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Radiological Imaging Results in HIV-Infected Patients in Mogadishu-Somalia: A Four-Year Retrospective Review

Somali-Mogadişu'da HIV Enfeksiyonlu Hastalarda Radyolojik Görüntüleme Sonuçları: Dört Yıllık Retrospektif Bir İnceleme

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Abstract

Somalia, which is one of the countries that has been trying to integrate with the rest of the world in terms of many socio-economic parameters, including the field of health in recent years, still faces some important health problems. One of these problems is the difficulties encountered in the early diagnosis and treatment of patients with human immunodeficiency virus (HIV) infection, primarily due to social discrimination and limited treatment access. In this study, it was aimed to examine the findings detected in the radiological imaging examinations requested during the first examination in patients who were diagnosed with HIV for the first time by detecting HIV seropositivity in tests performed for different clinical reasons, and to determine the pathologies caused by advanced disease in patients who did not receive treatment. The study includes 235 patients who were diagnosed for the first time out of 269 patients with HIV confirmed by two different serological diagnostic tests during a previous comprehensive seroepidemiological study, and 14 patients with a suspicious test result for HIV infection but the presence of infection cannot be definitively proven in the absence of molecular diagnostic methods. In retrospective examinations, it was determined that 117 (49.8%) and 13 (92.9%) patients in both groups had radiological imaging (magnetic resonance imaging-MRI, computed tomography-CT, ultrasonography, and chest X-ray), respectively. While 16 of 117 HIV-infected patients had non-specific radiological findings and 53 had normal radiological findings, at least one radiological imaging of 48 patients revealed abnormal radiological imaging findings that may be associated with HIV infection. In these 48 patients, pneumonia findings in thorax CT and chest X-ray examinations, and encephalitis-related findings in patients with central nervous system involvement were the most common anomalies. In addition of these, other abnormal radiological findings included mass lesions compatible with neoplasia, lesions compatible with metastasis, lymphadenopathies, hepatosplenomegaly, and lesions indicating spleen involvement. The presence of similar findings (lesions compatible with pneumonia, encephalitis, and neoplasia)

in 9 of 13 patients whose HIV infection could not be confirmed indicates that radiological tests can make significant contributions to clinical evaluations in the management of patients with suspicious laboratory results. The data we present from a region where significant obstacles are encountered in the diagnosis and follow-up of HIV infections due to the fear of discrimination (*stigma*) of the patients and the lack of molecular tests draw attention to the fact that many patients have advanced lesions when they are diagnosed, and this situation will have negative effects in the patient management and treatment process.

Keywords: HIV, AIDS, Radiological examination, Pneumonia, Encephalitis.

Özet

Son yıllarda sağlık alanı da dahil olmak üzere birçok sosyoekonomik parametre yönünden dünyanın geri kalanıyla entegre olmaya çalışan ülkelerden biri olan Somali halen bazı önemli sağlık sorunlarıyla yüz yüzedir. Bu sorunlardan biri de başta toplumsal dışlanma ve tedavi erişim kısıtladıkları gibi nedenler ile insan immün yetmezlik virüsü (human immunodeficiency virus, HIV) enfeksiyonlu hastaların erken tanı ve tedavisinde karşılaşılan güçlüklerdir. Bu çalışmada farklı klinik gerekçelerle yapılan testlerinde HIV seropozitifliği saptanarak ilk kez HIV enfeksiyonu tanısı alan hastalarda, ilk muayeneleri sırasında istenilen radyolojik görüntüleme tetkiklerinde saptanan bulguların incelenmesi ve tedavi almayan hastalarda ilerlemiş hastalığın neden olduğu patolojilerin belirlenmesi amaçlanmıştır. Çalışma daha önce yapılan kapsamlı bir seroepidemiyolojik çalışma sırasında iki farklı serolojik tanı testi ile doğrulanmış HIV tanısı alan 269 hastadan ilk kez tanı alan 235 hastayı ve HIV enfeksiyonu için şüpheli test sonucu olan ancak moleküler tanı yöntemlerinin yokluğunda enfeksiyon varlığı kesin olarak kanıtlanamayan 14 hastayı içermektedir. Retrospektif incelemelerde her iki grupta yer alan hastaların sırasıyla 117'si (%49.8) ve 13'ünün (%92.9) radyolojik görüntülemelerinin (manyetik rezonans görüntüleme-MRG, bilgisayarlı tomografi-BT, ultrasonografi ve göğüs grafisi) olduğu belirlendi. HIV enfeksiyonlu 117 hastanın 16'sında non-spesifik radyolojik bulgular ve 53'ünde normal radyolojik bulgular saptanırken, 48 hastanın en az bir radyolojik görüntülemesinde HIV enfeksiyonu ile ilişkili olabilecek anormal radyolojik görüntüleme bulguları saptandı. Bu 48 hastada toraks BT ve göğüs X-ray incelemelerinde pnömoni bulgularının, santral sinir sistemi tutulumu olan hastalarda ise ensefalit ile ilişkili bulguların en sık görülen anomaliler olduğu belirlendi. Bunların dışında diğer anormal radyolojik bulgular olarak neoplazi ile uyumlu kitle lezyonları, metastaz ile uyumlu lezyonlar, lenfadenopatiler, hepatosplenomegali ve dalak tutulumuna işaret eden lezyonlar saptandı. HIV enfeksiyonu doğrulaması yapılamayan 13 hastanın 9'unda da benzer bulguların olması (pnömoni, ensefalit ve neoplazi ile uyumlu lezyonlar), şüpheli laboratuvar sonuçları olan hastaların yönetiminde radyolojik testlerin klinik değerlendirmelere önemli katkılar sunabileceğini göstermektedir. Hastaların dışlanma korkusu ve moleküler testlerin eksikliği nedeniyle HIV enfeksiyonlarının tanı ve takibinde önemli engellerle karşılaşılan bir bölgeden sunduğumuz verilerin birçok hastanın tanı aldığında ilerlemiş lezyonlara sahip olduğunu ve bu durumun hasta yönetiminde ve tedavi sürecinde olumsuz etkilere neden olacağına dikkat çekmektedir.

