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FREQUENCY OF HYDRONEPHROSIS ASSOCIATED WITH NEPHROLITHIASIS IN HAYATABAD MEDICAL COMPLEX, PESHAWAR (A SONOGRAPHIC BASED STUDY)

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Abstract

Background: *Hydronephrosis is a condition where renal pelvis and calyces become swollen or enlarged, is a significant health concern that can result from nephrolithiasis (kidney stones). The research study aimed to assess the frequency of hydronephrosis in conjunction with nephrolithiasis and to evaluate the use of sonography as a diagnostic tool.*

Methodology: *A cross-sectional descriptive study was carried out at Hayatabad Medical Complex, Peshawar. A total of 272 patients who underwent abdominal ultrasound for suspected nephrolithiasis were included. The study involved a comprehensive analysis of ultrasound reports to determine the presence and grade of hydronephrosis and size and location of nephrolithiasis.*

Results: *Out of 272 patients, 62 (22.8%) had both hydronephrosis and nephrolithiasis visualized on ultrasound. The majority of stones were observed in the size range of 7-12mm. No significant correlation was found between stone size or location and the presence of hydronephrosis. Gender distribution showed a higher incidence in males, and the 21–40 years age group was most affected.*

Conclusion: *Sonography proved effective in identifying nephrolithiasis and hydronephrosis, indicating a higher prevalence of both conditions in males and the specified age group. The study underlines the importance of ultrasound in diagnosing renal conditions, which could lead to timely and appropriate management of patients.*

INTRODUCTION

Hydronephrosis is the enlargement or dilatation of the kidney pelvis and calyces as a result of obstruction of the urinary tract [2]. It is a common condition affecting individuals of all ages and caused by both intrinsic and extrinsic obstruction [3]. Hydronephrosis most commonly occurs due to intrinsic obstruction such as kidney stones, tumors, congenital abnormalities, or urinary tract infections. When renal calculi obstruct the urinary tract, they can lead to the development of hydronephrosis [4]. Despite of the location, large stones most probably cause hydronephrosis [6]. Understanding the frequency of hydronephrosis due to kidney stones in the general population are crucial for effective management and prevention of complications [7].

Causes

The most prominent causes of postnatal hydronephrosis in newborns are UPJ blockage and intermittent (transient) hydronephrosis [1]. There are numerous causes of hydronephrosis in children and adults: Congenital anomalies, tumors, renal and ureteric stones, UTIs, fibroepithelial polyps, POP, neuromuscular problem, post-operative/inflammatory/ischemic stricture, malignancy, pregnancy, BPH, and adhesions [2,3,4].

In men, BPH is the most prevalent cause of hydronephrosis, whereas in women, pregnancy is a natural cause of hydronephrosis caused by excessive amounts of circulating progesterone [3]. Overall, the prevalent and leading cause of hydronephrosis in young adults after ureteric stone is renal calculi and has prevalence of 23%. [5].

Sign and Symptoms

Hydronephrosis can be symptomatic or asymptomatic [4]. Flank pain, or pain and discomfort in groin area or on the rear and side of the abdomen, is a common symptom contributing 26% [4-8]. Additionally, individuals may experience symptoms such as vomiting, nausea, pain during urination, increased frequency and urgency of urination, elevated body temperature, involuntary urine leakage (incontinence), and the sensation of incomplete urination [8]. Flank pain, or pain in the side of the body, is the primary symptom of hydronephrosis, in contrast to conditions such as inflammation in the urinary tract, blood in the urine (hematuria), and kidney problems. The symptoms vary depending on the type and degree of urinary obstruction [6]. Newborns diagnosed with congenital hydronephrosis might not display noticeable symptoms, although in more severe cases, they could exhibit reduced appetite and experience recurrent urinary tract infections (UTIs) [7].

Complications

- **Urinary Tract Infection (UTI):** It is a common complication of hydronephrosis. When there is an obstruction in the urinary tract, stagnant urine can become a breeding ground for bacteria, increasing the risk of infection. UTIs can lead to discomfort, pain, and if not treated on time, can progress to more severe infections such as pyelonephritis, which is an infection of the kidneys themselves [7].
- **Post Obstructive Diuresis:** Post-obstructive diuresis is a phenomenon that occurs after the obstruction is relieved. It refers to an excessive production of urine by the kidneys as they attempt to eliminate the accumulated waste and excess fluid. This can lead to significant fluid and electrolyte imbalances and can be particularly concerning if not managed appropriately, especially in cases of severe or chronic obstruction [7].
- If hydronephrosis isn't treated, it can lead to serious problems, including sudden and long-term kidney failure [5].

Anatomy of Kidney

The kidneys are retroperitoneal organs located on the posterior abdominal wall, one on each side of the spinal column from T12 to L3. Each kidney is covered with a tough outer layer called the renal capsule, which helps protect its sensitive inner parts. Inside the kidney, there are multiple pyramid or cone-like sections. The kidney consists of two main areas: the outer part called the renal cortex and the inner part called the renal medulla [9].

The cortex contains various structures like renal corpuscles, convoluted and straight tubules, and vasculature. The medulla consists of structures like medullary rays, which extend from the medulla into the cortex, as well as pyramids, which are cone-shaped structures. Nephrons are the functional units of the kidneys. They filter the blood and produce urine.. There are about 2 million nephrons in each adult kidney [10].

Poles of the Kidney

The kidneys are divided into two poles:

1. **Upper Pole:** The upper pole of each kidney is positioned closer to the midline of the body by about 2 centimeters than the lower pole. The meeting point of the lateral and medial borders of the kidney defines the upper pole. This border is smoothly rounded and extends towards the upper pole. The upper pole's positioning is essential to consider during medical procedures involving the kidneys.

2. **Lower Pole:** The lower pole of the kidney is located farther from the midline than the upper pole. Similar to the upper pole, it is formed at the junction of the lateral and medial borders of the kidney. The

lateral border's smooth and rounded contour continues towards the lower pole. Understanding the distinct features and positions of the upper and lower poles is crucial for performing procedures like percutaneous and endoscopic renal interventions [9].

Pelvicalyceal System

The renal collecting system or pelvicalyceal system is composed of the minor calyx, the major calyx, the renal pelvis, and the ureter. The minor calyces join forces with their neighbors to produce two or three bigger chambers known as the main calyces. The main calyces lead into a funnel-like structure known as the infundibulum. Usually, two of these structures join to create the renal pelvis, with one coming from the upper part and another from the lower part of the kidney. Sometimes, there's an additional one for the middle part of the kidney. The renal pelvis narrows down near the lower end of the kidney and then becomes the ureter [11].

Size and Structure

The kidneys are bean-shaped organs with the normal length of 10-12cm, 6 cm width and 3cm thickness. The right kidney usually sits a bit lower than the left one because of the liver's position. The size of an adult's kidney can differ based on their age and height. Generally, each kidney is about as big as a fist when it's closed [9,12].

