World Journal of Pharmaceutical Sciences
ISSN (Print): 2321-3310; ISSN (Online): 2321-3086
Published by Atom and Cell Publishers
Available online at: http://www.wjpsonline.org/
Review Article

Hydronephrosis: A tale of water inflammation in nephron

Akil Bhavnagri, Tejas Chaudhary, Vivek Chaudhary, Hiren Maheshwari and Prof. Dr. Dhrubo Jyoti Sen

Shri Sarvajanik Pharmacy College, Gujarat Technological University, Arvind Baug, Mehsana-384001, Gujarat, India

Received: 29-05-2015 / Revised: 04-07-2015 / Accepted: 21-07-2015

ABSTRACT

Hydronephrosis is the enlargement of the parts of the kidney that collect urine from both sides. Bilateral means both sides. Bilateral hydronephrosis occurs when urine is unable to drain from the kidney into the bladder. Hydronephrosis is not itself a disease. It occurs as a result of a problem that prevents urine from draining out of the kidneys, ureters, and bladder. Disorders associated with bilateral hydronephrosis include: Acute bilateral obstructive uropathy - sudden blockage of the kidneys, Bladder outlet obstruction - blockage of the bladder that does not allow drainage, Chronic bilateral obstructive uropathy - a gradual blockage of the kidneys, Neurogenic bladder - poorly functional bladder, Posterior urethral valves - flaps on the urethra that causes poor emptying of the bladder (in boys), Prune belly syndrome - poorly emptying bladder that causes distention of the belly, Retroperitoneal fibrosis - increased scar tissue that blocks the ureters, Uteropelvic junction obstruction - blockage of the kidney at the point where the ureter enters the kidney, Vesicoureteric reflux - backup of the urine from the bladder up to the kidney. Signs of the problem are often detected in a baby before birth during a pregnancy ultrasound. A urinary tract infection in a newborn baby can signal a blockage in the kidney. An older child who gets repeat urinary tract infections should also be checked for blockage. A higher than normal number of urinary tract infections is often the only symptom of the problem. The following tests can show bilateral hydronephrosis: CT scan of the abdomen or kidneys, IVP (used less often), Pregnancy (fetal) ultrasound, renal scan, Ultrasound of the abdomen or kidneys. Placing a tube into the bladder (Foley catheter) may open the blockage. Draining the bladder, Relieving pressure by placing tubes in the kidney through the skin, placing a tube (stent) through the ureter to allow urine to flow from the kidney to bladder. The underlying cause of the blockage needs to be found and treated once the buildup of urine is relieved. Outlook (Prognosis): Surgery performed while the baby is in the womb or shortly after birth can have good results in improving kidney function. Possible Complications: Kidney damage may result from conditions that cause hydronephrosis. When to Contact a Medical Professional. This problem is often found by the health care provider. An ultrasound during pregnancy can show a blockage in the baby's urinary tract. This allows the problem to be treated with early surgery. Other causes of blockage such as kidney stones can be detected early if people notice warning signs of kidney problems.

Keywords: Nephron, Kidney, Uretero-vesical junction Hydronephrosis, Hydoureter, CT Scan, IVU, MRI, Ureter, Uropathy, Hydroureteronephrosis, Renal calculi

INTRODUCTION

Hydronephrosis — literally "water inside the kidney" — refers to distension and dilation of the renal pelvis and calyces, usually caused by obstruction of the free flow of urine from the kidney. Untreated, it leads to progressive atrophy of the kidney. In cases of hydroureteronephrosis, there is distention of both the ureter and the renal pelvis and calices. Hydronephrosis describes the condition where the urine collecting system of the kidney is dilated. This may be a normal variant or it may be due to an underlying illness or medical condition. Normally, the kidney filters waste products from blood and disposes of it in the urine. The urine drains into individual calyces that form the renal pelvis. This empties into the ureter, a tube that connects the kidney to the bladder. The urethra is the tube that empties the bladder.[1]

Definition: Hydronephrosis is the swelling of the kidneys when urine flow is obstructed in any part

***Corresponding Author Address: Prof. Dr. Dhrubo Jyoti Sen,** Shri Sarvajanik Pharmacy College, Gujarat Technological University, Arvind Baug, Mehsana-384001, Gujarat, India; Email: dhrubosen69@yahoo.com*

of the urinary tract. Swelling of the ureter, which always accompanies hydronephrosis, is called hydroureter. Hydronephrosis implies that a ureter and renal pelvis (the connection of the ureter to the kidney) are overfilled with urine.

Description: The kidneys filter urine out of the blood as a waste product. It collects in the renal pelvis and flows down the ureters into the bladder. The ureters are not simple tubes, but muscular passages that actively propel urine into the bladder. At their lower end is a valve (the uretero-vesical junction) that prevents urine from flowing backward into the ureter. The bladder stores urine. The prostate gland surrounds the bladder outlet in males. Urine then flows through the urethra and out of the body as a waste product. Because the urinary tract is closed save for the one opening at the bottom, urine cannot escape.

