JAI GURU DEV

MAHARISHI VIDYA MANDIR

BIOLOGY INVESTIGATORY PROJECT

2025 – 2026

A COMPREHENSIVE CASE STUDY

ON

NEPHROLITHIASIS

Submitted by:

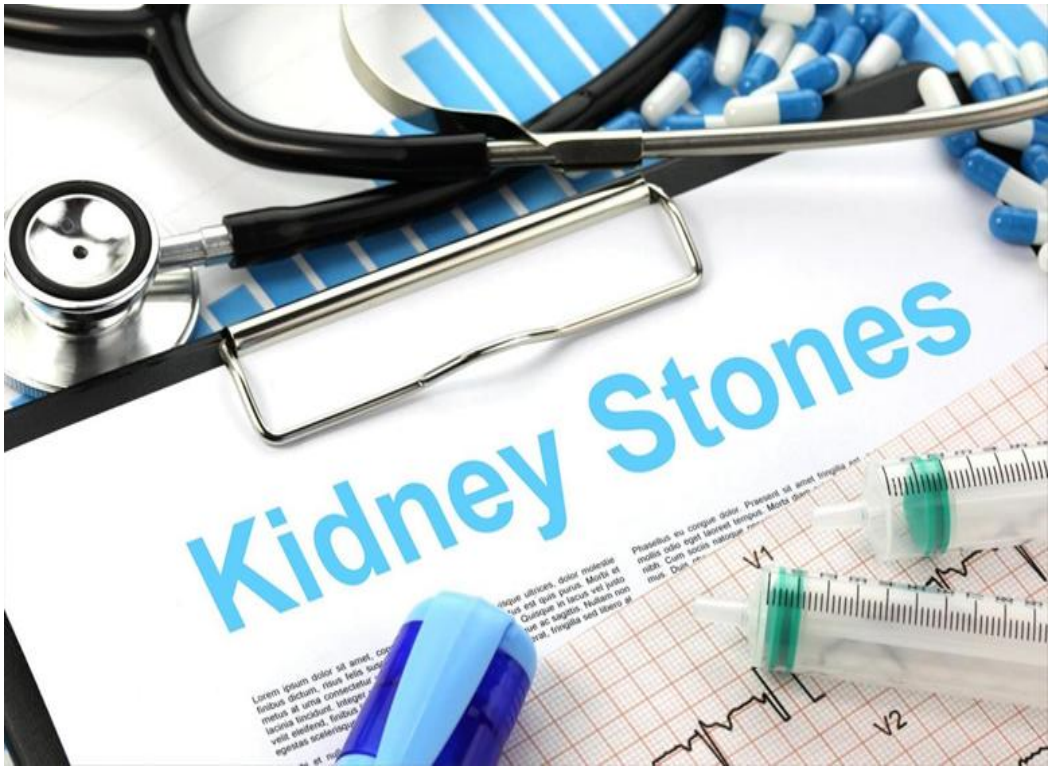
PADMAPRIYA.K

XII – S2

INDEX

SYNOPSIS:

Nephrolithiasis, commonly known as “Kidney stones”, is a medical condition involving the formation of solid masses (crystals) in the kidney. This case study explores on the causes, symptoms, diagnosis, treatment and preventive measures in a detailed manner

