



# **Assessment of Incidence of Hydroureteronephrosis among Pregnant Women of a Tertiary Care Hospital**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Background:** Some degree of dilatation of the upper two-thirds of the ureter and the pelvicalyceal system is observed in physiological hydroureteronephrosis. It may be present in 90% of pregnancies and is more pronounced on the right side. It develops as early as 6-10 weeks of gestation and disappears a few weeks after birth. Smooth muscle-relaxant effects of progesterone and mechanical compression have been postulated as contributing factors. Ultrasound is the imaging modality of choice. Most of the cases resolve with conservative measures.

**Objectives:** The study aimed to assess the incidence of hydroureteronephrosis in pregnancy using ultrasound, to assess the laterality of hydroureteronephrosis in pregnancy and to assess the proportion of subjects with hydroureteronephrosis in pregnancy requiring intervention.

**Materials and Methodology:** A prospective study was conducted among the pregnant women presenting to the department of obstetrics and gynecology in a tertiary health care hospital from January 2021 to April 2021. A simple random sampling technique was employed, 40 subjects were identified for the study. The relationship between hydroureteronephrosis and gestational age, urinary tract problems and parity were compared.

**Results:** Unilateral right-sided hydroureteronephrosis was present in 7 (36.8%) of the study subjects with hydroureteronephrosis. Hydroureteronephrosis was observed in 22.5% and 15% of the study subjects on the right and left side respectively during the second trimester.

Hydroureteronephrosis was observed in 30% and 15% of the study subjects with urinary tract problems on the right and left side respectively. Hydroureteronephrosis was observed in 13 (52%) of the study subjects with no previous delivery.

**Conclusion:** The incidence of hydroureteronephrosis was found to be 47.5%. Differentiation of physiological and pathological hydroureteronephrosis is necessary. A coordinated approach between obstetricians and urologists is essential to provide the best care for the mother and the fetus.

**Keywords:** Incidence; hydroureteronephrosis; pregnancy; physiological; laterality; parity; gestational age; urinary tract problems.

## 1. INTRODUCTION

The kidneys enlarge during pregnancy up to 1 cm and the volume of the kidneys increase by 30%. This is accounted for by the dilation of the entire collecting system and increased kidney vascular and interstitial volume [1]. The presence of hydroureteronephrosis can be physiological or pathological [2, 3]. Mild asymptomatic hydroureteronephrosis is a maternal physiological change in pregnancy where in some degree of dilatation of the upper two-thirds of the ureter and the pelvicalyceal system is observed. It may be present in 90% of pregnancies [4].

Hydroureteronephrosis develops as early as 6-10 weeks of gestation [5, 6]. It disappears a few weeks after birth. Hydroureteronephrosis is more pronounced on the right side as compared to the left side. Smooth muscle-relaxant effects of progesterone and mechanical compression of the gravid uterus on the ureters have been postulated as contributing factors for the development of hydroureteronephrosis [7,8,9]. Mechanical compression causes partial obstruction to the urine outflow, increased pressure in the proximal ureter and subsequent development of ureteral and calyceal dilatation. Ultrasound remains the imaging modality of choice for the evaluation of hydroureteronephrosis in pregnancy [10,11]. Most of the cases resolve with conservative measures with less than 10% requiring surgical drainage with stent insertion [12, 13].

Most studies on physiological hydroureteronephrosis are approximately three decades old. Not many studies have been done in our environment to determine the pattern of dilatation of the collecting system of the kidneys during pregnancy. Since there is a gap in the literature in India on this fast-growing problem, this study was intended to explore more about the effects of urinary tract problems and parity on

the grade of hydroureteronephrosis during pregnancy.

### 1.1 Aims and Objectives

The present study was designed to,

1. Assess the incidence of hydroureteronephrosis in pregnancy using ultrasound.
2. Differentiate between physiological and pathological causes of hydroureteronephrosis in pregnancy.
3. Assess the proportion of patients with hydroureteronephrosis in pregnancy requiring intervention.
4. Assess the laterality of hydroureteronephrosis in pregnancy.

