Section: Infectious Diseases

Original Research Article

SPECTRUM OF ABDOMINAL ULTRASONOGRAPHIC FINDINGS IN AGED PEOPLE LIVING WITH HIV IN THE ART ERA AND CORRELATING WITH CD4 COUNTS

Sumit Kumar[1], Naga Anvesh[2], Vinita Rathi[3], Alpana Raizada[4], Anupama Tandon[5]

[1]*Assistant Professor, Department of Radiology, UCMS and GTBH, Dilshad Garden, Delhi, India.*
[3]*Post Graduate (PGY3), Department of Radiology, UCMS and GTBH, Dilshad Garden, Delhi, India.*
[3]*Director Professor, Department of Radiology, UCMS and GTBH, Dilshad Garden, Delhi, India.*
[4]*Director Professor, Department of Medicine (ART Clinic), UCMS and GTBH, Dilshad Garden, Delhi, India.*
[5] *Professor, Department of Radiology, UCMS and GTBH, Dilshad Garden, Delhi, India.*

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Corresponding Author:
Dr. Vinita Rathi,
Director Professor, Department of Radiology, UCMS and GTBH, Dilshad Garden, Delhi, India.
Email: vineetarathi@yahoo.com

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ABSTRACT

Background: As antiretroviral therapy (ART) extends the lifespan of people living with HIV (PLHIV), older adults increasingly face a dual burden of HIV-related complications and age associated comorbidities. This study evaluated the spectrum of abdominal ultrasonographic (USG) findings in PLHIV aged > 50 years, assessing the prevalence of abnormalities in asymptomatic individuals and their correlation with CD4 cell counts.

Materials and Methods: A prospective observational study was conducted at Tertiary care hospital, Delhi (April 2024 – August 2025), involving 100 HIV-positive participants. Clinical evaluations, viral load assessments, and CD4 counts were paired with standardized abdominal USG. Data were analyzed using descriptive statistics and Pearson's correlation.

Results: The cohort (mean age 59.4 years; 70% male) was largely stable, with 99% achieving viral suppression and 87% maintaining CD4 counts >350cells/mm³. While 89% of the population was asymptomatic, USG detected abnormalities in 38% of all participants. This included 90.9% of symptomatic patients and a significant 31.4% of asymptomatic individuals. Prevalent findings included fatty liver, hepatomegaly, benign prostatic enlargement, splenomegaly, cholelithiasis, and medical renal disease. Although abnormalities occurred more frequently at lower CD4 levels, the correlation did not reach statistical significance.

Conclusion: A substantial proportion of older PLHIV—including those without clinical symptoms—exhibit abdominal pathologies. These findings suggest that routine USG screening is a valuable tool for the early detection and management of comorbidities in aging HIV populations, potentially enhancing long-term health outcomes and quality of life.

Keywords: HIV; elderly; ultrasonography; abdominal findings; CD4 count; fatty liver.

INTRODUCTION

Global estimates indicate approximately 37.6 million people are living with HIV (PLHIV), with a significant demographic shift toward older populations. In India, where approximately 2.43 million people live with HIV, the incidence among patients aged 50 years and older reached an estimated 1.8 lakhs in 2020. The success of Antiretroviral Therapy (ART) has transitioned HIV into a chronic condition, resulting in a steadily rising average age within this population; for instance, nearly 50% of PLHIV in the USA were over age 50 by 2015.[1,2] Despite the clinical benefits of ART, older PLHIV remain at elevated risk for opportunistic infections and HIV-associated malignancies, which frequently involve abdominal organs—the second most common site of manifestation after the lungs. Late diagnosis remains a critical challenge, often driven by a lack of awareness, social stigma, and inadequate

healthcare access, particularly in resource-limited settings.[3,4]

Clinical diagnosis in older PLHIV is frequently confounded by non-specific symptoms and blunted immune responses that can mask underlying pathology. While CD4+ counts remain a primary marker of immunodeficiency, discordance between these counts and viral loads is increasingly observed in long-term ART patients, complicating disease monitoring. Ultrasonography (US) serves as a pivotal, non-invasive, and cost-effective modality for the early detection of abdominal abnormalities, including hepatosplenomegaly, lymphadenopathy, and visceral malignancies.[5,6] In the Indian context, US is essential for identifying treatable complications such as tubercular lymphadenopathy, thereby reducing mortality. Despite its utility, there is a paucity of data specifically evaluating the sonographic spectrum of the geriatric HIV cohort (age > or =50yr) within India. This study addresses this literature gap by characterizing abdominal US findings in older PLHIV to facilitate earlier intervention and improve clinical outcomes in this increasingly prevalent demographic.[7]