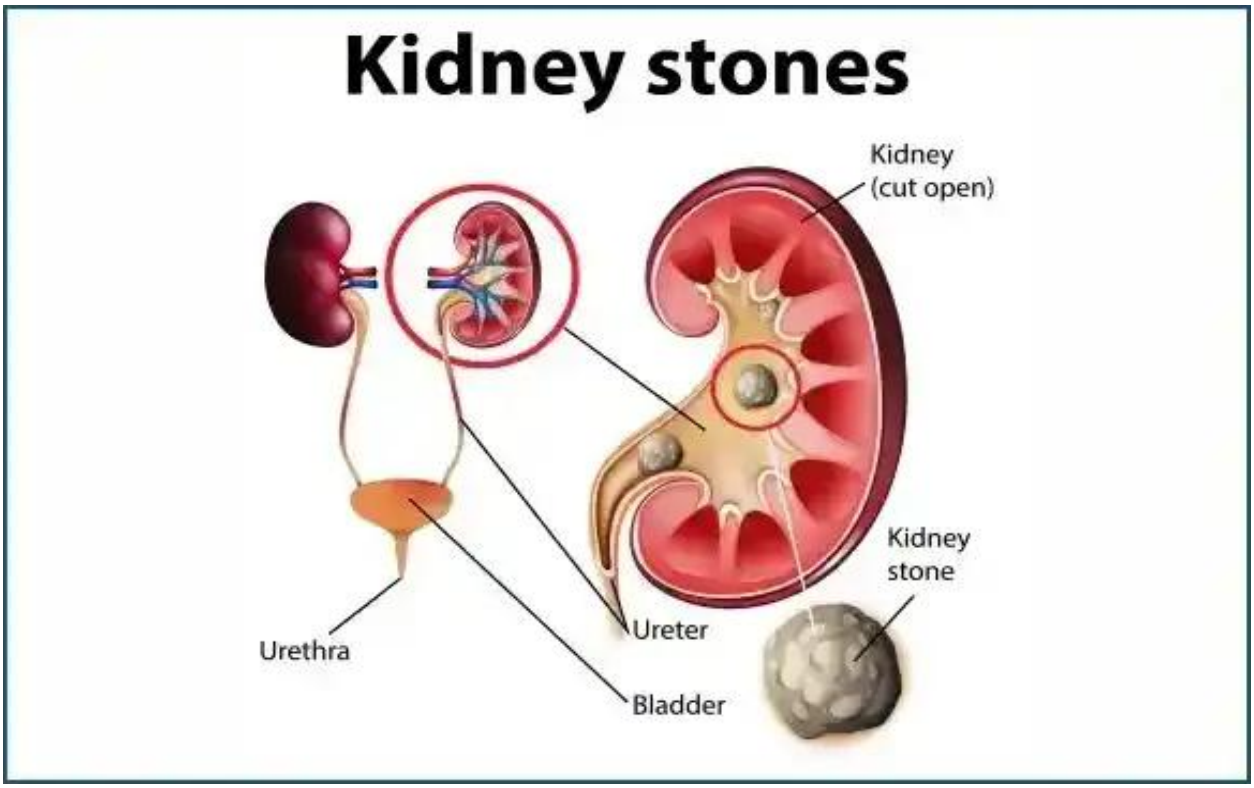


AIM:

To understand the formation, symptoms, diagnostic methods, and treatment options for nephrolithiasis and to analyze a case to apply theoretical knowledge in practical setting.

INTRODUCTION:

Kidney stones affects millions globally and is characterized by the presence of calculi in the kidneys. It may cause intense pain and other urinary symptoms. This case study provides a background on the condition including its types and formation.



MATERIALS REQUIRED:

- Patient History
- Diagnostic reports (ultrasound/CT scan)
- Medical references
- Consultation notes
- Patient case data
- Medical reference books

PROCEDURE:

1. Collect the medical history of at least five patients with their informed consent.

2. Carefully review their medical reports and highlight all relevant details.

3. Record your observations and analyze the following aspects:
    - Cause of kidney stone formation
    - Diagnostic methods used
    - Treatment prescribed
    - Severity of the condition
    - Impact on the patient's quality of life

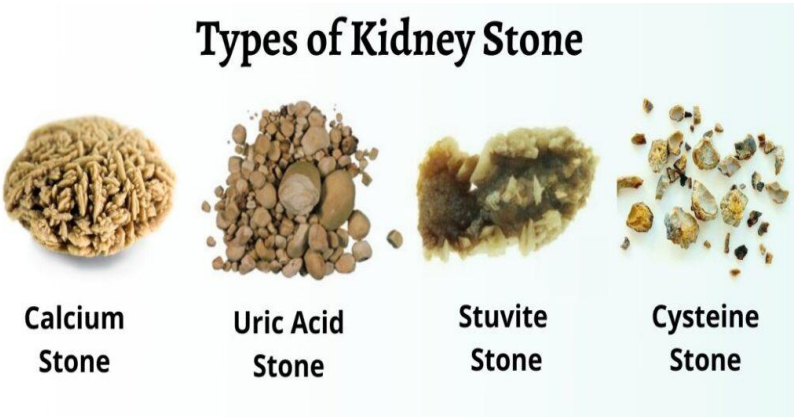
4. Ask questions and have detailed discussions with the patients about their experiences.

