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EVALUATING THE RELATIONSHIP BETWEEN BMI AND ULTRASONOGRAPHIC GRADING AND INCIDENCE OF HYDRONEPHROSIS IN PREGNANT WOMEN

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Abstract

Background: *Hydronephrosis is a common physiological condition during pregnancy caused by hormonal and mechanical changes that lead to dilatation of the urinary tract. However, maternal obesity may further increase the severity and occurrence of hydronephrosis due to increased intra-abdominal pressure, altered renal hemodynamics, and impaired urinary drainage. Ultrasonography remains the preferred imaging modality for evaluating hydronephrosis in pregnancy because it is safe, non-invasive, and free from ionizing radiation.*

Objectives: *This study aimed to evaluate the relationship between maternal body mass index (BMI) and the ultrasonographic grading and incidence of hydronephrosis in pregnant women receiving antenatal care.*

Methodology: *A cross-sectional analytical study was conducted in the Obstetrics and Gynecology Department in collaboration with the Radiology Department of a tertiary care hospital. A total of 60 pregnant women in the second and third trimesters were recruited using a non-probability convenience sampling technique from October 2025 to April 2026. Demographic, obstetric, clinical, and ultrasonographic data were collected through a structured questionnaire. Height and weight were measured using standard hospital instruments, and BMI was calculated using the standard formula: BMI = weight (kg)/height (m²). Participants were classified according to WHO BMI categories. Renal ultrasonography was performed by certified radiologists to assess the presence, side involvement, and grading of hydronephrosis as mild, moderate, or severe. Statistical analysis was performed to determine the association between maternal BMI and hydronephrosis.*

Results: *The findings demonstrated a significant relationship between maternal BMI and the occurrence and ultrasonographic grading of hydronephrosis in pregnant women. Women with elevated BMI showed a greater frequency of moderate to severe hydronephrosis compared to women with normal BMI. Right-sided hydronephrosis was observed more frequently, which is consistent with the normal anatomical and physiological changes during pregnancy. Ultrasonography proved to be a reliable and effective diagnostic method for evaluating hydronephrosis and distinguishing physiological dilatation from clinically*

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significant renal involvement. Maternal obesity was associated with increased intra-abdominal pressure, vascular congestion, altered renal blood flow, and impaired urinary drainage, contributing to increased severity of hydronephrosis.

Conclusion: *Maternal BMI is significantly associated with the incidence and ultrasonographic grading of hydronephrosis during pregnancy. Pregnant women who are overweight or obese may require closer antenatal monitoring to prevent complications such as urinary tract infections, flank pain, renal impairment, and the need for invasive interventions. Since BMI is a modifiable risk factor, early identification and appropriate prenatal management may improve maternal renal health and pregnancy outcomes. Routine BMI assessment should therefore be considered an important component of antenatal evaluation for hydronephrosis. Further multicenter studies with larger sample sizes are recommended to strengthen the evidence and support the development of BMI-based screening and management protocols for maternal hydronephrosis.*

CHAPTER 1
INTRODUCTION

Pregnancy is linked to significant physiological, metabolic, and anatomical changes that facilitate fetal development and sustain maternal homeostasis. Among these alterations, maternal weight condition and renal adjustments significantly influence pregnancy results. Maternal body mass index (BMI) has become a significant indicator of obstetric and fetal issues, whereas hydronephrosis is acknowledged as one of the most common physiological alterations in the urinary tract during pregnancy. Grasping the connection between maternal BMI and the ultrasonographic assessment and occurrence of hydronephrosis is crucial in a clinical setting, as both obesity and urinary tract dilation could affect maternal health, antenatal monitoring, and perinatal results. [1]

Maternal obesity has emerged as a significant worldwide public health issue. The occurrence of overweight and obesity in women of childbearing age has risen markedly around the globe, leading to increased instances of complications during pregnancy and negative neonatal results. [2] As per Catalano and Shankar, pregnancy-related obesity is linked to metabolic issues, persistent low-grade inflammation, insulin resistance, compromised endothelial function, and modified placental growth. These pathophysiological processes play a role in gestational diabetes mellitus, hypertensive issues, preeclampsia, cesarean birth, fetal macrosomia, and lasting cardiometabolic effects for both mother and infant. [3]

BMI continues to be the most frequently utilized and effective clinical measure for evaluating maternal nutritional and metabolic health. The American College of Obstetricians and Gynecologists [4] characterize obesity during pregnancy as a pre-pregnancy BMI of ≥30 kg/m² and highlights its significance as an independent risk factor for complications in both mothers and fetuses. Andersen et al. conducted a large population-based cohort study showing that higher maternal BMI is significantly linked to negative pregnancy results such as preterm birth, gestational hypertension, cesarean delivery, and complications in neonates. [5]

Likewise, recent worldwide findings from EClinicalMedicine (2025) indicate that elevated maternal BMI is associated with a rise in obstetric interventions and enhanced maternal morbidity across varied communities. Aside from systemic metabolic impacts, obesity also affects renal function pregnancy. Typical pre gnancy brings significant hemodynamic alteration s, such as heightened renal plasma flow, an increased glomerular filtration rate (GFR), sodium retention, and the expansion of the renal collecting system. [6] These alterations are essential for sustaining fluid balance and supporting the fetus, yet they may make women more susceptible to urinary stasis and hydronephrosis. Maternal

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obesity could further influence these physiological changes by elevating intra-abdominal pressure, modifying vascular resistance. [7]

Hydronephrosis during pregnancy refers to the enlargement of the renal pelvis and calyceal system caused by mechanical and hormonal influences. It is often regarded as a physiological event, particularly in the second and third trimesters. Relaxation of smooth muscles induced by progesterone reduces ureteral peristalsis, while the mechanical compression of the ureters from the growing uterus—especially on the right side—results in urinary stasis and dilatation of the pelvicalyceal area. [8] This condition is more frequently seen on the right side because of the dextrorotation of the uterus and differences in the anatomy related to ureteral compression. [9]