Anahtar Kelimeler: HIV, AIDS, Radyolojik inceleme, Pnömoni, Ensefalit.

Introduction

The disease known as acquired immunodeficiency syndrome (AIDS) was first described in 1981 in the United States in a group of homosexual men with *Pneumocystis jirovecii* pneumonia and Kaposi's sarcoma [1,2]. In the following period, human immunodeficiency virus 1 (HIV-1) and HIV-2, classified in the *Retroviridae* family Lentivirus genus, were defined as the infectious agents of AIDS in 1983 and 1986, respectively [3,4]. HIV infection is mainly transmitted through sexual contact (mucosal surfaces), mother-to-baby transmission (transplacental, during birth or breastfeeding), percutaneous inoculation (intravascular needle sharing, stab wounds), and transfusion of blood and blood products [5,6]. Viral particles coming from an infected person who expresses the virus in body fluids during sexual contact, which is the most important transmission route, reach the target cells of the immune system in the lamina propria layer that lies under the genital or gastrointestinal mucosa of the susceptible person [7]. HIV, which enters the cell by interacting with CD4 receptors and related co-receptors (CCR5 and CXCR4) via surface glycoproteins (gp120 and

gp41), shows tropism mainly to $CD4^+$ T lymphocytes and more weakly to macrophages [8,9]. The virus replicates in infected cells, then infects other susceptible cells, and spreads throughout the body via the lymphatic system through infected cells [7]. Both proinflammatory and antiviral cytokines and chemokines are systemically strongly upregulated, after initial infection and local tissue inflammation, before the onset of plasma viremia, and during viral expansion [10]. After rapid viral replication and spread to susceptible cells, besides inflammation, the HIV genome integrates into the genome of $CD4^+$ T cells, thus forming a permanent viral reservoir of HIV virus in resting cells [10,11]. The process in which the number of $CD4^+$ T cells decreases over many years as a result of the death of infected $CD4^+$ T cells, primarily by the cytopathic effects of the virus and in addition by the effects of the chronic inflammatory process, and the inability to replace the dead $CD4^+$ T cells, is the basic mechanism in the pathogenesis of HIV infections [12].

Two to four weeks after HIV enters the body, symptoms of primary infection appear, followed by a long process of chronic HIV infection that can last for decades [13]. When the number of $CD4^+$ T cells, which is constantly decreasing in lymphoid tissues and peripheral blood, falls below 200, the host immune defense cannot prevent opportunistic infections (such as oral candidiasis, vaginal candidiasis, herpes zoster and tuberculosis) and malignancies, and in the last stage, a disease picture defined as AIDS develops with fever, fatigue, weight loss, diarrhea and general lymph node enlargement accompanied by an increase in viral load, and the process results in death in untreated cases [12].

HIV infection mainly targets the immune system, and in the chronic stage of infection, the areas of sustained HIV replication and cell destruction are the lymph nodes and spleen, but many other tissues and organs, including the central nervous system and respiratory system, may be affected by the infection [12]. While many complications can be prevented with antiretroviral therapy (ART), the devastating effects of infection are more evident in countries and regions that are undiagnosed and have limited access to treatment. There is limited knowledge about the HIV prevalence, the rate of patients receiving antiretroviral therapy, and HIV-related complications or deaths in Somalia [14,15].

Routine laboratory diagnosis of HIV infections can be easily made by demonstrating viral RNA (*ribonucleic acid*) and DNA (*deoxyribonucleic acid*) in blood samples or viral antigens and antibodies against these antigens [11,16]. However, patients with HIV infection in Somalia face stigma and discrimination, thus avoiding diagnosis and treatment, and most of the cases are diagnosed with HIV during clinical examinations conducted for different health problems or the process of obtaining a health certificate [14,15,17,18]. This study aims to examine the radiological images of newly diagnosed HIV-infected patients who do not starting ART therapy.

Material and Method

The study was conducted after obtaining approval from the institutional ethics committee (Ethics Committee of Somalia Türkiye Recep Tayyip Erdogan Education and Research Hospital, date: 05.12.2019, decision no: 178, number: MSTH/2719). Our study group consisted of people who applied to our hospital voluntarily, all patient's information was protected with confidentiality, and the study was conducted in accordance with the Declaration of Helsinki.

A total of 269 patients (*reached in a comprehensive epidemiological study* [15] *in which 82,954 people were evaluated*) with confirmed seropositive HIV test results between June 2015 and November 2019 included in the study. HIV serological tests were performed using the Architect HIV Ag/Ab Combo Reagent Kit (Abbott Diagnostics, Wiesbaden, Germany) on the Architect I 2000 SR (Abbott Diagnostics, Abbott Park, IL USA) system. The results were considered as S/Co ≥1.00 reactive and S/Co <1.00 non-reactive. All reactive samples were retested using a second screening assay (Elecsys HIV combi PT assay) on Cobas e 411 analyzers (Roche Diagnostics, Rotkreuz, Switzerland) [15].

The radiological imaging results of 14 patients who had lower titer of the reactive test results with two different serological diagnostic

methods but could not be diagnosed with HIV because of the absence of molecular diagnostic methods were also analyzed.