The size of the kidneys varies between males and females. In males, the kidneys are generally larger, weighing around 150 to 200 grams. In females, the kidneys are slightly smaller, with a weight of about 120 to 135 grams [10].

Blood Supply

The kidneys get more than 1 liter of blood every minute, accounting for more than 20% of total cardiac output. Usually, each kidney gets blood from a single renal artery. These arteries, one for each side, start from the lateral part of the abdominal aorta. They are located between the first and second lumbar vertebrae (L1 and L2), slightly lower than the initial point of the superior mesenteric artery [9,13]. The right renal artery emerges from the aorta slightly superior and passes behind the inferior vena cava (IVC) [10]. Near the hilum, each renal artery divides into five segmental arteries [13].

The renal veins lie anteriorly to the renal arteries and arise from small branches leaving the hilum [3]. The renal veins run medially to drain into the inferior vena cava [9]. The vein connected to the left kidney is longer, Because of where the inferior vena cava is located [13]. The left vein receives the left gonadal, suprarenal, and inferior phrenic veins. Lumbar veins often merge with it. On the right, gonadal and renal veins typically join the inferior vena cava [10].

Function Of Kidney

The kidneys serve as vital organs responsible for a range of essential functions, including waste filtration, electrolytes and blood pressure regulation, acid-base balance, fluid balance, reabsorption and secretion, and hormone production [10]. However, their primary role is the removal of metabolic waste products in the form of urine [14]. These functions collectively contribute to maintaining overall homeostasis and ensuring the proper functioning of various physiological processes within the body [10].

The high pressure caused by hydronephrosis might harm kidney function if it's not reduced soon enough [5].

Diagnosis Of Hydronephrosis

For Initial diagnosis of hydronephrosis, do a thorough check of the patient's abdomen and ask about their medical history. Feel for any unusual lumps, large organs, or signs of past surgeries. Gently tap and feel the bladder area to see if it's too big or causing any pain, and check if the kidneys seem larger than normal. Measure the blood pressure and check for signs of too much fluid in the body. Look at the external genital area. For men, also do an internal check through the rectum. For women, a specialized doctor should examine the genital area, but this is usually not needed [3].

Assessing the existence, causes, and extent of obstruction typically requires the use of radiographic investigations, and in certain instances, evaluations involving radionuclide and urodynamic assessments may also be employed [15].

Ultrasonography (US) and computed tomography (CT) are the initial imaging modalities to be used when there is a suspicion of dilatation. Doppler US (CDUS) distinguishes between genuine obstructions in order to boost the sensitivity of the US. CTU and MRU are essential imaging techniques. However, invasive endoscopic diagnostic techniques may also be necessary [16].

Magnetic Resonance Urography (MRU) is a valuable and recommended diagnostic approach for significant hydronephrosis accompanied by compromised renal function. This is particularly relevant in cases involving bilateral hydronephrosis, duplex systems, or fusion anomalies. MRU has superseded conventional diagnostic techniques in these scenarios [1].

Before the invention of ultrasound, the diagnosis of hydronephrosis required retrograde pyelography or intravenous urography (IVU), which are more invasive procedures [16]. Intravenous urography (IVU) stands as the preferred technique for identifying hydronephrosis. It allows for the assessment of expansion, visualization of the obstruction's level, and occasionally the determination of the obstruction's nature [17].

In many clinical contexts, sonography has now taken the place of these procedures as a screening tool for evaluating potential hydronephrosis [16].

Ultrasound is considered as the screening test of choice for the diagnosis of hydronephrosis with accuracy of 85.2% [17].

Ultrasound

In the last decades, the diagnosis rate of hydronephrosis has increased due to the widespread use of ultrasound imaging for the detection of renal disorders [18]. Ultrasound (US) is extensively used, easily available, radiation free and non-invasive imaging modality. It is quite helpful in finding and grading hydronephrosis, showing the length, size, and parenchyma of kidneys and anatomy of bladder [19-20].

Kidney stones can be easily detected with ultrasound imaging [18]. The stones are identified as acoustic sharp shadowing [5]. With an efficiency of up to 81.3% and 57.3%, ultrasound can detect ureteric stones with and without hydronephrosis. Although ultrasound imaging is not as effective as computed tomography (CT) when it comes to finding stones, it is nonetheless advised as the primary imaging modality, particularly in pregnant and pediatrics [18].

With ultrasonography, it is typically possible to distinguish between the dilated calyces and the dilated pelvis in hydronephrosis, which shows as an anechoic fluid-filled area with enlarged renal sinus [12].

Grading of Hydronephrosis

Based on the maximum calyceal diameter, hydronephrosis can be categorized as mild, moderate, or severe hydronephrosis following diagnosis [21].

There are four categories of HN, according to the Society of Fetal Urology (SFU) categorization system:

Grade-1: Renal pelvis dilatation only (mild hydronephrosis).

Grade-2: The renal pelvis and major calyces' dilatation (mild hydronephrosis).

Grade-3: Renal pelvis and both major and minor calyces' dilatation (moderate hydronephrosis).

Grade-4: Severe renal parenchyma thinning and dilatation of the renal pelvis and all calyces (severe hydronephrosis) [19-4].

The SFU classification system is not only for children but for adults as well. This system is reliable because different people can use it and get similar results. It's especially useful for evaluating newborns with hydronephrosis (HN) [19]. In pregnancy, moderate and severe cases of hydronephrosis are important because they often come with noticeable symptoms [21].

The size of the stone was the only factor strongly linked to severity of hydronephrosis. Bigger stones were more likely to lead to hydronephrosis and also tended to cause more severe cases of it. Surprisingly, where the stone was located did not influence whether or not hydronephrosis occurred [22].

The likelihood of finding stones was higher in grades 1 to 3, but then it decreased in grade 4. This ecrease in grade 4 might be because of chronic causes not related to a stone. [18].

According to a research study at Amran hospital's ultrasound department in Yemen between January 1, 2016, and October 31, 2017, it was found that hydronephrosis occurred more often in men than in women. The most frequent severity level of this condition was mild (grade-2), affecting 58% of cases [19].

Treatment

Treatment options for hydronephrosis are diverse, ranging from medical management to surgical interventions [23]. Surgery is recommended if pain, infection, or abdominal symptoms arise [24]. Medical treatment is often reserved for asymptomatic cases in elderly individuals or mild bilateral cases with a favorable prognosis. Surgical options include nephrectomy, nephroureterectomy, partial nephrectomy, nephropexy, and ureteral procedures. Kidney nerve surgery could be an option for when too much nerve activity causes water buildup in the kidney (hydronephrosis) [23]. In situations where the end of the tube connecting the kidney and bladder is narrowed (terminal ureter strictures), a special connection surgery might be needed (uretero-neo-cystostomy). For cases of ongoing urine buildup or a bladder that doesn't empty properly, different procedures to redirect urine flow might be considered (diversion procedures) [23].