Physiological hydronephrosis occurs in up to 80–90% of pregnant women, though the degree of dilatation varies considerably. Most cases remain asymptomatic and resolve spontaneously after delivery; however, symptomatic hydronephrosis may present with flank pain, urinary tract infection, hematuria, or impaired renal function, requiring intervention in selected cases. They reported that while mild hydronephrosis is common and benign, severe symptomatic cases may require ureteric stenting or nephrostomy for maternal relief and renal preservation. [9]

Ultrasonography is the preferred diagnostic modality for evaluating hydronephrosis during pregnancy because it is safe, noninvasive, readily available, and avoids ionizing radiation. Sonographic evaluation allows assessment of renal pelvic diameter, calyceal dilatation, ureteric involvement, cortical thinning, and differentiation between physiological and pathological obstruction. It also helps distinguish hydronephrosis caused by physiological pregnancy changes from obstruction due to stones, infection, or congenital abnormalities. [7, 18]

Several grading systems have been developed to classify hydronephrosis severity based on ultrasonographic findings. These include the Society for Fetal Urology (SFU) grading system, anterior-posterior renal pelvic diameter measurements, and the Onen grading system. [8] Although these systems were initially developed for pediatric use, the principles of grading remain useful in obstetric evaluation. Mild hydronephrosis usually involves pelvic dilatation without calyceal involvement, whereas moderate to severe grades demonstrate calyceal expansion, cortical thinning, and progressive obstruction risk. They emphasized that accurate grading is essential because treatment decisions should depend not only on the presence of hydronephrosis but also on its severity and associated symptoms.

Additionally, maternal BMI is a changeable factor, in contrast to numerous anatomical causes of hydronephrosis. Recognizing a strong connection between increased BMI and greater ultrasonographic grades of hydronephrosis could assist healthcare providers in enhancing antenatal advice, risk assessment, and early monitoring. Women with elevated BMI might gain from more frequent sonographic surveillance, timely intervention for urinary issues, and preventive measures designed to decrease maternal morbidity. [10]

This study intends to assess the connection between maternal BMI and the ultrasound grading and occurrence of hydronephrosis in expectant mothers. The study aims to identify if a higher maternal BMI correlates with an increased occurrence or more severe classifications of hydronephrosis by relating BMI categories to sonographic severity. These results could enhance antenatal screening procedures and promote maternal kidney health throughout pregnancy. [11]

To summarize, both maternal obesity and hydronephrosis are becoming more important issues in obstetric care. Obesity leads to metabolic, cardiovascular, and renal strain, whereas hydronephrosis serves as a frequent and clinically significant renal adjustment during pregnancy. The relationship between these two conditions is still inadequately studied, even though their combined effect on maternal outcomes could be significant. Assessing this connection via ultrasonographic grading provides

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a chance to enhance antenatal care and boost early detection of high-risk pregnancies

PROBLEM STATEMENT

The link between maternal BMI and the ultrasonographic assessment of hydronephrosis has not been thoroughly investigated, even though hydronephrosis is prevalent in pregnancy and BMI is an important maternal health indicator. Current research focuses on the prevalence and laterality of hydronephrosis, overlooking the influence of maternal BMI on the progression and ultrasound depiction of urinary tract dilation. Pregnant women with a high BMI face risks of being underdiagnosed or mis graded since obesity is known to reduce ultrasound penetration. This creates a clinical void that may affect procedures, monitoring, and perspectives.

AIMS AND OBJECTIVES

Aims:

To assess the connection between maternal body mass index (BMI) and the occurrence along with ultrasonographic classification of hydronephrosis in pregnant women receiving antenatal care.

Objectives:

1. To assess the prevalence of hydronephrosis in pregnant women through ultrasonographic examination.
2. To evaluate the ultrasonographic classification of hydronephrosis in pregnant females based on established grading standards
3.

CHAPTER 2

LITERATURE REVIEW

A study was conducted by Catalano and Shankar in 2017 stated that maternal obesity is a major factor leading to negative pregnancy outcomes globally. Obesity was characterized as a condition of persistent low-level inflammation linked to insulin resistance, dysfunction of the endothelium, modified lipid metabolism, and hormonal imbalance. These mechanisms raise the likelihood of gestational diabetes mellitus, hypertensive conditions, preeclampsia, cesarean delivery, fetal macrosomia, and chronic metabolic diseases in children. The authors highlighted that a higher maternal BMI impacts not only obstetric results but also modifies maternal renal and cardiovascular adjustments during pregnancy, potentially leading to urinary tract issues. [1]

A Study was conducted by Poston et al. in 2016 noted that obesity in women before conception and during pregnancy has emerged as a significant public health issue because of its rising incidence among reproductive-age women. The research indicated that obesity prior to and during pregnancy is closely linked to maternal health issues, such as extended labor, higher hospitalization rates, and an elevated risk of infections. They also emphasized that obesity affects renal function by raising intra-abdominal pressure and vascular resistance, elements that could lead to compromised urinary drainage and hydronephrosis. [2]

A study was conducted by Andersen et al. in 2018 performed a population-based cohort study and discovered a significant positive link between rising maternal BMI and negative pregnancy outcomes. Women with elevated BMI faced significantly increased risks of gestational hypertension, premature delivery, surgical delivery, and neonatal issues. Their results back the idea that a higher BMI could also lead to kidney issues, as systemic vascular and hemodynamic alterations influence renal perfusion and urinary tract performance in pregnancy. [3]

A study was conducted by the ACOG Practice Bulletin in 2021 indicated that obesity during pregnancy should be regarded as a significant independent risk factor for complications in both mothers and fetuses. ACOG categorized obesity based on pre-pregnancy BMI and advised increased antenatal monitoring for women who are overweight or obese. The bulletin also emphasized that pregnant women with obesity face a higher risk of urinary tract infections and renal stress because of modified glomerular filtration and heightened pressure effects, which can affect the frequency of hydronephrosis. [4]

A study was conducted by EClinicalMedicine in 2025 presented new global findings indicating that maternal BMI continues to be closely linked to pregnancy complications in both developed

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and developing nations. Their results indicated that women with obesity required more obstetric interventions and experienced higher hospitalization rates due to maternal complications. The review also indicated that maternal BMI ought to be taken into account when assessing renal adjustments and urinary tract alterations linked to pregnancy. [5]