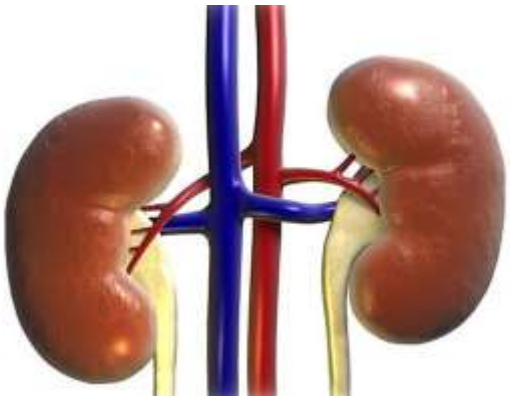

Figure-1: Natural life & Physiological life

Instead, the parts distend. Rupture is rare unless there is violent trauma like an automobile accident. Obstructed flow anywhere along the drainage route can cause swelling of the upper urinary tract, but if the obstruction is below the bladder, the uretero-vesical valve will protect the upper tract to ascertain extent. Even then, with no place to go, the urine will back up all the way to its source. Eventually, the back pressure causes kidney function to deteriorate. Obstruction need not be complete for problems to arise. Intermittent or partial obstruction is far more common than compete blockage, allowing time for the parts to enlarge gradually. Furthermore, if an uretero-vesical valve is absent or incompetent, the pressure generated by bladder emptying will force urine backward into the ureter and kidney, causing dilation even without mechanical obstruction. While hindrance or blockage is the most frequent cause of hydronephrosis, it may be due to problems that occur congenitally in a foetus (prenatal) or may be a physiologic response to pregnancy.[2]

Theoretically, hydronephrosis specifically describes dilation and swelling of the kidney, while the term hydroureter is used to describe inflammation of the ureter. Hydronephrosis may be unilateral involving just one kidney or bilateral involving both. A difficulty of hydronephrosis is decreased kidney function. The increased pressure of extra fluid within the kidney decreases the blood filtration rate and may cause structural harm to kidney cells. This decrease in function is reversible if the fundamental condition is corrected but if the hydronephrosis lasts many weeks, the damage may be lasting.

Causes and symptoms:

Causes are numerous. Various congenital deformity of the ureter may sooner or later produce high thrust of physiological back pressure. Kidney stones are a common cause. They form in the renal pelvis and become lodged in the kidney, usually at the uretero-vesical junction. In older men, the continued growth of the prostate gland leads commonly to restricted urine flow out of the bladder. The signs and symptoms of hydronephrosis depend upon whether the obstruction is acute or chronic, partial or complete, unilateral or bilateral. Hydronephrosis that occurs acutely with sudden onset (as caused by a kidney stone) can cause intense pain in the flank area (between the hips and ribs). Historically, this type of pain has been described as "Dietl's crisis." Conversely, hydronephrosis that develops gradually will generally cause no pain or attacks of a dull discomfort. Nausea and vomiting may also occur. An obstruction that occurs at the urethra or bladder outlet can cause pain and pressure resulting from distension of the bladder.

Blocking the flow of urine will commonly result in urinary tract infections which can lead to the development of additional stones, fever, and blood or pus in the urine. If complete obstruction occurs, kidney failure may follow. Blood tests may show impaired kidney function (elevated urea or creatinine) or electrolyte imbalances such as hyponatremia (high level of sodium) or hyperchloremic (high level of chloride) in metabolic acidosis. Urinalysis may indicate an elevated pH due to the secondary destruction of nephrons within the affected kidney. Physical examination may detect a palpable abdominal or flank mass caused by the enlarged kidney.[3]

