

Hydronephrotic Kidney Assessment via Ultrasonography

BHAGWAN DAS¹, KAILASH KUMAR DASEJA², INAYATULLAH³, MUHAMMAD RASHID RASUL⁴, AKHTAR HUSSAIN PHUL⁵, IMRAN KHAN MEMON⁶

^{1,2}Assistant Professors, Department of Radiology, Chandka Medical College Hospital, Larkana

³Assistant Professor, Department of Radiology, Ghulam Muhammad Mahar Medical College, Sukkur

⁴Assistant Professor, Department of Radiology, DG Khan Medical College, Dera Ghazi Khan

⁵Assistant Professor, Department of Radiology, Khairpur Medical College, Khairpur Mir's

⁶Assistant Professor, Department of Radiology, Chandka Medical College Hospital, Larkana

Correspondence to: Bhagwan Das, Email: drbd32@gmail.com, Cell: 03337551881

ABSTRACT

Objective: To assess hydronephrotic kidney assessment via ultrasonography.

Study Design: Prospective study.

Place and Duration of Study: Department of Radiology, Chandka Medical College Hospital, Larkana from 1st August 2020 to 31st September/2021.

Methodology: Two hundred patients visited for the complaint and suspicion of hydronephrosis and within them 40 patients were diagnosed with hydronephrosis. The both kidneys were examined in the longitudinal as well as transvers planes of scanning using colored Doppler technique in ultrasonography. In older age patients a curved-array transducer having centered frequencies (3-6 MHz) was applied while in case of younger patients' linear array-transducer was used with high centre frequencies.

Results: The age of the patients was between 12-72 years with more elderly patients than youngsters. Most of the patients were males rather than females. Ureteropelvic obstruction in junction, primary megaureter as well as urethral valve involvement was observed in ultrasound imaging of hydronephrotic pediatric kidney. End stage hydronephrosis was presented in adult patients with cortical thinning.

Conclusion: Ureter and kidney stone appeared to be a common reason of hydronephrosis.

Keywords: Hydronephrosis, Ultrasonography, Blockage, Calculi

INTRODUCTION

Hydronephrosis is one of the most common renal conditions which require clinical assessment for proper identification and diagnosis. The obstruction causing hydronephrosis can be presented anywhere within the urinary tract. The cause behind the obstruction is a defect in ureteropelvic-junction, urinary tract obstruction or extra uropathic-lesion.¹⁻³ Uropathy can be an effect of interrupted urine flow in kidney as well as urethra, or bladder, prostate, alterations of retroperitoneum or the vascular system.^{4,5}

Ultrasound has been used as a main method of detecting hydronephrosis. Unfortunately, there are various interfering factors in the detection of hydronephrosis. This escalates the need of additional and improved ultrasound imaging technique for better diagnostic value.⁵

Hydronephrosis has been detected as either unilateral or present bilaterally. The presentation may also be acute or as chronic. The aetiology of the hydronephrosis in young adults mostly involved presence of calculi. Whereas in adults it is seemed to be associated with hypertrophy of the prostate, cancer, retroperitoneal abnormality, pelvic neoplasm in addition to calculi.⁶⁻

⁸ Symptoms of the hydronephrosis includes margin pain, mass in abdomen, vomiting, nausea, UTI, fever, dysuria, increased urination as well as urine urgency.⁹⁻¹¹ The present study was designed to evaluate the ultrasound findings of the hydronephrotic kidney. This will assist in better understanding of the imaging reports and management of the disease.

MATERIALS AND METHODS

It was a prospective study which was conducted at Department of Radiology, Chandka Medical College Hospital, Larkana from 1st August 2020 to 31st September 2021. Two hundred patients visited for the complaint and suspicion of hydronephrosis and within them 40 patients were diagnosed with hydronephrosis. The ultrasonographical imaging was performed in each patient in supine positioning. The both kidneys were examined in the longitudinal as well as transverse planes of scanning using coloured Doppler technique in ultrasonography. A transducer was placed in flanks. In conditions where renal insonation was obscured through intestinal air, the supine-scanning position was further combined with lateral-decubitus position along with transducer being moved in dorsal position. The scan is initiated in

the longitudinal plane which is parallel to the diameter (long) of kidney making identification easier. In older age patients a curved-array transducer having centered frequencies (3-6 MHz) was applied while in case of younger patients' linear array-transducer was used with high centre frequencies. Lower ribs artefacts shadowed upper kidney poles but complete kidney examination could be done during respiration, holding of the breath as kidney followed diaphragm and altered in position consequently. Data was statistically analyzed using SPSS version 26.

RESULTS

The age of the patients was between 12-72 years with more elderly patients than youngsters. The mean age of the patients was 42.3±4.4 years. Most of the patients were males rather than females (Table 1).

Hydronephrosis was observed as anechoic-fluid filled, interconnected space along with augmentation in renal-sinus. Dilated pelvis was visibly differentiable from the dilated calyces. Ureteropelvic obstruction in junction, primary megaureter as well as urethral valve involvement was observed in ultrasound imaging of hydronephrotic pediatric kidney (Fig. 1).

In case of the adult patients urolithiasis (57.89%) was commonly observed which obstructed the renal pelvis outlet or ureter. Retroperitoneal fibrosis was presented in 2.6% of adult population. There were only two cases with an age between 12-17 years of age. Prostate Hypertrophy was observed in 21.05% of adult cases (Table 2).

There five categorizations of hydronephrosis which can be classified as slight renal pelvis expansion till end stage hydronephrosis. End stage hydronephrosis was presented in adult patients with cortical thinning (Fig. 2).

