Cranial Computed Tomographic (CT) findings in HIV-positive Nigerian patients presenting for neurosurgical evaluation

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Summary

Introduction: **The central nervous system (CNS) is an important site of HIV infection. As many as one quarter of AIDS patients present with neurological symptoms and up to 75% of the patients may have CNS abnormalities at autopsy. Under these circumstances therefore, differential diagnoses in HIV-positive patients with neurological symptoms constitute a management challenge.**
Objective: **To describe the pattern of cranial computed tomographic (CT) findings in neurosurgical patients with HIV infection.**
Study design: **Retrospective analysis.**
Patients and method: **A total of 1907 patients were admitted from October 1996 to October 2001. Sixteen patients were positive for HIV using the Western blot. We reviewed their biodata, clinical features and cranial CT findings.**
Results: **There were 10 male and 6 female patients. Twelve patients had cranial CT. Four patients had lesions that could be attributed to direct infection by HIV virus. Two patients had lesions that suggested immunosuppression from HIV infection. Diffuse breakdown in blood brain barrier (BBB) with contrast enhancement as well as mass effect that was disproportional to the enhancing lesion were common findings in three patients. The other lesions seen on cranial CT could not be directly linked to HIV infection.**
Conclusion: **Apart from the diffuse breakdown in blood brain barrier with disproportional mass effect, our findings were similar to previous reports. Further study with a larger population of patients and, especially, biopsy of the CNS lesion will be needed to confirm our findings.**

Key-words: ***HIV, AIDS, Neurosurgery, Cranial CT.***

Résumé

Introduction: Le système nerveux central (SNC) est un siège très important pour l'infection du VIH. Autant qu'un quart des patients atteints du SIDA présentent les symptômes neurologiques et jusqu' à 75% des patients peuvent avoir les anormalités du SNC au cours d'une autopsie. Donc, dans ce cas, des diagnostics divers chez des patients séropositifs avec des symptômes neurologiques posent un problème de la prise en charge.
Objectif: Décrire la tendance des résultats de la tomographie crânienne assistée par ordinateur (TAO) chez des patients avec l'infection du VIH.
Plan d'Etude: Une analyze rétrospective.
Patients et Méthode: Un total de 1907 patients ont été admis d'octobre 1996 en octobre 2001. Seize patients étaient séropositifs avec l'utilisation du Western blot, (tache occidentale). Nous avons fait le bilan de leur biodonnées, traits cliniques et résultats de la tomographie crânienne assistée par ordinateur (TAO).
Résultats: Il y avait 10 patients du sexe masculin et 6 du sexe feminin. Douze patients avaient eu la tomographie crânienne assistée par ordinateur. Quatre patients avaient eu des lésions que l'on pourrait attribuer à une infection directe par le virus VIH. Deux patients avaient eu des lésions attribuable à l'immunosuppression à travers l'infection du VIH. Dépression indéfinie dans la barriére du sang du cerveux (BSC) avec une augmentation rehaussement contrastée ainsi qu'un effet en masse qui était disproportionnel au rehaussement de la lésion étaient des résultats ordinaires chez trois patients. Les autres lésions vues sur TAO crânienne ne sont pas attribuable directement à l'infection du VIH.
Conclusion: Indépendamment du fait de la dépression indéfinie dans la barriére du sang du cerveux avec un effet en masse disproportionnel, nos résultats sont semblables aux rapports précédents. Des études complementaires avec une plus grande population des patients et la biopsie de la lésion du (SNC) en particulier, sont exigées afin de confirmer nos résultats.

Introduction

The Human Immunodeficiency Virus (HIV) is a neurotropic organism[1]. It is therefore not surprising that as many as one quarter of HIV patients have neurological symptoms as their first presentation[2,3] and that up to 75% of HIV patients show evidence of nervous system involvement at autopsy[4,5] Surgical procedures in HIV-positive patients was once a controversial issue and was avoided as much as possible because of the risk of accidental exposure; it is now well accepted that an HIV positive patient in whom the disease is well controlled should not be denied surgery, when indicated, provided universal precautions are adopted. While some neurological com-

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plications of HIV have fairly well defined clinical presentations and can therefore be managed empirically, diagnostic biopsy will still be required in a significant proportion of patients. Furthermore, surgical lesions of the central nervous system unrelated to the HIV virus may be present in patients with established HIV status, and the latter may be determined for the first time in the course of investigation for neurological symptoms. The accurate diagnosis of neurological lesions by relatively non-invasive methods in HIV positive patients remains a worthy goal particularly for lesions such as toxoplasmosis, cryptococcal meningitis and tuberculosis the treatment for which is largely medical. The main advantage of this will be the avoidance of a) additional morbidity from surgery in these immunocompromised patients; and b) the exclusion of the risk to health care workers from accidental exposure during the procedure.