MATERIALS AND METHODS

A prospective observational study was conducted from 01/04/2024 to 31/08/2025 after getting approval from Institutional IEC-2024-64-152. Written well informed consents were taken from all the patients. USG abdomen was done in HIV positive patients, of age 50 years or more of any gender referred from the ART clinics, OPD or wards in 100 patients after using EPI software for sample calculation. Patients with Skin lesions or wounds, burns etc, localised over abdomen wall that interfere with US methodology were excluded. Patients with recent US abdomen with normal study report were excluded. Fig.1 depicts the patient enrollment flow chart.

The study was carried out on HD-7 XE Color Doppler Ultrasound, Philips (Bothell, WA, USA) / Logic P6 Pro Color Doppler (GE USG Korea, Ltd)/ MODEL Q 7 Color Doppler, E cube 7 Alpinion USG Korea, Samsung RS80 EVO. The study was conducted using a 2-5 MHz convex transducer followed by a 3-16MHz linear probe in all patients. Patients with positive US finding were followed up clinically at 6 monthly intervals till the end of study period. Laboratory investigations done were recorded including CD4 counts, viral load.

Statistical Analysis: Descriptive and analytical statistics were used; expressed as mean +/- SD and percentages. Correlation between numerical variables was tested by applying Pearson's correlation coefficient.

RESULTS

A total of 100 participants meeting the inclusion criteria were enrolled in the study. An overview of the baseline demographic profile, incorporating variables such as age distribution, gender composition, and relevant socioeconomic indicators, is presented in Table 1, providing context for the demography of the sample. The clinical characteristics observed at the time of enrolment, including duration of illness, history of comorbidities, and presenting symptoms, have been systematically summarised in Table 2 to illustrate the overall health status of the cohort.

Abdominal ultrasonography revealed noteworthy structural abnormalities among older PLHIV enrolled in the study. The overall pattern of ultrasound findings demonstrated a diverse spectrum of hepatobiliary, renal and splenic changes in this aging cohort listed in Table 3. Even among individuals without gastrointestinal or systemic complaints, imaging detected clinically relevant abnormalities, highlighting the silent nature of intra-abdominal pathology in this population listed in Table 4. Further stratification by immune status underscored that several ultrasonographic abnormalities persisted despite immune recovery, with a distinct subset of lesions observed among participants with CD4 cell counts above 350 cells/mm³ listed in Table 5. Collectively, these findings support the utility of routine abdominal ultrasound for early detection of subclinical abnormalities in older PLHIV, irrespective of symptomatology or immune reconstitution.

The result overview is given in fig 2. which illustrate the older people living with HIV (n=100), categorized into asymptomatic and symptomatic groups and further stratified by CD4 cell count. It summarizes abdominal ultrasound findings across these subgroups, highlighting the prevalence of normal studies versus single or multiple abnormalities. Common abnormalities include fatty liver, hepatomegaly, renal and prostatic conditions, with higher complexity seen in symptomatic individuals.

3.1 Statistical Analysis

- Twenty eight out of eighty-nine (31.4%) asymptomatic older PLHIV had ultrasound abdomen abnormalities
- Fisher's exact test, showed no statistically significant association between 'CD4 Count' and significant abdominal ultrasound abnormality (P value >0.05)
- Ultrasound helped in management in 10/11(90.9%) symptomatic and 22/28(78.5%) in asymptomatic older PLHIV.
- Thirty seven out of eighty seven (42.5%) of older PLHIV with a CD4 cell count of >350cells/mm3 showed positive ultrasound findings, while 1/13(7.6%) with CD4 cell count of <350cells/mm3 showed an ultrasound abdomen finding of sub-centimetric mesenteric lymph node. No obvious correlation was found between ultrasound findings and CD4 cell count. (p>0.05).

- Ultrasound abdomen helped in management of 10/11(90.9%) symptomatic patients and 22/28 (78.5%) asymptomatic older PLHIV.