Most of the patients with symptoms of hydronephrosis can be successfully treated using simple, non-invasive methods also known as conservative methods. These methods involve using pain relievers, antibiotics, and ensuring good fluid intake. For about 80% of patients with moderate to severe symptoms, these conservative approaches appear to be sufficient. The medical condition of hydronephrosis during pregnancy is generally not dangerous. Only a small number of patients need treatment, and even fewer need a thin tube (called a stent) placed in their ureter and hence has good prognosis [21].

For newborns, many instances of hydronephrosis will naturally get better or completely heal after birth, without needing any surgery [1].

Grade 1 complications after surgery are those that can be managed with antipyretics, electrolytes, antiemetics, diuretics, pain relievers, and physical therapy. Grade 2 complications are more serious and need special nutrition through veins, blood transfusions, and medications to control high blood pressure. Grade 3 complications are even more severe, requiring procedures like imaging, scope exams, or additional surgery. Finally, Grade 4 complications are extremely serious, involving the failure of body organs and posing a risk to life. [25].

Percutaneous nephrolithotomy (PNL) is widely recognized as the best minimally invasive technique for treating kidney stones that are bigger than 2 centimeters [25].

Treatment of hydronephrosis is directed at the cause. In situations where a big staghorn calculus leads to hydronephrosis, a nephrostomy is used to relieve pressure in the upper urinary tract first. This also creates a way to perform percutaneous nephrolithotomy, a method to effectively break down the stone. When dealing with a blockage at the point where the pelvis and ureter meet, a condition known as pelviureteric junction obstruction, treatment involves pyeloplasty. This procedure can be done using laparoscopic or open techniques. A source of medical guidelines, the National Institute for Health and Care Excellence (2002), states that both of these procedures show very high success rates. Typically, over 90% of patients experience the removal of obstructions successfully through these methods [3].

Rationale

The rationale of our research is to determine the frequency of hydronephrosis associated with nephrolithiasis at HMC, Peshawar because it can lead to serious complications like complete renal failure if not treated on time. Our study has a substantial impact on clinicians helping them in evaluation, follow up, and management of hydronephrosis.

Objectives

To evaluate the frequency of hydronephrosis with nephrolithiasis on ultrasound.

Literature Review

Alshoabi, in 2017 observational research, aimed to understand the relationship between varying grades of hydronephrosis and the detection rate of urinary stones using B-mode ultrasound imaging. The study analyzed 210 ultrasound reports of patients diagnosed with hydronephrosis between January 2016 and October 2017. Findings revealed that of the 210 patients, the majority (91.8%) had unilateral hydronephrosis, and in 60% cases the urinary stones were the cause. There was a noted increase in the detection rate of urinary stones from Grade-I (50%) to Grade-III (71.4%) hydronephrosis. However, Grade-IV experienced a drop. The logistic regression analysis further highlighted that in Grade-III hydronephrosis, urinary stones were detected four times higher than in Grade-IV. In conclusion, the study suggested that the likelihood of detecting urinary stones as a reason for hydronephrosis via ultrasound augments with the severity, peaking at Grade-III but subsequently decreased in Grade-IV [18].

Sultan Abdulwadoud Alshoabi et al. conducted a retrospective analysis between 1st January 2016 and 31st October 2017 with the objective of evaluating the efficacy of ultrasound (US) imaging in identifying the causes of Hydronephrosis (HN) - a condition characterized by the dilation of the kidney's collecting system due to urine outflow obstruction. The study, which encompassed 233 patients, revealed that a vast majority (91.41%) were adults and 66.10% were male. Notably, HN affected the right kidney in 55.36% of patients. Furthermore, US imaging was able to diagnose the underlying cause of HN in 70.4% of cases. Remarkably, kidney or ureteric stones were identified as the primary cause in 54.1% of cases. Within this subset, the most frequent location for these calculi was the vesicoureteric (VUJ) junction, accounting for 25.3% of the instances. The study concludes by underscoring the capability of US imaging in diagnosing the cause of HN in a significant number of patients and highlights calculi, especially at the VUJ junction, as the predominant cause of HN [19].

Thotakura and Anjum (2023) explored the conditions of hydronephrosis and hydroureter, which are both consequences of urine flow obstruction at various levels in the urinary system, affecting diverse age groups and necessitating prompt intervention to mitigate severe renal dysfunction. The study clarifies that hydronephrosis is when the kidney's collecting system becomes enlarged and swollen because something is blocking it past the renal pelvis. Hydroureter, on the other hand, is when the ureter (the tube that carries urine from the kidney to the bladder) gets wider due to a blockage that prevents urine from flowing properly.

The etiologies can be intrinsic, like renal stones or malignancies, or extrinsic, like pregnancy or trauma. In children, anatomical abnormalities, such as urethral valves or strictures, are prevalent causes. Mostly, kidney stones are the main reason why young adults in the U.S. face a specific kind of blockage and swelling in their urinary system, affecting around 600,000 adults in the country each year. The research also highlights the pronounced prevalence of hydronephrosis in pregnant women due to the enlarging uterus and hormonal effects. If untreated, prolonged obstruction could lead to permanent kidney damage from tubular atrophy and interstitial fibrosis. The study accentuates the need for a collaborative interprofessional team, comprising nephrologists, urologists, and dieticians, for enhanced patient outcomes and the prevention of recurrent complications [7]. Goertz and Lotterman embarked on a retrospective study aiming to investigate the correlation between the extent of hydronephrosis on renal ultrasound and the size of kidney stones observed on computed tomography. Drawing data from adult patients in the emergency department, the severity of hydronephrosis was determined and categorized. The study revealed that patients exhibiting none or mild hydronephrosis, which accounted for 72.9% of the sample, were less likely to have kidney stones larger than 5 mm compared to those with moderate or severe hydronephrosis. Specifically, the prevalence was 12.4% in the former group versus 35.4% in the latter, suggesting a significant relationship with a negative predictive value of 0.876. Thus, the degree of hydronephrosis could be a potential indicator of the size of ureteral calculi [27]. Venturing into the realm of focused emergency department (ED) ultrasonography, Calabro and team embarked on a retrospective pilot study to explore the possible correlation between the degree of hydronephrosis and kidney stone size. Examining the medical records of patients who received specialized ED kidney ultrasounds, their findings were crystallized into a sample size of 44 patients diagnosed with kidney stones via noncontract CT. Their pivotal observation was that while the degree of hydronephrosis ranged from none to severe, there was no discernible correlation between the degree of hydronephrosis and size of the kidney stone. Despite the high specificity and sensitivity of focused ED renal ultrasonography in detecting hydronephrosis, they conclude that the mere presence of hydronephrosis might not be an accurate gauge for determining the kidney stone's size [28].