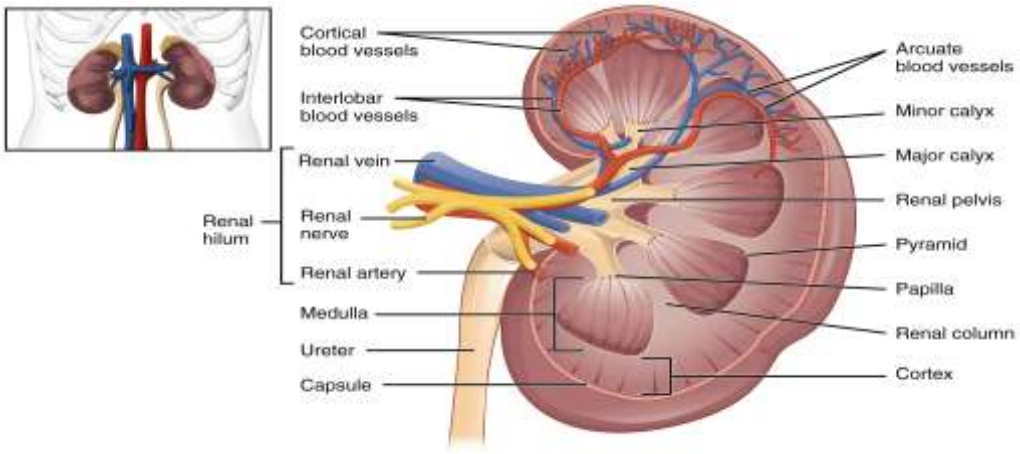

Figure-2: Anatomy of kidney

There may or may not be direct symptoms of hydronephrosis depending upon the underlying cause. Individuals with acute hydronephrosis, for example symptoms from renal colic due to a kidney stone begin with an acute onset of intense flank or back pain radiating to the groin, associated with nausea, vomiting, and sweating. Colicky pain comes and goes and its intensity may cause the person to writhe or roll around or pace in pain. There may be blood seen in the urine. Prostate cancer and cancer anywhere else along the urine pathways, can obstruct flow. Pregnancy normally causes ureteral obstruction from the pressure of the enlarged uterus (womb) on the ureters. Symptoms relate to the passage of urine. Sometimes, urine may be difficult to pass, irregular, or uncontrolled. Pain from distension of the structures is present. Blood in the urine may be visible, but it is usually microscopic.[4]

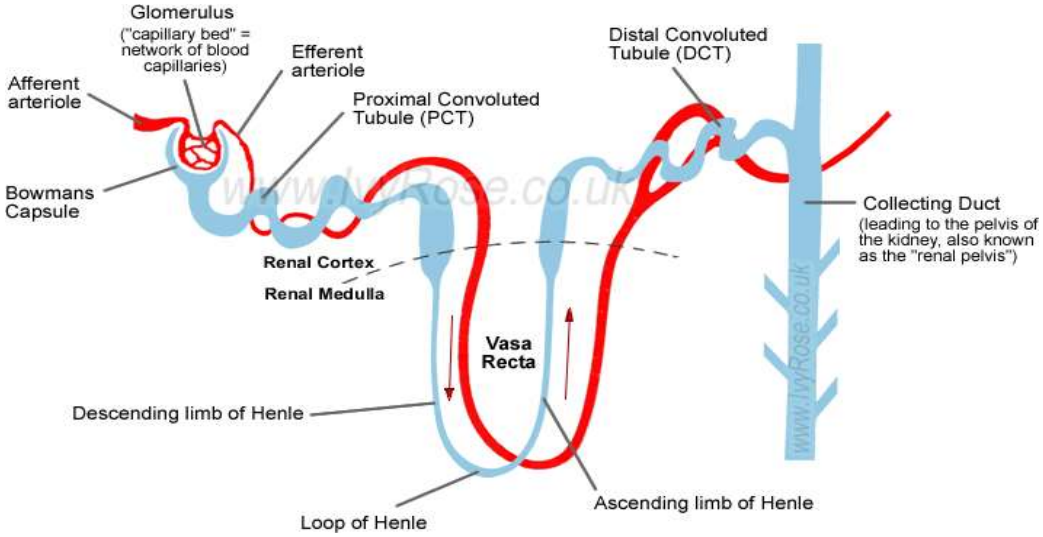

Figure-3: Anatomy of nephron

In all cases where bodily fluids cannot flow freely, infection is inevitable. Symptoms of urinary infection may include:

- painful, burning urine
- cloudy urine
- pain in the back, flank, or groin
- fever, sweats, chills, and generalized disco mfort

Patients often mistake a serious urinary infection of the flu. Causes: There are abundant causes of hydronephrosis that are categorized based upon the location of the swelling and whether the cause is intrinsic (located within the urinary collecting system), extrinsic (outside of the collecting system) or if it due to a modification in function. Hydronephrosis is the result of any of several abnormal pathophysiological occurrences. Structural abnormalities of the junctions between the kidney, ureter, and bladder that lead to hydronephrosis can occur during fetal development. Some of these congenital defects have been identified as inherited conditions; however the benefits of linking genetic testing to early diagnosis have not been determined. Other structural abnormalities could be caused by injury, surgery, or radiation therapy.

Compression of one or both ureters can also be caused by other developmental defects not completely occurring during the fetal stage such as an abnormally placed vein, artery, or tumor. Bilateral compression of the ureters can occur during pregnancy due to enlargement of the uterus. Changes in hormone levels during this time may also affect the muscle contractions of the bladder, further complicating this condition. Sources of obstruction that can arise from other various causes include kidney stones, blood clots, or retroperitoneal fibrosis. The obstruction may be either partial or complete and can occur anywhere from the urethral meatus to the calyces of the renal pelvis.