Table 1: Age and gender distribution of older people living with HIV(PLHIV) (n=100)

S. No.	AGE (IN YEARS)	TOTAL NO. OF PATIENTS	NO. OF PATIENTS	
			MALE	FEMALE
1.	50-60	55	35	20
2.	61-70	39	30	9
3.	71-80	6	5	1
	TOTAL	**100**	**70**	**30**

Table 2: Clinical complaints of older people living with HIV(PLHIV) at the time of presentation for ultrasound (n=100)

S. No.	CLINICAL COMPLAINTS	NO. OF PATIENTS
1.	Clinical complaints absent	89
2.	Right upper quadrant pain	2
3.	Flank pain	2
4.	Frequency of micturition	2
5.	Hematuria	1
6.	Low grade fever	1
7.	Low grade fever with dry cough	1
8.	Bleeding per rectum	1
9.	Umbilical hernia	1
10.	Others	nil
	TOTAL	**100**

Table 3: Ultrasound abdomen findings in older people living with HIV(PLHIV) (n=100)

S.no.	Sonographic findings		No. of patients
1.	Normal		**62**
2.	Fatty liver-Grade-1	a) Without hepatomegaly	**7**
		b) With hepatomegaly	**4**
3.	Hepatomegaly without fatty liver*		**5**
4.	Splenomegaly*		**5**
5.	Gall Bladder calculi*		**4**
6.	Dilated Common Bile Duct		**1**
7.	Mesenteric lymph nodes(sub-centimetric)		**1**
8.	Increased renal echogenicity /Medical Renal Disease*		**4**
9.	Renal calculus*		**1**
10.	Ureteric calculus*		**1**
11.	Renal cortical cysts*		**7**
12.	Urinary bladder Carcinoma		**1**
13.	Benign prostatic enlargement*	Grade I	**7**
		Grade II	**1**
14.	Hepatic cyst*		**2**
15.	Splenunculus		**1**
16.	Umbilical hernia*(omentum)		**1**
17.	Ovarian cyst		**1**
18.	Uterine fibroid		**1**

These number represent the number of findings not the absolute number of the patients in which the findings were positive.

Table 4: Distribution of positive ultrasound findings in asymptomatic older PLHIV(n=28)

S. No.	US ABDOMEN finding	No. of patients
1	diffuse fatty liver (grade 1) without hepatomegaly*	6
2	Hepatomegaly without fatty liver*	4
3	Splenomegaly*	5
4	Hepatomegaly with grade 1 fatty liver*	2
5	Increased renal echogenicity (MRD)*	2
6	Gall bladder stone	2
7	Renal cysts*	5
8	Hepatic cyst	2
9	Benign prostatic enlargement*	5
10	Mesenteric lymph nodes(Sub-centimetric)	1
11	Uterine fibroid(2x1.2cm)	1
12	Dilated CBD	1
13	Simple ovarian cyst(2x1.5cm)	1
14	Splenunculus	1

These number represent the number of findings not the absolute number of the patients in which the findings were positive.

Table 5: Positive abdominal US findings associated with CD4 cell count>350cells/mm3 in older people living with HIV(PLHIV) (n=37)

S.no.	Abdominal sonographic findings		CD4cell count>350cells/mm^3
1.	diffuse fatty liver (grade 1)* without hepatomegaly		**7**
2.	Hepatomegaly without fatty liver*		**5**
3.	Splenomegaly*		**5**
4.	Hepatomegaly with grade 1 fatty liver*		**4**
5.	GB calculi*		**4**
6.	Renal calculus*		**1**
7.	Ureteric calculus*		**1**
8.	Benign prostatic enlargement*	Grade-1	**7**
		Grade-II	**1**
9.	Urinary bladder Carcinoma		**1**
10.	Dilated CBD		**1**
11.	Increased renal echogenicity (MRD)*		**4**
12.	Splenunculus		**1**
13.	Uterine fibroid(2x1.2cm)		**1**
14.	Simple ovarian cyst(2x1.5cm)		**1**
15.	Hepatic cysts		**2**

These number represent the number of findings not the absolute number of the patients in which the findings were positive.

