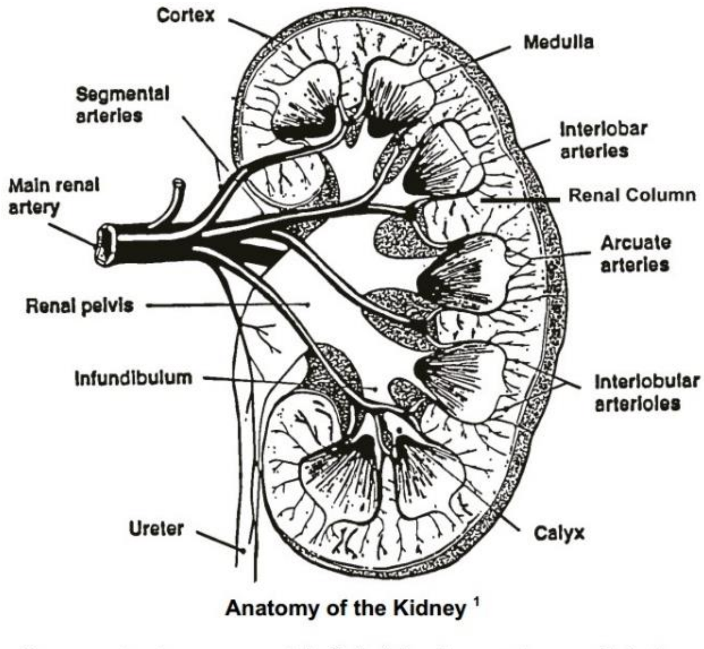


Figure 2.1 Show the kidney gross structure (Devin, 2005).

2.1.1.2 Nephron

The nephron is the functional unit of the kidney. It is responsible for filtration of the blood and for the re-absorption of water and salts and the absorption of glucose. About 1.25 million nephrons can be found in the cortex. The nephron consists of a renal tubule and a renal corpuscle. The tubule is approximately 50mm in length and consists of the convoluted tubule and the loop of Henle. The renal corpuscle is made up of the Bowman's capsule and the capillary network of the glomerulus (Tucker 2002).

2.1.1.3 Blood and nerve supply of the kidney

The right and left renal arteries transport about 20–25% of the total cardiac output and approximately 1200ml will pass through the kidney each minute. As the renal artery enters the renal sinus, it divides into the five segmental arteries, which then subdivide into a series of interlobar arteries that radiate outwards and between the renal columns. At the base of the renal pyramids the arteries arch between the medulla and the cortex and are known as the arcuate arteries. These divide again to form the interlobular arteries. The interlobular arteries enter the renal cortex and become efferent arterioles which deliver blood to the capillaries known as peritubular capillaries. Blood exits the kidney via the peritubular venules which then join the interlobular veins. These drain through the arcuate veins into the interlobar veins, which, in turn, join the segmental veins.

The segmental veins join the renal vein which leaves the kidney at the hilum (Ellis 2004).

2.1.1.4 Nerve supply of the kidney

The nerve supply to the kidneys is from the renal nerves, which are derived from the renal plexus of the sympathetic division of the autonomic nervous system. The nerves enter the kidney at the hilum and run alongside the blood supply to reach the individual nephrons. The nerves regulate the circulation of blood in the kidneys by controlling the size of the arterioles (Martini 2004).

2.1.1.5 Ureters

The ureters are muscular tubes that link the kidneys to the bladder. They are approximately 30cm in length and 3mm in diameter. They consist of three layers: an inner layer of transitional epithelium, a middle layer made up of longitudinal and circular bands of smooth muscle and an outer layer of connective tissue which is continuous with the renal capsule. There are slight differences in the ureters in men and women as they have to accommodate the position of the reproductive organs. The ureters transport urine from the kidneys to the bladder. Urine is forced along the ureter due to peristaltic action. The ureters enter the bladder on the posterior wall and pass into the bladder at an oblique angle. This prevents backflow when the bladder contracts (Ross et al. 2001).

2.1.1.6 Bladder

The bladder is a hollow, muscular organ that collects and stores urine. It is situated in the lower part of the abdomen and is lined with a membrane called the urothelium. The cells of this membrane are called transitional cells or urothelial cells. The bladder wall has three layers: mucosa, submucosa and muscularis. The muscularis is made up of layers of longitudinal smooth muscle with a circular layer sandwiched in between. This muscle layer is known as the detrusor muscle, and it is this muscle that contracts to expel urine from the bladder and into the urethra. The bladder initially stores urine, however, afferent fibres in the pelvic nerves carry impulses to the spinal cord, which, in turn, sends messages to the thalamus and then along projection fibres to the cerebral cortex. At this point you become aware that your bladder requires emptying. The muscle of the bladder can then be contracted to force urine out of the body through a tube called the urethra (Ellis 2004).

2.1.1.7 Urethra

The urethra extends from the neck of the bladder to the exterior of the body. In women, the urethra is a very short tube, in front of the vagina, approximately 4cm in length. In men, the tube is considerably longer, 18–20cm long; it needs to be longer as it has to pass through the prostate gland and the length of the penis. It is made up of stratified epithelium (Ross et al. 2001; Thibodeau & Patton 2002; Martini 2004).

2.1.2 Renal sonography

2.1.2.1 Examination Technique

The examination begins with the patient in the supine position. Scans are performed in the sagittal and transverse planes from the anterior approach using the liver and spleen as acoustic windows. Various maneuvers may enhance demonstration of the kidneys: left lateral decubitus or lateral oblique positions for the right kidney and right lateral decubitus or lateral oblique positions for the left kidney. Coronal longitudinal and transverse scans may also be obtained and are recommended for evaluating the renal pelvis and proximal ureter on hydronephrotic patients. The highest frequency transducer permitting adequate penetration is used. This is usually in the 3 to 5 MHz range. A phased array sector probe with its small footprint permits subcostal and intercostal scanning (Devin, 2005).

2.1.2.2 Normal Sonographic Appearances of Kidneys

The kidney is an ellipsoid structure when demonstrated in its long axis. The capsule is an echogenic white boundary separating the kidney from adjacent structures anteriorly and the musculature posteriorly. Perirenal fat is highly echogenic. The renal cortex is homogeneous, fine textured and poorly echogenic. The cortex is equal to, or less echogenic than the normal liver.The renal columns (septal cortex or columns of Bertin) are the projections of cortex that extend between the pyramids. The columns are sonographically identical to the peripheral cortex.The medulla consists of pyramids which are anechoic structures with their bases adjacent to the renal cortex and their apices directed towards the renal sinus.The renal sinus is the most echogenic portion of the adult kidney. This echogenic area is called the central echo complex. In the nonhydrated state the renal pelvis is collapsed (Devin, 2005).