Radiologic imaging (radiography, ultrasound, computed tomography, magnetic resonance imaging) of HIV-positive patients was evaluated by two radiologists with 10 and 12 years of experience, forming a consensus. Pathological findings related to HIV were recorded. Chest radiographs were performed in the posteroanterior projection and standing with a floor-mounted digital X-ray machine. Abdominal sonography was performed using a standard 1–6 MHz convex US probe with a portable device (Canon Aplio 500, Otawara, Japan) [19]. Computed tomography (CT) examinations were performed with a 16-slice MDCT system (Sensation 16; Siemens, Forchheim, Germany) [19]. All CT images (brain and thoracoabdominal) were performed in the axial plane with a section thickness of 0.625-1.250 mm, and then sagittal and coronal planes were obtained by multiplanar reconstruction. Magnetic resonance (MR) images were obtained with 1.5 Tesla MR (Avanto; Siemens, Erlangen, Germany). T2-weighted (TW2) imaging, fluid-attenuated inversion recovery (FLAIR), diffusion-weighted imaging (DWI) and pre-postcontrast T1-weighted (TW1) sequences were routinely obtained in brain MR imaging. Gray matter, white matter, temporal lobe, frontal lobe, parietal lobe, occipital lobe, basal ganglia/thalami, brainstem, cerebellum, and limbic system were evaluated in the brain. The distribution, number and features of the lesions, brain atrophy, presence of hydrocephalus, mass effect, and contrasting features were recorded [20]. All images were obtained from the hospital's image archive and communication system (PACS, Fonet Information Technologies, Istanbul, Türkiye.

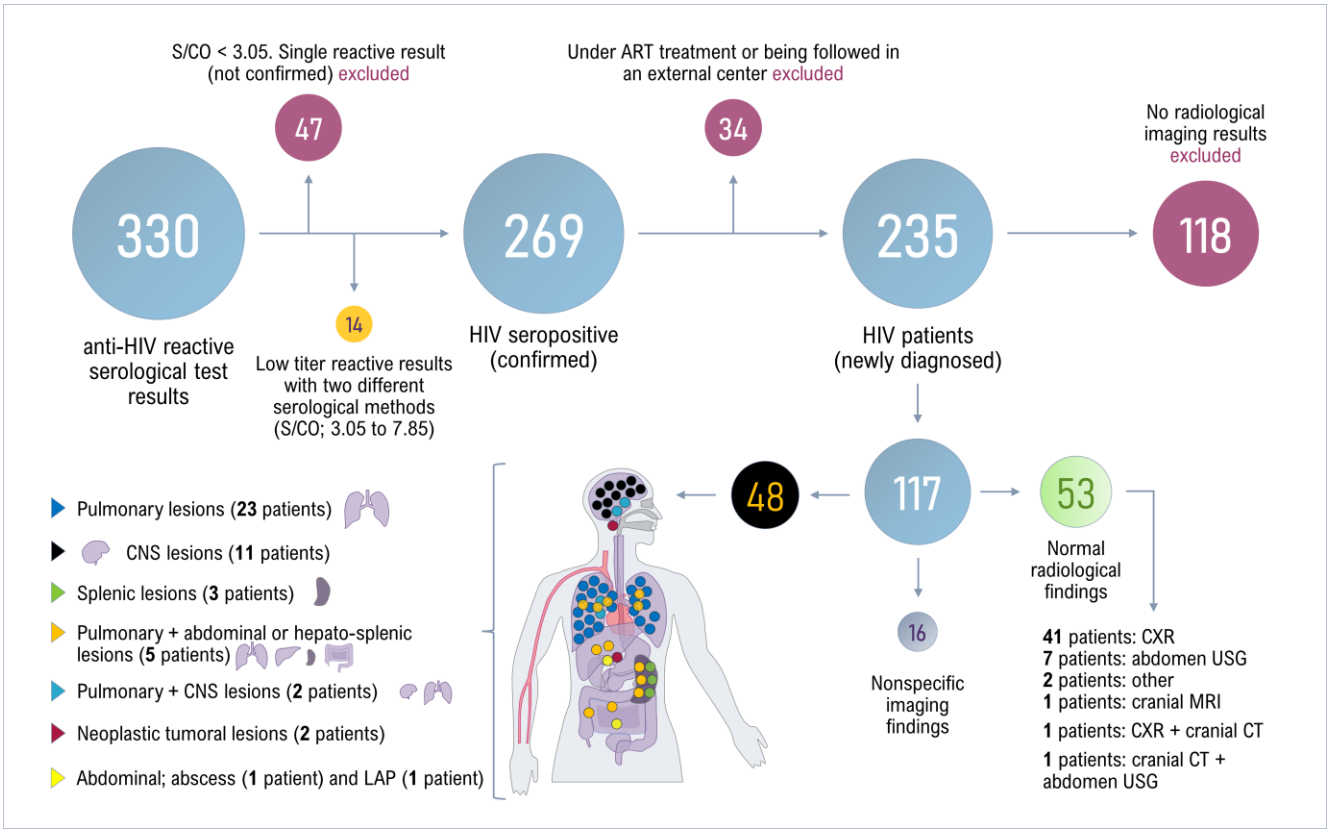

Figure 1. Flow chart for patients included and excluded from the study.

Results

Thirty-four (12.6%) of 269 people with confirmed HIV seropositivity were receiving ART, and these patients were excluded from the study. The remaining 235 (87.4%) were newly diagnosed individuals. Hospital information systems were examined retrospectively; of these 235 newly diagnosed patients, 117 patients

(49.8%) had at least one of the chest X-ray, ultrasonography (USG), CT, or magnetic resonance imaging (MRI). When the records of 117 patients were examined, 16 of the patients had non-specific findings unrelated to HIV infection, 53 had normal radiological findings, and 48 had various lesions and abnormal findings that could be associated with HIV infection.

Table 1. HIV seropositive patients with abnormal pulmonary findings.