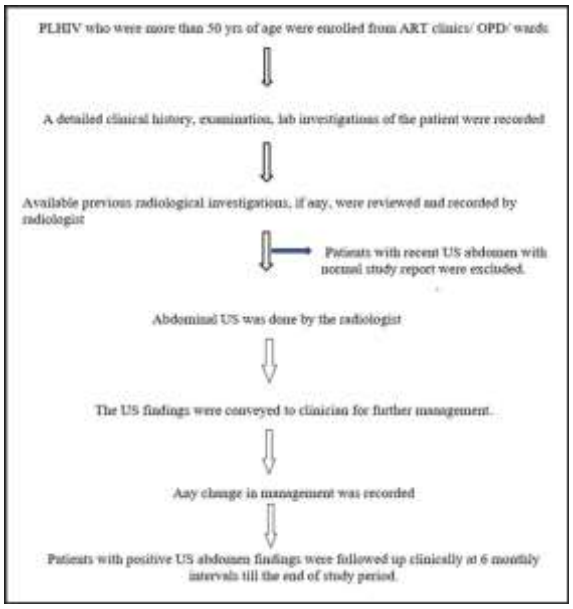

Figure 1: Patient enrollment flow chart

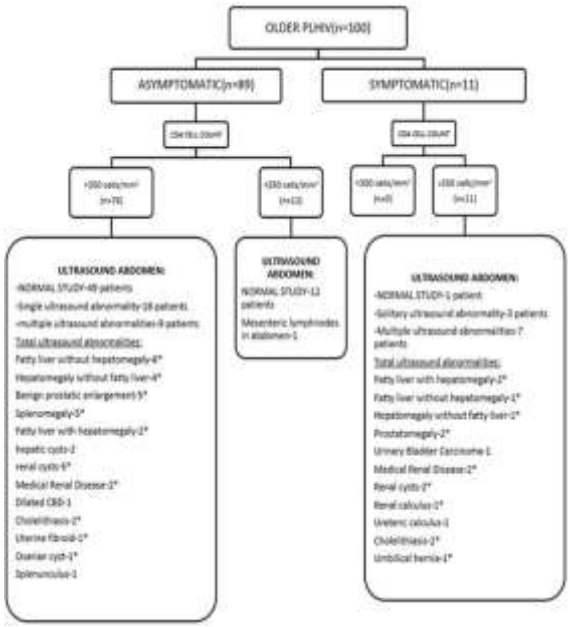

Figure 2: Abdominal Ultrasound finding overview in relation to CD4 counts

Figure 3: In a 73 yr male patient living with HIV(PLHIV) with CD4 cell count of 493 cells/mm3 and with complaints of hematuria since 2 months; Transverse grey scale ultrasound image of the pelvis using convex probe shows a distended urinary bladder with a polypoid intraluminal mass(white arrow) projecting from the right postero-lateral wall with minimal internal vascularity on color Doppler. The mass was confirmed as urinary bladder carcinoma on cystoscopic biopsy. The patient underwent treatment at a cancer institute.

Figure 4: In a 55 yr old asymptomatic male patient living with HIV(PLHIV) with CD4 cell count of 235 cells/mm^3 (suggesting severe immunosuppression)

underwent abdominal ultrasonography: Transverse grey scale ultrasound image (using 2MHz-9MHz linear probe) of the abdomen in periumbilical region shows sub-centimetric hypoechoic lymph nodes with no fatty hilum(yellow arrow) largest 3.8mm in short axis diameter (A,B). Subsequently he complained of weakness and fatigue after 2 months; he was started on anti-tubercular therapy and responded to it. He had no past history of tuberculosis.

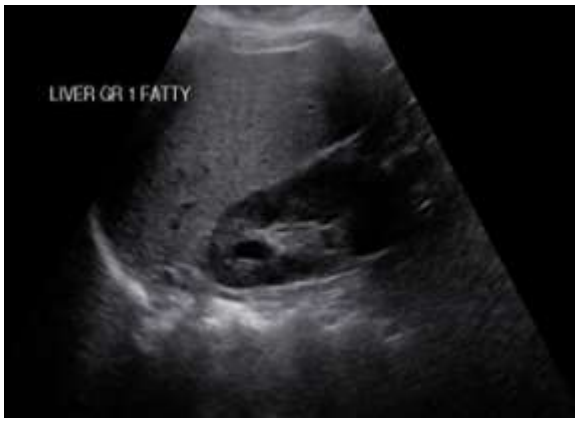

Figure 5: In a 50 yr old asymptomatic female patient living with HIV(PLHIV) with CD4 cell count of 549 cells/mm3; Longitudinal grey scale ultrasound image of the abdomen using convex probe in midaxillary line in right upper quadrant shows increased echogenicity of liver(A,B) compared to right kidney (grade I) with no biliary radicle dilatation or space occupying lesion. The patient has normal LFT and has not co-infected with HBV/HCV.