Hydronephrosis can also result from the reverse flow of urine from the bladder back into the kidneys. This reflux can be caused by some of the factors listed above as well as compression of the bladder outlet into the urethra by prostatic enlargement or impaction of feces in the colon, as well as abnormal contractions of bladder muscles resulting from neurological dysfunction or other muscular disorders.

Diagnosis: If the bladder is significantly distended, it can be felt through the abdomen. An analysis of the urine may reveal blood (if there is a stone), infection, or chemical changes suggesting kidney damage. Blood tests may also detect a decrease in kidney function. All urinary obstructions will undergo imaging of some sort. Beginning with standard X-ray to look for stones, radiologists, physicians specializing in the use of radiant energy for diagnostic purposes, will select from a wide array of tests. Ultrasound is simple, inexpensive, and very useful for these conditions. Standard X-rays can be enhanced with contrast agents in several ways. If the kidneys are functioning, they will filter an X-ray dye out of the blood and concentrate it in the urine, giving excellent pictures and also an assessment of kidney function. For better images of the lower urinary tract, contrast agents can be instilled from below. This is usually done with a cystoscope placed in the bladder. Through the cystoscope, a small tube can be threaded into the ureter through the uretero-vesical valve, allowing dye to be injected all the way up to the kidney. CT and MRI scanning provide miraculous detail, more than is often needed for this condition.

Prenatal diagnosis is possible, and in fact, most cases in pediatric patients are incidentally detected by routine screening ultrasounds obtained during pregnancy. However, approximately half of all prenatally identified hydronephrosis is transient, and resolves by the time the infant is born, and in another 15%, the hydronephrosis persists but is not associated with urinary tract obstruction (so-called non-refluxing, non-obstructive hydronephrosis). For these children, regression of the hydronephrosis occurs spontaneously, usually by age 3. However, in the remaining 35% of cases of prenatal hydronephrosis, a pathological condition can be identified postnatally.[5]

Diagnostic workup depends on the age of the patient, as well as whether the hydronephrosis was detected incidentally or prenatally or is associated with other symptoms. Blood tests (such measurement of creatinine) are typically indicated, though they must be interpreted cautiously. Even in cases of severe unilateral hydronephrosis, the overall kidney function may remain normal since the unaffected kidney will compensate for the obstructed kidney. Urinalysis is usually performed to determine the presence of blood (which is typical for kidney stones) or signs of infection (such as a positive leukocyte esterase or nitrite). Impaired concentrating ability or elevated urine pH (distal renal tubular acidosis) are also commonly found due to tubular stress and injury. Imaging studies — such as an intravenous urogram (IVU), ultrasound, CT or MRI — are also important investigations in determining the presence and/or cause of hydronephrosis. Whilst ultrasound allows for visualization of the ureters and kidneys (and determine the presence of hydronephrosis and/or

hydroureter), an IVU is useful for assessing the anatomical location of the obstruction. Ante grade or retrograde pyelography will show similar findings to an IVU but offer a therapeutic option as well. Real-time ultrasounds and color-flow Doppler tests in association with vascular resistance testing helps determine how a given obstruction is affecting urinary functionality in hydronephrotic patients. In determining the cause of hydronephrosis, it is important to rule out urinary obstruction. This can be done several ways. One way is to test the kidney's functionality. This can be done by, for instance, adiuretic intravenous pyelogram, in which the urinary system is observed radiographically after a medium that increases urine production (such as 5% mannitol) and a contrast medium (such as Couray 420) have been introduced into the circulatory system through a vein. A useful test that also helps determine the location of obstruction is the Whittaker (or pressure perfusion) test. In this test, the collecting system of the kidney is accessed directly through the skin (percutaneously), and the fluid is introduced at high pressure and constant rate of 10ml/min at the same time as the pressure within the renal pelvis is measured. A rise in pressure above 22cm H_2O suggests that the urinary collection system is obstructed. When arriving at this pressure measurement, bladder pressure is subtracted from the initial reading of internal pressure. (The test was first described by Whittaker in 1973 to test the hypothesis that patients' whose hydronephrosis persists after the posterior urethral valves have been oblate usually have ureters that are not obstructed, even though they may be dilated.)