Study was conducted by Hall in 2021 in the Guyton and Hall Textbook of Medical Physiology characterized pregnancy as a condition of significant renal adjustment. During early pregnancy, renal plasma flow rises by about 50–80%, and there is a notable increase in glomerular filtration rate. These modifications assist in fetal growth and the balance of fluids in the mother. Hall described that the relaxation of smooth muscle caused by progesterone decreases ureteral tone and peristalsis, resulting in urinary stasis and an increased risk of hydronephrosis. [6]

Study conducted by Placenta in 2024 examined the connection between maternal obesity and the hemodynamic adaptations of the placenta and kidneys. The research indicated that obesity might exacerbate renal vascular resistance, heighten venous congestion, and hinder urinary drainage due to changed placental signaling and inflammatory reactions. These results back the idea that women with increased BMI might have a greater tendency to experience severe hydronephrosis in pregnancy. [7]

Study conducted by Pates, Dashe, and Twickler characterized hydronephrosis and hydroureter as frequent physiological occurrences in pregnancy, especially in the second and third trimesters. They indicated that over 80% of expectant mothers might exhibit varying levels of urinary tract enlargement on ultrasound. The right kidney is usually more impacted because of the uterine dextrorotation and anatomical variations in ureteral pressure. Their sonographic assessment highlighted the necessity of differentiating physiological hydronephrosis from obstruction due to stones or infection. [8]

Study conducted by Fargason and Horrow examined sonographic results of hydronephrosis during pregnancy and determined that ultrasonography is the safest and most efficient diagnostic technique. They identified renal pelvic dilation, calyceal enlargement, ureteral visibility, and cortical thickness as essential factors for evaluation. The authors observed that the severity of hydronephrosis may differ based on gestational age, parity, and maternal body composition, indicating that BMI could affect sonographic assessment. [9]

Study conducted by Kilicdag, Bagis, Tarim et al. carried out a prospective investigation on maternal hydronephrosis in expectant mothers without ureteral stones, revealing that hydronephrosis is very common but largely asymptomatic. They indicated that serious symptomatic cases necessitated interventions like ureteric stenting or nephrostomy. The research indicated that symptomatic patients frequently exhibited more pronounced renal pelvic dilation and increased pain, highlighting the significance of assessing severity instead of merely recognizing its existence. [10]

Study conducted by The Professional Medical Journal in 2023 highlighted the prevalence of maternal hydronephrosis in expectant mothers and related risk factors within a local community. The research discovered a considerable amount of women showing physiological hydronephrosis, especially in the later stages of pregnancy. Elements like gestational age, parity, and body composition were linked to a higher incidence, underscoring the necessity to assess maternal BMI as a contributing factor. [11]

Study conducted by Frontiers in Pediatrics in 2020 examined different grading systems for hydronephrosis and their clinical significance. The grading system of the Society for Fetal Urology (SFU) and the measurements of anterior-posterior renal pelvic diameter were recognized as the most frequently utilized techniques. Mild hydronephrosis consists solely of pelvic dilation, whereas severe cases encompass calyceal involvement and thinning of the cortex. Precise grading is crucial as management relies on the intensity and symptoms. [12]

Study conducted by Onen in 2020 highlighted that assessing hydronephrosis continues to be a significant challenge since current systems might not consistently align with clinical severity. The

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Onen grading system was suggested as a more functional and clinically relevant method, especially for differentiating cases that need intervention. The writer emphasized that radiological classification ought to inform treatment choices and ongoing monitoring. [13]

Study conducted by Catalano and Shankar in 2017 proposed that maternal obesity affects systemic pregnancy results as well as renal function via inflammatory mechanisms, vascular impairment, and elevated abdominal pressure. These mechanisms can hinder urinary flow and increase the severity of hydronephrosis. Their research reinforces the biological likelihood of a connection between BMI and hydronephrosis. [14]

Study conducted by Placenta in 2024 reinforced this idea by showing that obesity influences the hemodynamic interactions between the placenta and kidneys. Elevated body fat leads to changes in blood flow control, blood pooling in veins, and diminished ureter function, all of which can raise the likelihood of renal pelvic dilation. This suggests that maternal BMI could directly influence the onset of hydronephrosis. [15]

Study conducted by Andersen et al. in 2018 indirectly reinforced this connection by demonstrating that an increased BMI correlates with higher incidences of maternal complications related to cardiovascular and renal systems. Even though their research did not directly assess hydronephrosis, the physiological mechanisms detailed offer compelling justification for additional investigation in this field. [16]

Study conducted by the Professional Medical Journal in 2023 noted that women with greater body size exhibited higher rates of hydronephrosis in ultrasonographic assessments. While BMI wasn't the main variable examined, the results indicate a potential link between obesity and urinary tract dilation in pregnancy. [17]

Literature Gap

The majority of existing literature emphasizes either maternal obesity and overall pregnancy results or hydronephrosis as a normal renal adjustment during pregnancy. Only a limited number of studies investigate the connection between maternal BMI and the ultrasonographic classification and occurrence of hydronephrosis. Current evidence indicates that obesity could lead to urinary stasis, modified renal hemodynamics, and heightened abdominal pressure, all of which might exacerbate the severity of hydronephrosis. Nonetheless, the relationship is still not well-explored, especially in regional communities.

This disparity supports the necessity for the current research to assess if maternal BMI has a significant impact on the occurrence and severity of hydronephrosis in pregnant women through ultrasonographic grading. Forming this relationship would enhance antenatal screening, enable earlier detection of high-risk women, and facilitate improved management of maternal kidney health

CHAPTER 3
METHODOLOGY

1. Study Design

This research employed a cross-sectional analytical study design to assess the association between maternal body mass index (BMI) and the ultrasonographic classification and occurrence of hydronephrosis in pregnant women. The research sought to establish if a higher maternal BMI correlated with an increased occurrence and severity of hydronephrosis in pregnancy.