Figure 6: In a 55 yr old asymptomatic male patient living with HIV(PLHIV) with CD4 cell count of 505 cells/mm3; Longitudinal grey scale ultrasound image of the abdomen using convex probe in midclavicular line in right upper quadrant shows an enlarged liver(18.1cm) with normal echogenicity and no biliary radicle dilatation suggestive of hepatomegaly. Patient has no past history of tuberculosis, with history of alcohol consumption for 15 years but has normal LFT values.

DISCUSSION

Out of 100 patients, 11% older PLHIV were symptomatic and the rest 89% were asymptomatic. All the patients were referred for a screening US. 87% patients had CD4 cell count >350cells/mm^3, suggesting moderate to good immunosuppression and 13% patients had <350cells/mm^3, suggesting mild to severe immunosuppression.

4.1 Demographics and Clinical Background:

The study consisted of 100 HIV-positive individuals aged ≥50 years, with a male predominance (70%) with male: female ratio of 70:30=2.33. The majority (55%) were within the 50–60-year age group. Only 6.0% patients were between 71-80 years of age. The mean age of our study population was 60.3 years. In most of the other studies on ultrasound abdomen the majority of HIV positive patients were younger, i.e. included patients less than 50 years age also.[5,8-11]

Most older PLHIV had been diagnosed with HIV for more than six years in our study, with 39% diagnosed for 6–10 years and 37% for 11–15 years. Since 89% older PLHIV in the study were asymptomatic, this reflects that our study population was a stable, aging HIV population on long-term ART. 87% had a CD4 count above 350 cells/mm^3, suggesting preserved immunity in the majority, while only 13% had CD4 cell count less than 350 cells/mm^3. All 100 older PLHIV had good virological control.

4.2 Spectrum of Abdominal Sonographic Findings:

In our study, 62% of older PLHIV had a normal abdominal ultrasound, probably due to good ART adherence; while 38% showed one or more abnormal findings.

4.2. 1. Urinary Bladder Carcinoma

The most significant finding was urinary bladder carcinoma detected in a 73-year-old male PLHIV on ART for 15 years, with a normal CD4 count (493 cells/mm^3) and suppressed viral load. He presented with intermittent hematuria for 2 months. Ultrasound demonstrated a 2.6 × 2.2 cm polypoidal intraluminal echogenic mass arising from the right posterolateral bladder wall, with minimal internal vascularity, suggestive of carcinoma as in fig 3. Diagnosis was confirmed on cystoscopic biopsy.

Previous reports describe bladder malignancies in PLHIV presenting with hematuria, often despite good immune status and viral suppression, similar to our case. Transitional and squamous cell carcinomas have been reported, with some cases linked to schistosomiasis or viral oncogenesis [12-14]. These findings highlight that bladder carcinoma in PLHIV may occur independent of advanced immunosuppression and should be considered in older patients presenting with hematuria.

4.2.2. Sub-centimetric Mesenteric Lymph Nodes

A 55-year-old asymptomatic male PLHIV with low CD4 count (235 cells/mm^3) and suppressed viral load showed a few discrete hypoechoic mesenteric lymph nodes (maximum SAD 3.7 mm) on ultrasound,

without matting or calcification as in fig 4. One month later, he developed constitutional symptoms, and empirical ATT was initiated for suspected tubercular lymphadenopathy, with subsequent clinical improvement.

Lymphadenopathy was rare in our cohort, occurring only in one patient with CD4 <350 cells/mm³, consistent with studies showing reduced lymph node involvement in patients on long-term effective ART. This contrasts with earlier literature reporting higher prevalence in immunocompromised or symptomatic PLHIV, suggesting altered disease expression in stable patients.[15,16] In contrast to this our study had 87% PLHIV which had a CD4 cell count of >350cells/mm^3 indicating moderate immunosuppression, while Bhabhor et al found only 29/80(36.25%) PLHIV had CD4 cell count>350cells/mm^3. This might be the reason for much lower incidence of lymphadenopathy (1%) in our study as compared to Bhabhor et al (45%). Kaushik et al similarly found that 47% patients showed lymphadenopathy on ultrasound abdomen, CD4 cell count being <350cells/mm^3 in 40/47(85.1%) patients, with significant P value, demonstrating a strong correlation between HIV and tubercular lymphadenopathy.[5,11]