Kay recommends that a neonate born with untreated in utero-hydronephrosis receive a renal ultrasound within two days of birth. A renal pelvis greater than 12mm in a neonate is considered abnormal and suggests significant dilation and possible abnormalities such as obstruction or morphological abnormalities in the urinary tract. The choice of imaging depends on the clinical presentation (history, symptoms and examination findings). In the case of renal colic (one sided loin pain usually accompanied by a trace of blood in the urine) the initial investigation is usually a spiral or helical CT scan. This has the advantage of showing whether there is any obstruction of flow of urine causing hydronephrosis as well as demonstrating the function of the other kidney. Many stones are not visible on plain X-ray or IVU but 99% of stones are visible on CT and therefore CT is becoming a common choice of initial investigation. CT is not used however, when there is a reason to avoid radiation exposure, e.g. in pregnancy. For incidentally detected prenatal hydronephrosis, the first study to obtain is a postnatal renal ultrasound, since as noted, many cases of prenatal hydronephrosis resolve spontaneously. This is generally done within the first few days after birth, although there is some risk that obtaining an imaging study this early may miss some cases of mild hydronephrosis due to the relative oliguria of a newborn. Thus, some experts recommend obtaining a follow up ultrasound at 4–6 weeks to reduce the false-negative rate of the initial ultrasound. A voiding cysto-urethrogram (VCUG) is also typically obtained to exclude the possibility of vesicoureteral reflux or anatomical abnormalities such as posterior urethral valves. Finally, if hydronephrosis is significant and obstruction is suspected, such as an uretero-pelvic junction (UPJ) or uretero-vesical junction (UVJ) obstruction, a nuclear imaging study such as a MAG-3 scan is warranted.

Pathophysiology: Obstruction that occurs anywhere along the upper urinary tract will lead to increased pressure within the structures of the kidney due to the inability to pass urine from the kidney to the bladder. Common causes of upper tract obstruction include obstructing stones and ureteropelvic junction (UPJ) obstruction caused by intrinsic narrowing of the ureters or an overlying vessel. Obstruction occurring in the lower urinary tract can also cause this increased pressure through the reflux of urine into the kidney. Common causes include bladder dysfunction (such as neurogenic bladder) and urethral obstruction (such as posterior urethral valves in male infants) or compression (such as from prostatic hypertrophy in older male adults). Anything that causes obstruction leads to increased pressure being transmitted to the delicate tissues that make up the filtration system within the kidneys, which could eventually result in infection, stone formation, or loss of function. Additional complications arising from obstruction of the lower urinary tract include the stagnation of urine flow which can also lead to infection in the bladder. Obstruction may be a result of a tumour in the pelvis compressing the ureters or urethra, for example in patients with advanced cervical cancer (stage IIIA to IVB).[6]

Treatment: The obstruction must be relieved, even if it is partial or functional, as in the case of reflux from the bladder. If not, the kidney will ultimately be damaged, infection will appear, or both. The task may be as simple as placing a catheter through a restricting prostate or as complicated as removing a cancerous bladder and rebuilding a new one with a piece of bowel.

In some cases, a badly damaged kidney may have to be removed. The objective of treatment for hydronephrosis is to resume the free flow of urine

from the kidney and decrease the swelling and pressure that builds up and decreases kidney function. The preliminary care for the patient is aimed at minimizing pain and preventing urinary tract infections. Otherwise, surgical involvement may be required. The timing of the process depends upon the underlying cause of hydronephrosis and hydroureter and the associated medical conditions that may be present.

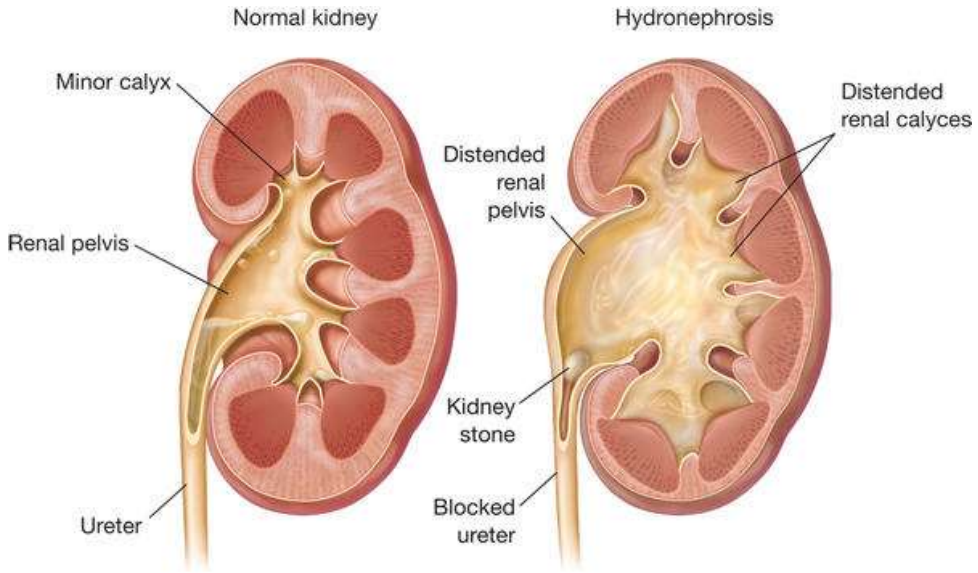

Figure-4: Hydronephrosis in kidney

For example, patients with a kidney stone may be allowed 1-2 weeks to pass the stone with only supportive pain control if urine flow is not completely blocked by the stone. If, however, the patient develops an infection or if they only have one kidney, surgical intervention may be done emergently to remove the stone. Shock wave lithotripsy (SWL or extracorporeal shock wave lithotripsy) is the most common treatment for kidney stones in the U.S. Shock waves from outside the body are targeted at a kidney stone causing the stone to fragment into tiny pieces that are able to be passed out of the urinary tract in the urine. Some conditions, for example retroperitoneal fibrosis or tumours, may require steroid therapy, a formal operation or laparoscopy to relieve the hydronephrosis or hydroureter while oral alkalinization therapy may be used to dissolve uric acid kidney stones.