Gender/age	Preliminary diagnosis	Abnormal pulmonary findings	Other accompanying findings	Imaging methods
F3	P	Bilateral ground glass appearance, reticular infiltration	HSMG, spleen involvement	CXR, USG
M16	P	Right paracardiac pneumonia, nodular lesions on left lung		CXR
F18, M40a	P	Bilateral diffuse infiltration		CXR
F23	P	Right perihilar infiltration, bilateral hilar LAP		CXR
M25a	PE	Left lung pleural effusion		CXR
M27a	TB	Left lung upper lobe consolidation and scar		CXR
M29	TB	Right lung upper lobe cavity		CXR
M30a	P	Bilateral ground glass, miliary involvement		CXR
F35a	P	Bilateral bronchopneumonia, cavity in left upper lobe of lung		CXR
M35a	PE	Bilateral pleural and pericardial effusion, nodules in lung parenchyma		TxCT
F35b	P	Bilateral basal pneumonia		CXR
M35b	P	Bilateral infiltration (pneumonia)	Intestinal wall thickening	CXR, USG
F36a, M68	P	Right paracardiac bronchopneumonia		CXR
M36	P	Bilateral basal bronchopneumonia		CXR
F38, M51b	P	Left lung pneumonia, left lung pleural effusion		CXR
M40b	P	Left lung lower zone pneumonia		CXR
M42	P	Bilateral interstitial septal thickening, scar in left lung upper zone		CXR
M43	P	Right paracardiac pneumonia	HIV encephalitis findings	CXR, CrCT
F45a	P	Bilateral basal infiltrates (pneumonia)	SMG, grade-1 renal parenchymal disease	CXR, USG
M45	P	Right lung ground glass pneumonia	Hydrocephalus and CNS involvement	CXR, CrCT
M47	P	Bilateral ground glass, miliary involvement, pleural effusion (*P. jirovecii*)	HSMG, spleen lesions	CXR, USG
M50a	P	Paracardiac nodular opacity		CXR
M50b	P	Right lung middle zone pneumonia		CXR
M51a	P	Consolidation of right lung middle-lower lobes		TxCT
M56a	P	Left upper zone bronchopneumonia, right lung upper zone nodule		CXR
M58	P	Bilateral pneumonia (upper left, lower right), left lung pleural effusion		CXR
M60	P	Focal opacities in bilateral upper lobes	Intraabdominal LAP	CXR, AbCT

P; pneumoniae. PE; pleural effusion. TB; tuberculosis. F; female. M; male. CXR; chest radiograph (chest x-ray). USG; ultrasonography. TxCT; thorax computed tomography. AbCT; abdominal computed tomography. LAP; lymphadenopathy. CNS; central nervous system.

Abnormal pulmonary imaging findings were detected in 30 (25.6%) of 117 patients, 26 of them (86.7%) had radiological findings compatible with pneumonia (*13 bilateral, 8 right, 4 left, 1 paracardiac*) (Table 1). Thirteen (11.1%) of the HIV infected patients had abnormal central nervous system findings, the most common finding was encephalitis with a rate of 69.2% (9/13) in this subgroup of patients (Table 2). In the abdominal imaging of 12 patients, hepatomegaly, splenomegaly, lesions indicating splenic involvement, lesions compatible with lymphadenopathy and neoplasia were detected (Table 3).

Among the 14 patients with suspicious (unconfirmed) HIV test results, one patient did not have imaging data, four of them had normal radiological imaging results, and 9 (64.3%) of the patients had abnormal radiological findings (Table 4). Similar to HIV seropositive patients, lesions compatible with pneumonia, encephalitis and neoplasia were identified in these patients.

