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Assessment of the Ultrasound Hepatic and Renal Pathological Imaging Findings: A Single Centre Retrospective Study

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Abstract **Original Research Article**

Background: The use of invasive guide techniques of sonography helps in the diagnosis and prognosis of liver pathologies, thus contributes to treatment and management. The study assessed the prevalence, patterns, and types of hepatic and renal pathologies in patients underwent ultrasound scans at Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi.

Materials and Methods: Retrospective study design was adopted for this study to analyzed 300 abdominal ultrasound reports conducted between April 2023 and April 2025. Data on patients' demographics, clinical histories, and sonographic findings were retrieved and analyzed using descriptive and inferential statistical tools.

Results: The most frequent renal conditions were nephrolithiasis 74 (36.6%), hydronephrosis 40(19.2%), and renal cysts 45(22.3%). Other renal findings nephritis, renal atrophy are the least frequent, which are 1(0.5%) each respectively. There are no statistically significant associations between demographic variables such as age($p=0.483$, $\chi2= 6.49$) and gender ($p=0.884$,$\chi2 =0.021$) with the presence/absence of renal diseases. There was no statistically significant association between the occurrences of hepatic and renal conditions in the study population at ($\chi2= 0.421, 0.516$).

Conclusion: We concluded that renal disorders were more frequently detected than hepatic conditions and that most cases occurred independently. It emphasized the diagnostic importance of ultrasound for early detection and monitoring of hepato-renal diseases. Recommendations included periodic ultrasound screening for high-risk groups, strengthened hypertension management, lifestyle modification programs, and integrated hepato-renal evaluation protocols to improve early diagnosis and patient outcomes.

Keywords: abdominal pain, kidney, liver, pathologies

INTRODUCTION

Ultrasound (US) is an investigative tool used in the diagnosis of the kidneys and lower urinary tract disease. It serves as a guide to the percutaneous procedure, such as hemodialysis catheter insertion and kidney biopsy, which requires proper interpretation of the clinical correlation. The use of invasive guide techniques of sonography helps in the diagnosis and prognosis of liver pathologies, thus contributes to treatment and management.[1] It has a vital role in the identification and treatment of chronic liver diseases through the provision of diagnostic and prognostic information as well as detecting complications such as hepatocellular carcinoma, and portal hypertension is well documented.[2] Also, abdominal sonography imaging may help in the identification of liver nodules, which might suggest several liver irregularities, such as cirrhosis and hypertensive portal signs. Ultrasound is a modality of choice due to its availability, no recorded adverse effect on the body tissues, and noninvasive in assessing patients.[3] However, several modes have been introduced, which include power Doppler mode, harmonic imaging mode, and 3D mode, making it more suitable as a diagnostic and prognostic tool in modern medicine in the evaluation of both liver and kidney complications.

The kidney and liver are metabolic organs situated in the abdominal region of the body; thus, the liver is located in the right hypochondria, the epigastrium and some part of the left hypochondria. The kidneys are positioned on both sides of the spine in the parietal region of the peritoneum and posterior abdominal wall.[4] The kidney is a bean-shaped organ encapsulated and separated from echogenic perirenal fat.[5] It is sub-divided into medulla and cortex and features both the renal pyramids and papillae, which are essential features of the medulla.[6] The renal sinus consists of renal calyces, renal pelvis, fats, and major intrarenal vessels. In the normal kidney, the urinary collecting system in the renal sinus is not visible, but it creates a heteroechoic appearance with the interposed fat and vessels. The parenchyma tends to be hypoechoic and homogenous and is divided into the outer cortex and the innermost medullar. The innermost medullar is slightly less echogenic.[5] The liver accounts for about 2-3% of the body weight. It is situated in the right upper quadrant of the abdominal cavity beneath the right hemidiaphragm. It is protected by the rib cage and maintains its position through peritoneal reflections, referred to as 'ligamentous attachments.[7] The liver comprises about 2% of an adult's body weight; thus, the liver is a complete organ because of its dual blood supply from the portal vein (which is approximately 75%), and the hepatic artery (approximately 25%). It is intertwined with nearly everybody system; hence, it is prone to a variety of clinical pathologies.[8]