Sternberg and his team examined the predictability of hydronephrosis on ultrasound (US) as a precursor for ureterolithiasis in patients experiencing acute renal colic. Drawing from data across three institutions between 2012 and 2015, they compared US and CT scan outcomes. Findings revealed that while US was proficient at detecting hydronephrosis (89.8%), its efficacy in identifying ureteral stones was limited to 25.9%. Conversely, CT scans diagnosed hydronephrosis in 91.8% and ureteral stones in 98.8% of cases. Thus, while ultrasound serves as a valuable tool in evaluating renal colic-associated hydronephrosis, complementary diagnostics may be essential for confirming ureterolithiasis [29].

Kaleem and colleagues performed a descriptive cross-sectional study focusing on the ultrasound-based evaluation of hydronephrosis, an acknowledged complication of renal obstructive disease. Sampling 100 patients comprising 56 females and 44 males at an ultrasound department, the researchers utilized a 3.5 MHz, TA, convex transducer for trans-abdominal ultrasound. The results revealed that mild hydronephrosis was the most prevalent at 56%, followed by moderate (25%), serious (13%), and extreme (6%). Leading causes were identified as kidney stone, ureteric stone, benign prostatic hypertrophy, and pregnancy. The study concluded that ultrasound is highly sensitive in determining the different grades of hydronephrosis and its root causes, emphasizing the importance of early detection to ascertain the precise causes [6] Iravani and team from the Department of Anatomy at the Yong Loo Lin School of Medicine presented an intriguing cadaveric study in 2014 to shed light on ureteric stones' outcomes. As a common causative factor for urinary tract obstruction, ureteric stones typically manifest with discernible signs such as acute ureteric colic and hematuria. However, in some instances, they might exhibit vague symptoms like low back pain, evading timely detection. Such delayed identification could culminate in the stone's growth and prolonged ureteric obstruction, leading to complications such as hydronephrosis and renal damage. The report details a unique case of a sizable ureteric stone in a cadaver, found to have caused complete blockage at the left ureterovesical junction. This obstruction resulted in marked dilatation of the left ureter and renal pelvis, offering invaluable insights into the progression and complications of untreated ureteric stones [30].

Materials And Methods

This study was approved by the Clinical Research Ethics Committee of School of Health Sciences (SHS) Peshawar. The approval for data collection was granted by Hayatabad Medical Complex (HMC) Peshawar. The data was obtained from the patients clinically diagnosed with hydronephrosis from June to November 2023 (4 to 6 months). A cross-sectional descriptive study was carried out through a proforma that contained information about hydronephrosis associated with nephrolithiasis obtained from ultrasound report. The research study was carried out at Hayatabad Medical Complex (HMC) Peshawar. Sample size was calculated using the given formula:

$N = Z^2 p\,(1\text{-}p)\,/E^2$ [26]

$N= (0.95)^2 (0.23)\,(1\text{-}0.23)/\,(0.05)^2$

$N= (3.84)\,(0.23)\,(0.77)/\,(0.0025)$

$N= 272$

Where n is the calculated sample size, Z is the desired level of confidence (95%), E is the standard sampling error (5%) (0.05), and p is the estimated prevalence 23%. Sample size in this study will be 272 P.

Sampling Technique

Non-Probability Convenient Sampling was used in this research study.

Inclusion Criteria

All the patients referred to ultrasound scan of kidney irrespective of age and genders, and patients with nephrolithiasis.

Exclusion Criteria

Congenital anomalies, unilateral nephrectomy patients, and kidney transplant patients are excluded from our study.

Data Collection Procedure

Data was collected through a standard and validated proforma which included all the variables related to our study. Approval letter for data collection was obtained from internal graduate study committee of HMC, Peshawar. Every part of ethical issues associated to the research study was comprehensively reviewed with the responsible head of departments; Hayatabad Medical Hospital Peshawar and each feature of the research study was appraised to guarantee the confidentiality and privacy of the study participants. Written consent was also taken from the study participants. We reviewed ultrasound reports for suggestive hydronephrosis and nephrolithiasis. We collected data from ultrasound reports of the patients and put all the desired data into the predesigned proforma. The desired data consists of patient's age, gender, hydronephrosis and kidney stone presence, and ultrasound results. We checked out ultrasound reports for hydronephrosis visualized, not visualized and kidney stones visualized, not visualized and if visualized then its mentioned diameter and association with hydronephrosis.

Statistical Analysis

Data analysis was performed by using SPSS (Statistical Package for Social Sciences) version 22.0. Descriptive statistics were applied for mean, percentage and frequency of variables. Continuous variable like age, frequency was presented in the form of mean and standard deviation, while categorical variable like gender, stage or severity of hydronephrosis was presented in the form of frequency and percentage (bar graph, pie chart, etc).

Results

The current study was conducted on 272 patients who were diagnosed with Abdominal Ultrasound in Hayatabad Medical Complex, Peshawar. At the time of study, we came across 300 plus patients who had done Abdominal Ultrasound but we selected only 272 patients who were in our inclusion criteria. The study contained 272 patients having maximum age 80 years and minimum age 5 years (mean 21y). The study was distributed as having 150 male patients of age limit 5 years to 80 years (mean 22 y) and 122 female patients of age limit 7 years to 80 years (mean 19 y).

Table: 4.1 Descriptive statistics of age

	N	Minimum	Maximum	Mean	Std. Deviation
Age in Years	272	1.00	4.00	2.1434	.70163
Gender	272	1.00	2.00	1.4485	.49826
Valid N (listwise)	272				

The age of the patients was divided into four intervals i.e. age range 1-20 y which was comprised of 20 male and 18 female (total 38 patients), age range 21-40y which was comprised of 85 male and 84 female (total 169 patients) and age range 41-60y consisted of 36 male and 17 female (total 53 patients) and age range 61-80y which was consisted of 9 male patients 3 female patients (total 12 patients) shown in table 4.2.

Table: 4.2 Distribution of age into intervals and gender

		Age in Years				
		1-20	21-40	41-60	61-80	Total
Gender	Male	20	85	36	9	150
	Female	18	84	17	3	122
Total		38	169	53	12	272

According to the result it was clarified that the maximum chances of occurrence of hydronephrosis plus nephrolithiasis is present in the age group 21-40y in both male and female. On the basis of ultrasound results the data was classified into four categories; category 1 comprised of those patients whose hydronephrosis plus nephrolithiasis was visualized on ultrasound, category 2 included those patients who had nephrolithiasis but no hydronephrosis was visualized on ultrasound, category 3 contained those patients who had hydronephrosis plus no nephrolithiasis was visualized on ultrasound and category 4 contained those patients who had no hydronephrosis plus no nephrolithiasis (figure 4.1).