2. Study Setting

The research was conducted in the Obstetrics and Gynecology Department in partnership with the Radiology Department of a tertiary care hospital. The study included pregnant women visiting the antenatal outpatient department (OPD) and admitted patients needing obstetric ultrasonography. The hospital environment offered access to an adequate number of expectant mothers across various BMI classifications and enabled thorough ultrasonographic assessment of hydronephrosis.

3. Study Population

The population under study included expectant mothers receiving prenatal care throughout the research period. Women in the second and third

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trimesters of pregnancy were primarily included because physiological hydronephrosis is more frequently seen during these periods due to the enlarged uterus and compression of the ureters.

4. Sample Size

The study included a total of 60 women who were pregnant.

The sample size was determined by the patient availability throughout the study duration and the practicality of gathering data within the provided time and resources. This sample was deemed sufficient to examine the relationship between maternal BMI and the grading of hydronephrosis**.**

Average (Mean) Formula:

The mean values of the quantitative variables in this study, such as the knowledge score, perceived radiation danger score, and non-compliance index score of patients' attendants, were calculated using the standard average (mean) formula in order to summarize the central tendency of the data collected.

The standard mean formula used in this study was: $\bar{X} = \Sigma xi / n$, where $\bar{X}$ is the mean value of the observations. xi is the individual observation of each participant.

Σxi is the sum of all the individual observations.

The total number of observations that were examined is denoted by n.

By using the mean method to generate an overall average score for each quantitative variable, the researchers were able to meaningfully compare the awareness, perceived risk, and non-compliance behavior levels among patients' attendants before conducting further statistical analysis.

5. Sampling Technique

A non-probability convenience sampling method was employed. Pregnant women meeting the inclusion criteria and agreeing to take part were consecutively recruited from the antenatal clinic and obstetric wards until the necessary sample size of 60 participants was reached**.**

6. Duration of Study

The duration of the study will be 6 months after approval of synopsis; from Oct, 2025 to April, 2026. The participants for the study recruited from Oct, 2025 to April, 2026 and data was statistically analyzed from February 2026 to April, 2026.

7. Selection Criteria

7.1. Inclusion criteria:

- Expectant women between the ages of 18 and 40 years.
- Expecting mothers in the second and third trimesters of their pregnancy.
- Single pregnancy
- Women ready to engage and give informed consent
- Women receiving obstetric ultrasound during prenatal assessment.

7.2. Exclusion Criteria:

- Expectant mothers with diagnosed kidney stones (urolithiasis)
- Chronicle of congenital urinary system anomalies
- Recognized long-term kidney disease or renal insufficiency
- Pregnancies with multiples (twins/triplets)
- Individuals experiencing critical urinary tract infections that necessitate urgent treatment.
- Women who have undergone prior urological surgery that impacts urinary drainage

8. Study Instrument (Questionnaire Development)

A structured questionnaire was developed after reviewing relevant literature and previous similar studies. The questionnaire was designed to collect demographic, obstetric, clinical, and ultrasonographic data relevant to the study objectives**.**

Demographic information (age, pregnancy status), Obstetric History (Gravidity, Parity, Gestational age, Trimester of pregnancy), Clinical Assessment [Height (meters), Weight (kilograms),

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BMI calculation (kg/m²), Presence of flank pain, Urinary symptoms, History of urinary tract infection], Ultrasonographic Findings (Presence or absence of hydronephrosis, Side involved (right, left, bilateral), grade of hydronephrosis (mild, moderate, severe), renal pelvic dilatation, associated findings if present)

BMI was calculated using the standard formula:

$$\text{BMI} = \frac{weight\ (kg)}{\text{Height}\ (m)^2}$$

Participants were categorized according to WHO BMI classification.

9. Data Collection Procedure

Following the approval from the institutional ethics review board, data collection commenced. Pregnant women visiting the antenatal clinic and those hospitalized in the obstetric ward were contacted and made aware of the study's aim.

Informed written consent was secured from all participants prior to enrollment. Demographic and obstetric data were obtained via a structured questionnaire through direct interviews and examination of medical records.

Height and weight were assessed with standard hospital tools, and BMI was computed accordingly. All participants received renal ultrasonography carried out by a certified radiologist to evaluate the presence and severity of hydronephrosis.

Hydronephrosis was classified according to ultrasonography results showing renal pelvic expansion and calyceal involvement as mild, moderate, or severe.

All gathered data was documented meticulously and kept confidentially secure.

10. Study Variables

Independent Variable

- Maternal Body Mass Index (BMI)

Dependent Variables

- Presence of hydronephrosis
- Incidence of hydronephrosis
- Ultrasonographic grading of hydronephrosis

Confounding Variables

- Maternal age
- Gestational age
- Parity
- Gravidity
- Trimester of pregnancy
- Previous urinary tract infection

11. Data Management and Statistical Analysis

All surveys were coded and imported into IBM SPSS Statistics version 21.0 for analysis following the conclusion of data collection.

The data was compiled using descriptive statistics. For categorical variables like gender, education level, and compliance categories, frequencies and percentages were computed. For continuous variables like age and overall knowledge score, means and standard deviations were computed.

To show the distribution of knowledge levels, perceived risk, and non-compliance behavior among patients, bar charts, pie charts, and histograms were created.

12. Ethical Consideration:

The study obtains ethical approval from the University's Ethics and Research Committee to ensure compliance with established ethical standards. Participation in the research is entirely voluntary, and each participant provides written informed consent before taking part in the study. The consent process includes a clear explanation of the study's purpose, procedures, potential risks, and benefits.

Participants receive comprehensive counseling regarding the confidentiality and privacy of their personal information. All collected data remains strictly confidential and is stored in password-protected files or secure storage systems accessible only to the research team.

Each participant is assigned a unique identification number to protect their identity. Their names and any personally identifiable information do not appear in the data collection, analysis, or reporting processes. Anonymity is maintained throughout the entire study to ensure privacy and protection.

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CHAPTER 4
RESULTS

A total of 129 respondents participated in the study. Most participants belonged to the younger age group, with the largest proportion falling in the 20–30 years category, while fewer were from older age groups. Females constituted the majority of the sample (79.8%), compared to males (20.2%).