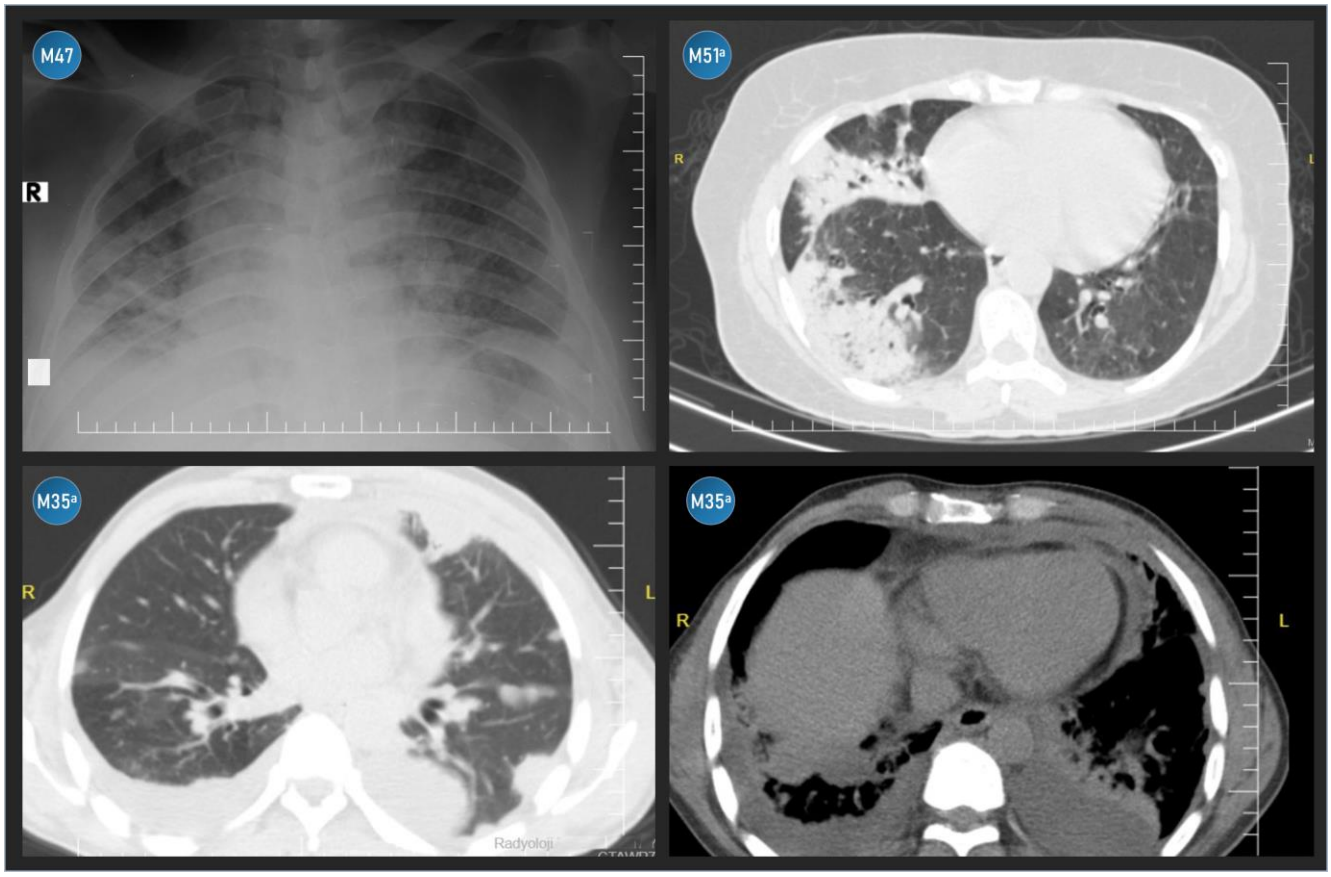

Figure 2. Pulmonary imaging results of three HIV seropositive patients (gender/age). **M47** (chest x-ray); Bilateral ground glass, miliary involvement, pleural effusion (*P. jirovecii*). **M51ª** (thorax computed tomography); Consolidation of right lung middle-lower lobes. **M35ª** (thorax computed tomography); Bilateral pleural and pericardial effusion, nodules in lung parenchyma.

Table 2. HIV seropositive patients with central nervous system findings possibly related to HIV infection.

Gender/age	Preliminary diagnosis	CNS findings	Other accompanying findings	Imaging methods
F25	Encephalitis	Focal pathological signals in the subcortical area, white matter in the centrum semiovale, and basal ganglia, mesencephalon, pons, and right cerebral peduncle (HIV encephalitis)		CrMRI
F26	Encephalitis	Hypodensities in the centrum semiovale and corpus callosum in the periventricular area white matter (HIV encephalitis)		CrCT
F31	Encephalitis	Focal pathological signals in the white matter in the centrum semiovale and in the basal ganglia, diffusion restrictions (HIV encephalitis)		CrMRI
F36b	Encephalitis	Hypodensities in the white matter in the left periventricular area and in the right basal ganglia (HIV encephalitis)		CrCT
F37	Encephalitis	Multiple lesions with minimal diffusion restriction with bilateral cerebral and cerebellar cortical-subcortical, white matter, brainstem and basal ganglia involvement (HIV encephalitis)		CrMRI
F41	Encephalitis	Diffuse symmetrical signal increase and diffuse atrophy in white matter (HIV encephalitis)	Dementia	CrMRI
M43	Encephalitis	Multiple hypodense lesions in white matter in centrum semiovale and periventricular area and basal ganglia (HIV encephalitis)	Pneumonia	CrCT, CXR
F43	Encephalitis	Diffuse atrophy inconsistent with age (HIV encephalitis)		CrMRI
M44	Encephalitis	White matter involvement in bilateral cerebellar hemisphere, brain stem, basal ganglia (HIV encephalitis)		CrMRI
F27	Astrocytoma, hydrocephalus	Cystic lesion (astrocytoma) with calcified solid component in the left cerebellar hemisphere, posterior fossa, hydrocephalus		CrCT
M45	Hydrocephalus	Hydrocephalus, symmetrical cyst in lentiform nuclei, symmetrical lacunar infarction in bilateral basal ganglia	Pneumonia	CrCT, CXR
M50c, M53	Ischemia	Periventricular chronic ischemic changes		CrMRI

F; female. M; male. CrMRI; cranial magnetic resonance imaging. CXR; chest radiograph (chest x-ray). CrCT; cranial computed tomography.