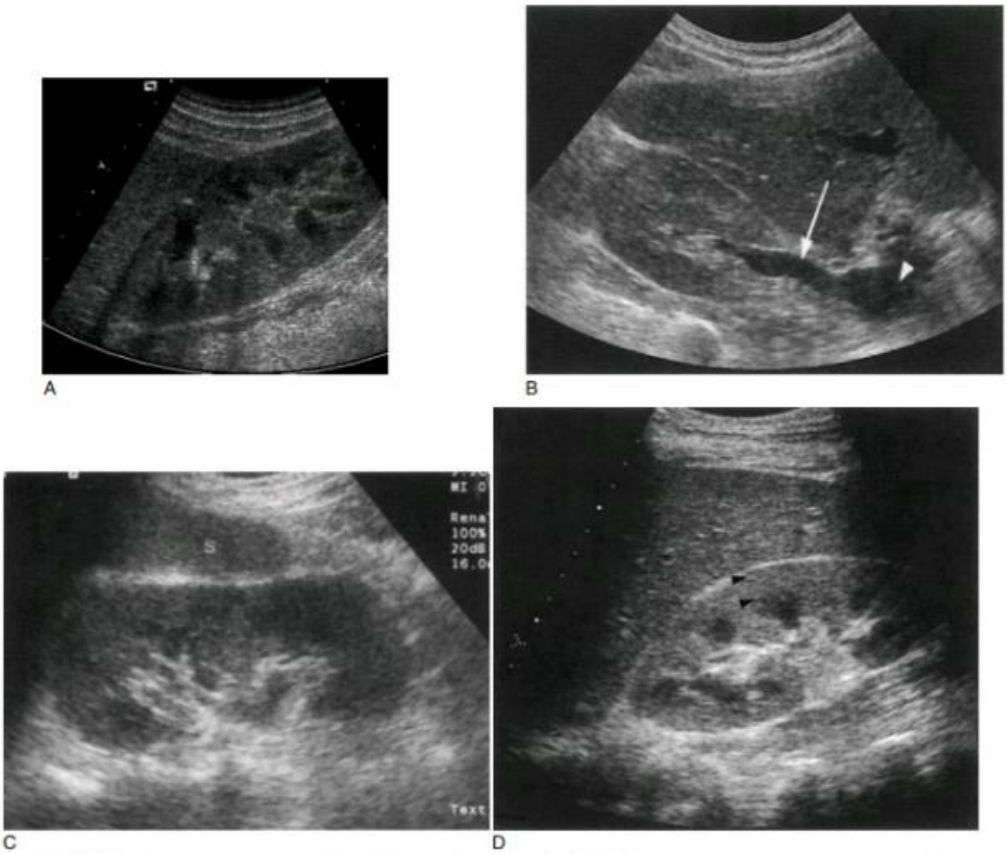


Figure 7.1 (A) Sagittal section through the normal right kidney (RK), using the liver as an acoustic window. The central echoes from the renal sinus are hyperechoic due to the fat content. The hypoechoic, triangular, medullary pyramids are demonstrated in a regular arrangement around the sinus. The cortex is of similar echogenicity to the liver. (B) TS through the hilum of the RK, demonstrating the renal vein (arrow) draining into the inferior vena cava (IVC) (arrowhead). (C) Left kidney (LK) in coronal section. The renal hilum is seen furthest from the transducer (s = spleen). (Compare this with the *sagittal* section of the RK in which cortex is seen all the way around the pelvicalyceal system.) (D) The renal cortex lies between the capsule and the lateral margin of the medullary pyramid (arrowheads).

Figure 2.2 Normal sonographic appearance of right and left kidneys (Jane A. 2004).

2.1.2.3 Normal Renal Measurements

"The size of the kidneys is affected by age, sex (greater in men than in women), and body size; furthermore, the left kidney is slightly larger than the right in most individuals." (Devin, 2005).

The normal renal length in female ranges from 9.5 to 12.1 cm and in males from 10.1 to 12.6 cm. Therefore, the normal adult kidney should measure 9-13 cm in length, 2.5 to 3.5 cm 3 to 4 in thickness and 4 to 5 cm in width (Devin, 2005).

2.1.3 Physiology

The kidneys eliminate water and are therefore the principal means of fluid volume regulation. Many metabolic wastes are eliminated by the kidneys; in particular, urea, uric acid, creatinine and ammonia which are wastes derived from the breakdown of protein. The kidneys also regulate the pH of plasma, the electrolyte pattern of extracellular fluid and play a role in the elevation of blood pressure (Marieb et al,2015).

2.1.3.1 Kidney Physiology

Urine formation and the adjustment of blood composition involve three major processes: glomerular filtration by the glomeruli, and tubular reabsorption and tubular secretion in the renal tubules. In addition, the collecting ducts work in concert with the nephrons to make concentrated or dilute urine (Marieb et al,2015).

1.Glomerular filtration is a passive process in which hydrostatic pressure forces fluids and solutes through a membrane. The glomeruli can be viewed as simple mechanical filters because filtrate formation does not consume metabolic energy. The glomerulus is a much more efficient filter than are other capillary beds. One reason is that its filtration membrane has a large surface area and is thousands of times more permeable to water and solutes. Furthermore, glomerular blood pressure is much higher than that in other capillary beds (approximately 55 mm Hg as opposed to 18 mm Hg or less), resulting in a much higher net filtration pressure. As a result of these differences, the kidneys produce about 180 L of filtrate daily, in contrast to the 2 to 4 L formed daily by all other capillary beds of the body combined. Molecules smaller than 3 nm in diameter such as water, glucose, amino acids, and nitrogenous wastes pass freely from the blood into the glomerular capsule. As a result, these substances usually show similar concentrations in the blood and the glomerular filtrate. Larger molecules pass with greater difficulty, and those larger than 5 nm are generally barred from entering the tubule. Keeping the plasma proteins in the capillaries maintains the colloid osmotic (oncotic) pressure of the glomerular blood, preventing the loss of all its water to the renal tubules. The presence of proteins or blood cells in the urine usually indicates a problem with the filtration membrane (Marieb et al,2015).

2. Tubular reabsorption: is a selective transepithelial process that begins as soon as the filtrate enters the proximal tubules. To reach the blood, reabsorbed substances follow either the transcellular or paracellular route.