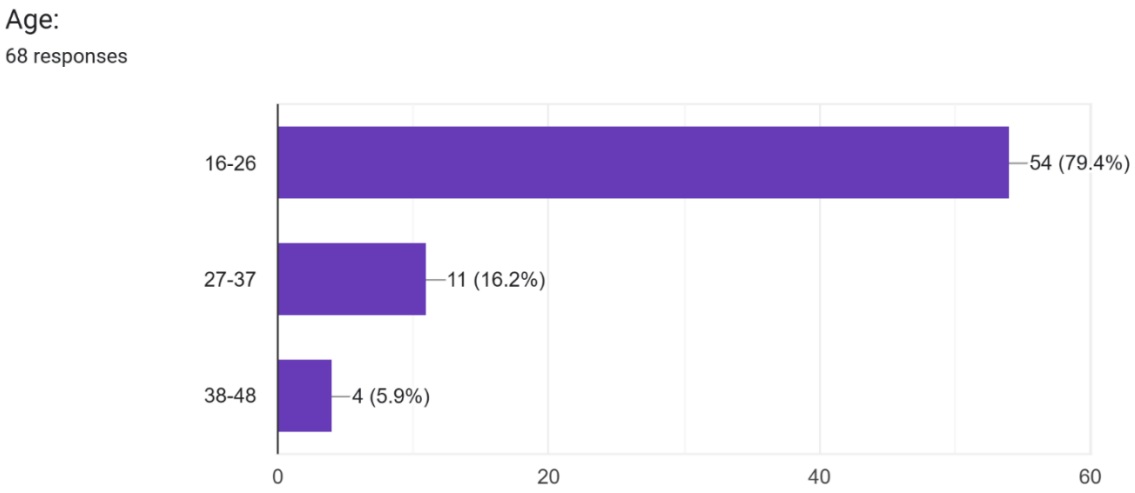

Figure 4.1: The column chart represents the different age frequencies.

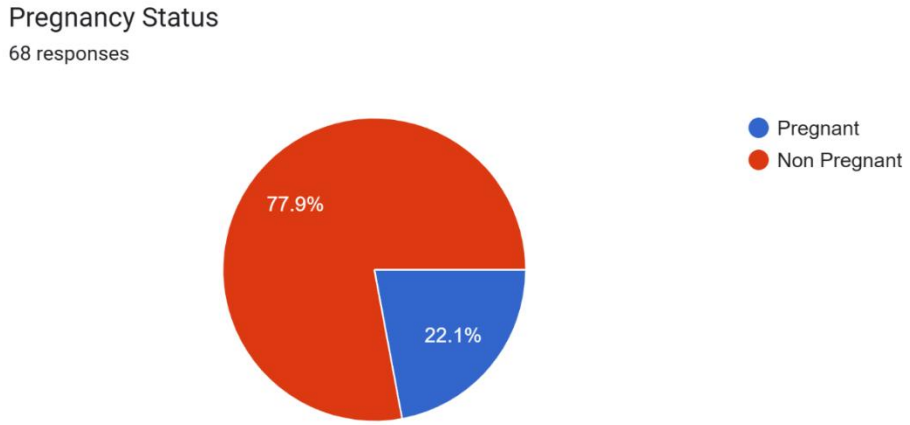

Figure 4.2: The Pie chart represents the pregnancy status.

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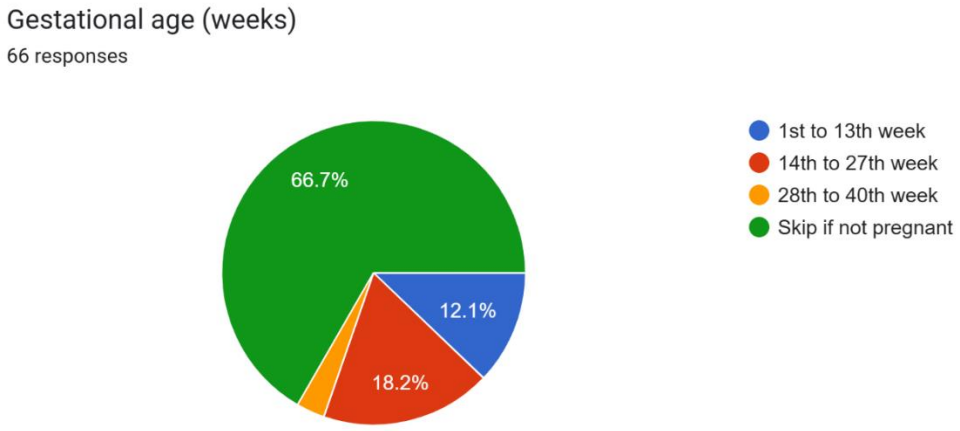

Figure 4.3: The Pie Chart presents the gestational age of the pregnant women.