Non-invasive imaging technique such as cranial computerized tomography (CT) and magnetic resonance imaging (MRI) have been very promising in this regard. Several workers have attempted to correlate CT and MRI findings of brain lesion with histological diagnosis in patients with HIV [1,6,7,8,9]. Despite this efforts, there are no known pathognomonic features on imaging studies, of brain lesion due to HIV infection [1,6,9]. In this study, we describe and discuss varieties of lesions seen on cranial CT scan of Nigerian HIV-positive patients presenting to our practice for neurosurgical evaluation.

Patients and methods

This is a retrospective analysis of patients who were confirmed by western blot to be HIV-positive. We reviewed the results of HIV screening that were performed for neurosurgical patients between October 1996 and October 2001. The patients were screening with Enzyme Linked Immunosorbent Assay (ELISA) methods. We confirmed the HIV status with the western blot method in those who were reactive on ELISA test. We reviewed the relevant biodata, clinical features and the cranial CT films of those who were confirmed to be HIV positive. The cranial CT examinations, which were performed at different centres in Nigeria were available in only 12 patients. In the remaining 4 patients financial and technical reasons precluded the performance of cranial CT scan. WE reviewed the films for the following features: location and morphology of the lesions, degree and nature of enhancement, presence of peri-lesional oedema, midline shift and local mass effect. We compared these findings with previously reported cranial CT findings in HIV positive patients.

Results

A total of 1907 patients were admitted into the neurosurgical unit of UCH from October 1996 to October 2001. We screened 601 patients for HIV 1 and HIV 2 as part of routine preoperative evaluation in 596 patients. In the re-

Table 1 Clinical diagnosis in HIV positive patients presenting for neurosurgical evaluation

S/N	Diagnosis	Number of patients
1.	Chronic subdural haematoma	3
2.	Neoplasms	4
	- Thalamic glioma	1
	- Anterior cranial base tumour	1
	- Ependymoma	1
	- Cerebellopontune angle tumour	1
3.	Intracranial abscess	1
4.	HIV encephalopathy	2
5*.	Fibrous dysplasia	1
6*.	Encephalocele + Hydrocephalus	1
7*.	Trigeminal Neuralgia	1
8.	Olivopontocerebellar atrophy	2
9*.	Unknown	1
	Total	**16**

**Cranial CT were not performed*

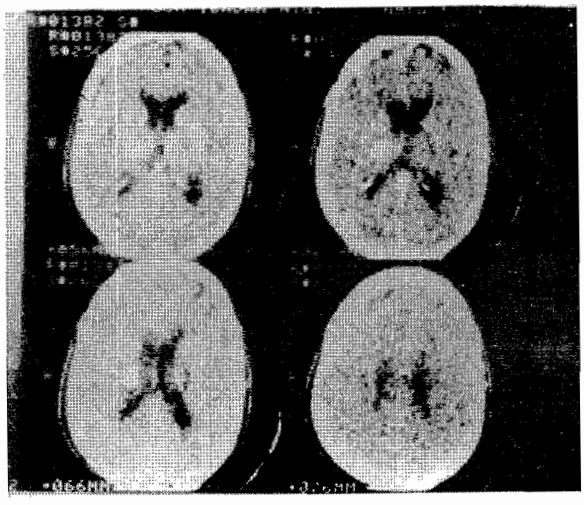

Fig. 1 ***Contrast enhanced CT scan for patient number 1 showing nodular contrast enhanced right basal ganglia and thalamic mass.***