In the transcellular route, transported substances move through the luminal membrane, the cytosol, and the basolateral membrane of the tubule cell and then the endothelium of the peritubular capillaries. Movement of substances in the paracellular route between the tubule cells is limited because these cells are connected by tight junctions. In the proximal nephron, however, these tight junctions are “leaky” and allow some important ions (Ca^{2+}, Mg^{2+}, K^+, and some Na^+) through the paracellular route. Given healthy kidneys, virtually all organic nutrients such as glucose and amino acids are completely reabsorbed to maintain or restore normal plasma concentrations. On the other hand, the reabsorption of water and many ions is continuously regulated and adjusted in response to hormonal signals (Marieb et al,2015).

3. Tubular secretion: essentially, reabsorption in reverse. Substances such as H^+, K^+, NH_4^+, creatinine, and certain organic acids either move into the filtrate from the peritubular capillaries through the tubule cells or are synthesized in the tubule cells and secreted. As a result, the urine eventually excreted contains both filtered and secreted substances. With one major exception (K^+), the proximal convoluted tubule is the main site of secretion, but the cortical parts of the collecting ducts are also active (Marieb et al,2015).

2.1.3.2 Blood pressure regulation

Long term regulation of blood pressure predominantly depends upon the kidney. The primarily occurs through maintenance of the extracellular fluid compartment. the size of which depends on the plasma sodium concentration. although the kidney cannot directly sense blood pressure, change in the delivery of sodium and chloride to the distal part of the nephron alter the kidneys secretion of the enzyme rennin. When the extracellular fluid compartment is expanded and blood pressure is high, the delivery of this ions is increased and rennin secretion is decrease. similarly, when the extra cellular fluid compartment is contracted and blood pressure is low, sodium and chloride delivery is decrease and renin secretion is increased in response (Arthur C et al, 2006).

2.1.3.3 Hormone secretion

The kidney secretes a variety of hormones, including erythropoietin calcitriol, and rennin erythropoietin is response to hypoxia (low level of oxygen at tissue level) in the renal circulation is stimulates erythropoiesis (production of red blood cell) in the bone marrow. Calcitriol, the activated form of vitamin D promotes intestinal absorption of calcium and renal re absorption of phosphate, part of rennin- angiotensin-aldosterone system, rennin is an enzyme involved in the regulation of aldosterone levels (Arthur C et al, 2006).

2.1.4 Pathology of the kidney

2.1.4.1 Nephrolithiasis

2.1.4.1.1 Kidney Stone

A stone located in the urinary system is called urolithiasis. Most urinary tract stones are formed in the kidney and course down the urinary tract. Stones consist of a combination of chemicals that precipitate out of urine. The most common chemical found in stones is calcium, along with oxalate or phosphate. Uric acid, cystine, and xanthine can also be found in kidney stones. Kidney stones are one of the most common kidney problems that can occur; they may cause obstruction, and this obstruction can be extremely painful. Most kidney stones are small and can travel through the urinary system without treatment or with increased hydration. Stones that are large and fill the renal collecting system are called stag-horn calculi. Kidney stones that travel down the urinary system may obstruct the ureter in constricted areas. Kidney stones are more common in men. Some people are more likely to form kidney stones than others, and once a kidney stone has formed, the person is at increased risk of getting stones in the future. The initial clinical sign of a kidney stone is extreme pain, typically followed by cramping on the side on which the stone is located; nausea and vomiting may also occur. The pain may subside while the stone is traveling down the ureter. Treatment for stones that cause obstruction varies depending on the size and location of the stone. Treatment can include extracorporeal shockwave lithotripsy (ESWL), percutaneous nephrolithotomy, and ureteroscopic stone removal. Extracorporeal shockwave lithotripsy uses ultrasound or x-ray to locate the stone, and shock waves are used to break up the stone into smaller particles, which can readily pass through the urinary system. Percutaneous nephrolithotomy is a surgical procedure in which an opening is made in the kidney, and a nephroscope is used to remove the stone from the kidney. For mid and lower urinary tract stones, a ureteroscope (which has a basket-like end) can be placed through the urethra and bladder and guided up to the level of the stone to capture and remove the stone. Early treatment of stones that cause obstruction is important to reverse any renal damage that the obstruction may cause (Sandra L, 2012).

2.1.4.1.2 Sonographic Findings of renal stones

Renal stones are highly echogenic foci with posterior acoustic shadowing. When searching for renal stones, the sonographer should scan along the lines of renal fat; usually, stones smaller than 3 mm may not shadow with the use of traditional B-mode. Prominent renal sinus fat, mesenteric fat, and bowel have high attenuation and may appear as an indistinct echogenic focus with questionable posterior acoustic shadowing, making it difficult to differentiate from stones. The use of tissue harmonics can demonstrate the shadowing of small stones measuring millimeters in size. Color and power Doppler have increased the sensitivity of confirming the presence of stones. Color and power Doppler cause a twinkling artifact posterior to the stone. This artifact is referred to as the twinkling sign and is imaged as a rapidly changing mixture of red and blue colors posterior to the stone. If the stone causes obstruction, hydronephrosis will be noted, and depending on the location of the stone, the ureter may be dilated superior to the level of obstruction. The ureter from the ureteropelvic junction to the bladder is not routinely visualized on a sonogram unless dilated. The superior and distal ends of the ureters are more readily visualized than the midsection. The ureters lie in the retroperitoneal cavity and are obscured by bowel gas. Stones can also be imaged when the urinary bladder is distended with fluid (Sandra L, 2012).

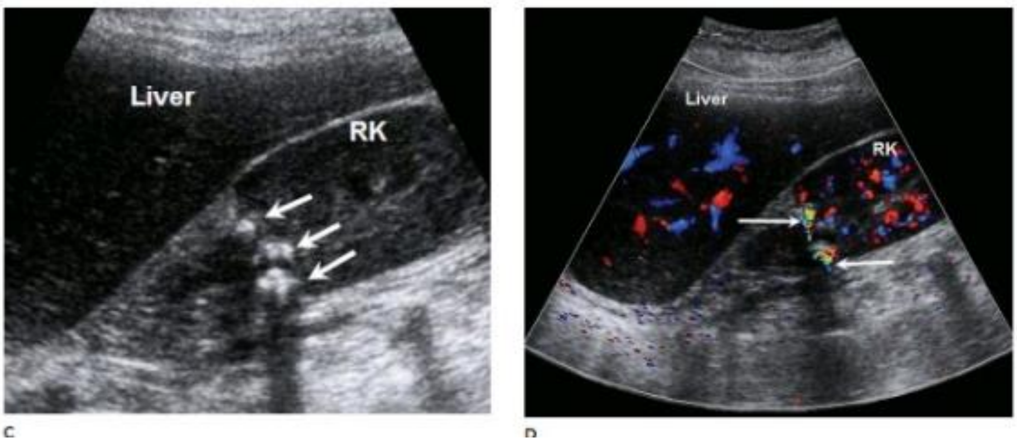


Figure 2.3 sonographic appearance of renal stones in B mode (left) and Doppler (right) (Diane M, 2012).