5. Examine each patient’s case thoroughly to learn more about kidney stones, including:
    - Formation process
    - Types of stones
    - Unique features and variations in each case

ASKING QUESTIONS TO PATIENTS FOR DETAILED ANALYSIS

TYPES OF KIDNEY STONES (NEPHROLITHIASIS):

There are several types of kidney stones, each formed from different substances. The most common type is **calcium stones**, usually made of calcium oxalate. **Uric acid stones** form when the urine is too acidic, often due to a high-protein diet. **Stuvite stones** can develop after a urinary tract infection and tend to grow quickly. **Cysteine stones** are rare and caused by a genetic disorder that leads to the buildup of cysteine in the urine.



CASE 1

NAME: Miss. Padmapriya. K

AGE: 17 years

GENDER: Female

MEDICAL HISTORY: Family history of kidney stones and low intake of water

SYMPTOMS: Severe lower abdomen and back pain accompanied with nausea.

DIAGONISIS: Multiple calculi seen in both kidneys, larger measures 4.8mm in right kidney, less than 3mm in left kidney. Mild right hydrouretronephrosis noted, calculus measuring 5.7mm noted on UV Scan.

TREATMENT: Hydration and dietary control.

IMPACT ON LIFE: Missed two weeks of school, initially faced anxiety. Sudden pain can cause distraction during class.

PHYSICIAN REFERED: Dr. Kannappa

CASE 2

NAME: Mr. Krishnamurthy.V

AGE: 49 years

GENDER: Male

MEDICAL HISTORY: No family history but history of dehydration and intake of oxalate rich foods like spinach and almonds were seen

SYMPTOMS: Sharp pain, vomiting accompanied with high fever and lower abdomen pain.

DIAGNOSIS: 12mm calculi (calcium oxalate) noted in left kidney, which was causing a mild blockage of flow of urine. Following year 10mm calculi was noted in right kidney with the help of CT scan

TREATMENT: Hydration, dietary changes, surgery

IMPACT ON LIFE: Significant changes in lifestyle, underwent surgery twice.

PHYSICIAN REFERED: Dr.Prasanth M. Kulkarni

CASE 3:

NAME: Mr. Arjun Sharma

AGE: 12 years

GENDER: Male

MEDICAL HISTORY: Obesity, high sodium intake. No family history

SYMPTOMS: High fever, unusual abdomen pain.

DIAGNOSIS: 4mm calculi noted in left kidney with the help of UV scan
Reports shows that he had difficulty in urinating, and he was advised to take painkillers regularly.

TREATMENT: Dietary changes, medications (painkillers)

IMPACT ON LIFE: Missed one month of school, changes in his day-to-day life, frequent hospital visits because of unbearable pain.

PHYSICIAN REFERED: Dr.Ram kumar

CASE 4:

NAME: Mrs. Savithri.V

AGE: 60 years

GENDER: Female

MEDICAL HISTORY: No family history, dehydration, high sodium intake.

SYMPTOMS: Nausea, back pain.

DIAGNOSIS: Right Kidney: Normal in size and outline. A small echogenic focus measuring approximately 3 mm is noted in the lower pole, suggestive of a renal calculus.

TREATMENT: Hydration and dietary changes
IMPACT ON LIFE: Missed one week of work, persistent lower back pain caused many troubles in day-to-day life

PHYSICIAN REFERED: Dr. Senthil kumar

CASE 5:

NAME: Mr.Balakrishnan

AGE: 65 years

GENDER: Male

MEDICAL HISTORY: High sodium intake. No family history

SYMPTOMS: Flank pain and high fever

DIAGNOSIS: 3mm calculi noted on left kidney, calculi was not seen in UV scan but later found through CT scan.

TREATMENT: Pain management and dietary changes.

IMPACT ON LIFE: Developed anxiety and significant changes in his food lifestyle.

PHYSICIAN REFERED: Dr.Venkatesh

CASE 6:

NAME: Mrs. Swathi Priyadharshini.S

AGE: 35 years

GENDER: Female

MEDICAL HISTORY: Stress, dehydration and high intake of caffeine. Family history of kidney stones.

SYMPTOMS: Sharp pain and nausea

DIAGNOSIS: 5mm calculi noted in left kidney causing mild urine blockage. This calculi was noted with the help of UV scan

TREATMENT: Medications and following yoga

IMPACT ON LIFE: Felt uncomfortable and irritated during day because of the pain.