## 2. METHODOLOGY

This study was done as a prospective study to assess the incidence of hydroureteronephrosis in a Tertiary health care hospital from January 2021 to April 2021. The minimum sample size required for the study was estimated to be 40 patients. They were identified for the study using a simple random sampling technique. All pregnant women presenting to the department of obstetrics and gynecology were included in the study. Patients with previously documented causes of hydroureteronephrosis were excluded. Informed consent was obtained from the subjects. The study tool was a structured questionnaire and ultrasonographic assessment was done. All the pregnant women emptied their urinary bladder before scanning to remove the effect of full bladder on the urinary tract dimensions. The pregnant women were in a prone position and the kidneys were scanned in the longitudinal plane from lateral to the medial edge.

A system of grading as detailed by Oyinloye et al was used.

Grade 0: Normal size, renal pelvicalyceal diameter 0-5 mm.

Grade I: Mild dilatation, renal pelvicalyceal diameter 6-10 mm.

Grade II: Moderate dilatation, renal pelvicalyceal diameter 10-15mm.

Grade III: Severe dilatation, renal pelvicalyceal diameter  $\geq$  16mm.

For analysis, the right and the left kidneys were considered separately, the pregnant women were divided into groups of three trimesters. Data analysis was done using the statistical package SPSS 22 version. The incidence of hydronephrosis among pregnant women with and without urinary tract problems and the incidence among primiparous and multiparous women were compared. Positive criteria for urinary tract history include increased urinary frequency, increased urgency, nocturia, decrease in the stream while urinating, intermittent urine stream, incontinence, flank pain, strain while urinating. The relationship between each trimester and hydronephrosis was also compared. Before the conduct of the study, ethical clearance was obtained from the institutional Ethics Committee.

### 3. RESULTS

#### 3.1 Association with Age

In the present study, it was found that among the 40 pregnant women, 18 (45%) of the study subjects belonged to the age group between 21–25 years, 16 (40%) of the study subjects belonged to the age group between 26-30 years and 6 (15%) of the study subjects belonged to the age group between 31 to 35 yrs. The mean age of the study subjects was 26.4 years with a standard deviation of 3.128 years. It was found that among the 18 pregnant women below 25 years, hydronephrosis was present in 8 (44.4%) of the study subjects. It was also found that among the 16 pregnant women belonging to the age group between 26 to 30 years, hydronephrosis was present in 8 (50%) of the study subjects. It was found that among the 6 pregnant women above 30 years, hydronephrosis was present in 3 (50%) of the study subjects.

#### 3.2 Association with Weight Status

In the present study, it was found that among the 40 pregnant women, 23 (57.5%) of the study subjects had a BMI of less than 24.9, 12 (30%) of the study subjects had a BMI between 25 to 29.9, and 5 (12.5%) of the study subjects had a BMI of more than 30. It was found that among the 23 pregnant women with a BMI of less than 24.9, hydronephrosis was present in 11 (47.8%) of the study subjects. It was also found that among the 12 pregnant women with a BMI between the range 25 to 29.9, hydronephrosis was present in 5 (16.6%) of the study subjects. It was found that among the 5 pregnant women with a BMI of more than 30, hydronephrosis was present in 3 (60%) of the study subjects.

#### 3.3 Incidence of Hydronephrosis

In the present study, it was found that among the 40 pregnant women, unilateral or bilateral hydronephrosis was present in 19 (47.5%) of the study subjects. It was found that among the 19 pregnant women with hydronephrosis, unilateral right-sided hydronephrosis was present in 7 (36.8%) of the study subjects and bilateral hydronephrosis was present in 12 (63.1%) of the study subjects. Grade I hydronephrosis was observed in 11 (27.5%) of the study subjects on the right side and 6 (15%) of the study subjects on the left side. Grade II hydronephrosis was observed in 7 (17.5%) of the study subjects on the right side and 4 (10%) of the study subjects on the left side while Grade III hydronephrosis was observed in 1 (2.5%) of the study subjects on the right side and 2 (5%) of the study subjects in the left side. It was found that among the 40 pregnant women, at least mild hydronephrosis was observed in 19 (47.5%) of the study subjects on the right side and 12 (30%) of the subjects on the left side. A higher incidence of hydronephrosis was noted on the right side.