4.2.3. Urinary Tract Calculi

Urinary tract calculi were detected in a 61-year-old PLHIV with right flank pain, showing obstructive ureteric calculus with moderate hydroureteronephrosis. Another patient had a non-obstructive renal calculus. Neither patient was receiving protease inhibitors, unlike previously reported cases of ART-related crystalluria. Thus, stone disease in our cohort could not be directly attributed to ART. Blake et al (1998), conducted a study for 3 months on 6 HIV patients (29-48 years of age) who were on indinavir therapy and had flank pain. All these patients had undergone CT abdomen and no radioopaque calculus was seen on non-contrast CT.[17]

4.2.4. Fatty Liver

Diffuse increased hepatic echogenicity consistent with Grade I fatty liver was the most common abnormality, seen in 11% of patients as in fig 5, with hepatomegaly in 4%. Most patients were asymptomatic. Laboratory abnormalities and viral hepatitis co-infection were present in 63.6% of cases with fatty liver. All affected patients were on dolutegravir-based ART.

Our findings are consistent with prior studies reporting fatty liver in 11–25% of PLHIV. Although dolutegravir has not been uniformly associated with steatosis, recent evidence suggests a possible association when combined with tenofovir – alafenamide[18,19]. Viral hepatitis co-infection likely contributed to hepatic changes in our patients, emphasizing the role of ultrasound in routine surveillance of older PLHIV.

4.2.5. Hepatomegaly Without Fatty Liver

Hepatomegaly without fatty infiltration was observed in 5% of patients, all with CD4 counts >350 cells/mm³. No focal lesions were identified as in fig 6. Unlike earlier studies reporting higher prevalence in younger or more immunocompromised cohorts, isolated hepatomegaly was uncommon in our older, stable population.

Bhabhor et al. found hepatomegaly was the most common liver finding on ultrasound in 20/80(25%) and 13 out of these 20 patients had CD4 cell count<350cells/mm3. However, in our study all 9 patients with hepatomegaly had CD4 cell count >350 cells/mm^3. Most of the ultrasound studies available in the literature are not exclusively in older PLHIV.[5]

4.2.6. Benign Prostatic Enlargement

Benign prostatic enlargement was identified in 8% of patients, predominantly Grade I, with most cases asymptomatic and all having CD4 counts >350 cells/mm³. Findings were consistent with age-related changes rather than HIV-specific pathology.

Ahlstrom at al, compared the incidence of Benign Prostatic Hyperplasia (BPH) in 4633 HIV infected and 46330 un infected Danish men (age-32-46 years), and found no increased risk of BPH in HIV infected individuals compared to general population.[20]

4.2.7. Splenomegaly

Splenomegaly was noted in 5% of asymptomatic patients, frequently associated with hepatomegaly, and without focal splenic lesions. No active infection or portal hypertension was identified. The lower prevalence compared to prior studies likely reflects the older, ART-stable cohort.

Kaushik et al reported splenomegaly as the most significant finding in 51% of patients with significant P value but they also did not exclusively study older PLHIV. Kyasa et al and Mankheshwar et al in 37.7 and 37.8% patients respectively and Obiejie et al in 22.4% cases.[10,11,21,22]

4.2.8. Increased Renal Echogenicity

Increased renal cortical echogenicity was seen in 4% of patients, all with elevated serum creatinine and CD4 counts >350 cells/mm³. One patient had advanced chronic kidney disease. Unlike prior studies linking renal changes to advanced immunosuppression, our findings suggest multifactorial renal involvement, including chronic disease and ART exposure.

Kaushik et al found increased cortical echogenicity in 3 % cases, Trivedi et al in 5% cases, Kyasa et al and Mankheshwar et al found it in 9.5% and 9.1% cases respectively. Bhabhor et al found increased echogenicity of kidneys in 22.5% cases. It was mainly due to HIV-associated nephropathy, and in some cases due to chronic kidney disease secondary to opportunistic infections or ART toxicity[5,10,11,21].

Bhabhor et al observed that in patients with increased renal echogenicity only 22.3% patients had CD4 count of >350cells/mm^3. However, in our study all patients (4/4 i.e.100%) who had increased renal echogenicity had CD4 cell count of >350 cells/mm^3.