PHYSICIAN REFERED: Dr. Kannappa

CASE 7:

NAME: Mrs. Gayathri.V

AGE: 60 years

GENDER: Female

MEDICAL HISTORY: No family history. Low intake of water had used many painkillers in the past.

SYMPTOMS: High fever and sharp pain.

DIAGNOSIS: Noted 3.5mm calculi in right kidney and less than 3mm calculi in left kidney through UV scan.

TREATMENT: Hydration, and dietary changes.

IMPACT ON LIFE: Pain was so severe to tolerate which caused many changes in her lifestyle.

PHYSICIAN REFERED: Dr. Udaya Kumar

CASE 8:

NAME: MR. Rajesh.N

AGE: 30 years

GENDER: Male

MEDICAL HISTORY: Family history. High intake of oxalate rich food and low intake of water

SYMPTOMS: Vomiting and sharp pain.

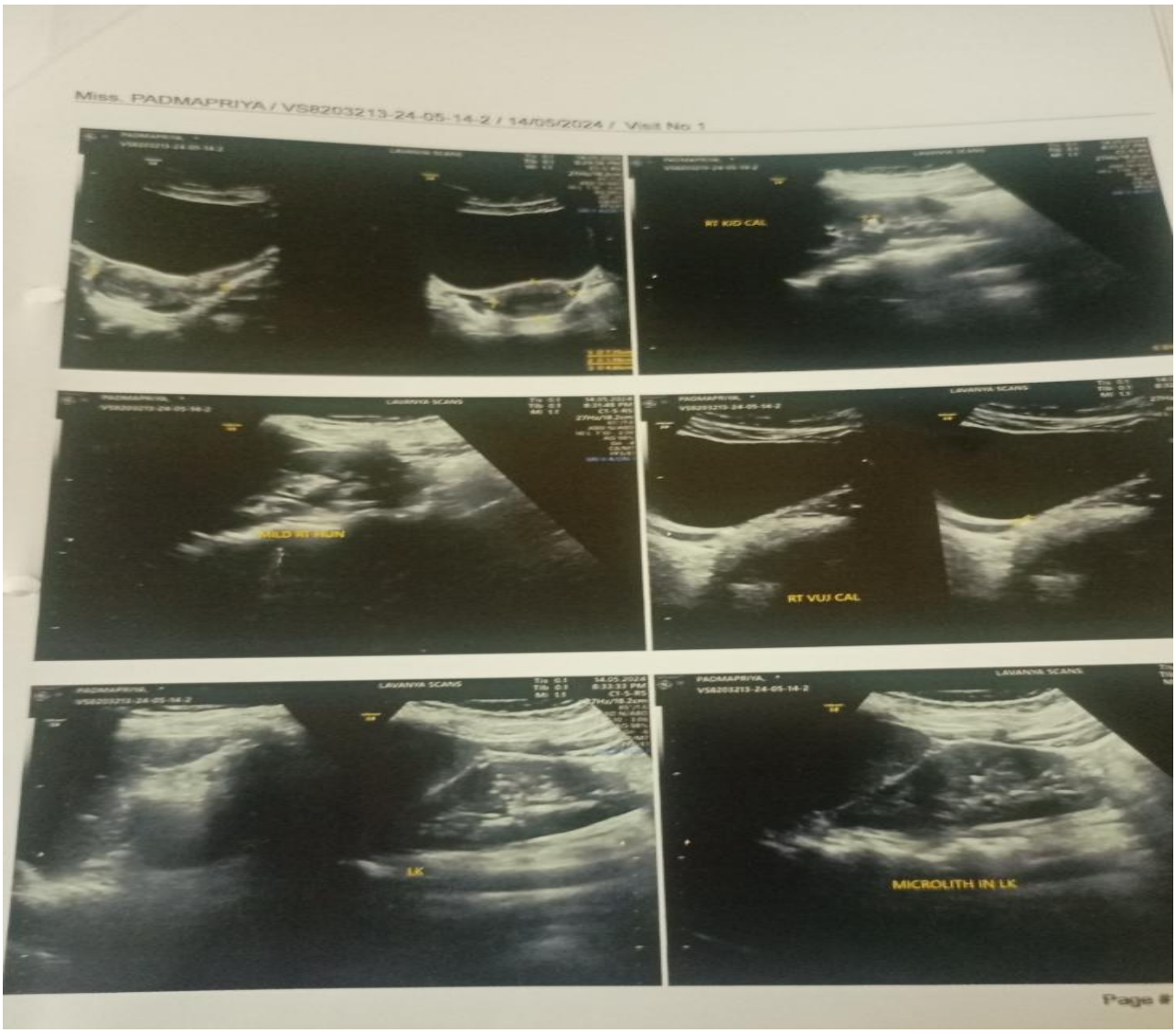
DIAGNOSIS: 2 to 3 calculi noted in both kidneys, larger measures 3.5mm in right kidney and 3.6 mm in left kidney. Found through UV scan.