#### 3.4 Association with Gestational Age

In the present study, it was found that among the 40 pregnant women, 11 (27.5%) of the study subjects belonged to the first trimester, 21 (52.5%) of the study subjects belonged to the second trimester and 8 (20%) of the study subjects belonged to the third trimester. It was

found that among the 11 pregnant women belonging to the first trimester, hydroureteronephrosis was observed in 10% of the study subjects on the right side and 2.5% of the study subjects on the left side. It was also found that among the 21 pregnant women belonging to the second trimester, hydroureteronephrosis was observed in 22.5% of the study subjects on the right side and 15% of the study subjects on the left side. It was found that among the 8 pregnant women belonging to the third trimester, hydroureteronephrosis was observed in 15% of the study subjects on the right side and 12.5% of the study subjects on the left side.

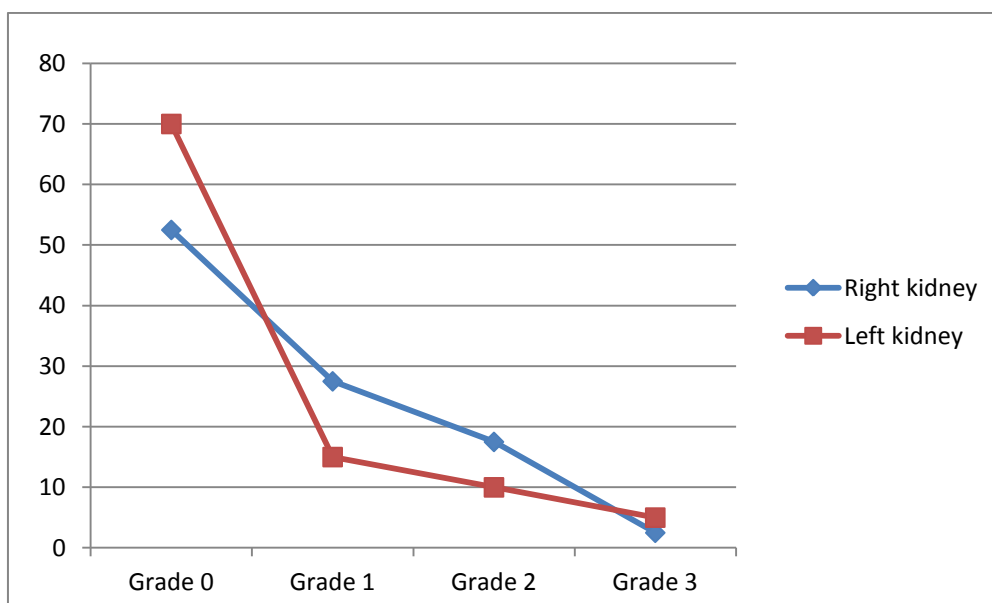
### 3.5 Association with Urinary Tract Problems

In the present study, it was found that 20 (50%) pregnant women had no urinary complaints during pregnancy. It was also found that among the 19 pregnant women with hydroureteronephrosis, increased urinary

frequency was observed in 2 (10.5%) of the study subjects, increased urinary urgency was observed in 3 (15.7%) of the study subjects, nocturia was observed in 1 (5.2%) of the study subjects, intermittent urine stream was observed in 3 (15.7%) of the study subjects and incontinence was observed in 1 (5.3%) of the study subjects. No pain, no decrease in stream or strain while urinating was observed in the study subjects. It was found that among the 20 pregnant women with urinary tract problems, hydroureteronephrosis was observed in 12 (30%) of the study subjects on the right side and 6(15%) of the study subjects on the left side. It was also found that among the 20 pregnant women without urinary tract problems, hydroureteronephrosis was observed in 7 (17.5%) of the study subjects on the right side and 6 (15%) of the study subjects on the left side. A higher incidence of hydroureteronephrosis was noted on the right side among study subjects having urinary tract problems than those without urinary tract problems.