Treatment of hydronephrosis focuses upon the removal of the obstruction and drainage of the urine that has accumulated behind the obstruction. Therefore, the specific treatment depends upon where the obstruction lies, and whether it is acute or chronic. Acute obstruction of the upper urinary tract is usually treated by the insertion of a nephrostomy tube. Chronic upper urinary tract obstruction is treated by the insertion of a ureteric stent or a pyeloplasty. Lower urinary tract obstruction (such as that caused by bladder outflow obstruction secondary to prostatic hypertrophy) is usually treated by insertion of a urinary catheter or a suprapubic catheter. Surgery is not required in all cases.

Alternative treatment

Catheters or other urinary diversions may be better for weak or ill patients who cannot tolerate more extensive procedures. There is support using botanical medicine that can help the patient using a catheter avoid infections. Consultation with a trained health care practitioner is necessary.[7]

Prognosis

After relief of the obstruction, a kidney may react with a brief flood of urine, but if the obstruction has been of short duration, normal kidney function will return. If one kidney is destroyed, the other will compensate for the lost organ. The prognosis of hydronephrosis is extremely variable, and depends on the condition leading to hydronephrosis, whether one (unilateral) or both (bilateral) kidneys are affected, the pre-existing kidney function, the duration of hydronephrosis (acute or chronic), and whether hydronephrosis occurred in developing or mature kidneys.

For example, unilateral hydronephrosis caused by an obstructing stone will likely resolve when the stone passes, and the likelihood of recovery is

excellent. Alternately, severe bilateral prenatal hydronephrosis (such as occurs with posterior urethral valves) will likely carry a poor long-term prognosis, because obstruction while the kidneys are developing causes permanent kidney damage even if the obstruction is relieved postnatally.

Prevention

Kidney stones can be prevented by dietary changes and medication. Prompt evaluation of infections and urinary complaints will usually detect problems early enough to prevent long-term complications. Hydronephrosis is a condition that typically occurs when one kidney becomes swollen due to the failure of normal drainage of urine from the kidney to the bladder. This swelling most commonly affects only one kidney, but both can be involved. Hydronephrosis is not a disease but a structural condition. It is a result of a blockage of or obstruction in the urinary tract. While this condition occurs in about 1 in 100 adults, it's also fairly common in babies. According to the Boston Children's Hospital, hydronephrosis affects about one in every 500 people (BHC).

Causes

What Causes Hydronephrosis?

Hydronephrosis is not a disease in and of itself. Instead, it can be caused by a number of internal and external conditions that affect the kidney and the kidney urinary collecting system. One of the most common causes is a condition is called acute unilateral obstructive uropathy. This is a sudden development of an obstacle in one of your ureters (the tubes that connect your kidneys to your bladder). The most common cause for this blockage is a kidney stone, but scarring and blood clots can also cause acute unilateral obstructive uropathy. A blocked ureter can cause urine to go back up into the kidney, which causes swelling. This backflow of urine is called vesico-ureteric reflux.

Other causes of blockage may include:

1. Kink in the urteropelvic junction (where the ureter meets the pelvis of the kidney) 2. Tumors in or near the ureter narrowing of the ureter from an injury or birth defect.

What Are the Symptoms?

In the normal human body, urine flows through the urinary tract with minimal pressure. If there is an obstruction in the urinary tract, pressure can build up. Once urine has built up for an extended period of time, your kidney can start to become enlarged. Your kidney may become so engorged with urine that it starts to press on nearby organs. If left untreated for too long this pressure can cause your kidneys to lose function permanently.[8]

The symptoms you have depend on how long you've had the obstruction. If you have hydronephrosis you could have mild symptoms like urinating more frequently and an increase in the urge to urinate. Other potentially severe symptoms you may experience are:

- pain in the abdomen or flank
- nausea and vomiting
- pain when urinating
- frequency of urination
- urgency of urination
- urinary tract infection (UTI)
- fever

When the flow of urine is interrupted, your chances of getting a urinary tract infection (UTI) increase. This is why UTIs are one of the most common symptoms of hydronephrosis. Some signs of a UTI include:

- cloudy urine
- painful urination
- weak urine stream
- back pain
- fever

If you see signs of hydronephrosis, schedule an appointment with your doctor to talk about the symptoms you're experiencing. It is important to remember that untreated UTIs may lead to more serious conditions such as pyelonephritis (infection of the kidney) and sepsis (infection in the bloodstream or blood poisoning).