TREATMENT: Dietary changes and hydration.

IMPACT ON LIFE: Missed one week of work due to pain.

PHYSICIAN REFFERED: Dr. Lavanya

UV SCAN REPORTS OF SOME PATIENTS



Dr LAVANYA SCANS AND DIAGNOSTICS

Dr. G. LAVANYA, MBBS, DMRD
Reg No. : 68169
CONSULTANT RADIOLOGIST

Patient name	Miss. PADMAPRIYA	Age/Sex	16 Years / Female
Patient ID	VS8203213-24-05-14-2	Visit no	1
Referred by	Dr. KANNAPPAN MBBS ,MD	Visit date	14/05/2024

WHOLE ABDOMEN REPORT

Real time B-mode ultrasonography of Abdomen, KUB, Uterus and Ovaries done

Abdomen

Liver normal in size(13.6cm) ,homogenous parenchymal echoes .
No abscess or mass lesion in the liver.
Gall bladder is partially distended.
Common duct appeared normal , No calculi seen in the common duct.
Pancreas appeared normal.
Spleen appeared normal.

KUB

Cortex of both kidneys appeared normal.
Right kidney measured 9.8 x 4.3 cms, normal in size
Left kidney measured 9.3 x 4.4 cms, normal in size
Multiple calculi seen in both kidneys ,larger measures 4.8 mm in right kidney mid pole and < 3 mm in left kidney
Mild right hydrouretronephrosis noted a calculus measures 5.7 mm noted in right distal ureter seen just proximal to VUJ.
No dilatation of left pelvic calyceal system and left ureter seen.
Bladder appeared normal.
No mass lesion seen in both iliac fossae.No e/o mesentric haziness and bowel wall thickening seen.No e/o inflammed appendix sen.

Pelvis

Transabdominal ultrasonography of the pelvis done.
Normal appearing uterus with homogeneous myometrial echoes.
Uterus measured 7.0 x 3.9 x 4.9 cms
Cavity echo appeared normal. (Thickness = 6.0 mm)
Right ovary appeared normal.
Right ovary measured 3.5 x 2.2 cms.
Left ovary appeared normal.
Left ovary measured 2.9 x 1.9 cms.
Both adnexa appeared normal.

IMPRESSION

Mild right hydrouretronephrosis due to distal ureteric calculus
Bilateral renal calculi.