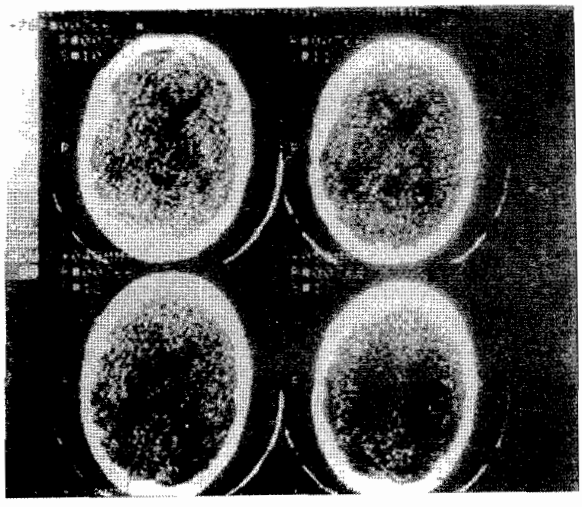

Fig. 2a ***Non enhanced cranial CT scan for patient 2 showing loss of gray/white matter differentiation with effacement of the right lateral ventricle.***

Table 2 Cranial CT findings in twelve HIV positive patients presenting for neurosurgical evaluation

S/N	Sex	Age	Clinical Presentation	Cranial CT findings	Differential diagnosis
1*	M	32yrs	Diarrhea and visual deterioration. Blindness with optic atrophy. Left hemiparesis.	Focal nodular enhancing lesion in the right internal capsule involving the lentiform nucleus and thalamus. Compression of posterior horn of right lateral ventricle. (Fig. 1)	– Lymphoma – Infection – Thalamic glioma
2**	M	32yrs	Headache, diarrhea, Visual deterioration and diplopia. Right facioparesis and left hemiparesis	Multiple areas of irregular pattern of enhancement with wide spread oedema and bilateral perisylvian enhancement. Disproportional mass effect of the right lateral ventricle with midline shift. (Fig. 2a and b)	Right frontotemporal cerebritis.
3*	M	33yrs	Native doctor, headache, fever, worsening sensorium and right hemiparesis.	– Widespread breakdown in the blood brain barrier. – Focal areas of curvilinear enhancement especially in the 1. Perisylvian fissures 2. Occipital region bilaterally. 3. Ring enhancing lesion in the left basal ganglion. – Widespread oedema maximum around (3) Mass effect around the left internal capsule with midline shift. (Fig. 3a and 3b).	– Toxoplasmosis – Lymphoma
4+	M	70yrs	Headache, vomiting, visual deterioration, worsening sensorium and left hemiparesis.	Right frontoparietal +left occipital subdural hypodense lesion with contrast enhancing membrane. Effacement of right lateral ventricle.	Bilateral chronic subdural haematoma
5+	M	44yrs	– Trauma – Headache – Blurring of vision – Left hemiparesis	– Right frontoparietal hypodense lesion – Suspicious contrast enhancement in the left parietal lobe Effacement of right lateral ventricles + midline shift.	Right chronic subdural haematoma
6**	F	33yrs	Recurrent headaches, worsening vision, confusion, left abducent nerve deficit, Right facioparesis	–Isodense left temproparietal mass with massive oedema. – Irregular, contrast enhancement. – Diffuse breakdown in BBB Effacement of the left lateral ventricle, sylvian fissure, and periquadrigeminal cistern + midline shift.	– Cerebritis – Tumor
7+	M	65yrs	– Worsening sensorium – Worsening Left hemiparesis	Right frontoparietal crescentic hypodense lesion. Effacement of ipsilateratral ventricle	Chronic subdural haematoma
8+	F	8yrs	– Nuchal pain – Headache, vomiting – Progressive weight loss – Visual deterioration – Ataxia – Worsening sensorium	Middle, homogenous hyperdense cerebellar lesion extending into the 4th ventricle – Contrast enhancing	Ependymoma Medulloblastoma
9+	F	40yrs	Frontal lobe syndrome + recurrent nasal discharge + epistaxisis.	Contrast enhacing anterior + middle cranial fossa lesion with extension into the adjoining paranasal sinuses. Effacement of right lateral ventricle.	Squamous cell carcinoma
10**	M	48yrs	Dysarthria dysgraphia, left sided weakness, lower cranial nerve deficits on the left with cerebellar signs. Normal mental status.	Hypodense areas with ill defined margins within both cerebellar hemispheres extending to the brain stem and cerebellopontine angle on the right.	Olivoponto-cerebellar atrophy.
11**	M	47yrs	Dysarthria, cerebellar signs. Normal mental status. Quadriparesis	Gross atrophy of the medulla, pons and cerebellum	Olivoponto-cerebellar atrophy.
12+	M	45yrs	Multiple lower cranial deficits + fistula-in-ano	Contrast enhancing left cerebellopontine angle mass.	Cerebellopontine angle tumour