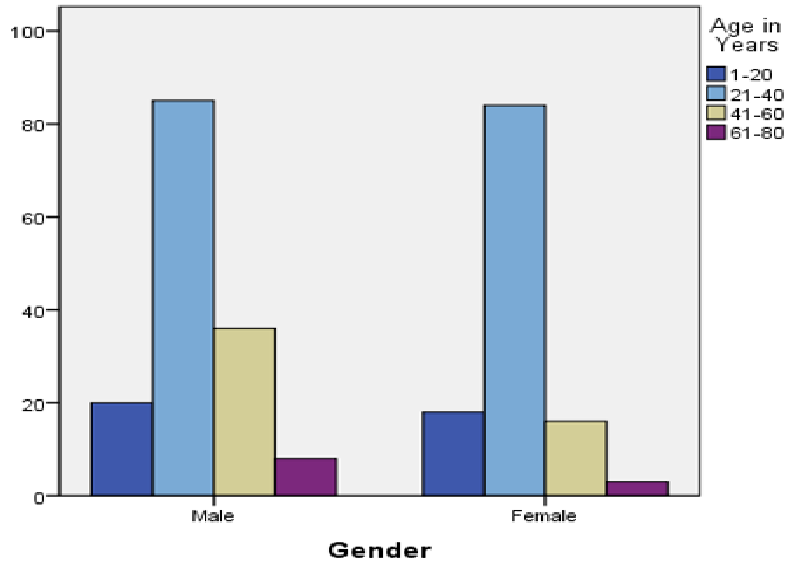

Figure: 4.1 Age intervals and gender

We analyzed ultrasound reports into visualized hydronephrosis plus nephrolithiasis and non-visualized hydronephrosis plus nephrolithiasis. In the study of 272 patients, the hydronephrosis plus nephrolithiasis was visualized in 62 patients, no hydronephrosis plus nephrolithiasis was visualized in 36, hydronephrosis plus no nephrolithiasis was visualized in 24 patients, while no hydronephrosis plus no nephrolithiasis was observed in 150 patients by sonologists and ultrasound-technologist (table 4.3).

Table 4.3 Hydronephrosis and nephrolithiasis visualization on ultrasound

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	nephrolithiasis + hydronephosis	62	22.8	22.8	22.8
	nephrolithiasis + no hydronephrosis	36	13.2	13.2	36.0
	no nephrolithiasis + hydronephrosis	24	8.8	8.8	44.9
	no nephrolithiasis + no hydronephrosis	150	55.1	55.1	100.0
	Total	272	100.0	100.0	

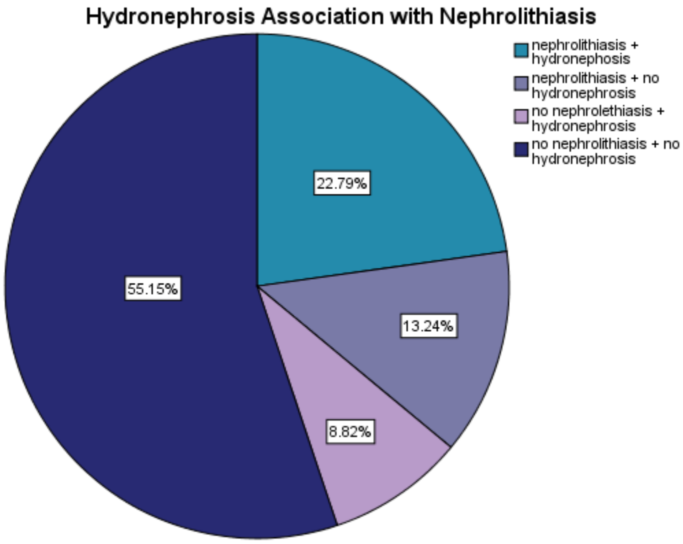

Figure: 4.2 Pie chart for Hydronephrosis and nephrolithiasis visualization on ultrasound

Table 4.4 shows that 20 patients had abnormal right kidney size out of 272 patients.

Table: 4.4 Right kidney size ultrasound

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	252	92.6	92.6	92.6
	Abnormal	20	7.4	7.4	100.0
	Total	272	100.0	100.0	

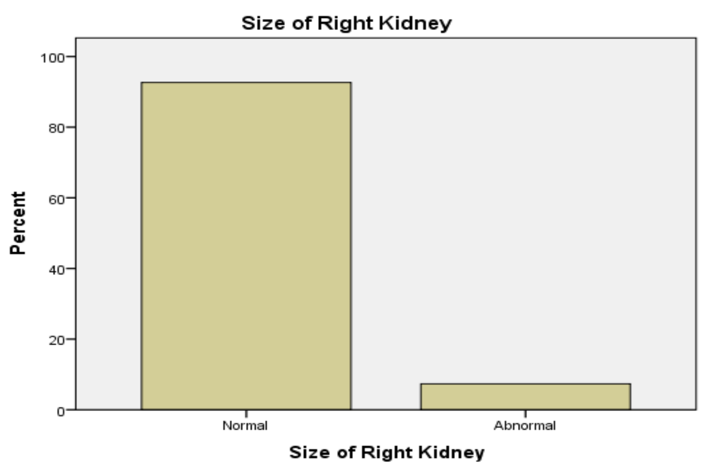

Figure: 4.3 Bar graph for size of right kidney on ultrasound

Table: 4.5 Left kidney size on ultrasound

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	226	83.1	83.1	83.1
	Abnormal	46	16.9	16.9	100.0
	Total	272	100.0	100.0	

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Table 4.5 shows that 46 patients had abnormal left kidney size out of 272 patients.

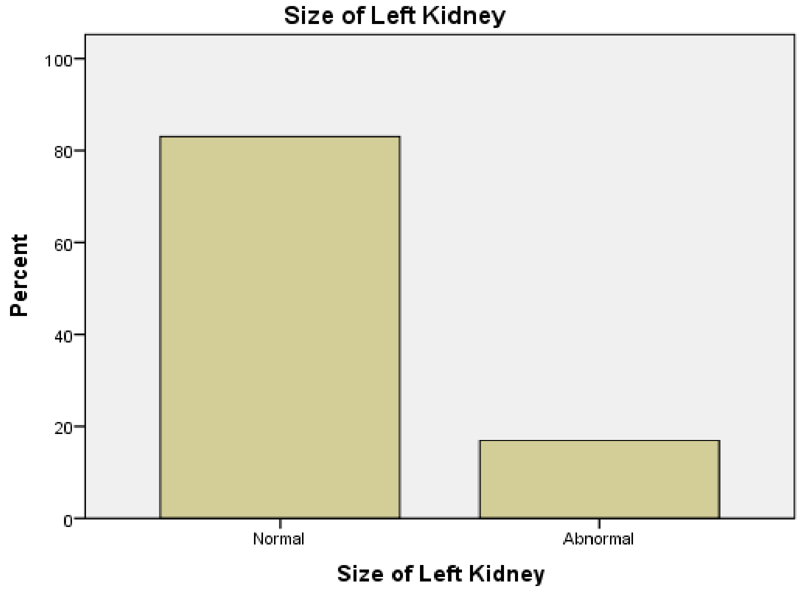

Figure: 4.4 Bar graph for size of left kidney on ultrasound

Table: 4.6 Size of Nephrolithiasis in Group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-6 mm	40	14.7	14.7	14.7
	7-12 mm	58	21.3	21.3	36.0
	Nil	174	64.0	64.0	100.0
	Total	272	100.0	100.0	