**Table 1. Laterality and grades of Hydroureteronephrosis**

Grade	Right side		Left side	
	N	%	N	%
0	21	52.5%	28	70
I	11	27.5%	6	15
II	7	17.5%	4	10
III	1	2.5%	2	5



**Fig. 1. Laterality and grades of hydroureteronephrosis**

**Table 2. Grades of hydroureteronephrosis in different trimesters**

Side	Grade	First trimester		Second trimester		Third Trimester	
		N	%	N	%	N	%
Right	0	7	17.5	12	30	2	5
	I	3	7.5	5	12.5	3	7.5
	II	1	2.5	4	10	2	5
	III	0	0	0	0	1	2.5
Left	0	10	25	15	37.5	3	7.5
	I	0	0	3	7.5	3	7.5
	II	1	2.5	2	5	1	2.5
	III	0	0	1	2.5	1	2.5

**Table 3. Grades of hydroureteronephrosis among the study subjects with and without urinary tract problems**

Side	Grade	Urinary tract problems		No urinary tract problems	
		N	%	N	%
Right kidney	0	8	20	13	32.5
	I	7	17.5	4	10
	II	5	12.5	2	5
	III	0	0	1	2.5
Left kidney	0	14	35	14	35
	I	3	7.5	3	7.5
	II	2	5	2	5
	III	1	2.5	1	2.5

**Table 4. Grades of hydroureteronephrosis among the primiparous and multiparous study subjects**

Side	Grade	Primiparous		Multiparous	
		N	%	N	%
Right kidney	0	12	30	9	22.5
	I	6	15	5	12.5
	II	6	15	1	2.5
	III	1	2.5	0	0
Left kidney	0	16	40	12	30
	I	4	10	2	5
	II	3	7.5	1	2.5
	III	2	5	0	0

### 3.6 Association with Parity and Foetal Position

In the present study, it was found that among the 40 pregnant women, 25 (62.5%) of the study subjects were primiparous and 15 (37.5%) of the study subjects were multiparous. Hydroureteronephrosis was observed in 13 (52%) of the 25 study subjects with no previous delivery and 6 (40%) of the 15 study subjects with 1 at least delivery. It was also found that among the multiparous study subjects with hydroureteronephrosis, 4 (66.6%) of the study subjects had a previous normal vaginal delivery and 2 (33.3%) of the study subjects had a

previous caesarean section. It was observed that 6 (75%) out of the 8 pregnant women belonging to the third trimester presented with a cephalic foetal position and hydroureteronephrosis was observed in 5 (83.3%) of these study subjects. A higher incidence of hydroureteronephrosis was noted among the primiparous study subjects.

In the present study, it was found that the incidence and the severity of hydroureteronephrosis were not related to comorbidities, diabetes, polycystic ovarian disease. Among the 20 symptomatic pregnant women with urinary tract problems, hydroureteronephrosis was observed in 12 (30%)

of the study subjects on the right side and 6(15%) of the study subjects on the left side. Symptomatic pregnant women were administered antibiotics like Ampicillin or Cephalexin or Nitrofurantoin or Trimethoprim-Sulfsmethoxazole. It was found that among the 19 pregnant women with hydroureteronephrosis, none of them required surgical intervention-Double J-stent placement or Percutaneous nephrolithotomy.

#### 4. DISCUSSION

Frequency, nocturia, urgency of micturition and urinary incontinence are common during pregnancy [14]. In the present study, out of the 40 pregnant women with an average age of 26.4 years, 20 (50%) of the study subjects had no urinary complaints during pregnancy. Rajaeisfahani et al in their study reported that out of the 59 pregnant women with an average age of 25.4 years, 33 (55.9%) of the study subjects had no urinary complaints during pregnancy which is consistent with the findings of our study [15]. Common symptoms of hydroureteronephrosis include flank pain, urinary tract infection, painful urination, increased urinary frequency and increased urinary urgency [16,17,18]. In the presence of symptoms or history suspicious for anatomic obstruction, differentiation of physiological versus pathologic findings is a frequent concern. Pathologic hydroureteronephrosis is a rare entity.

It was found that among the 19 pregnant women with hydroureteronephrosis, increased urinary frequency was observed in 2 (10.5%) of the study subjects and incontinence was observed in 1 (5.3%) of the study subjects. Rajaeisfahani et al in their study reported that among the 41 pregnant women with hydroureteronephrosis, increased urinary frequency was observed in 11 (26.8%) of the study subjects and incontinence was observed in 2 (4.9%) of the study subjects [15]. In the present study, flank pain was absent in 19 pregnant women with hydroureteronephrosis. Similarly in the study conducted by Watson et al, a poor correlation between flank pain and hydroureteronephrosis was observed and in the study conducted by Farr et al, there was no correlation between the grade of hydroureteronephrosis and pain intensity [19,20].