Dr. G.LAVANYA MBBD.,DMRD
RADIOLOGIST

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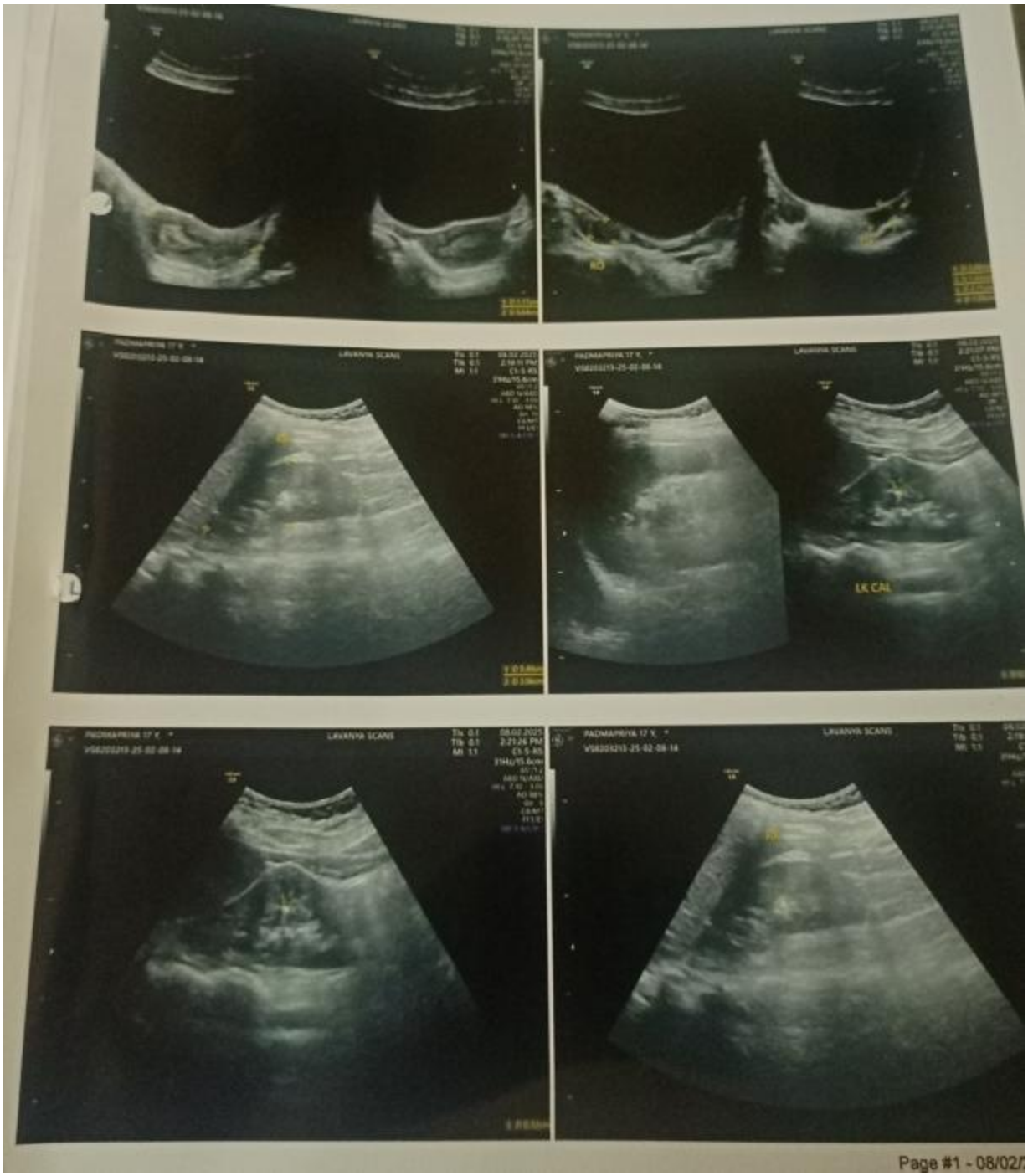
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WHOLE ABDOMEN REPORT

Real time B-mode ultrasonography of Abdomen, KUB, Uterus and Ovaries done

Abdomen

Liver is normal in size and filled with homogeneous parenchymal echoes. No abscess or mass lesion in the liver.
Gall bladder appeared normal. No calculi seen in the gall bladder.
Common duct appeared normal. No calculi seen in the common duct.
Pancreas appeared normal.
Spleen appeared normal.
Aorta appeared normal. No Para aortic nodes seen.
No free fluid in the peritoneal cavity

KUB

Both kidneys are normal in size and cortical echoes .
Right kidney measured 9.4 x 3.9 cms
Left kidney measured 10.0 x 4.4 cms
2 to 3 calculi noted in both kidneys,larger measures 3.5 mm in right kidney and 3.6 mm in left kidney.
No dilatation of bilateral collecting system & ureters seen.
Bladder appeared normal.
No mass lesion seen in both iliac fossae.

Pelvis

Transabdominal ultrasonography of the pelvis done.
Normal appearing uterus with homogeneous myometrial echoes
Uterus measured 6.6 x 4.4 x 5.1 cms
Cavity echo appeared normal. (Thickness = 11.7 mm)
Both ovaries are normal in size .
Right ovary measured 3.2 x 1.6 cms
Left ovary measured 2.7 x 1.5 cms
Both adnexa appeared normal.
POD is free.