Hepatic and renal sonography encompasses scanning of patient's right upper quadrant, entailing the left and right margins correspondingly from different planes. Patients are placed in different positions for a sonographer to have a good visualization and evaluation of the organs and as well as detecting abnormalities related to these organs.[9] Ultrasound is one of the best modalities used by Radiographers or Radiologist for liver and kidney imaging because of its ability to reveal their structure, and easier detection abnormalities of these organs.[5] However, its availability, low cost, non-invasiveness and use of non-ionizing radiation makes it more reliable.[8] Furthermore, sonography has a crucial role in assessing both morphological changes using B-Mode and patterns of vascularization with the aid of color-Doppler and contrast-enhanced ultrasound.[10] Thus, it contributes to chronic kidney diseases diagnosis and a follow-up of its progress.

Emamian[5] reported that the liver has a higher echogenicity when compared with that of the kidney. Also, the echogenic nature of the liver provides an exception of free blood vessels along with the gall bladder during ultrasound imaging. Hepatic pathologies include hepatitis, liver cirrhosis, fatty liver, abscess, liver cyst, hepatomegaly, hepatocellular carcinoma, and portal hypertension.[5] Renal ultrasound is a standard pathological examination, which is used in practice in diagnosis and assessment of

renal functions along with its ultrastructure.[9] Technological innovations have resulted in high-quality scanners that are both moveable and affordable, and have highly increased the use of point-of-care sonography by clinicians.[11] . A normal kidney on ultrasound is hypoechoic relative to the liver and spleen, but it can be isoechoic or even hyperechoic in infants. The central renal sinus appears hyperechoic than the renal cortex, the liver, and the spleen.

A report has shown that male is at advanced risk of having both liver and kidney diseases than their female counterpart, and the age of those at higher risk ranged from 20-49 years.[12] Furthermore, the most typical pathological finding of the liver is cirrhosis, while pyelonephritis is the most diagnosed kidney diseases.[12] . Reports from Otieno and Odhiambo[13] showed that fatty infiltration is the most common diagnosed liver disease and renal parenchyma disease type I and II are the most kidney disease been diagnosed. Oglat[8] reported in his study that portal hypertension and liver cirrhosis were the most common findings. Also, ultrasound sensitivity has about 80% efficiency despite reports on the common pathological findings associated with liver and kidneys in different regions of the world.

The kidney and liver are organs situated in the abdominal region of the body .According to Moore[4], the liver is located in the right hypochondria, the epigastrium and some part of the left hypochondria while the kidneys lie on the upper part of the posterior abdominal wall .Ultrasound is often the first line of investigation for suspected liver or kidney pathology and the decision to proceed to secondary investigative procedures such as further radiological or histological are frequently determined by the findings of the initial ultrasound scan. Ultrasound is used in the diagnosis, staging and monitoring of liver disorders and also contributes to the treatment with ultrasound-guided invasive procedures. According to O'Neill [11] , ultrasound is an essential tool in nephrology for not only the diagnosis and management of kidney disease, but also for guidance of invasive procedures. Increasingly, ultrasound is also a reliable tool for more focused, complex examinations. Advancement in technology and techniques now resulting to improved diagnostic accuracy and are increasingly obviating the need for further radiology

There is scarcity of data on the prevalence and common pathological conditions associated with renal and hepatic ultrasound scans especially in the study location, hence this study.

MATERIALS AND METHODS

A retrospective study design was adopted in this study to evaluate the common ultrasound findings in patients scanned for liver and kidneys in Nnamdi Azikiwe Teaching Hospital Nnewi, Anambra State, Nigeria. Three hundred (300) ultrasound scan reports archived from April 2023 to April, 2025 met the inclusion criteria, which include but not limited to; reports that contained complete demographic information (age, gender, occupation), reports that documented renal and/or hepatic ultrasound findings with clear diagnostic impressions and adult and pediatric patients regardless of gender or occupation and form the study sample size. These reports were selected using purposive sampling technique as only those with liver and kidney information were selected.