In the present study, it was found that hydroureteronephrosis was present in 47.5% of the study subjects while Pepe et al in their study

reported that hydroureteronephrosis was present in 27% of the study subjects [21]. It was found that among the nineteen pregnant women with hydroureteronephrosis, unilateral right-sided hydroureteronephrosis was observed in 7 (36.8%) of the study subjects while Rajaeisfahani et al in their study reported that among the 41 (69.5%) pregnant women with hydroureteronephrosis, unilateral right-sided hydroureteronephrosis was observed in 24 (58.5%) of the study subjects [15].

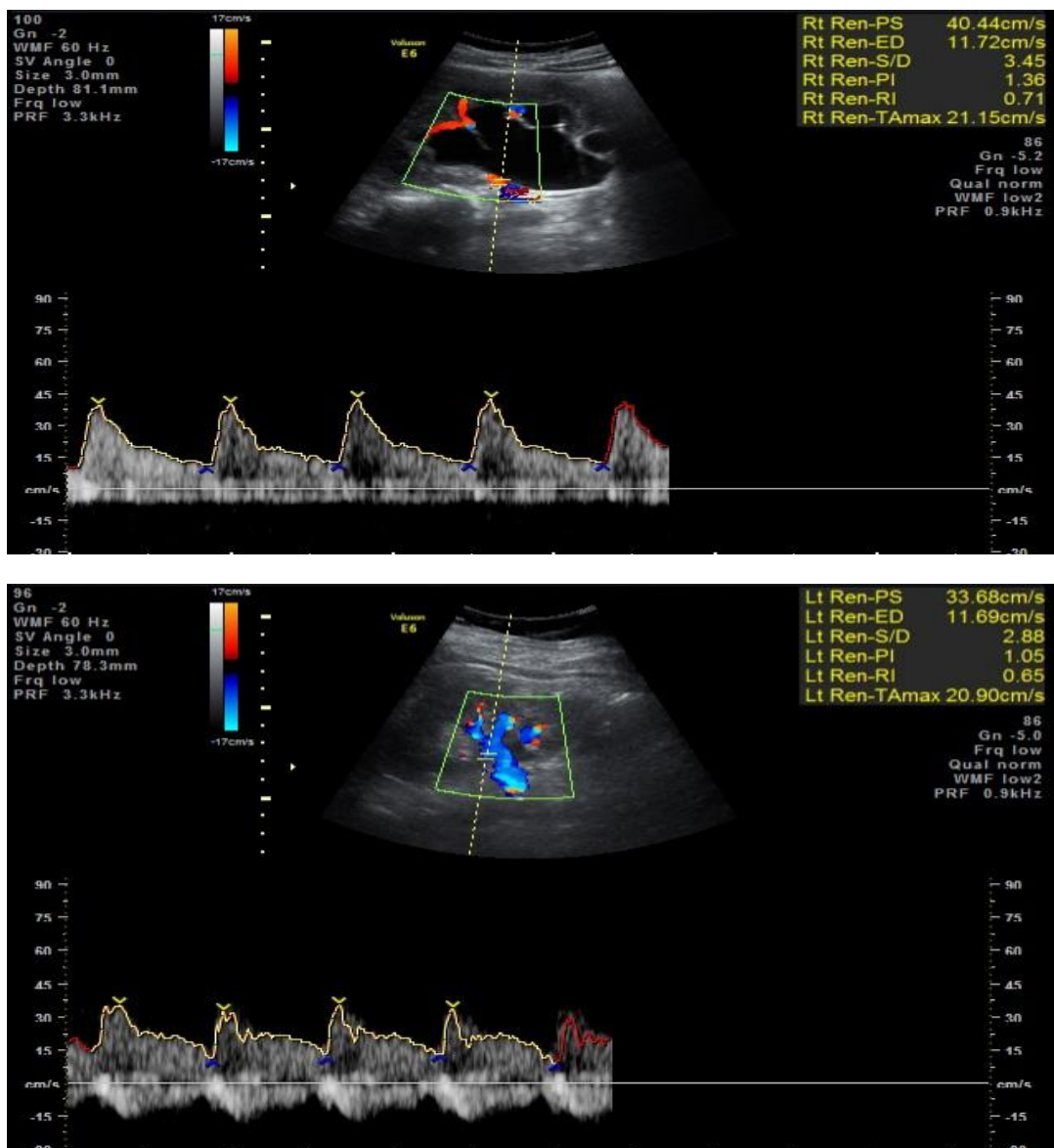
In the present study, hydroureteronephrosis was observed in 47.5% of the study subjects on the right side and 30% of the study subjects on the left side while Oyinloye et al in their study reported that hydroureteronephrosis of pregnancy was observed in 93.4% of the study subjects in the right side and 84.4% of the study subjects in the left side [22]. Dell'atti et al in their study reported that hydroureteronephrosis of pregnancy was observed in 61% of the study subjects on the right side and in 39% of the study subjects on the left side which is consistent with the findings of our study [23]. Hydroureteronephrosis is more pronounced on the right side. This could be attributed to the dextrorotation of the uterus to the right side and protection of the right ureter by the sigmoid colon. Also, the right ureter crosses the iliac and the ovarian vessels at an angle before entering the pelvis, whereas the left ureter at a less acute angle and travels in parallel with the ovarian vein [24]. It was also found that hydroureteronephrosis affects primiparous women more than multiparous women which is consistent with the findings of the study conducted by Mutiso et al. [25].