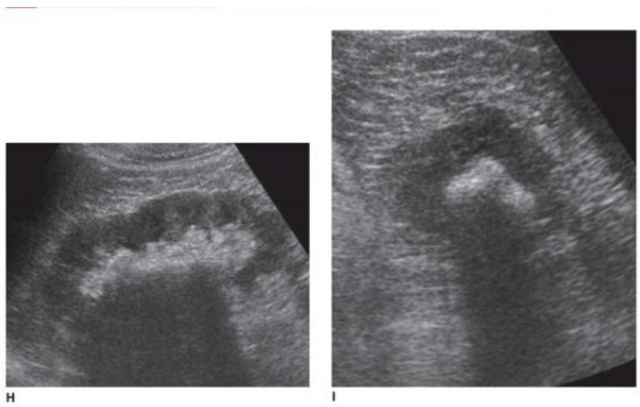


Figure 2.4 sonographic appearance of stag-horn stone (Diane M, 2012).

2.1.4.2 Hydronephrosis

Hydronephrosis refers to dilatation of the renal collecting system most frequently caused by incomplete or complete obstruction(Devin,2005). Hydronephrosis is the separation of renal sinus echoes by interconnected fluid-filled calyces. In 1988, the Society for Fetal Urology proposed the following classification of grading hydronephrosis:

• Grade 1: small fluid-filled separation of the renal pelvis.

• Grade 2: dilatation of some but not all of the calyces; calyx orientation still concave

• Grade 3: complete pelvocaliectasis; calyx orientation changed in convex; echogenic line separating collecting system from renal parenchyma can be demonstrated.

• Grade 4: prominent dilatation of the collecting system, thinning of renal parenchyma, and no differentiation between collecting system and renal parenchyma (Sandra L, 2012).

2.1.4.3 Hydroureter

Is dilatation of the ureter also caused by complete or incomplete obstruction (Devin,2005).

2.1.4.4 Nephrocalcinosis

Nephrocalcinosis is the formation of calcium deposits in the renal parenchyma. It most commonly occurs in the medullary pyramids but calcium salts also may be deposited in the renal cortex - either exclusive of, or in conjunction with, medullary calcification (Devin,2005).

2.1.4.5 Renal cystic disease

2.1.4.5.1 Simple Renal Cysts

These are true cysts that have a serous epithelial lining and are fluid filled, benign cortical masses. They meet all the ultrasound criteria of a simple cyst: they are spherical, anechoic, thin-walled and have accentuated posterior enhancement.

2.1.4.5.2 Atypical Renal Cysts

An atypical renal cyst is any cyst that does not meet the strict criteria of a simple cyst. Many atypical cysts are simple cysts complicated by hemorrhage or infection (Devin,2005).

2.1.4.5.3 Parapelvic Cysts

Parapelvic cysts are cysts of the renal sinus. Most parapelvic cysts are asymptomatic although they may cause hematuria, hypertension, hydronephrosis or become infected. Generally, they are anechoic and exhibit posterior acoustic enhancement(Devin,2005).

2.1.4.5.4 Multicystic Dysplastic Kidney

Multicystic dysplastic kidney disease (MCDK) is a congenital, nonhereditary, cystic renal disease. It is the most common cause of a palpable abdominal mass in a newborn. MCDK is typically unilateral, affecting a single kidney in its entirety, but may be bilateral or segmental (Devin,2005).

2.1.4.5.5 Autosomal Recessive Polycystic Renal Disease (ARPRD)

Autosomal recessive polycystic kidney disease is an inherited disorder characterized by nephromegaly, microscopic or macroscopic cystic dilatation of the renal collecting tubules, and periportal hepatic fibrosis. The renal abnormalities are seen early in life, while the liver pathology becomes predominant with increasing age. ARPRD is associated with pulmonary hypoplasia (Devin,2005).

2.1.4.5.6 Autosomal Dominant Polycystic Renal Disease (ADPRD)

This is an autosomal dominant disorder which often lies latent for many years and then manifests itself in the third, fourth, or fifth decades in what had appeared to abnormal renal parenchyma. ADPRD consists of numerous cystic lesions in an enlarged kidney. It is a slowly progressive bilateral disorder that eventually develops into renal failure when the normal parenchyma is depleted. The disorder was formerly called adult polycystic kidney disease (APKD) (Devin,2005)

2.1.4.5.7 Medullary Cystic Disease

Medullary cystic disease is a hereditary disorder resulting in cysts located within the medullary portions of the kidney. There is a childhood recessive form and an adult dominant form. (Devin,2005).

2.1.4.6 Calyceal Diverticulum

This is an outpouching from the calyx. Stasis of urine may occur predisposing the patient to infection and stone formation. The diverticulum can project into the renal parenchyma (Devin,2005).

2.1.4.7 Neoplasms

2.1.4.7.1 Angiomyolipoma (AML)

AML is a benign solid tumor containing variable amounts of blood vessels (angio), smooth muscle (myo) and fat (lipoma). The sonographic appearances depend upon the predominance of one of the three components. Typically, AMLs are extremely hyperechoic indicating the predominance of fat however, if muscle or vascular components predominate the lesion may be hypoechoic. Shadowing is demonstrated in 33% of AMLs (Devin,2005).

2.1.4.7.2 Oncocytoma

Oncocytoma is a benign solid renal tumor occurring most often in men in their 60's. It is usually asymptomatic and an incidental finding. Sonographically, the tumor is solid, homogeneous and generates low levels of echogenicity. A stellate central hyperechoic scar is seen in about 25% of cases and then only in lesions greater than 3 cm. However, no imaging finding reliably distinguishes this tumor from renal cell carcinoma. Diagnosis is made by surgical excision or biopsy (Devin,2005).

2.1.4.7.3 Renal Cell Carcinoma (RCC)

This is a primary tumor of the renal parenchyma thought to originate from the renal tubular epithelium. It is also called a hypernephroma or a renal adenocarcinoma (Devin,2005). Renal cell carcinomas (RCC) are the most common primary malignant renal parenchymal tumors (86%). These tumors occur most frequently in males between the fifth to the seventh decade. They are usually unilateral and clinically silent until they become large (Devin,2005). The most common presenting complaints are painless hematuria, dull flank pain and palpable mass. Weight loss, malaise and hypertension may also be associated with RCC (Devin,2005).