An ethical approval with reference number **(NAUTH/CS/66/VOL.17/VER.3/073/2025/67)** was obtained from the Ethics and Research Committee of Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Anambra State. Permission to conduct the research at the Radiology department of NAUTH was sought and obtained. No information, which revealed the patients' identity were obtained.

The information extracted includes patients' demographic data (age and sex), clinical history, ultrasound findings, and diagnosis. Only complete records containing both demographic and sonographic information were included. The data were carefully sorted, coded, and entered into a structured data proforma for analysis. Data obtain were used for purpose of this study only.

Descriptive statistical methods such as frequency distribution and percentages were used to summarize the data. Chi-square tests were applied to determine the associations between hepatic and renal pathologies as well as between

demographic factors and the presence or absence of these diseases. The level of statistically significance was set at $p< 0.05$.

RESULTS

Table 1. Frequency and percentage distributions of demographic variables

Age (Years)	Frequency (%)	
	Liver pathology (%)	Kidney Pathology (%)
0-10	2 (2)	5 (2.5)
11-20	13 (13.3)	12 (5.9)
21-30	17 (17.3)	25 (12.4)
31-40	22 (22.4)	26 (12.9)
41-50	28 (28.6)	44 (21.8)
51-60	6 (6.1)	29 (14.4)
61-70	2 (2)	29 (14.4)
71 years & above	8 (8.2)	32 (15.8)
Total	**98 (100)**	202 (100)
Gender		
Male	62(63.3)	105(52.0)
Female	36(36.7)	97(48.0)
Total	**98(100)**	**202(100)**

From table 1 above, out 98 ultrasound reports for hepatic cases, the majority 28 (28.6%) were within the age group of 41=50 years of age and followed by 22 (22.4%), which are in the age bracket of 31-40years of age. Greater number 44 (21.8%) of the cases of renal, are within the age range of 41-50 years and the least 5 (2.5%) are in the age bracket of 0-10years(Table 1). In both liver and renal cases, males were highest , which are 62(63.3%) and 105 (52%) each for liver and renal respectively.

Table 2 Prevalence of renal and hepatic pathologies among patients that underwent Abdominal ultrasound at NAUTH

Variable	Frequency (n=300)	Percentage
Hepatic Pathologies	98	32.7%
Renal pathologies	202	67.3%

Out of 300 reports included in this study, the majority 202(67.3%) had renal pathologies while hepatic pathologies accounted for 98(32.7%)(Table 2).

Table 3 Association between the occurrence of hepatic and renal conditions in the study population and their co-existence

		Hepatic Pathologies				
		None	**Present**	**Total**	**X^2**	***p*-value**
Renal Pathologies	**None**	929 (76.5%)	84 (6.9%)	1013 (83.4%)	0.421	0.516
	Present	188 (15.5%)	15 (1.2%)	202 (16.6%)		
Total		1117	98	1215		

There was no statistically significant association between the occurrences of hepatic and renal conditions in the study population at (χ^2= 0.421, 0.516) (Table 3).

Table 4. Frequency and percentage distributions of the renal pathologies

Variable	Frequency	Percentage (%)
Nephrolithiasis	74	36.6
Hydronephrosis	40	19.8

Renal Cysts	45	22.3
Pyelonephritis	18	8.4
Renal Parenchyma Disease	10	5.0
Renal ectopic	4	2.0
Renal Malignancy	1	0.5
Nephropathy	5	2.5
Wilms Tumor	1	0.5
Renal Agenesis	1	0.5
Renal disease	1	0.5
Nephritis	1	0.5
Renal atrophy	1	0.5

Table 4 shows that the most frequent renal conditions were **nephrolithiasis** 74 **(36.6%), hydronephrosis 40(19.2%)**, and **renal cysts 45(22.3%).** Other renal findings nephritis, renal atrophy are the least frequent, which are 1(0.5%) each respectively.