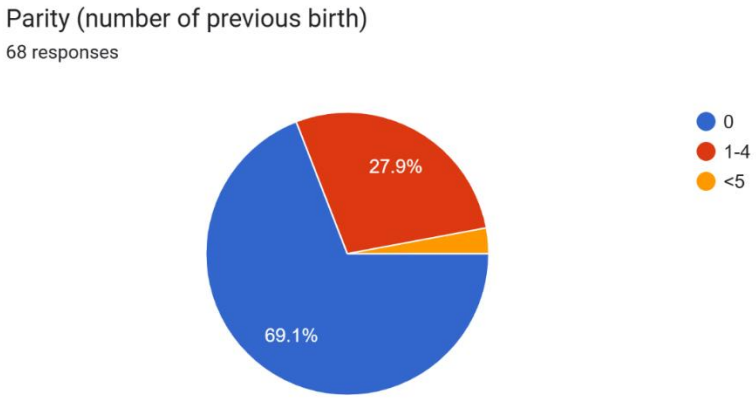

Figure 4.4: The Pie Chart presents the Parity of the Women

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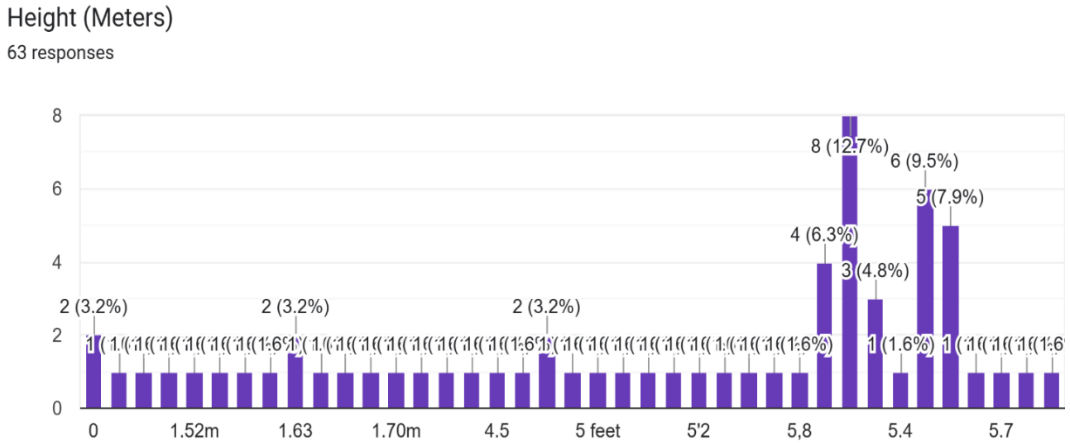

Figure 4.5: The bar chart represents the frequency of the height of the pregnant and non-pregnant women

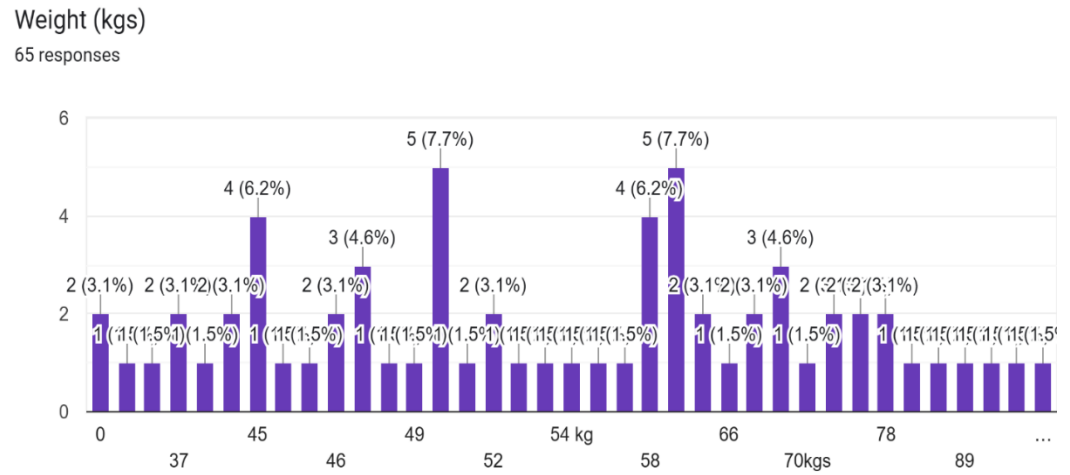

Figure 4.6: The bar chart represents the frequency of the weight of the pregnant and non-pregnant women

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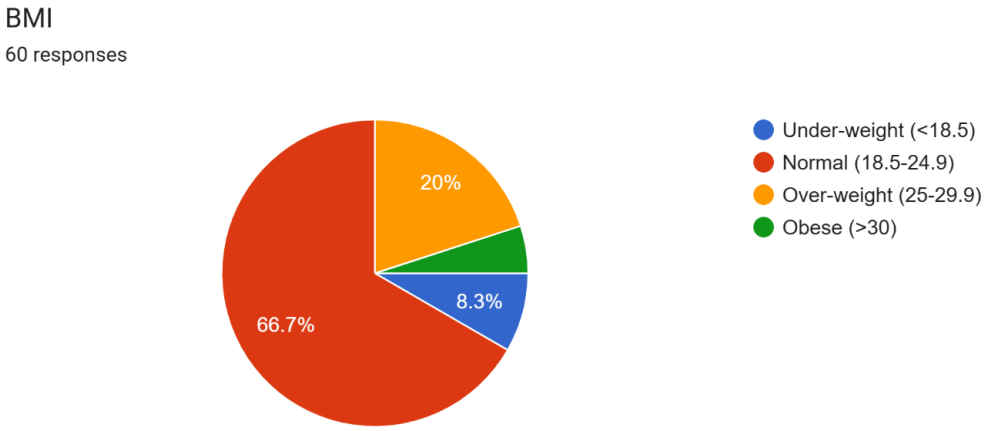

Figure 4.7: The Pie Chart presents the BMI of the pregnant and non-pregnant women

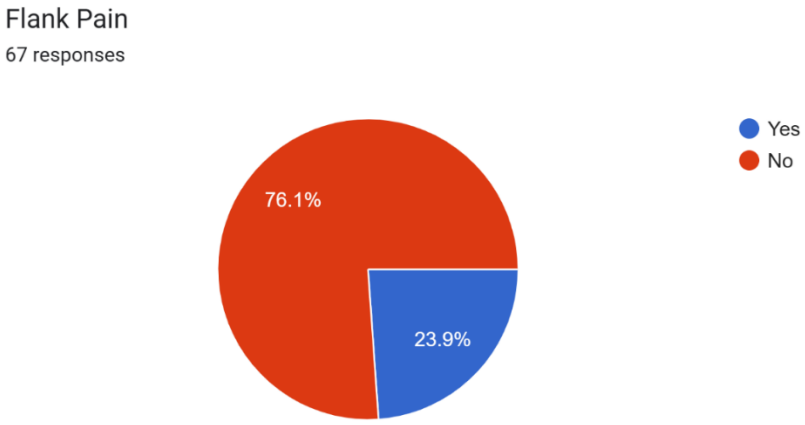

Figure 4.8: The Pie Chart presents the Flank Pain if hydronephrosis present in the the pregnant and non-pregnant women