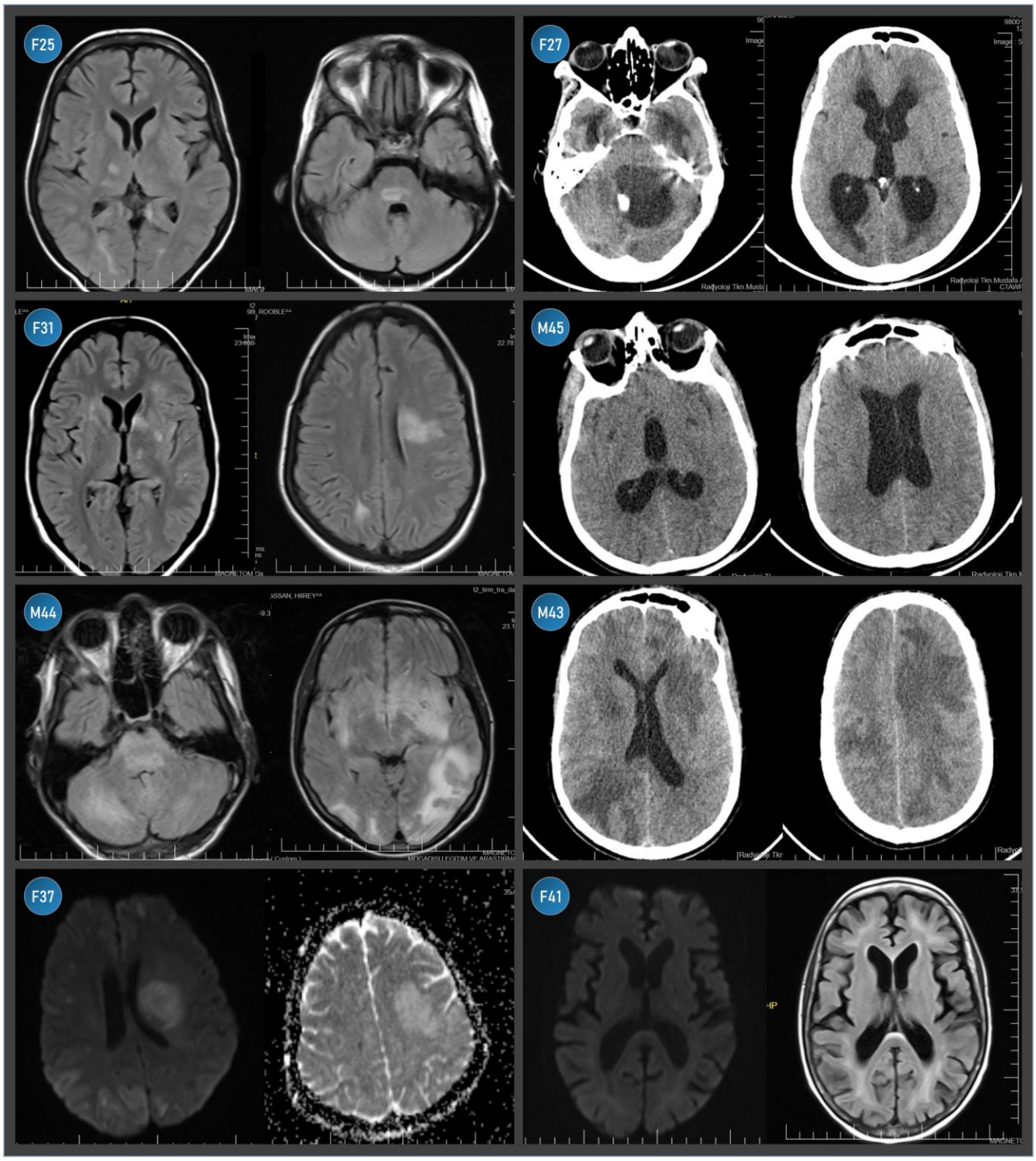

Figure 3. Radiologic imaging results of eight HIV seropositive patients (gender/age). **F25** (cranial magnetic resonance imaging; CrMRI); Focal pathological signals in the subcortical area, white matter in the centrum semiovale, and basal ganglia, mesencephalon, pons, and right cerebral peduncle (encephalitis). **F27** (cranial computed tomography; CrCT); Cystic lesion (astrocytoma) with calcified solid component in the left cerebellar hemisphere, posterior fossa, hydrocephalus. **F31** (CrMRI); Focal pathological signals in the white matter in the centrum semiovale and in the basal ganglia, diffusion restrictions (encephalitis). **M45** (CrCT); Hydrocephalus, symmetrical cyst in lentiform nuclei, symmetrical lacunar infarction in bilateral basal ganglia. **M44** (CrMRI); White matter involvement in bilateral cerebellar hemisphere, brain stem, basal ganglia (encephalitis). **M43** (CrCT); Multiple hypodense lesions in white matter in centrum semiovale and periventricular area and basal ganglia (encephalitis). **F37** (CrMRI); Multiple lesions with minimal diffusion restriction with bilateral cerebral and cerebellar cortical-subcortical, white matter, brainstem, and basal ganglia involvement (encephalitis). **F41** (CrMRI); Diffuse symmetrical signal increase and diffuse atrophy in white matter (encephalitis).

Table 3. HIV seropositive patients with abdominal and other imaging findings possibly related to HIV infection.

Gender/age	Preliminary diagnosis	Abnormal abdominal radiological findings	Other accompanying findings	Imaging methods
M27b	SI	Hypoechoic lesions in the spleen (infection)	Abdominal pain, nausea, vomiting	USG
M47	HSMG, SI	Hepatosplenomegaly, splenic lesion compatible with abscess	Pneumonia	USG, CXR
F3	HSMG, SI	Hepatosplenomegaly, multiple lesions in the spleen (foci of infection)	Pneumonia	USG, CXR
F30a	SMG	Splenomegaly		USG
F45a	SMG	Splenomegaly	Pneumonia, bilateral grade-1 renal parenchymal disease	USG, CXR
F45b	SI	Multiple hypoechoic lesions in the spleen (infection)		USG
M32	LAP	Several LAPs at the level of the porta hepatis (~2 cm)		AbCT
M35b		Intestinal wall thickening	Pneumonia	USG, CXR
M60	LAP	Several LAPs in the celiac chain and adjacent to the SMA (~2 cm)	Pneumonia	AbCT, CXR
F45c		~10 cm subcutaneous abscess on the anterior abdominal wall (infection)	Normal chest X-ray	AbCT, CXR
M25b	Neoplasia	Paraaortic 10 cm mass, supraclavicular LAP (lymphoma)		AbCT, USG
M30b	Neoplasia	Nasopharyngeal hard palate 15 mm mass, cervical LAP		CerMRI

SMA; superior mesenteric artery. CerMRI; Cervical magnetic resonance imaging. CXR; chest radiograph (chest x-ray). USG; ultrasonography. AbCT; abdominal computed tomography. SI; splenic involvement. SMG; splenomegaly. HSMG; hepatosplenomegaly. LAP; lymphadenopathy.

Table 4. Abnormal radiological imaging findings in patients with low titer HIV reactive serological results.