IMPRESSION

Bilateral renal calculi

DR.G.LAVANYA MBBS, DMRD
RADIOLOGIST

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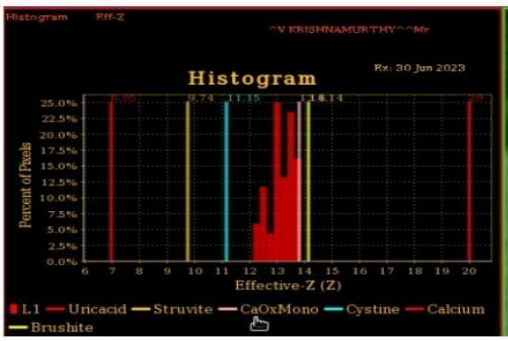

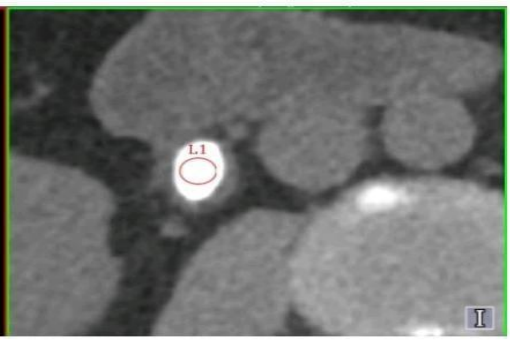

IMPRESSION:

- **Right pelviureteric junction calculus (1.3 x 1.0 x 1.6 cm) causing moderate hydroureteronephrosis.**
- **Two small left renal calculi.**
- **Diffuse fatty infiltration of liver.**

Dr Ankush Rawat
DNB Resident

Dr. Karthik.G.A, MDRD
Senior Consultant Radiologist
Lead in body imaging

Dr. Gokul G
Radiology Resident

Patient Name	Mr V KRISHNAMURTHY	**Requested By**	Dr. Prashanth M Kulkarni
MRN	10020000947607	**Procedure DateTime**	30-06-2023 14:59
Age/Sex	48Y 1M / Male	**Hospital**	NH-Health City

DUAL ENERGY CT – ABDOMEN AND PELVIS (PLAIN)

CLINICAL DETAILS: H/o left renal surgery, USG- right renal pelviureteric junction calculus 14 mm.

TECHNIQUE: Axial sections were obtained from the diaphragm down to the symphysis pubis without contrast. Sagittal and coronal reformats were obtained.

FINDINGS:

The liver is normal sized and shows decrease in attenuation. There is no intra/extra hepatic biliary dilatation. The common bile duct and the ampulla of Vater appear normal sized.

The gallbladder is normal sized with smooth walls. No radio-dense calculus is seen in it.

The pancreas shows a normal size, configuration and tissue density. No significant ductal dilatation / calcification is seen.

The spleen is normal in size and parenchymal attenuation.

The gastro-esophageal junction is normal. No bowel wall thickening / dilatation is seen. The appendix is within normal limits. Mild fecal loading of colon.

The suprarenal glands show normal size and configuration of their limbs.

Both kidneys are normal sized with homogeneous cortical density. Two radio dense calculus noted in left kidney, largest measuring 1.2 x 1 mm (~291 HU) in upper pole calyx.

A radio dense calculus noted in right pelviureteric junction measuring 1.3 x 1.0 x 1.6 cm (AP x TR x CC) (~947 HU) causing moderate hydroureteronephrosis and mild periureteric fat stranding. On spectral analysis, calculus composition is ***calcium oxalate monohydrate***.

The urinary bladder shows a smooth contour. No intravesical mass or calculus is seen.

The prostate is not enlarged.

No retroperitoneal or mesenteric lymphadenopathy is seen.

Mesenteric fat appears normal. There is no free or loculated peritoneal fluid collection.

Mild degenerative changes of the spine are noted. Bilateral basal lobe atelectasis.

Right pelviureteric junction calculus: ***calcium oxalate monohydrate***

OBSERVATION:

The observations were compiled from the analysis of the USG reports, focusing on kidney stone characteristics and associated complications.

- **General Observations (Across Patients):**
  - All patients exhibited renal calculi, with sizes ranging from 3 mm to 12 mm.
  - The right kidney was more commonly affected in Padmapriya, Krishnamurthy, Savithri, and Rajesh, while Arjun Sharma, Balakrishnan, Gayathri had a left-sided stone.
  - No significant bladder abnormalities were noted across all patients, suggesting that the primary issue was renal or ureteral in nature.
- **Patient-Specific Observations:**
  - **Padmapriya:** Multiple calculi and moderate hydroureteronephrosis indicate a higher risk of urinary tract obstruction, potentially leading to renal damage if untreated.
  - **Krishnamurthy:** The progression of stone formation from the right to the left kidney over a year suggests a chronic stone-forming tendency.