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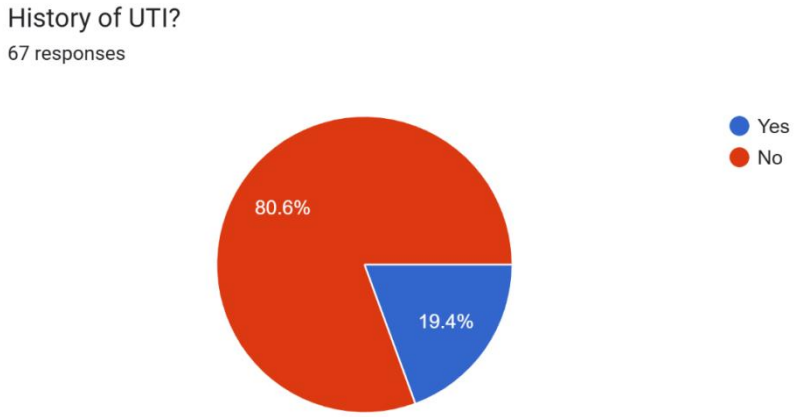

Figure 4.9: The Pie Chart presents if any history of UTI present in the the pregnant and non-pregnant women

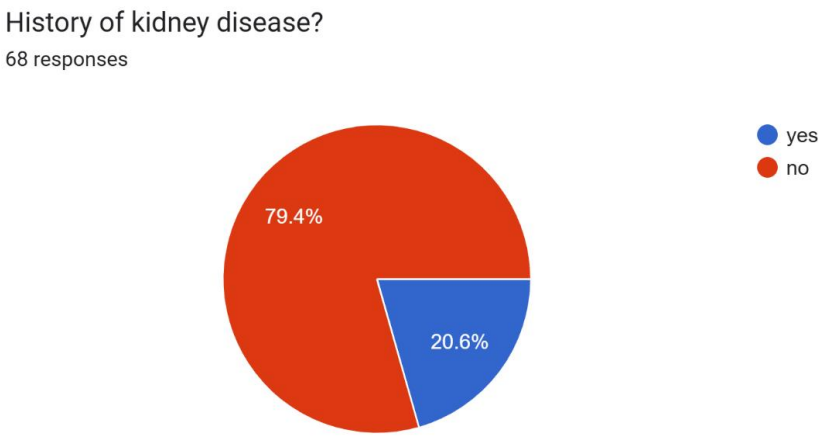

Figure 4.10: The Pie Chart presents if any history of kidney disease present in the the pregnant and non-pregnant women

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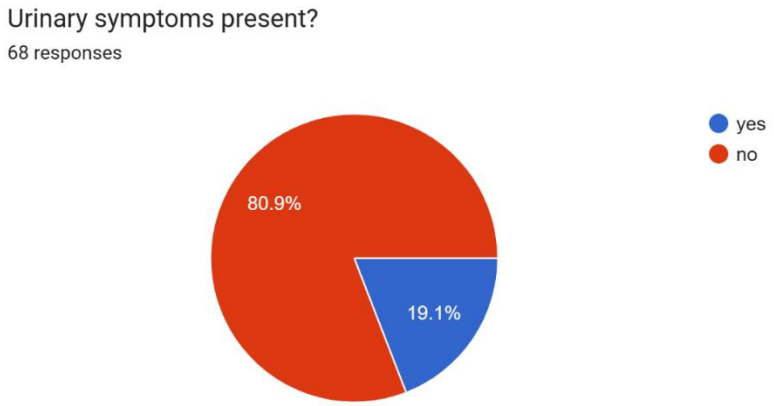

Figure 4.11: The Pie Chart presents if any urinary symptoms present in the the pregnant and non-pregnant

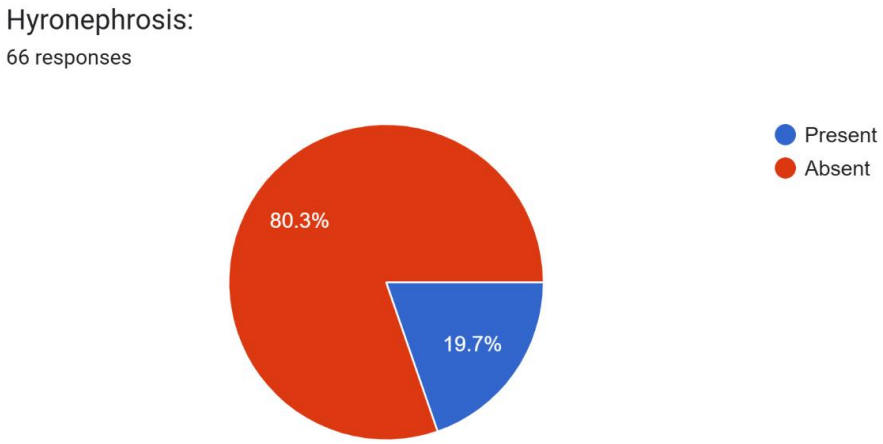

Figure 4.12: The Pie Chart presents if hydronephrosis present in the the pregnant and non-pregnant women

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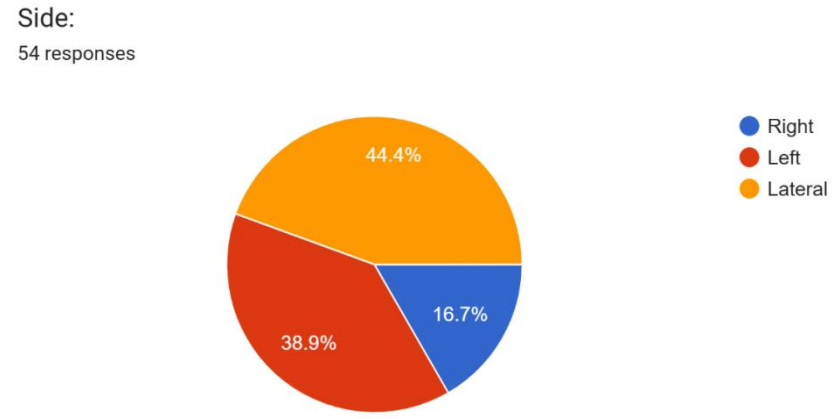