Table 4.5 Most prevalent history among patients with renal pathologies

Variable	Frequency	Percentage (%)
Known hypertensive	23	11.4
Peptic ulcer disease	21	10.4
Alcohol use	19	9.4
Long-standing hypertension	19	9.4
Hepatitis B positive	18	8.9
No significant past history	18	8.9
History of urinary tract infection	17	8.4
Recurrent abdominal pain	17	8.4
Abdominal swelling	15	7.4

Known diabetic	12	5.9
Recurrent renal colic	12	5.9
Fever and malaise	11	5.4

Table 5 shows the clinical histories for those with renal pathologies as follows; **hypertension 23(11.4%), peptic ulcer disease 21(10.4%), alcohol use 19(9.4%) and long-standing hypertension 19(9.4%). Hepatitis B positivity** and **urinary tract infection** were also common, each affecting about **8–9%** of patients.

Table 6 Frequency and frequency of gender distribution of common Hepato-renal pathological findings

	Frequency (%)			**Frequency (%)**	
Liver pathology	Male	Female	Kidney Pathology	Male	Female
Fatty Liver	33 (63.4)	17 (36.9)	Nephrolithiasis	37 (33)	37 (41.1)
Hepatomegaly	10 (19.2)	15 (32.6	Hydronephrosis	21 (18.8)	19 (21.1)
Hepatic Cysts	1 (1.9)	4 (8.7)	Renal Cysts	29 (25.9)	16 (17.8)
Hepatitis	3 (5.8)	1 (2.2)	Renal Parenchyma disease	6 (5.4)	4 (4.4)
Portal Hypertension	1 (1.9)	1 (2.2)	Renal ectopic	1 (0.9)	3 (3.3)
PLCC	1 (1.9)	0 (0)	Pyelonephritis	11 (9.8)	7 (7.8)
Liver Trauma	1 (1.9)	0 (0)	Renal Agenesis	1 (0.9)	0 (0)
Haemangioma	1 (1.9)	0 (0)	Nephropathy	2 (1.8)	3(3.3)
Hepatic Lipoma	0 (0)	1(2.2)	Renal Diseases	1 (0.9)	0 (0)
Cirrhosis	1 (1.9)	4 (8.7)	Renal Malignancy	0 (0)	1 (1.1)
Hepatic mass	0 (0)	3 (6.5)	Wilma’s Tumor	1 (0.9)	0 (0)
			Renal Atrophy	1 (0.9)	0 (0)

			Nephritis	1 (0.9)	0 (0)
Total	52 (100)	46 (100)		112 (100)	90 (100)

Of those with liver pathologies, the greater number 52 were males while females accounted for 46. Those with kidney pathologies varies as follows, males 112 and females were 90(Table 6).

Table 7 Frequency and percentage distributions of hepatic pathologies

Variable	Frequency	Percentage (%)
Fatty Liver	50	51.0
Hepatomegaly	25	25.5
Hepatitis	4	4.1
Cirrhosis	5	5.1
Haemangioma	1	1.0
Liver trauma	1	1.0
Hepatic Cysts	5	5.1
PLCC	1	1.0
Simple hepatic cysts	3	3.1
Hepatic Mass	3	3.1
Hepatic Lipoma	1	1.0

Of the population with liver diseases, fatty liver disease was highest 50(51%), followed by Hepatomegaly 25(25.5%) and the least were liver trauma, PLCC, and hepatic lipoma, which are 1(1%) each respectively(Table 7)

Table 8 Most occurring history among patients with hepatic pathologies

Variable	Frequency	Percentage (%)
Long-standing hypertension	11	11.2
Peptic ulcer disease	11	11.2