4.2.9. Gallbladder Calculi

Gallbladder calculi were incidentally detected in 2% of patients, without sonographic evidence of cholecystitis. This prevalence was lower than

reported in studies involving younger or symptomatic PLHIV. Similarly, Kyasa et al and Mankheshwar et al showed gall bladder calculi in 1.4% and 1.5% cases respectively in symptomatic patients (e.g. patients with abdominal pain, fever, abnormal LFT, weight loss). In other studies on PLHIV gall bladder stones were observed in 9% patients, 3% cases and 5.7%.[10,11,21,22] The most common biliary tract abnormality seen on sonography by Grumbach et al (1989), was gallbladder wall thickening, noted in 55% of patients which was not seen in our study.[23]

4.2.10. Dilated Common Bile Duct

A mildly dilated CBD (9 mm) was identified in one asymptomatic patient with normal LFTs. The smooth, uniform dilation was similar to patterns previously described in AIDS-related papillary stenosis. No further work-up was pursued due to lack of symptoms.

In biliary ducts, Grumbach et al (1989) noted, extrahepatic ductal dilation in 23% of PLHIV, but only 5% of patients had intrahepatic ductal dilation. The extrahepatic ductal abnormalities seen in their patients consisted of uniform dilation of the common hepatic and common bile ducts to the level of the ampulla without irregularity, beading, or strictures similar to our case. These findings were most compatible with papillary stenosis rather than sclerosing cholangitis, although cholangiographic proof was lacking in their study.[23]

4.2.11. Gynecological Findings

A left ovarian simple cyst measuring 1.5x2cm with no internal septation or solid component was seen in one 56 year old female PLHIV. Another 55 year old female patient had a small uterine fibroid measuring 1.2x2cm. Both patients had no abdomino-pelvic complaints and were post-menopausal patients. Hence, no follow up was necessary.

4.2.12. Umbilical Hernia

It was seen in a 64 year old female patient with normal CD4 cell count and suppressed viral load with complaints of swelling in the umbilical region. The umbilical hernia had omental fat as content. The patient also had hepatomegaly.

4.2.13. Other Incidental Findings

Additional incidental findings included splenunculus, simple hepatic cysts, and renal cortical cysts, all clinically insignificant and nephropathy in some cases due to chronic kidney disease secondary to opportunistic infections or ART toxicity.[5]

4.3 Abdominal Findings and History of Tuberculosis:

Among the 31 patients with a past history of tuberculosis (TB), 24/31 patients (77.4%) were asymptomatic and 7/31(22.5%) patients were symptomatic. 13/31 patients (42%) had abnormal ultrasound findings. The significant ultrasound findings included hepatomegaly with fatty liver (3%), splenomegaly (2%), cholelithiasis (2%), hepatomegaly (1%), benign prostatic enlargement (1%), renal calculus(1%), ureteric calculus (1%), urinary bladder carcinoma (1%), dilated CBD (1%), increased cortical echogenicity (1%). Five patients showed more than one ultrasound abdomen abnormality. However clinically no active TB infection or other opportunistic infection was suspected by physicians. Remaining 18 patients with past history of TB had normal ultrasound abdomen.

4.4 Ultrasound abdomen in asymptomatic older PLHIV:

In our study, the majority of older PLHIV (89%) were clinically asymptomatic at the time of abdominal ultrasound. Despite the absence of symptoms, (n=28/89) 31.4% of these asymptomatic patients demonstrated some significant sonographic abnormalities Table 4. These results highlight the critical role of ultrasound in detecting subclinical disease in asymptomatic PLHIV. Among 8% patients with fatty liver, only 4 patients had abnormal LFT; increased renal echogenicity in 2 asymptomatic older PLHIV correlated directly with elevated serum creatinine so, ultrasound is needed for close monitoring to assess progression of disease in older PLHIV. Similarly, normal appearance of kidneys on ultrasound in 9 older PLHIV with increased serum creatinine levels provides a baseline for comparison if the patient develops proteinuria or uraemia later. Ultrasound finding of subcentimetric lymph nodes in an asymptomatic older PLHIV with low CD4 cell count, resulted in this patient being started on ATT empirically when he started complaining of weakness and fatigue. On the other hand benign prostatic enlargement was an expected age related ultrasound finding.

The insignificant ultrasound abnormalities in asymptomatic patients included renal cortical cysts (5%), hepatic cysts (2%) and splenunculus (1%). Uterine fibroid (1%) and simple ovarian cyst-2x1.5cm (1%) were of no consequence in post menopausal females.