2.1.4.7.4 Transitional Cell Carcinoma (TCC)

This is a malignancy involving the epithelial lining of the renal collecting system, ureters or bladder. It usually occurs in older age groups between 50 to 70, with a higher incidence in males. Bladder TCC is 50 times more common than renal pelvic TCC because of the large surface area. Painless hematuria is the most common complaint, however if there is ureteral obstruction, there will be flank pain (Devin,2005).

2.2 Previous Studies

2.2.1 Abdalla BA, Ahmed S, et al. evaluate the recurrent urinary tract stones in Sudanese patients,113 patients were seen in soba university hospital and ibn sina hospital, of those 39 gave history of previous nephrolithiasis. The previous stone either passed spontaneously or was removed surgically. A positive family history was considered to be present when at least one of the first degree relatives has experienced a renal stone. All patients were investigated by measurement of serum and urinary acid, Calcium, phosphate, magnesium, zinc, oxalate. Qualitative and quantative stone analysis and urine culture when indicated. Matched controls were biochemically investigated in a similar manner. urinary tract infection is suspected from the history and from urinary examination and confirmed by urine culture.

Result was out of 113 patients studied 39 experienced recurrent renal stones (34.5%). The previous stone either passed spontaneously (48.7%) or was removed surgically (51.3%). There were 23 (60%) males and 16 (40%)females. 35% had a positive family history which is more common in female stone formers than the male stone formers. 82% had urinary tract infection and 12.8% had urinary bilhariasis. The biochemical profile of recurrent renal stone formers compared to non-stone formers showed significantly higher difference in urinary uric acid. Urinary phosphate and urinary zinc. Otherwise there is no significant difference. While serum uric acid, Magnesium, alkaline phosphate, calcium and zinc showed significantly higher difference.

2.2.2 Mitra P, Kumar D, et al study Does quality of drinking water matter in kidney stone disease: A study in West Bengal, India Patients admitted in the Department of Urology, the Institute of Post Graduate Medical Education and Research, Kolkata, West Bengal, India, during April 2013 to April 2017 were recruited as study subjects. The diagnosis of stones was confirmed by plain X-ray film and renal ultrasound. Information about age, gender, residence, daily volume of water intake, and source of drinking water were collected from the study participants through a questionnaire. We also checked the participants' clinical profiles and studied parameters like calcium, oxalate, citrate, potassium, phosphate, and urate from urine samples. Patients with histories of known metabolic, gastrointestinal, renal, or endocrinologic disorders; with excess urinary calcium, oxalate, citrate, or urate. Collection of water samples Water that was being used for drinking purpose, for at least 10 years, was collected in 500-mL high-density, clean and sterile polyethylene bottles from those particular places where we got a maximum number of patients (case areas). We also collected water from the areas where kidney stone occurrence was 0% to 1% (control areas). Analysis of water samples The drinking water samples were analyzed for pH, alkalinity, hardness, total dissolved solutes, electrical conductivity (EC), and salinity. pH was studied because it denotes the acidic load of water and indicates the pollution level. The EC gives an idea about the mineral content and salinity of water, another indicator of the inorganic pollution load of water.

Results of study, a total of 1,266 patients with kidney stones, aged 18 to 75 years and admitted in the Department of Urology, the Institute of Post Graduate Medical Education and Research, Kolkata, from April 2013 to April 2017 were recruited. 781 of the patients, were men (61.7%) and 485 were women (38.3%), indicating an approximate 2:1 sex ratio of men to women. The tendency for stone formation was higher (68.2%) in individuals who had a sedentary lifestyle. In the West Bengal population, the average stone size was from 1 to 3 cm, and stone formation was common in the kidneys, ureter, and urinary bladder. Calcium oxalate, calcium phosphate, and struvite stones were most common in population. however, we focused only on whether there was any association of water quality with kidney stone formation. Keeping in mind the working status, outdoor activities, and daily food habits of the patients and also the climate (subtropical to tropical) of West Bengal, we set a water consumption of 3 L/d as the cutoff value as recommended by the clinician involved in the study. Accordingly, we found that 53.6% of the patients in the present study consumed less than 3 L of water. This observation was similar to our previous finding, in which we did a case-control study and found that the tendency for low water consumption was significantly higher ($p=0.0002$) in patients than in controls. Drinking water in various places in West Bengal was found to be suitable for consumption, and we found no association of water quality with kidney stone occurrence.

Chapter Three

3.1 Materials

The study conducted in Sudan, Khartoum state, salha region in the ultrasound department of Albalsam medical center.

3.1.1 patient

Study includes 50 patients (males and females) that complaining loin pain comes to ultrasound department. from September 2018 to February 2019. The inclusion criteria all patients come with loin pain and living in salha for at least one year. Patients with urinary system anomalies are excluded.

3.1.2 machine

Mindary DP-10 ultrasound machine, convex probe with frequency (3-5MHz).

3.2 Methods

3.2.1 Technique

The machine setting and image parameters was adjusted such as overall gain, focusing, and depth.

3.2.1.2 Right kidney survey

The patient lies supine and place the probe at the right midaxillary line at 11 o'clock use the liver as acoustic window, angling probe slightly posteriorly (toward the kidney). Gently rock the probe (up and down or side to side) to scan the entire kidney, full inspiration to visualize shape and size and echo texture of the kidneys, which allows for subtle movement of the kidney. Obtain longitudinal and transverse sections.

3.2.1.2 Left kidney survey

The patient lies supine or in the right lateral decubitus position coupling gel. Place the probe in the lower intercostal space at 1 o'clock. The placement will be more cephalad and posterior than when visualizing the right kidney. rock the probe to scan the entire kidney. Obtain longitudinal and transverse views Depending on which axis you use to obtain you images, the sonographic shape of the kidney will change. On longitudinal view, the kidney will appear football-shaped and will typically be 9-12 cm in length and 4-5 cm in width (normally within 2 cm of each other). On transverse view, the kidney appears C-shaped. The normal kidney will have a bright area surrounding it which is made, in addition to oblique and prone position were also needed where possible. The sonographic criteria of renal stone are highly echogenic foci with posterior acoustic shadowing.

3.2.2 Image interpretation

The sonographic procedure was performed by two expert sonologists who wrote the final report for every patient and there were no interobserver errors.

3.2.3 The study variables

the population of study will be assessing against Age, gender and time that staying in salha. The data collecting sheet designed especially for the study.

3.2.4 data analysis

the data analysis program used is statistical package for the social sciences (SPSS).