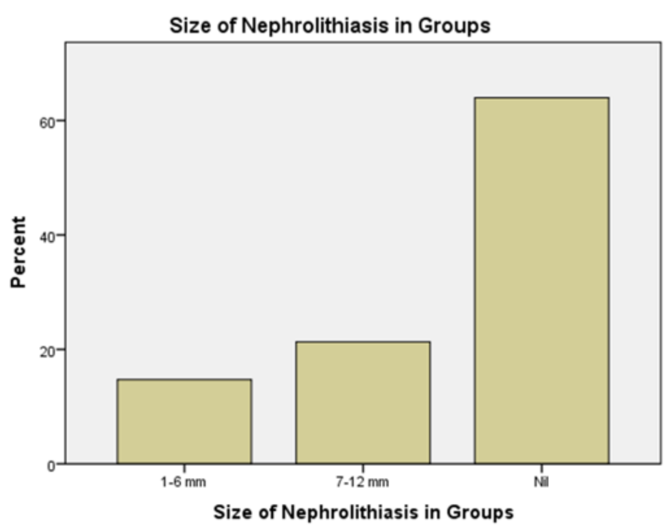

Figure: 4.5 Bar graph for size of nephrolithiasis on ultrasound reports

In those 98 patients who had nephrolithiasis visualized and its diameter mentioned on ultrasound reports, diameter of 7mm and 12mm were found more frequently (table 4.6).

Table: 4.7 Evidence of nephrolithiasis from ultrasound report

Evidence of Nephrolithiasis

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	98	36.0	36.0	36.0
	No	174	64.0	64.0	100.0
	Total	272	100.0	100.0	

Table :4.7 Shows that 98 patients out of 272 had nephrolithiasis.

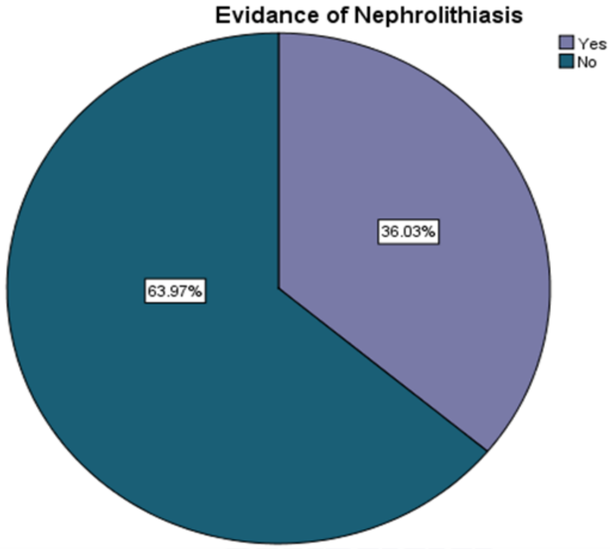

Figure: 4.6 Pie chart for evidence of nephrolithiasis on ultrasound

Table: 4.8 Location of nephrolithiasis on ultrasound report

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Upper pole	20	7.4	7.4	7.4
	Mid pole	30	11.0	11.0	18.4
	Lower pole	22	8.1	8.1	26.5
	Renal pelvis	20	7.4	7.4	33.8
	Ureteropelvic junction	6	2.2	2.2	36.0
	Nil	174	64.0	64.0	100.0
	Total	272	100.0	100.0	

According to the abdominal ultrasound reports, the distribution of nephrolithiasis location was as follows: stones at the mid pole of the kidney were observed in 30 patients (11.0%), whereas the upper pole and renal pelvis each accounted for 20 cases (7.4%). Lower pole stones were present in 22 patients (8.1%), and the ureteropelvic junction was the site of stones in 6 patients (2.2%). Notably, a significant proportion of patients, 174 (64.0%), showed no stones on the ultrasound report (table 4.8).

Stones located at the mid pole were the most prevalent among specified locations, affecting 30 patients out of 272 (fig 4.7)

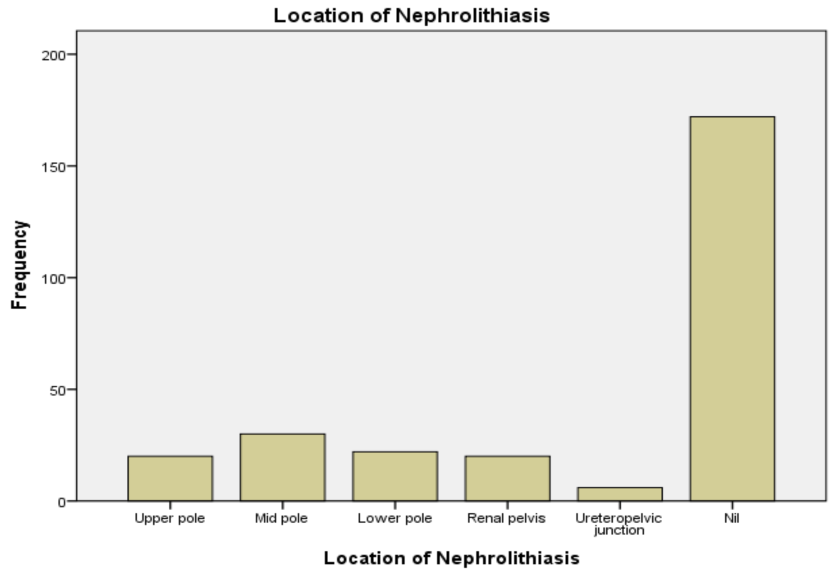

Figure: 4.7 Bar graph for location of nephrolithiasis on ultrasound reports

Table 9 Grades of Hydronephrosis on ultrasound report
Grade of Hydronephrosis

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild	45	16.5	16.5	16.5
	Moderate	30	11.0	11.0	27.6
	Severe	9	3.3	3.3	30.9
	Normal	188	69.1	69.1	100.0
	Total	272	100.0	100.0	

It was observed that the majority, 188 patients (69.1%), presented with normal renal pelvis and no hydronephrosis. Mild hydronephrosis was reported in 45 patients (16.5%), moderate hydronephrosis was noted in 30 patients (11.0%), and severe hydronephrosis was identified in 9 patients (3.3%). The cumulative percentage of cases with some degree of hydronephrosis (mild to severe) was 30.9%, highlighting a notable prevalence of non-obstructive cases in this study population (table 4.9).