- **Arjun Sharma:** The 4 mm stone near the VUJ and mild hydroureter explain the difficulty in urinating, highlighting the impact of stone location
- **Savithri:** The 3 mm stone in the right kidney is currently non-obstructive, but her age increases the risk of future
- **Mr. Balakrishnan:** Patient experienced flank pain and fever, with a 3mm kidney stone detected only through CT scan after initial UV scan failed.
- **Mrs. Swathi Priyadharshini. S:** Patient showed signs of dehydration and stress, with a 5mm kidney stone identified through UV scan.
- **Mrs. Gayathri. V:** Patient had severe pain and fever, and UV scan revealed stones in both kidneys due to low water intake and past painkiller use.
- **Mr. Rajesh. N:** Patient suffered from vomiting and sharp pain, with multiple stones found in both kidneys linked to high oxalate diet and poor hydration.

RESULT:

The analysis of USG and clinical data across the patient cases indicates that **renal calculi (kidney stones)** are predominantly associated with **lifestyle factors** such as **inadequate hydration, high sodium or oxalate intake, stress**, and in some cases, a **family history of stone formation**. The stones ranged in size from **3 mm to 12 mm**, with both **unilateral and bilateral occurrences**. Notably, the **right kidney** was slightly more frequently affected than the left.

The **severity of symptoms** (such as flank pain, fever, nausea, and urinary obstruction) correlated with **stone size, location, and hydration status**. Imaging techniques like **UV scan** were helpful in diagnosis, but in at least one case (**Mr. Balakrishnan**), a **CT scan was necessary** for accurate detection.

While no bladder abnormalities were found, the presence of **hydroureteronephrosis in some patients** highlights the risk of urinary tract obstruction. The findings reinforce the importance of **early detection, lifestyle modification, and personalized treatment plans** in the effective management of renal calculi.

CONCLUSION:

The study of patient cases through USG analysis reveals that **kidney stone formation is significantly influenced by lifestyle-related factors**, including **low fluid intake, high sodium or oxalate-rich diets, stress, and inadequate physical activity**. In a few cases, **genetic predisposition** also played a role. The condition manifested with symptoms such as **sharp flank pain, fever, nausea, and urinary discomfort**, all of which impacted patients' daily activities and quality of life.

Although most stones were **small (3–5 mm)** and potentially manageable with hydration and dietary changes, the **location of the stones**, particularly near the **VUJ** or causing **obstruction**, resulted in more severe symptoms. The findings also highlight the **limitations of UV scans** in detecting smaller stones in certain cases, emphasizing the need for **advanced imaging** when symptoms persist**.**

This observation underscores the importance of **preventive healthcare through hydration, dietary regulation, stress management, and routine screening**, especially for individuals at risk. Early diagnosis and proper intervention can **prevent complications**, reduce patient discomfort, and **improve long-term renal health outcomes**.

PRECAUTION:

1. **Patient Consent:** Ensure that informed consent is obtained from all patients before collecting or using their medical history and diagnostic details for analysis.

2. **Confidentiality:** Maintain strict confidentiality of personal data, using only relevant clinical information without revealing full identities unless authorized.

3. **Data Accuracy:** Cross-verify medical reports (USG, CT scans, prescriptions) to avoid any misinterpretation of stone size, location, or diagnosis.

4. **Ethical Considerations:** Respect the ethical guidelines for handling patient data and discussing their medical conditions, particularly when dealing with sensitive health issues.

5. **Medical Supervision:** Interpret diagnostic results (like USG or CT findings) under the guidance of a qualified medical professional to avoid incorrect conclusions.

6. **Consistent Observation:** Follow a standardized observation format for all patient cases to maintain uniformity in data collection and analysis.

7. **Imaging Limitations:** Acknowledge the limitations of imaging techniques like UV scan and the need for additional tests (e.g., CT scan) in certain undetectable cases.

8. **Lifestyle Factors:** Consider external influencing factors (diet, hydration, stress) that may vary day-to-day and affect results, avoiding generalizations from small samples.

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