ORIGINAL ARTICLE

Ultrasonographic Evaluation and Causes of Hydronephrosis Multi-Center Study Bashir Health Services, Aslam Medical Complex, Private Clinic

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ABSTRACT

Objectives: The primary aim of this study is to assess and classify hydro-nephrosis in adults using ultrasound imaging and seeks to determine the its main causes.

Methodology: A descriptive cross-sectional study design was utilized for this research. In this approach, existing medical records and ultrasound reports of adult patients previously diagnosed with hydronephrosis were reviewed to evaluate the frequency and etiology of hydronephrosis.

The study was conducted at the Department of Radiology, of three hospitals in Sialkot, Pakistan. The study was conducted over a 6-month period from 1st July 2024 to 31st December 2024. A nonprobability purposive sampling technique was used to select relevant patient records. A total of 83 patients met the inclusion criteria.

Result: Age group of 25-50 years showed 81.9% patients presented with hydronephrosis with 47 males and 36 females. Pain being the most common symptoms was (32%). Right sided hydronephrosis was seen most commonly. Hydro ureter status was seen in 55% of patients who never had a stone. Mild hydronephrosis was the most common sign. Causes of hydronephrosis were ureteric and renal stones 29% and 23% respectively followed by pregnancy 12% and BPH 11%.

Conclusion: Overall, these findings reinforces the clinical utility of ultrasound in the prompt detection and management of hydronephrosis.

Keywords: hydronephrosis, ureteric stones, renal stones, neurogenic, stricture, structure, Ultrasonography etc.

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Introduction

Hydronephrosis is a condition characterized by the swelling of the kidney's collecting system due to obstruction in the flow of urine. This obstruction can arise from the various causes, including congenital blocka-ges, scarring from previous injuries or surgeries, tumors, urinary tract infections (UTIs), benign prostatic hyperplasia (BPH), and pregnancy. If left untreated, hydrone-phrosis can lead to severe complications, including acute and chronic renal failure[1].

Previous studies have identified calculi as the most common cause of hydronephrosis in adults, followed by tumors in the kidney, ureter, and bladder. Other less common causes include inflammatory ureteral strict-ures and neurogenic bladder issues. The presentation of hydronephrosis varies bet-ween adults and children, with anatomical abnormalities being more prevalent in the

pediatric cases. In pregnant women, hydronephrosis is often a physiological finding due to hormonal changes and mechanical compression of the ureters[1]. Despite the established causes and symptoms, there remains a need for comprehensive studies that assess the prevalence and classify-cation of hydronephrosis using modern imaging techniques.

While existing literature has explored various causes and presentations of hydronephrosis, there is a lack of focused research that systematically evaluates the condition using ultrasound in a diverse adult population. Many studies do not adequately classify the severity of hydronephrosis or identify the underlying causes in a comprehensive manner. Additionally, the impact of metabolic disorders, such as diabetes and gout, on the incidence of hydronephrosis has not been thoroughly investigated. This gap highlights the need for a study that not only assesses the prevalence of hydro-nephrosis but also classifies its severity and identifies main causes in a clinical setting.

This study is significant as it aims to provide a detailed evaluation of the hydronephrosis using ultrasound, which is a non-invasive and widely accessible imaging modality. By classifying the severity of hydronephrosis & identifying its primary causes, the research can contribute to better diagnostic and treatment strategies. Understanding the relationship between hydronephrosis and underlying conditions, such as metabolic disorders, can enhance patient manage-ment and potentially reduce the risk of severe complications. Furthermore, the findings may inform clinical practices and guidelines for the early detection and intervention of hydronephrosis.

Objectives

The primary aim of this study is to assess and classify hydronephrosis in adults using ultrasound imaging. Additionally, research seeks to determine the main causes of hydronephrosis within the study population. By analyzing demographic data and clinical history, the study will provide insights into the frequency and severity of hydroneph-rosis, ultimately contributing to improved patient care and outcomes in renal health.

Methodology

A descriptive cross-sectional study design was utilized for this research.

In this approach, existing medical records and ultrasound reports of adult patients previously diagnosed with hydronephrosis were reviewed to evaluate the prevalence and leading causes of hydronephrosis within a defined past time frame.

The study was conducted at the Department of Radiology, Bashir Health Services/ Aslam Medical Hospital and Private Clinic, Sialkot, Pakistan.

The study was conducted over a 6-month period from 1st July 2024 to 31st December 2024.

A non-probability purposive sampling technique was used to select the relevant patient records. A total of 83 patients met to the inclusion criteria as follow:

- Patients aged between 25 to 80 years,
- referred for lumbosacral spine MRI,
- primarily presented with low back pain were included

However following patients were excluded;

- Patients under 25 or over 80 years,
- Not referred for lumbosacral spine MRI,
- Absence of low back pain

Data analysis was performed using SPSS version 22. Descriptive statistics were used to define variables.

Results

We observed that 81.9% patients were in tha age group of 25-50 years. 47 males and 36 females were examined.