Table 1: Distribution of age and gender among enrolled patients

Variable	No.	%
Age (years)		
12-22	3	7.5
23-52	11	27.5
53-72	26	65
Gender		
Male	29	72.5
Female	11	27.5

Table 2: Comparison in young and adult for reasons of hydronephrosis

Hydronephrosis Cause	No.	%
Young cases (n=2)		
Primary megaureter	1	50.0
Obstructed kidney	1	50.0
Urolithiasis	2	100.0
Adult Cases (n=38)		
Kidney Stones	10	26.31
Ureter Stones	11	28.9
Retroperitoneal fibrosis	1	2.6
Carcinoma	4	10.52
Pelvic Neoplasm	1	2.6
Pregnancy Related	3	7.89
Prostate Hypertrophy	8	21.05



Fig. 1: Ureteropelvic junction obstruction observed in young patient with hydronephrosis



Fig. 2: End stage hydronephrosis with cortical thinning

DISCUSSION

Obstructive hydronephrosis is obstruction in urine flow from kidney due to functional and structural changes in kidney. This can be done due to interruption of urine discharge in bladder, prostate, urethra, kidney or changes in vascular system.^{12,13} Ultrasonography is used for the detection and diagnosis of uropathies particularly hydronephrosis. It can unilateral, involving one kidney or sometime bilateral, problem in both kidneys. Likewise, it can be chronic or acute. Etiological profile is different in young and older patients, calculi in younger individuals whereas, calculi, pelvic neoplasm and carcinoma in older patients.^{7,8}

Common sign and symptoms of hydronephrosis include fever, abdominal mass, urinary tract infection, vomiting and nausea, dysuria, increased urinary urgency, increased urinary frequency.^{14,15} Hydronephrosis is also observed in pregnant females which occurred due to progesterone effect or due to ureter compression due to pregnancy.^{9,16} In the present study, 26% of the patients had kidney stones, 28.9% of the patients had ureter stones, almost 10% of the individuals had carcinoma, pelvic neoplasm in 2% of the patients while from young cases, 50% (n=1) had primary megaureter.

It is primarily not a disease but a secondary disease that occurred due to number of underlying conditions. It's an obstruction or blockage in urinary tract. Ultrasound helps in clinical evaluation and diagnosis when combined with other findings for proper disease management.¹⁰

CONCLUSION

Ureter and kidney stone appeared to be a common reason of hydronephrosis. Ultrasonography will prove beneficial for the evaluation and diagnosis of the disease condition when combined with other clinical findings.

REFERENCES

- Portero M, de Merlo EM, Perez C, Bernito M, Daza MA, Fragio C. Cerebrospinal fluid and blood lactate concentrations as prognostic biomarkers in dogs with meningoencephalitis of unknown origin. *Vet J* 2019; 254: 105395.
- Muraoka S, Lin W, Chen M, Hersh SW, Emili A, Xia W, et al. Assessment of separation methods for extracellular vesicles from human and mouse brain tissues and human cerebrospinal fluids. *Methods* 2020; 177: 35-49.
- Ohata Y, Tomita Y, Sunakawa K, Drusano GL, Tanigawara Y. Cerebrospinal pharmacokinetic and pharmacodynamic analysis of efficacy of meropenem in paediatric patients with bacterial meningitis. *Int J Antimicrob Agents* 2019; 54(3): 292-300.
- Zeidel ML. Obstructive uropathy. In: Goldman L, Schafer AI, ed. *Cecil medicine*. 24th ed. Philadelphia: Saunders, 2011.
- Pepe P, Motta L, Pennisi M, Aragona F. Functional evaluation of the urinary tract by color-doppler ultrasonography (CDU) in 100 patients with renal colic. *Eur J Radiol* 2005; 53:131-5.
- Liu X, Song JL, Wang SH, Zhao JW, Chen YQ. Learning to diagnose cirrhosis with liver capsule guided ultrasound image classification. *Sensors* 2017; 17(1): 149.
- Varma G, Nair N, Salim A, Marickar YMF. Investigations for recognizing urinary stone. *Urol Res* 2009;37(6):349-52.
- Tanagho JW, McAninch EA *Smith's general urology*. 16th ed. New York: Lange Medical Books 2004; 175-87.
- Kawashima A, Vrtiska TJ, LeRoy AJ, Hartman RP, McCollough CH, King BF Jr.. *CT Urography*. *Radiographics* 2004;24(Suppl 1): S35-54.
- Blandino A, Gaeta M, Minutoli I, Salamone I. MR Urography of the ureter: pictorial essay. *AJR* 2002;179(5):1307-14.
- Lameire N, Van Biesen W, Vanholder R. Acute renal failure. *Lancet* 2005;365(9457):417-30.
- Zeidel ML. Obstructive uropathy. In: Goldman L, Schafer AI, eds. *Cecil medicine*. 24th ed. Philadelphia, Saunders 2011.
- Pepe P, Motta L, Pennisi M, Aragona F. Functional evaluation of the urinary tract by color-Doppler ultrasonography (CDU) in 100 patients with renal colic. *Eur J Radiol* 2005;53:131-5.
- Singh I, Strandhoy JW, Assimos DG. Pathophysiology of urinary tract obstruction. In: Wein AJ, ed. *Campbell-Walsh urology*. 10th ed. Philadelphia: Saunders, 2011.
- Semins MJ, Trock BJ, Matlaga BR. The safety of ureteroscopy during pregnancy: a systematic review and meta-analysis. *J Urol* 2009;181:139-43.
- Glanc F, Maxwell C. Acute abdomen in pregnancy. Role of sonography. *J Ultrasound Med* 2010;29:1457-68.