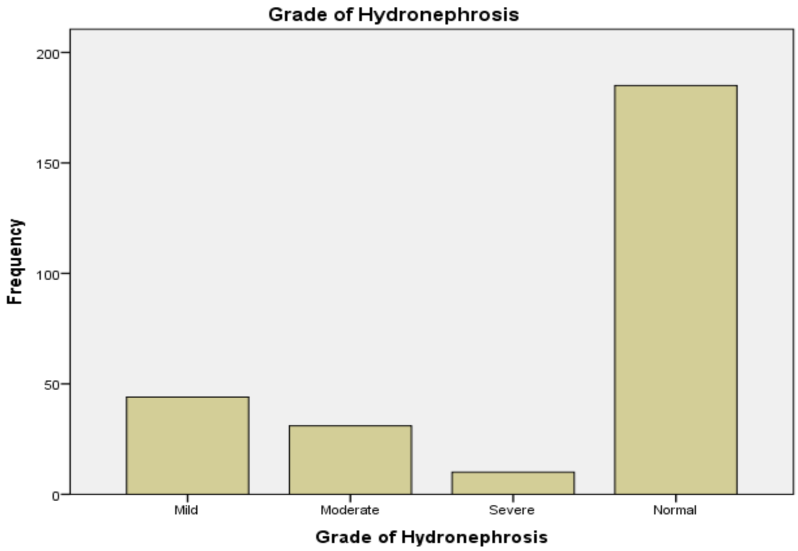

Figure: 4.8 Bar graph for grades of Hydronephrosis on ultrasound reports

Table: 4.10 Evidence of Hydronephrosis from ultrasound reports

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	85	31.3	31.3	31.3
	No	187	68.8	68.8	100.0
	Total	272	100.0	100.0	

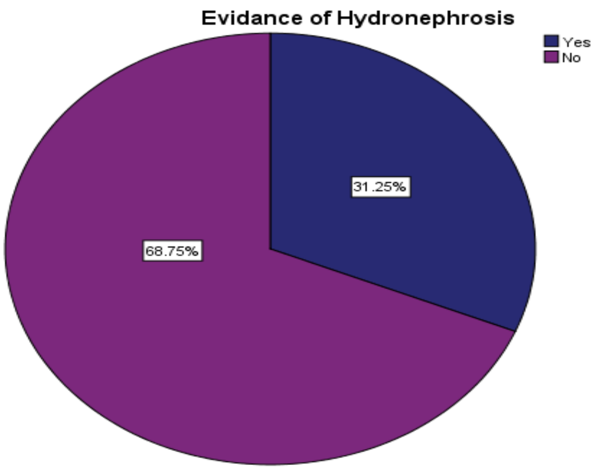

Figure: 4.9 Pie chart for evidence of hydronephrosis on ultrasound

Out of 272 patients reports, a significant portion, 68.75%, did not exhibit hydronephrosis while the remaining 31.25% of the cases did show evidence of hydronephrosis. This visual representation helps underscore the prevalence of hydronephrosis in the studied population, highlighting that nearly one-third of the patients had hydronephrosis determined by the diagnostic criteria used in this study (fig 4.9).

Discussion

Hydronephrosis is the dilatation of the renal pelvis and calyces as a result of obstruction of the urinary tract. It is caused by both intrinsic and extrinsic obstruction and affects individuals of all ages. Ultrasound imaging has emerged as a valuable diagnostic tool for assessing hydronephrosis due to its non-invasive, radiation-free nature, cost-effectiveness, and wide availability [7,19].

Several Studies are performed in the past to find frequency of hydronephrosis, age in which hydronephrosis is most frequently occurred, and gender in which the disease is more common. Studies are conducted to find out modalities and other procedure which helps in the diagnosis of hydronephrosis and to find out its association with nephrolithiasis. Variety of studies showed that ultrasound is helpful in diagnosis of hydronephrosis. In the current study we are focused on to find out the frequency of hydronephrosis associated with nephrolithiasis and how the two parameters (hydronephrosis and nephrolithiasis) are related to each other.

In our study 272 abdominal ultrasound reports were collected from the patients visited to radiology department of Hayat Abad Medical Complex. 150 (55.1%) patients were male and the remaining 122 (44.9%) were females. The age of participants ranges from 1 to 80 years and were categorized into 4 groups. The most affected group was 21-40 and followed by the least affected group was 61-80 years. Out of these 272 patients, 85 (31.3%) had hydronephrosis in which 52 males (19.12%) and 33 females (12.13%) which shows that the frequency of hydronephrosis among males were slightly high than female patients. The tendency of hydronephrosis with nephrolithiasis was higher (22.8%) than hydronephrosis without nephrolithiasis (8.8 %) among those 272 patients.

In 2020 Akash John and colleagues carried out a study to discern the etiological factors and prevalence of hydronephrosis. A total of 213 patients were encompassed in their analysis, with the 41-50 age bracket displaying the highest prevalence (45%) of hydronephrosis. The study unveiled a gender discrepancy, with 70% of the cases being male. Remarkably, 86% had hydronephrosis in a unilateral kidney. Ultrasound assessments divulged that Renal Calculi (60%) stood out as the predominant cause, trailed by conditions like pregnancy (13% in females) and Benign Prostatic Hyperplasia (8.9% in males). This extensive research accentuated the preeminence of renal calculi as a root cause of hydronephrosis [4].

Abdelmaboud and colleagues carried out a study aiming to classify hydronephrosis and ascertain its causes using ultrasound as a diagnostic tool. In their investigation, which involved 100 patients suspected of renal diseases and referred for ultrasonographic examination, the results unveiled a dominance of mild hydronephrosis, which constituted 53% of cases. As for the underlying causes, ureteric stone (31%) and kidney stone (23%) were the most frequent, followed by pregnancy (12%) and benign prostatic hypertrophy (11%). A significant 63% of their study sample had a history of renal stones. Their findings underscore the efficacy of ultrasound as a primary investigative tool for the renal system, noting its sensitivity in assessing and categorizing hydronephrosis and identifying its root causes. Furthermore, they identified metabolic disorders, specifically gout and diabetes, as prominent risk factors for renal obstructive diseases [5].

Recommendation

Hydronephrosis can be prevented by maintaining a healthy lifestyle to avoid the conditions that lead to it. Staying well-hydrated, reducing salt intake, and limiting foods that are high in oxalates can decrease the risk of kidney stones. Timely management of urinary tract infections, careful monitoring of health during pregnancy, and avoiding medications that may impair kidney function can also be crucial in preventing hydronephrosis.

Limitations

The scope and scale of the research were constrained due to a limited budget, which restricted the extent of resources and methodologies that could be employed. Additionally, the study's timeframe was relatively brief, potentially impacting the analysis and follow-up of cases, which is crucial for understanding the progression and outcomes of hydronephrosis1 associated with nephrolithiasis.