Chapter Four

Results

Table 4.1 show frequency of renal stones

Renal Stone			
	Frequency	Percent	Cumulative Percent
Negative	32	64.0	64.0
Positive	18	36.0	100.0
Total	50	100.0	

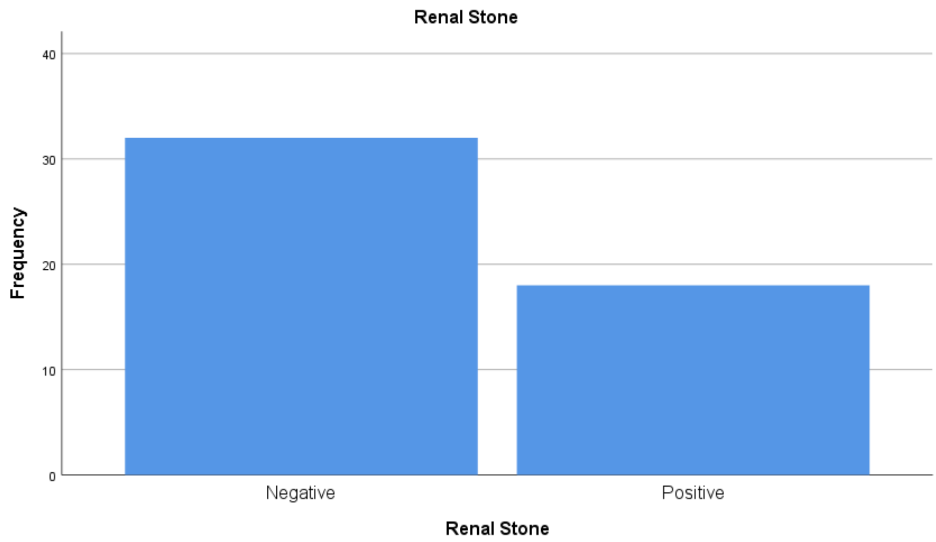
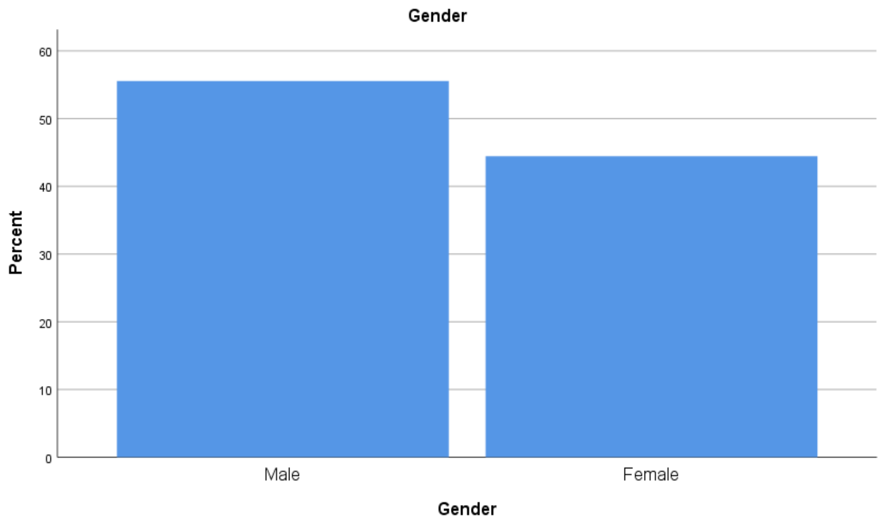


Figure 4.1 represent frequency of renal stones

Table 4.2 show gender frequency

Gender			
	Frequency	Percent	Cumulative Percent
Male	10	55.6	55.6
Female	8	44.4	100.0
Total	18	100.0	



Graph 4.1 represent gender frequency

Table 4.3 show age and stone frequency

Age Interval				
	Interval	Frequency	Percent	Cumulative Percent
1	0-10	1	5.6	5.6
2	11-20	4	22.2	27.8
3	21-30	2	11.1	38.9
4	31-40	5	27.8	66.7
5	41-50	2	11.1	77.8
6	51-60	2	11.1	88.9
7	61-70	2	11.1	100.0
Total		18	100.0	

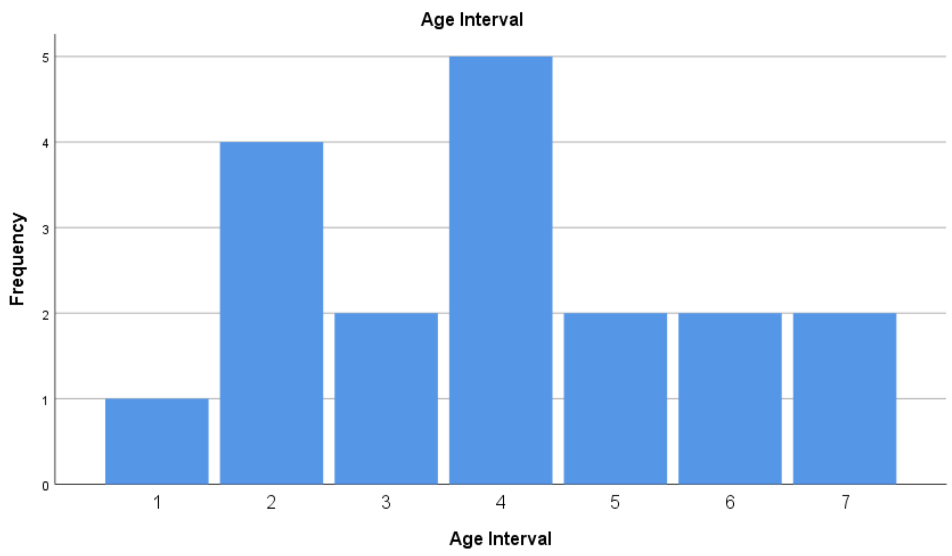
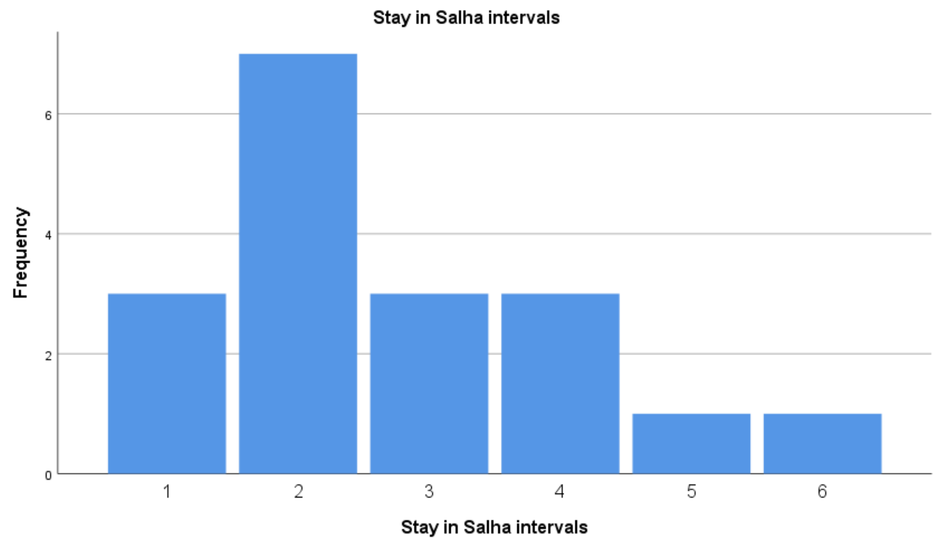