Fever and malaise	10	10.2
Known hypertensive	10	10.2
Abdominal swelling	9	9.2
Alcohol use	9	9.2
History of urinary tract infection	9	9.2
Hepatitis B positive	8	8.2
No significant past history	6	6.1
Recurrent abdominal pain	6	6.1
Recurrent renal colic	5	5.1
Known diabetic	4	4.1

Table 8 shows that among those with hepatic pathologies, the most frequent medical histories were **long-standing hypertension 11(11.2%), peptic ulcer disease 11(11.2%), fever and malaise 10(10.2%),** and **hypertension 10(10.2%).** Other common factors were **abdominal swelling (9.2%), alcohol use (9.2%),** and **urinary tract infection (9.2%)**. Hepatitis B positive (8.2%), recurrent abdominal pain and recurrent renal colic were also identified.

Table 9 Association between demographic distribution (age and gender) and the presence/absence of renal diseases

Variables	***p*-value**	χ^2
Age	0.483	6.49
Gender	0.884	0.021

There are no statistically significant associations between demographic variables such as age($p=0.483$, $\chi^2= 6.49$) and gender ($p=0.884$,$\chi^2 =0.021$) with the presence/absence of renal diseases (table 9)

Table 10 Association between demographic distribution (age and gender) and the presence/absence of hepatic diseases

Variables	*p*-value	χ^{22}
Age	0.630	5.242
Gender	0.773	0.084

There are no statistically significant associations between demographic variables such as age($p=0.630$, $\chi^2= 5.242$) and gender ($p=0.773$,$\chi^2 =0.084$) with the presence/absence of hepatic diseases (table 10).

DISCUSSION

This study revealed that renal pathologies were more prevalent than hepatic pathologies among patients who underwent abdominal ultrasound at NAUTH. This pattern aligns with the findings of Abubakar *et al*[12], who reported a higher occurrence of renal compared to hepatic abnormalities in Sokoto metropolis, particularly pyelonephritis and liver cirrhosis. Similarly, Gareeballah and Gameraddin[14] found renal parenchymal diseases to be common in patients undergoing abdominal sonography, often accompanied by other abdominal abnormalities. The higher renal prevalence in the current study could reflect the increasing detection of nephrolithiasis and hydronephrosis, which were also emphasized by Creditt[15] as major renal pathologies identifiable via ultrasound due to its high diagnostic sensitivity.

The hepatic prevalence recorded in this study was lower than the hepatomegaly and cirrhosis reported by Kapoor and Arora[16] However, it closely agrees with the study by Maàji, Yakubu and Odunko[17], who also reported liver cirrhosis and chronic hepatic disease as dominant hepatic findings in their sample population. These variations may be attributed to population differences, diagnostic scope, and lifestyle or metabolic risk factors in the study regions.

The analysis showed that only little of the patients had coexisting hepatic and renal pathologies, with no statistically significant relationship between the two conditions. This observation is comparable to the work of Otieno, Odhiambo and Onyambu[13], who reported that hepatic and renal pathologies may occur concurrently but are often independent in etiology, although they may share metabolic or infectious mechanisms. Their study identified hepatic steatosis and renal parenchymal disease as the main co-pathological findings, which is similar to the mild hepatic steatosis and renal parenchymal disease pattern identified in this study. The low rate of co-occurrence in this study further supports the assertion that most hepatic and renal abnormalities manifest separately unless compounded by systemic or chronic metabolic diseases.

The dominant renal findings in this study were nephrolithiasis, hydronephrosis, and renal cysts. These results are consistent with the findings of Creditt[15], who highlighted hydronephrosis and nephrolithiasis as common ultrasound findings in renal disorders. Likewise, Akinmoladun et al [18] documented a low prevalence of simple renal cysts in their study population and emphasized their association with hypertension and advancing age. The presence of renal cysts in this study population supports their observation that cystic changes increase with age and may occur incidentally during sonography. In addition, Rathaus and Werner[19] identified pyelonephritis

as a frequent renal lesion with a characteristic hyperechoic sonographic appearance, corresponding to the pyelonephritis cases detected in this study. Collectively, these findings reaffirm the diagnostic value of ultrasound in detecting renal obstructions and cystic or inflammatory conditions, as also indicated by El-Mekkawy *et al*[20] who validated the efficiency of ultrasound in differentiating benign and malignant renal masses.