Conclusion

It is concluded from our current study that the frequency of hydronephrosis associated with nephrolithiasis is higher in males than females. In our study, the chances of occurrence of hydronephrosis were highly seen in age group 21-40. Hydronephrosis with nephrolithiasis was visualized on ultrasound in 62 patients (22.8%). Mild hydronephrosis was highly reported in 45 patients (16.5%). We noticed on ultrasound reports in both hydronephrosis and without hydronephrosis cases that the frequent diameter of stone was 7-12mm. It was observed that renal stone location and diameter has no relation with hydronephrosis. Out of 272 patients, only 85 patients (31.3%) did show the evidence of hydronephrosis.

REFERENCES

1- Riccabona M. Assessment and management of newborn hydronephrosis. World journal of urology. 2004 Jun;22(2):73-8.
2- Krajewski W, Wojciechowska J, Dembowski J, Zdrojowy R, Szydełko T. Hydronephrosis in the course of ureteropelvic junction obstruction: An underestimated problem? Current opinions on the pathogenesis, diagnosis and treatment. Advances in Clinical & Experimental Medicine. 2017 Aug 1;26(5).
3- Patel K, Batura D. An overview of hydronephrosis in adults. British Journal of Hospital Medicine. 2020 Jan 2;81(1):1-8.
4- John A, Faridi TA, Dar AJ, Hassan SB, Hamid I, Samreen K. The Prevalence and aetiology of Hydronephrosis in adults: aetiology of Hydronephrosis. Life Science Journal of Pakistan. 2023 Jan 31;5(1):03-7.
5- Abdelmaboud SO, Gameraddin MB, Ibrahim T, Alsayed A. Sonographic evaluation of hydronephrosis and determination of the main causes among adults. Int J Med Imaging. 2015;3(1):1-5.
6- Kaleem, Mariam, et al. "Sonographic Evaluation of Hydronephrosis and the Prevalence of Leading Causes in Adults." (2021).
7- Thotakura R, Anjum F. Hydronephrosis and hydroureter. InStatPearls [Internet] 2022 Sep 26. StatPearls Publishing.
8- Yeh HC, Jan HC, Wu WJ, Li CC, Li WM, Ke HL, Huang SP, Liu CC, Lee YC, Yang SF, Liang PI. Concurrent preoperative presence of hydronephrosis and flank pain independently predicts worse outcome of upper tract urothelial carcinoma. PLoS One. 2015 Oct 15;10(10):e0139624.
9- Mahadevan V. Anatomy of the kidney and ureter. Surgery (Oxford). 2019 Jul 1;37(7):359-64.
10- Soriano, Roberto M., Dana Penfold, and Stephen W. Leslie. "Anatomy, Abdomen and Pelvis, Kidneys." (2018).
11- Gandhi KR, Chavan S. Revisiting the morphology of pelvicalyceal system in human cadaveric kidneys with a systematic review of literature. Asian Journal of Urology. 2019 Jul 1;6(3):249-55.
12- Hansen KL, Nielsen MB, Ewertsen C. Ultrasonography of the kidney: a pictorial review. Diagnostics. 2015 Dec 23;6(1):2.
13- McBride JM. Embryology, anatomy, and histology of the kidney. The Kidney: A Comprehensive Guide to Pathologic Diagnosis and Management. 2016:1-8.
14- Rayner HC, Thomas M, Milford D, Rayner H, Thomas M, Milford D. Kidney Anatomy and Physiology: The Basis of Clinical Nephrology. Understanding Kidney Diseases. 2016:1-0.
15- Diament MJ, Takasugi J, Kangarloo H. Hydronephrosis in childhood—reliability of ultrasound screening. Pediatric radiology. 1984 Jan;14:31-6.
16- Ilgi Sr M, Bayar G, Abdullayev E, Cakmak S, Acinikli H, Kirecci SL, Horasanli K. Rare Causes of Hydronephrosis in Adults and Diagnosis Algorithm: Analysis of 100 Cases During 15 Years. Cureus. 2020 May 21;12(5).
17- Dalla-Palma L, Bazzocchi M, Pozzi-Mucelli RS, Stacul F, Rossi M, Agostini R. Ultrasonography in the diagnosis of hydronephrosis in patients with normal renal function. Urologic radiology. 1983 Dec;5:221-6.
18- Alshoabi SA. Association between grades of Hydronephrosis and detection of urinary stones by ultrasound imaging. Pakistan journal of medical sciences. 2018 Jul;34(4):955

19- Alshoabi SA, Alhamodi DS, Alhammadi MA, Alshamrani AF. Etiology of Hydronephrosis in adults and children: Ultrasonographic Assessment in 233 patients. Pakistan Journal of Medical Sciences. 2021 Sep;37(5):1326.
20- Onen A. Grading of hydronephrosis: an ongoing challenge. Frontiers in pediatrics. 2020 Aug 27;8:458.
21- Mutiso SK, Sequeira E. Symptomatic hydronephrosis in pregnancy: a case series and literature review. Is bigger always better?. Journal of Obstetrics and Gynaecology of Eastern and Central Africa. 2015;27(1):15-9.
22- Song Y, Hernandez N, Gee MS, Noble VE, Eisner BH. Can ureteral stones cause pain without causing hydronephrosis? World Journal of Urology. 2016 Sep;34:1285-8.
23- Yates-Bell JG. Hydronephrosis. Proceedings of the Royal Society of Medicine. 1953;46(1):31-38. doi:10.1177/003591575304600106
24- O'conor, V. J. (1955). Diagnosis and Treatment of Hydronephrosis. The Journal of Urology, 73(3), 451–454. doi:10.1016/s0022-5347(17)67423-8
25- Micoogullari U, Yucel C, Sueluzgen T, Kisa E, Keskin MZ, Isoglu CS, Ilbey YO. Effects of severe hydronephrosis on the outcomes of percutaneous nephrolithotomy with one-shot dilation method. Urologia Journal. 2022 May;89(2):221-5.
26- Zohni A. Practical Issues in Calculating the Sample Size for Prevalence Studies Practical Issues in Calculating the Sample Size for Prevalence Studies.
27- Goertz JK, Lotterman S. Can the degree of hydronephrosis on ultrasound predict kidney stone size?. The American journal of emergency medicine. 2010 Sep 1;28(7):813-6.
28- Calabro JL, Raio CC, Theodoro D, Nelson MJ, Patel J, Lee DC. Does kidney stone size correlate with degree of hydronephrosis on focused emergency department ultrasonography? Annals of Emergency Medicine. 2004 Oct 1;44(4):S114.
29- Sternberg KM, Pais VM, Larson T, Han J, Hernandez N, Eisner B. Is hydronephrosis on ultrasound predictive of ureterolithiasis in patients with renal colic?. The Journal of Urology. 2016 Oct;196(4):1149-52.
30- Iravani O, Tay EW, Bay BH, Ng YK. Unilateral ureteric stone associated with gross hydronephrosis and kidney shrinkage: a cadaveric report. Anatomy & Cell Biology. 2014 Dec 1;47(4):267-70.