Figure 4.3 represent age groups and stone frequency

Table 4.4 show frequency of renal stone and time staying in salha

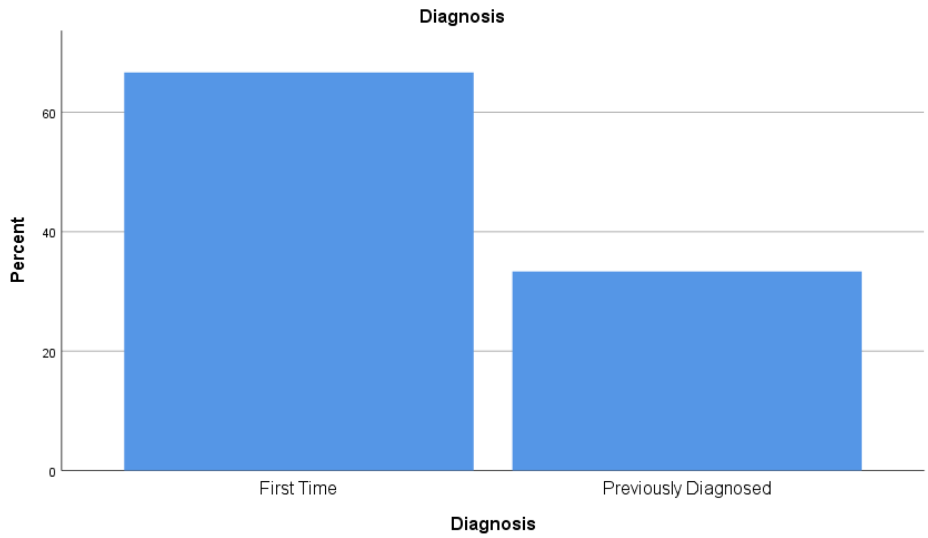
Stay in Salha intervals				
	Interval	Frequency	Percent	Cumulative Percent
1	0-5	3	16.7	16.7
2	6-10	7	38.9	55.6
3	11-15	3	16.7	72.2
4	16-20	3	16.7	88.9
5	21-25	1	5.6	94.4
6	26-30	1	5.6	100.0
Total		18	100.0	



Graph 4.4 represent frequency of renal stone and staying in salha

Table 4.5 Show time of Diagnosis

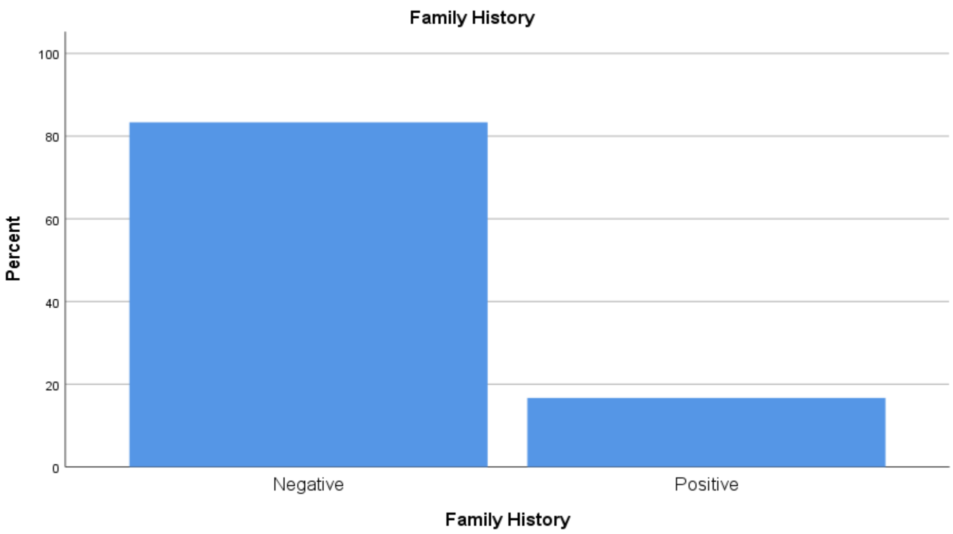
Diagnosis			
	Frequency	Percent	Cumulative Percent
First Time	12	66.7	66.7
Previously Diagnosed	6	33.3	100.0
Total	18	100.0	



Graph 4.5 represent time of diagnosis

Table 4.6 show family history in positive renal stone patients

Family History			
	Frequency	Percent	Cumulative Percent
Negative	15	83.3	83.3
Positive	3	16.7	100.0
Total	18	100.0	



Graph 4.6 represent family history in positive renal stone patients

Chapter Five

Discussion, conclusion

5.1 Discussion

This study was carried out in 50 patients 18 of them had positive renal stones which represent (36%) and 32 had negative renal stones which is (64%) show (Table 4.1) (Figure 4.1).

Regarding the gender 10 patients had positive renal stones ware males (55.6%) while 8 were females which is (44.4%), the renal stones affect males more than females, this result as the same results as Abdalla BA, et al. 1996. And Mitra P et al, 2018 (Table 4.2) (Figure 4.2).

The data collected from people ages range from 10 to 70 divided to intervals, the most affected age group is (31-40 years) (27.8%), study found that there was no strong correlation between age and stone formation (Table 4.3) (Figure 4.3).

On this study there is no directional relation between time that patients staying in salha and stone formation the patient data ranges from 2 to 30 years of staying divided to groups of 5 intervals, the group has higher frequency is (6-10 years) which represent (38.9%) (Table 4.4) (Figure 4.4).

According to this study we observed that 12 patients (66.7%) were first time diagnosed as a positive renal stone and 6 patients (33.3%) diagnosed previously, two third of patients are new cases (Table 4.5) (Figure 4.5).

Regarding the family history 15 patients had negative family history (83.3%), 3 patients had positive family history (16.7%) this result was mismatch with the study which done by Abdalla Ba, et al. 1996. Which found (35.8% had positive family history) (Table 4.6) (Figure 4.6).