Diagnoses of Hydronephrosis

Making sure that you're diagnosed as early as possible is extremely important. If your condition is left untreated for too long your kidneys could be permanently damaged. Your doctor will likely begin his or her questioning by getting an overall assessment of your health status and then focus on any urinary symptoms you might have. On physical examination, your doctor may be able to feel your enlarged kidney by palpating the abdomen and flank area.

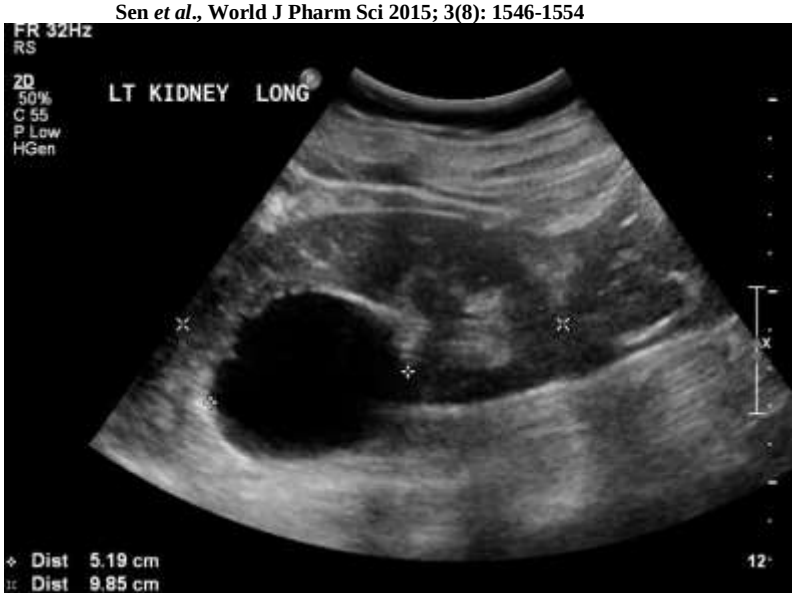

Figure-5: CT Scan of nephron in hydronephrosis

Your doctor may use a catheter to drain some of the urine from your bladder. If he or she is able to release a large amount of urine in this way it could mean that your obstruction is in your bladder or your urethra. The urethra is a tube that carries urine from your bladder to the outside of your body.

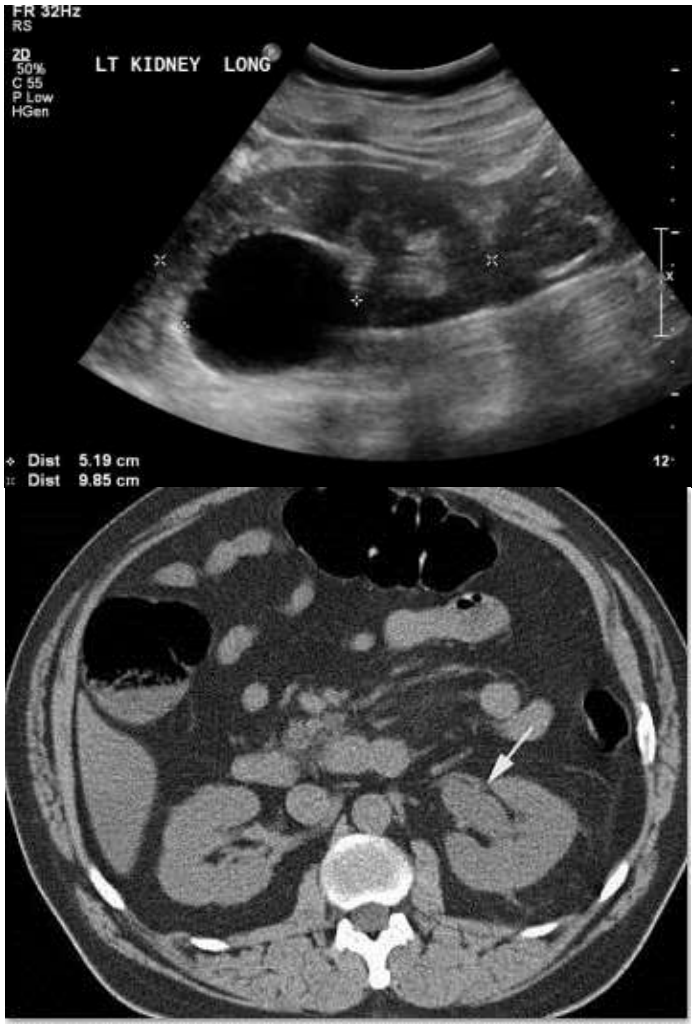

Figure-6: Ultrasound picture of hydronephrosis caused by a left ureteral stone

Your doctor may also want to perform an ultrasound or computed tomography (CT) scan to have a closer look at the extent of the swelling and to possibly locate the area of the blockage. Both of these procedures let your doctor view an image of the inside of your body.[9]

Conclusion:

Treatment for hydronephrosis is primarily focused on getting rid of whatever is obstructing the flow of urine. The treatment option your doctor chooses for you will depend on the cause of your obstruction.