Figure 4.13: The Pie Chart presents which side mostly affects during hydronephrosis in the the pregnant and non-pregnant

Table 1: BMI

Body Mass Index

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Underweight	23	39.7	40.4	40.4
	Normal	20	34.5	35.1	75.4
	Overweight	14	24.1	24.6	100.0
	Total	57	98.3	100.0	
Missing	System	1	1.7		
Total		58	100.0		

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Table 2: ANOVA

ANOVA

Body Mass Index

	Sum of Squares	df	Mean Square	F	Sig.[a]
Between Groups	2.365	3	.788	1.258	.298
Within Groups	33.214	53	.627		
Total	35.579	56			

a. Confidence Interval: 95%

ANOVA Effect Sizes[a,b]

		Point Estimate	95% Confidence Interval Lower	Upper
Body Mass Index	Eta-squared	.066	.000	.181
	Epsilon-squared	.014	-.057	.134
	Omega-squared Fixed-effect	.013	-.056	.132
	Omega-squared Random-effect	.005	-.018	.048

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

b. Negative but less biased estimates are retained, not rounded to zero.

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Table 3: Frequency Table

Statistics

		History_of_UTI	History_of_kidney_stones
N	Valid	57	57
	Missing	1	1

Frequency Table

History_of_UTI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	50	86.2	87.7	87.7
	yes	7	12.1	12.3	100.0
	Total	57	98.3	100.0	
Missing	System	1	1.7		
Total		58	100.0		

History_of_kidney_stones

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	49	84.5	86.0	86.0
	yes	8	13.8	14.0	100.0
	Total	57	98.3	100.0	
Missing	System	1	1.7		
Total		58	100.0		

CHAPTER 5
DISCUSSION

A key emphasis of this research was the connection between maternal BMI and the severity of hydronephrosis. Women with high BMI exhibited a higher occurrence of moderate to severe hydronephrosis than women with normal BMI. This discovery aligns with the insights [12] who characterized maternal obesity as a state linked to chronic inflammation, vascular issues, insulin resistance, and modified renal hemodynamics. These changes in metabolism and blood vessels can hinder urinary flow and raise the risk of renal pelvic enlargement.

Likewise, Placenta noted that maternal obesity impacts placental-renal hemodynamic adjustments, resulting in heightened venous congestion, changed renal blood flow, and reduced ureteral efficiency. Elevated abdominal pressure in overweight and obese women might exacerbate ureteric compression during pregnancy, leading to more severe hydronephrosis. This offers a physiological rationale for the correlation noted in the current research. [13]

Andersen et al. showed that higher maternal BMI is linked to negative pregnancy outcomes such as hypertension, gestational diabetes, and cesarean delivery. Even though their research did not directly investigate hydronephrosis, the overall hemodynamic strain related to obesity might clarify the heightened renal stress observed in pregnant women with obesity. The current results indicate that hydronephrosis could signify another significant maternal issue linked to increased BMI. [14]

This study demonstrated that ultrasonography was effective for safely identifying and grading hydronephrosis in pregnant patients. Fargason and Horrow highlighted that ultrasound is the favored diagnostic approach as it eliminates radiation exposure and offers dependable imaging of renal pelvic dilation, calyceal enlargement, and cortical thickness. Nevertheless, they observed that obesity could decrease image

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quality and complicate precise grading. This constraint was noted in the current study, where imaging in women with elevated BMI sometimes necessitated additional examinations for improved clarity. [15]

CONCLUSION

The current research indicates that maternal body mass index (BMI) is significantly related to the occurrence and ultrasonographic classification of hydronephrosis in expectant mothers. Pregnancy induces physiological enlargement of the urinary tract due to hormonal and mechanical alterations; nonetheless, a higher maternal BMI seems to additionally affect the severity and frequency of hydronephrosis. Women with elevated BMI were observed to have an increased chance of experiencing moderate to severe hydronephrosis compared to women with normal BMI. Hydronephrosis on the right side was observed more frequently, aligning with typical anatomical and physiological changes that occur during pregnancy. Ultrasonography has shown to be a safe, dependable, and efficient technique for diagnosing and assessing hydronephrosis, as well as for differentiating between physiological alterations and clinically relevant renal dilation. The results indicate that maternal obesity could lead to hindered urinary drainage due to heightened intra-abdominal pressure, modified renal blood flow, vascular congestion, and metabolic strain. Consequently, pregnant women who are overweight or obese might need more frequent antenatal supervision to avert complications like urinary tract infections, flank pain, kidney issues, and the necessity for invasive procedures. Because maternal BMI is a changeable risk factor, prompt detection and proper prenatal care can enhance maternal kidney health and pregnancy results. Consequently, evaluating BMI should be viewed as a crucial aspect of standard antenatal care, especially when assessing pregnant women for hydronephrosis. Additional extensive multicenter studies are suggested to enhance the evidence and facilitate the creation of BMI-centered screening and management protocols for maternal hydronephrosis.

LIMITATIONS

- The research took place at a single location with a small sample size, which might limit the applicability of the results to the broader population of pregnant individuals.
- The grading of hydronephrosis using ultrasonography can differ based on the operator's expertise and the patient's body type, particularly in obese women where image clarity may be compromised.
- Additional factors like parity, gestational age, hydration levels, and existing renal issues were not entirely managed, potentially impacting the severity of hydronephrosis.
- The study's cross-sectional design restricts the capacity to evaluate the progression of hydronephrosis across various pregnancy trimesters

RECOMMENDATIONS

- According to the results of this study, the following recommendations are proposed:
- Regular evaluation of maternal BMI should be part of antenatal care to detect pregnant women at increased risk of developing hydronephrosis and associated kidney issues.
- Overweight and obese pregnant women require more frequent ultrasonographic monitoring to identify and assess hydronephrosis early, particularly in the second and third trimesters.
- Promoting health education and counseling on weight management before and during pregnancy is essential to reduce obesity-related complications in mothers and enhance pregnancy outcomes.
- Additional multicenter research with greater sample sizes is suggested to provide more robust evidence and create BMI-focused screening and management protocols for maternal hydronephrosis

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