5.2 Conclusion

Study of renal stone in salha region using ultrasonography found that (36%) had positive renal stones in abdominal ultrasound scan, males affected more than females (55.6%), (44.4%) respectively. It is not the quality of water, rather the quantity of water consumed that matters most in the occurrence of nephrolithiasis.

On this study the most affected age group is (31-40 years) which represent (27.8%) and there are four age groups with same percentage (11.1%) that means there is no correlation between positive renal stone frequency and patients age, also there is no directional relation of time that patients staying in salha and stone formation, most affected group which stay for (6-10 years).

This study found that there are 12 patients (66.7%) were first time diagnosed as a positive renal stone and recurrent renal stone were 6 patients (33.3%).

Study of family history showing the negative family history were 15 patients which represent (83.3%) which mismatching the previous studies in Sudanese people, this result and the percentage of new cases (66.7%) indicate there were increased number of first time affected patients, Therefor Routine ultrasound screening is advisable to detect the renal stone and avoid the progression of complication.

5.3 Recommendations

- Daily intake of suitable liquid volume (minimum 2L water\day).
- Avoid strictly vegetarian diets.
- Avoid excessive animal protein diets.
- Avoid excessive salt (NACL) diets.

References

Abdalla BA, Ahmed S. recurrent urinary tract stones in Sudanese patients. Sudan medical journal. 1996; 34:36-38.

Arthur C, John E. Textbook of medical physiology. 11th edition. Pennsylvania: Elsevier, 2006.

Devin D. Abdominal Ultrasound and instrumentation. Part1. Module2. 1st ed. The burwin institute of diagnostic medical ultrasound. Canada: Luneburg; 2005.p. 23-27.

Diane M. Kawamura, et al. Diagnostic Medical Sonography Abdomen and Superficial Structures. Third Edition. Baltimor: Julie K. Stegman, 2012.

Ellis H. Clinical Anatomy. A Revision and Applied Anatomy for Clinical Students. first edition. Oxford: Blackwell Science, 2004.

Grases F, Costa-bauza A, preito R. Renal lithiasis and nutrition. Nutrition Journal 2006; 5: 1-7.

Hussain, M., M. Lai, B. Ali, S. Ahmed, N. Zafar, A. Naqvi, and A. Rizvi. “Management of Urinary Calculi Associated with Renal Failure.” Journal of the Pakistan Medical Association. 1996:45 (8): 205–8.

Jane A. Abdominal Ultrasound How, Why and When. 2nd ed. Philadelphia; Elsevier, 2004.

Marieb E, Hoehn K. Human anatomy and physiology, 10^{th} ed. Pearson:2015.

Martini F. Fundamentals of Anatomy and Physiology. second edition. San Francisco: Benjamin Cummings, 2004.

Mitra P, Kumar D. Does quality of drinking water matter in kidney stone disease: A study in West Bengal, India. ICurology. 2018; 59:158-165.

Prezioso D, Strazzullo P, et al. Dietary treatment of urinary risk factors for renal stone formation. A rchivio Italiano di Urologia e Andrologia 2015; 87, 105-120.

Raferty A. Applied Science for Basic Surgical Training. Fourth edition. Edinburgh: Churchill Livingstone, 2000.

Ross J, Wilson R, Waugh A. Ross and Wilson Anatomy and Physiology in Health and Illness. 10th edithion. Edinburgh: Churchill Livingstone, 2001.

Rumack CM, Wilson SR, Charboneau JW, LevineD. Diagnostic ultrasound. 4th ed. Philadelphia: Elsevier mosby, 2011.

Sandra L. Textbook of diagnostic sonography. 7th edition. St. Louis, Missouri: Elsevier, 2012.

Thibodeau G, Patton KT. Anatomy and Physiology. 5th edition. New York: Mosby, 2002.

Tucker L. An Introductory Guide to Anatomy and Physiology. revised edition. Cambridge: Holistic Therapy Books, 2002.

Appendices

Appendix 1: Data collecting sheet

No	Age	Gender	Renal stone	Family history	Time of staying in salha	Diagnosis
1						
2						
3						
4						
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Appendix2: Some images of research

Figure A.1 Represent Rt kidney renal stone

Figure A.2 Represent Lt kidney stone

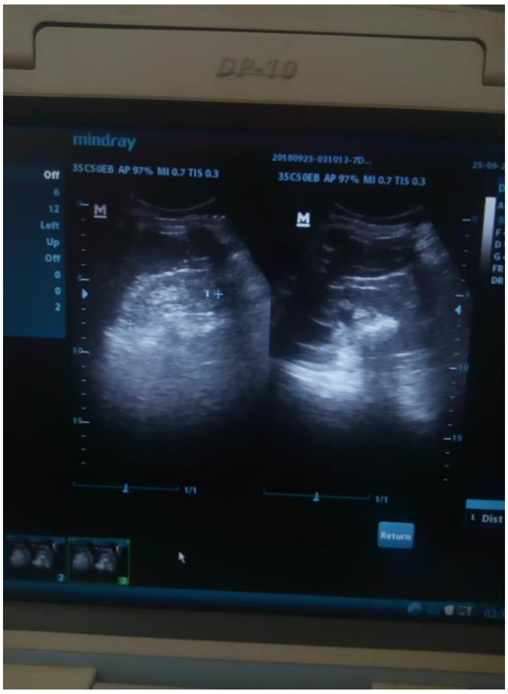

Figure A.3 Represent Rt kidney renal stone

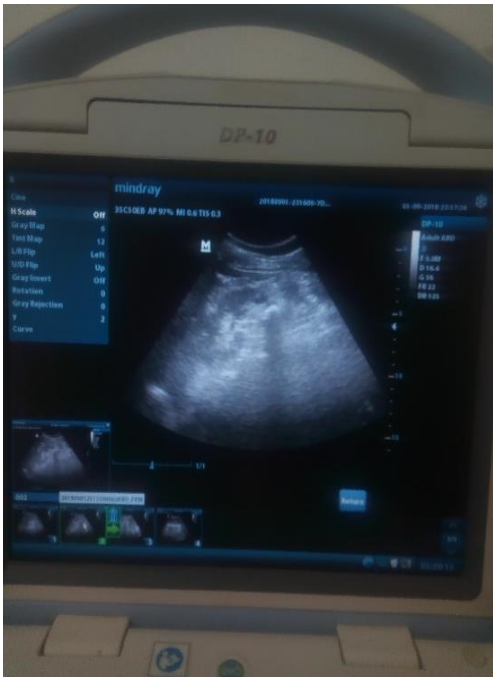

Figure A.4 Represent Lt kidney stone