Category	N	%
<25	10	12.0
25–50	68	81.9
51–70	3	3.6
>70	2	2.4

Table 1. Age distribution of patients (n = 83)

Category	N	%
No history	42	50.6
History of Gout	8	9.6
History of Diabetes mellitus	22	26.5

Table 2. Chronic medical conditions in patients with hydronephrosis (n = 83)

Category	n	%
Flank pain	27	32.5
Urinary tract infection (UTI)	24	28.9
Hematuria	18	21.7
Urinary retention	14	16.9

Table 3. Presenting renal problems (n = 83)

Category	n	%	Cumulative %
Left-sided HN	27	32.5	32.5
Right-sided HN	44	53.0	85.5
Bilateral HN	12	14.5	100.0

Table 4. Laterality of hydronephrosis (n = 83)

Category	n	%	Cumulative %
Mild HN	46	55.4	55.4
Moderate HN	25	30.1	85.5
Severe HN	12	14.5	100.0

Table 5. Severity of hydronephrosis (n = 83)

Figure (1): According to presence of hydroureter

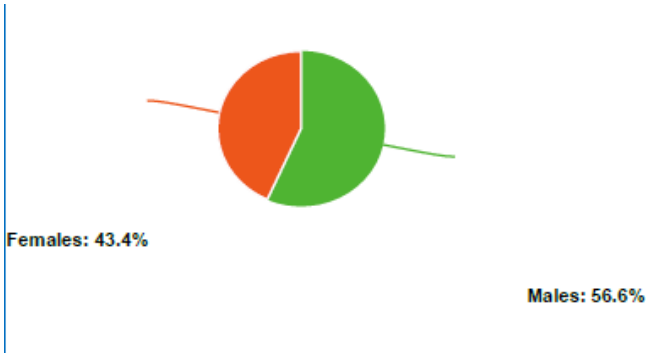

Figure (2): The gender distribution of study population is shown (44% females and 56% males).

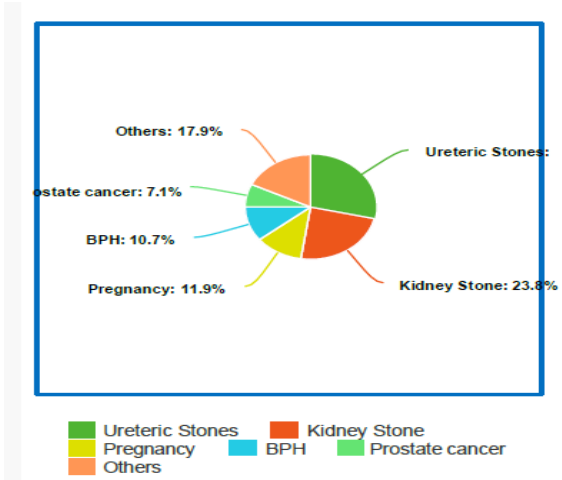

Figure 3: Subject Description according to causes of hydronephrosis

Discussion

This study aimed to examine the severity, frequency, and the leading causes of the

hydronephrosis in the adults, and to integrate the findings. Across all datasets, mild hydronephrosis emerged as the most frequently observed grade, ranging from 53% to 56% of cases, followed by moderate (25–30%) and severe (12%). These results are consistent with the previous studies conducted[2].

Researchers also reported a predominance of mild to moderate presentations, suggesting that early detection through ultrasound screening is increasingly common in clinical practice. [2]

Gender distribution patterns also indicated a higher prevalence among females due to pregnancy related physiological changes and a generally lower threshold for renal effects in the women. The current data also supported the assertion by Rasmussen and Nielsen that right sided hydronephrosis is more common in the pregnant women, likely due to the progesterone induced ureteral relaxation. [3]

In terms of etiology, ureteric stones 29% and kidney stones 23% consistently ranked as the most common causes.[4] Pregnancy (12%), and the benign prostatic hyperplasia (11%) were the second and the third most common gender-specific causes in females and males, respectively. These findings corroborate the conclusions of a study that urinary stones are the primary etiology in approximately 60% of hydronephrosis cases with detection rates increasing from grade one to grade three.[4]

Symptomatically, flank pain was the most prevalent presenting complaint i.e. 32%, followed by hematuria, urinary tract infection and urinary retention. This symptom pattern reflects the pathophysiology of obstructive uropathy, in which acute or partial obstructions produce pain, whereas chronic obstructions may remain asymptomatic until the advanced.[5]

These findings have the important clinical implications. First, they underscore critical role of ultrasonography as a sensitive non-invasive, and widely available diag-nostic tool for both grading hydronephrosis and identifying underlying causes. Second, the predominance of mild hydronephrosis highlights the opportunity for early inter-vention to prevent progression to chronic kidney disease or renal failure.[5]

Conclusion

Overall, the synthesis of these findings reinforces the clinical utility of ultrasound in the prompt detection and management of hydronephrosis, emphasizes the predominance of urinary calculi as an etiological factor, and identifies target areas—such as stone prevention strategies and screening in high-risk populations—for future research.

Limitation

The included studies were cross-sectional and hospital-based, potentially limiting generalizability to the wider population.

In addition, while ultrasonography is highly sensitive, its specificity for certain causes (e.g., early neoplasms) is limited compared to CT or MRI. Finally, patient history and comorbidities may introduce confounding factors that were not fully controlled across the studies.

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