4.5 Correlation of ultrasound abdomen with CD4 cell count:

Amongst older PLHIV >50 years age, 87 patients had CD4 cell count >350cells/mm^3 and 13 patients had CD4 cell count of <350cells/mm^3. Surprisingly, (37/38) 97.3% patients with abnormal sonographic findings occurred in patients with CD4 cell count >350 cells/mm^3 as given in Table 5.

These findings challenge the conventional understanding that lower CD4 counts would be associated with more ultrasound abdomen abnormalities. Bhabhor et al and Kaushik et al studies have shown an increasing prevalence and severity of abdominal abnormalities in patients with lower CD4 counts, but they have not studied older PLHIV exclusively.[5,11]

In our study, only 1/13(7.6%) patients with CD4 cell count<350 cells/mm^3 showed few sub-centimetric mesenteric lymph nodes- which were given importance when the patient started showing symptoms of weakness and fatigue. ATT was started and patient recovered. All symptomatic patients (11%) in our study who underwent ultrasound abdomen also had CD4 cell count>350 cells/mm^3. The low incidence of lymphadenopathy in older

PLHIV with low CD4 cell count (<350cells/mm^3) represents a marked change from earlier ultrasound studies.

Fisher's exact test was used to explore the association between 'CD4 cell count' and ultrasound abnormalities. The p value was >0.05 indicating no significant association between the ultrasound findings and CD4 cell count in our study. In contrast, Kaushik et al[11] showed significant association of CD4 cell count with splenomegaly, enlarged nodes, hypoechoic liver lesions; probably due to 67% of their patients having CD4 cell count of < 350 cells/mm^3.

4.6 Role of ultrasound abdomen in management of older PLHIV:

- It served as an indispensable diagnostic modality in n=10/11 (90.9%) symptomatic older PLHIV. One older PLHIV with urinary bladder carcinoma detected on ultrasound was appropriately managed at a cancer institute. One patient with renal calculus and another with ureteric calculus underwent percutaneous nephrolithotomy and extracorporeal shockwave lithotripsy respectively, for relief of pain.
- 28/89(31.4%) of positive sonographic findings which appeared clinically significant were seen in asymptomatic patients, reinforcing the utility of ultrasound as a screening and surveillance tool.
- ➢ One asymptomatic patient with sub-centimetric mesenteric lymph nodes on ultrasound who had low CD4 cell count of 235 cells/mm^3, was given anti-tubercular therapy based on clinical suspicion of tubercular lymphadenopathy; and was relieved of his symptoms.
- ➢ Ultrasound findings of 11 patients showing fatty liver, was conveyed to the physician for appropriate management, to prevent progression of liver disease.
- ➢ Patients with benign prostatic enlargement, detected in 2 symptomatic patients and incidentally detected in 6 asymptomatic patients on ultrasound abdomen, was an age related pathology and henceforth monitored by the urologist on regular basis to initiate timely medical/surgical management.
- ➢ Three patients diagnosed with Grade I Medical Renal Disease on ultrasound were placed under regular care of a nephrologist.
- ➢ Two patients with symptomatic gall bladder calculi were advised elective surgery.
- ➢ Asymptomatic patients with hepatomegaly, idiopathic splenomegaly, incidental gall bladder calculi and dilated CBD were kept under surveillance.
- ➢ Ultrasound abdomen helped in suggesting long-term follow-up in 22/28 (78.5%) asymptomatic older PLHIV.

Limitations: This was a single-center, observational study without an HIV-negative control group, which limits comparative interpretation. Additionally, histopathological analysis for many ultrasound abnormalities e.g. increased echogenicity of liver or kidneys was not done.

CONCLUSION

This study highlights the evolving nature of HIV-associated abdominal sonographic findings in older PLHIV on long term ART. Our study gives a valuable insight into the unique imaging profile of older PLHIV on long duration of ART (for 5-20 years), distinguishing it from younger and more immunosuppressed populations (CD4 cell count<350cells/mm3). The strength of the study lies in its exclusive focus on the older PLHIV population—a group underrepresented in imaging studies—and the integration of sonographic findings with longitudinal clinical follow-up during the study period.

Given the affordability, easy availability and safety of ultrasound, it should be routinely incorporated into the baseline assessment and care of older PLHIV, particularly those on long-term ART with or without known comorbidities.

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