In the present study, the kidney measurements exceeded 10 mm in 5% of the study subjects in the right and the left kidneys during the third trimester. The kidney measurements exceeded 15 mm in 5% of the study subjects in the right and the left kidneys during the third trimester. Historically, by term, the pelvicalyceal dilation of 15 mm in the right kidney and the pelvicalyceal dilation of 5 mm in the left kidney may be present [26]. On the contemporary, in the analysis conducted by Wadasinghe et al encompassing 509 patients, kidney measurements exceeded 10 mm in 9.7% of the study subjects in the right kidney and 2.1% of the subjects in the left kidney during the third trimester [27]. Kidney measurements exceeded 15 mm in 4.1% of the subjects in the right kidney and 0.4% of the subjects in the left kidney during the third



trimester. This shows that measurements greater than 10 mm remain relatively uncommon although the mean renal pelvis diameter increases as pregnancy progress. Dilatation begins early in pregnancy and indicates that factors other than mechanical compression play a role. Smooth muscle relaxation caused by progesterone, relaxin and endothelin may contribute to dilatation [28,29,30]. Mechanical compression by the uterus exerts direct compression of the ureters predominantly on the right. Such dilatation begins by the second month and peaks during the second trimester, with the ureteral diameter increasing up to 2 cm.

Doppler ultrasound is used to assess the renal resistive index which helps to differentiate between obstructed and non-obstructed collecting systems [31,32]. Renal resistive index is calculated according to the formula, Renal resistive index =  $(PSV - EDV) / PSV$  where PSV is the peak systolic velocity, EDV is the end-diastolic velocity. A renal resistive index value of 0.70 is considered the upper normal threshold [33,34]. In the present study, a resistive index value of > 0.70 was observed in 6 pregnant women and hydronephrosis was observed in 5 of these study subjects.



Figs. 2 and 3. Renal resistive index

## 5. CONCLUSION

The incidence of hydronephrosis among pregnant women was found to be 47.5%. A higher incidence of hydronephrosis was noted on the right side and among the primiparous study subjects. Higher incidence was also noted on the right side among study subjects having urinary tract problems. The urinary tract undergoes anatomical and functional changes during pregnancy.

## 6. RECOMMENDATIONS

Differentiation of physiological and pathological hydronephrosis is necessary. The health of the pregnant women and the developing fetus is paramount when considering investigations and treatment. A coordinated approach between urologists and obstetricians is essential to provide the best care.

## 7. LIMITATIONS

This is an observational study. Therefore, complications like miscarriage, preterm labour, PPH, pregnancy induced hypertension, foetal growth retardation couldn't be observed.

Blood pressure of mother, urine culture, renal function test, TLC, CRP and foetal parameters like size, liquor malformation were not analysed. Differentiation of physiological and pathological hydronephrosis couldn't be done.

## ETHICAL APPROVAL

Before the conduct of the study, ethical clearance was obtained from the institutional Ethics Committee.

## CONSENT

Informed consent was obtained from Participants.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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