If your condition is caused by a blocked ureter, the following procedures might be performed:

1. Insertion of a ureteral stent (tube that allows the ureter to drain into the bladder)
2. Insertion of a nephrostomy tube (allows the blocked urine to drain through the back)
3. Antibiotics to control infection

It is possible that the doctor could remove the obstruction with surgery. If the blockage is caused by something like scar tissue or a blood clot, the affected area may be removed completely. Your surgeon can then reconnect the healthy ends of your ureter to restore normal urine flow. Hydronephrosis due to a kidney stone at the ureteral vesicular junction seen on CT. Massive hydronephrosis as marked by the arrow. If the cause of your hydronephrosis is a kidney stone, surgery may be needed to remove it. Your kidney stone might be removed with endoscopic surgery, which uses tiny instruments to perform the procedure. This allows your doctor to make smaller incisions, drastically reducing your healing and recovery time. Your doctor might prescribe you a trial of low-dose of antibiotics. This will help ensure you don't develop a kidney infection.

Fatal Hydro necrosis: This article focuses on hydronephrosis that is detected by prenatal ultrasonography. This method of surveillance detects a significant fetal anomaly in 1% of pregnancies, of which 20-30% of cases are genitourinary in origin, and 50% manifest as hydronephrosis. If not for prenatal ultrasonographic detection, many of these urologic anomalies would manifest, as they did in the past, later in life as pyelonephritis, symptomatic flank or abdominal pain, renal calculi, hypertension, or even end-stage renal disease.

The degree and laterality of hydronephrosis may depend on the stage of pregnancy and the underlying etiology. Ultrasonography can detect the fetal bladder and kidney by 15 weeks' gestation and distinguish a central echo (renal sinus) by 18-20 weeks. At 20 weeks' gestation, the fetus is larger, and an anomaly is easier to detect. Antenatal hydronephrosis has received significant attention since prenatal ultrasonography became a mainstream screening tool; however, management and treatment remain controversial in terms of patient outcome. In addition, much of the controversy stems from diagnostic dilemmas and difficulties in ascertaining which lesions are obstructive and potentially harmful to the developing fetal kidney and other organ systems affected by renal function. In general, patients with obstructive uropathy that poses a significant risk of neonatal demise due to pulmonary hypoplasia may be considered candidates for antenatal treatment. Once prenatal treatment is decided, controversy remains regarding the efficacy of therapeutic intervention because of the limited knowledge of the underlying natural history and the difficulty in standardizing patient selection and determining appropriate outcome measures. Furthermore, early diagnosis of hydronephrosis may cause significant parental anxieties during the rest of the pregnancy.

REFERENCES

1. Kumar, V., Fausto, N., Robbins, S. L., Abbas, A.K., Cotran, R.S., Pathologic Basis of Disease (7th ed.). 2005, Philadelphia PA: Elsevier Saunders. p. 1012–4.
2. Mergener, K. *et al*., Dietl's crisis: a syndrome of episodic abdominal pain of urologic origin that may present to a gastroenterologist. Am J Gastroenterol 1997; 92(12): 2289–1.
3. Toka, H.R., Toka, O., Hariri, A., Nguyen, H.T., Congenital anomalies of kidney and urinary tract. Semin. Nephrol. 2010; 30(4): 374–6.
4. Koh, J.S., Wong. M.Y., Li, M.K., Foo, K.T., Idiopathic retroperitoneal fibrosis with bilateral lower ureteric obstruction—a case report with literature review. Singapore Med J 1998; 39(9): 416–7.
5. Estrada, C.R., Prenatal hydronephrosis: early evaluation. Current Opinion in Urology 2008; 18(4): 401–3.
6. Woodward M, Frank, D., Postnatal management of antenatal hydronephrosis. BJU Int 2002; 89(2): 149–6.
7. Carmody, J.B., Carmody, R.B., Question from the clinician: management of prenatal hydronephrosis. Pediatr Rev 2011; 32(12): e110–2.
8. Aksu, N *et al*., Postnatal management of infants with antenatally detected hydronephrosis. Pediatr Nephrol 2005; 20(9): 1253–9.
9. Onen, A., Treatment and outcome of prenatally detected newborn hydronephrosis. J Pediatr Urol 2007; 3(6): 469–6.