Fatty liver and hepatomegaly were the most frequently diagnosed hepatic conditions in the current study. This agrees with Kapoor and Arora[16], who identified hepatomegaly and fatty liver as leading hepatic findings in their series of 592 patients. The predominance of fatty liver in the current study also corresponds with Otieno, Odhiambo and Onyambu[13], who found diffuse hepatic fat infiltration as the main liver pathology in their sonographic evaluation. Gerstenmaier and Gibson[2] further emphasized that fatty liver remains the most frequently detected hepatic abnormality across various ultrasound modalities, underscoring its clinical significance. Other hepatic abnormalities detected in this study, such as hepatitis, cirrhosis, and PLCC, correspond with the observations by Nwokediuko *et al*[21], who reported PLCC and cirrhosis as major liver pathologies in their retrospective review. Likewise, Maàji *et al*[17] documented liver cirrhosis as the most common hepatic disease in their sonographic evaluation of chronic liver disease patients. The consistency across studies highlights the reliability of sonography for identifying structural and parenchymal changes associated with chronic hepatic disorders.

The most prevalent medical histories among patients with renal pathologies included hypertension, peptic ulcer disease, and alcohol use. This finding corroborates Akinmoladun, Takure and Ogunleye[18], who linked renal cysts with hypertension and other systemic complications. Similarly, Gareeballah and Gameraddin [14] noted that renal parenchymal disease often co-exists with systemic conditions such as ascites and liver cirrhosis, suggesting interconnected vascular and metabolic influences.

Among hepatic pathology patients, long-standing hypertension and peptic ulcer disease were the most recurrent histories. These findings align with the observations of Yasui and Hashimoto [22], who established that non-alcoholic steatohepatitis can progress to hepatocellular carcinoma, often in patients with metabolic and cardiovascular comorbidities such as hypertension and obesity. The presence of alcohol use and hepatitis B positivity in several hepatic cases in this study mirrors the findings of Abdelouafi, Ousehal, Ouzidane and Kadiri[23], who associated hepatic abnormalities with infectious and inflammatory origins, particularly in cases of amebic and pyogenic abscesses.

Mild hepatic steatosis, hepatomegaly, renal parenchymal disease, and nephrolithiasis were among the most frequent ultrasound features recorded. These findings reinforce the observations of Kawasaki et al[24], who demonstrated that ultrasound is reliable for detecting fatty infiltration of the liver and renal perirenal changes. The study also corresponds with the work of Gareeballah and Gameraddin[14], who observed that ultrasound effectively detects co-existing abdominal abnormalities like ascites and liver cirrhosis among patients with renal parenchymal diseases. Liau, Blumgart and Dematteo[25] further highlighted ultrasound's diagnostic capacity in differentiating hepatic cystic lesions from abscesses, a finding supported by the detection of simple and complex hepatic cysts in this research.

The findings revealed no significant associations between demographic variables (age and gender) and the presence or absence of hepatic and renal diseases. This result is partly consistent with Nwankpa[26], who found minimal gender and age variation in liver and kidney disease occurrence within Asaba urban. However, it differs from Abubakar *et al*[12], who reported higher susceptibility among males and those aged 20–49 years. The difference may be due to environmental and occupational exposure variations between the study populations.

CONCLUSION

The study concluded that renal pathologies are more commonly detected than hepatic

pathologies among patients undergoing abdominal ultrasound in NAUTH. Nephrolithiasis, hydronephrosis, and renal cysts were the leading renal findings, while fatty liver and hepatomegaly were the predominant hepatic conditions. Age and gender did not statistically associate with the occurrence of renal and hepatic pathologies\

Declaration by Authors

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