Gender/age	Preliminary diagnosis	Abnormal radiological findings	Imaging methods
F28	Encephalitis	Cortical-subcortical edema and diffusion restriction in right frontopariteoccipital corpus callosum, left frontal lobe white matter, meningeal enhancement (meningoencephalitis)	CrMRI
F65	Pneumonia	Bilateral hilar engorgement in the lungs (pneumonia), normal findings on cranial imaging	CXR, CrMRI
F30b	Pneumonia, neoplasia?	Ground-glass appearance in the right lung, pericardial effusion. Multiple masses in the liver (metastasis?), mass in the right ovary	USG, CXR
M9		Perforated appendix, multiple intra-abdominal abscess foci	**AbCT**
M11	Pneumonia	Bilateral perihilar infiltration (pneumonia)	CXR
M50d	Pneumonia	Interstitial septal thickening (pneumonia?), chronic kidney failure patient	CXR
M55	Pneumonia, cerebral ischemia	Ground glass opacity, bronchopneumonia. Right parietooccipital acute ischemia on cranial imaging	CXR, CrMRI
M56b	Neoplasia	5 cm cavitary mass (neoplasia?) in the lower lobe of the left lung	TxCT
M49	Neoplasia	Tumoral mass in the ascending colon and dilatation of the cecum, normal pulmonary imaging	**AbCT**, CXR

CrMRI; cranial magnetic resonance imaging. CXR; chest radiograph (chest x-ray). USG; ultrasonography. AbCT; abdominal computed tomography. TxCT; thorax computed tomography.

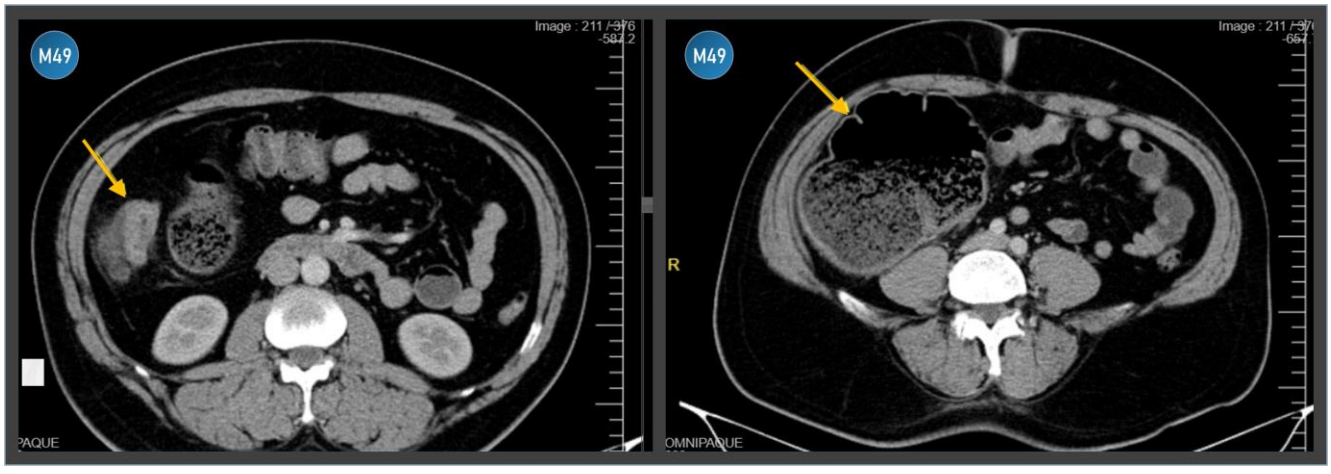

Figure 4. Radiologic imaging findings a patient (gender/age) had low titer HIV reactive serologic results. **M49** (abdominal computed tomography); Tumoral mass in the ascending colon and dilatation of the cecum.

Discussion

In the 40 years since the start of the AIDS pandemic, it is estimated that 79.3 million people worldwide have been infected with the HIV and 36.3 million have died [21]. According to The Joint United Nations Programme on HIV/AIDS (UNAIDS) 2021 report, it is estimated that 37.7 million people worldwide live with HIV in 2020, and the annual number of deaths is around 680 thousand, of which 68% of them are in the African continent [21]. Although antiretroviral drugs have become very powerful tools in the fight against the HIV epidemic, it is estimated that 10.2 million people worldwide are not receiving antiretroviral treatment as of the end of 2020, and HIV infections continue to be a major cause of mortality and morbidity, mostly in regions with insufficient access to treatment [21,22].

Due to the presence of a replication-competent reservoir in different cell populations, including long-lived resting $CD4^+$ T cells and macrophages, containing pro-viral DNA integrated into the genome, the virus cannot be completely cleared by ART, even though it is suppressed, and therefore treatment requires continuity [7,11]. In addition, HIV infection, for which a successful preventive vaccine has not yet been developed despite intensive efforts, continues to be a global health crisis with 1.5 million new cases (60% are in sub-Saharan Africa) [21,23].

Pulmonary complications of HIV and AIDS are probably the most frequently considered and encountered problems in the clinical setting. HIV infection, even without AIDS, predisposes the individual to various infectious and non-infectious lung problems [24]. Upper respiratory tract infections and acute bronchitis are common pulmonary complications and non-infectious complications include Kaposi's sarcoma, non-Hodgkin lymphoma, sarcoidosis, lung cancer, and emphysema [24]. In HIV-1 infections, lymphocytic alveolitis, which develops as a result of macrophage and lymphocyte activation, secretion of proinflammatory cytokines and chemokines, and accumulation of $CD8^+$ T cells in the alveolar space, improves with antiretroviral treatment and the alveolar microenvironment returns to normal [25]. In untreated patients, these changes affect pulmonary immunity and reduce the ability to respond to common bacteria and mycobacteria and when advanced immunological disorders develop, the infected person becomes susceptible to opportunistic pathogens [25].

HIV is a pathogen that should be considered in the differential diagnosis of patients who present with interstitial pneumonia and do not improve despite antibiotic treatment. It is recommended that patients with clinical, radiological and laboratory findings compatible with opportunistic infection should be investigated for HIV, with the consent of the patient, regardless of their age and history. In a study from Türkiye, in which five HIV-infected cases aged between 39 and 55 were included, reticular density on AC radiographs and diffuse ground glass appearance on thoracic CTs were found in four of the patients applied to the hospital for differential diagnosis of lung disease without knowing the serology positivity [26]. With further investigations, three of these patients were diagnosed with *P. jirovecii* pneumonia and one with H1N1 infection. While the other patient with cervical lymphadenopathy (LAP) and skin nodules was diagnosed with Kaposi's sarcoma, a density compatible with pleural fluid was detected in both chest x-ray and thoracic CT of the patient [26]. Abnormal pulmonary radiological findings were detected in approximately one fourth (25.6%) of the patients in our study group, which consisted of patients, most of whom were diagnosed with HIV while being examined for different clinical reasons, patients who were diagnosed for the first time and had radiological imaging (Table 1). In patients with abnormal pulmonary radiology, 86.7% had radiological findings consistent with pneumonia. Consistent with the literature, there were findings consistent with pleural effusion in two patients and pulmonary tuberculosis in two patients.

HIV lymphadenopathy, another common HIV-related pathology, has various causes and is generally categorized as follows; (i) inflammatory or reactive (such as immune reconstitution syndrome), (ii) infectious (tuberculosis and non-

tuberculous mycobacterial infections and HIV infection itself), (iii) neoplastic (like lymphoma, Kaposi's sarcoma and Castleman's disease) [27]. In our study group, bilateral hilar LAP in one and intra-abdominal LAP in two of the HIV-diagnosed patients was detected, on the other hand, the presence of LAP accompanying neoplasia-tumor compatible lesions was detected in different images of two patients. Considering that the risk of developing malignancy in HIV-infected patients is higher than in non-HIV-infected patients [28], in a population with a high rate of late HIV diagnosis, such as Somalia, we think that it may be important for clinicians to evaluate patients for HIV infections in patients with suspicious lesions that may be associated with malignancy, especially in those with an early onset and more aggressive course.

The central nervous system (CNS) is also affected by HIV infection. Microglia in the CNS are the main cell types infected with HIV and are thought to be carried by infected T cells or monocytes to the brain [12]. Problems with the CNS may include meningitis, focal demyelinating lesions, or malignancies resulting from immunosuppression [24]. Patients may have complaints such as headache, meningismus, mental status changes, vision changes, focal weakness or seizures [24]. HIV-related central nervous system diseases can be divided into three groups according to their etiology [29]; (i) impairment directly caused by HIV-related neurological diseases, HIV encephalopathy, and HIV vasculopathy, (ii) toxoplasmosis, progressive multifocal leukoencephalopathy, cryptococcosis, tuberculosis, and primary CNS lymphoma, (iii) ART-related conditions: immune reconstitution inflammatory syndrome and ART-induced brain damage. Classification can also be made according to the patterns observed in MRI (i) diffuse and bilateral, (ii) focal (iii) meningitis meningoencephalitis. With the widespread use of antiretroviral therapy, the prognosis of people infected with HIV has improved and the frequency of HIV-related CNS diseases has decreased [29]. HIV encephalopathy shows a diffuse bilateral pattern, whereas progressive multifocal leukoencephalopathy, HIV-associated primary CNS lymphoma and CNS toxoplasmosis show focal patterns on MRI [29]. While it is difficult to distinguish between HIV and CNS diseases based on imaging alone, pattern recognition approaches can contribute to early differentiation [29]. In this study, patients with abnormal CNS images; 9 (69.2%) of 13 had lesions compatible with HIV encephalitis (Table 2), two of the patients with CNS involvement were also accompanied by pneumonia.

HIV encephalopathy is a neurocognitive disorder caused by HIV. HIV enters the CNS within the first few weeks after infection (immediately after seroconversion) and causes chronic inflammation [29,30]. Even when ART is started, many anti-HIV drugs do not cross the blood-brain barrier and HIV in the brain continues to multiply [29]. In the later stages, when patients have severe immunodeficiency and cognitive symptoms appear, pathological findings indicate HIV leukoencephalopathy, characterized by diffuse myelin and axonal degeneration. Recognizing and diagnosing the disease as early as possible is essential, as in most cases the symptoms improve with ART [29]. The prevalence of HIV-associated neurocognitive disorders in HIV-infected individuals has been reported to be around 25% [30]. In our study, lesions compatible with HIV encephalopathy were found in a significant portion of the patients who were diagnosed with HIV and had CNS imaging due to neurocognitive symptoms, and it was revealed that HIV infection caused advanced lesions in the absence of ART and due to delayed diagnosis (Figure 3).

One of the important limitations of this study is that HIV infections, confirmed serologically by two different tests, could not be definitively diagnosed by molecular diagnostic tests. In in these conditions, when the data of 14 patients who had suspicious results for HIV infection with two different serological test methods were examined, it was remarkable that there were similar lesions that could be associated with HIV infections in these patients, as in the other patient group, although a definitive diagnosis could not be made due to the absence of molecular confirmation tests (Table 4). In the absence of molecular tests, radiological imaging methods and other laboratory data can offer valuable results for

clinical evaluations in the management of patients with questionable serological results for HIV infection. However, the comprehensive epidemiological research [15] we refer to when determining the study group has revealed another problem, namely that only 3.18% of the patients who were diagnosed with HIV infection during their controls in our hospital or had suspicious results applied for control tests. The inability of a significant part of the patients to start their treatment, probably for fear of exclusion, and the difficulties in patient follow-up for diagnosis and treatment in the absence of molecular tests continue to be important public health problems specific to the region.

Conclusion

Somalia continues to be a region with special conditions where access to diagnosis and treatment for many complicated infections and diseases, including HIV infections, is still problematic. The study was conducted in Mogadishu, the largest populated city of Somalia, a geography that urgently needs accessible health services and protective measures. These region-specific conditions lead to the observation of advanced infections that are less likely to occur in other parts of the world for many diseases and atypical clinical findings seen in patients who do not receive treatment. In this study, which included HIV patients who did not receive treatment and were mostly diagnosed incidentally, radiological imaging findings observed in patients who were diagnosed for the first time are presented. We think that these data presented from Somalia, a region where epidemiological and clinical data are limited, will contribute to the literature.

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