** Lesions due to probable immunosuppression **Lesions due to probable HIV infection + Lesions not currently linked to HIV infection*

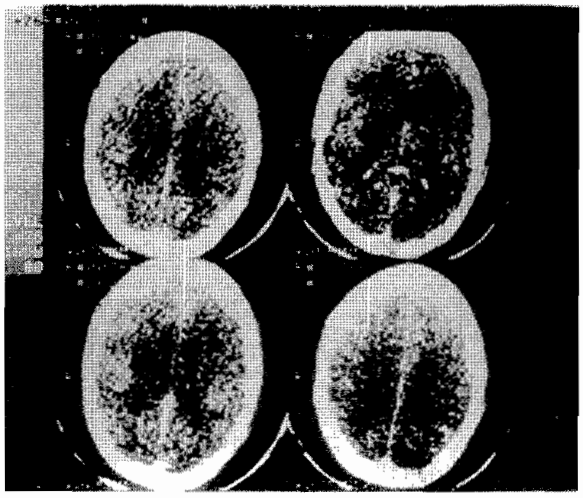

Fig. 2b *Contrast enhanced cranial CT for patient number 2 showing wide spread irregular contrast enhancement in addition to finding in 2a.*

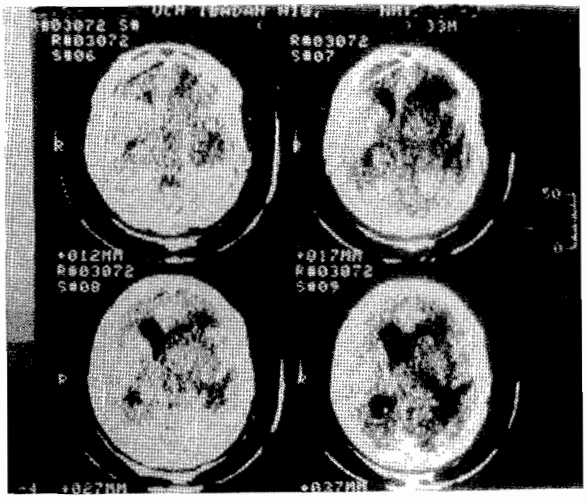

Fig. 3a *Non contrast enhanced cranial CT scan for patient 4 showing mixerd density lesion in the left basal ganglia with extensive perilesional oedema and effacement of the ipsilateral lateral ventricle.*

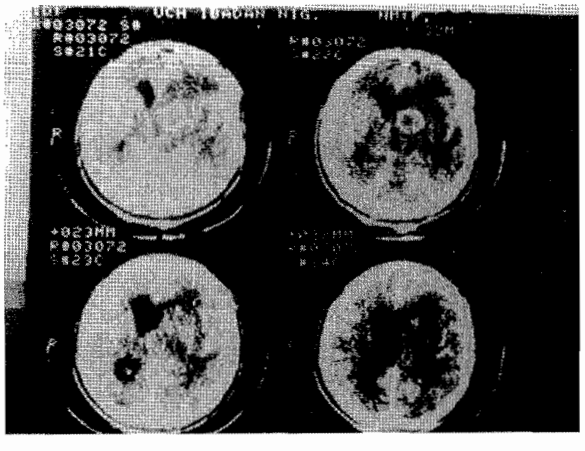

Fig. 3b *Contrast enhanced cranial CT for patient 4 showing ring enhancing basal ganglia lesion (see table 2 for further illustration).*

Table 3 Location of lesions demonstrated on cranial CT

Location of lesions	Number of patients
Basal ganglia and internal capsule	2
Frontotemporal lobes	2
Frontoparietal subdural lesion	3
Fourth ventricle	1
Anterior and middle cranial fossa mass	1
Brainstem and cerebellum	2
Cerebellopontine angle	1
Total	**12**

maining 5 patients, clinical features suggestive of HIV infection necessitated screening. There were sixteen HIV -positive patients over the study period. Ten of them were males and six were females. The age range was 4 months to 79 years. Three quarters of the patients were between 30 and 50 years of age with six patients in the fifth decade. The clinical diagnoses in the patients are shown in table 1. Cranial CT was performed in 12 patients. The clinical diagnoses in patients for whom CT was not available were trigeminal neuralgia, fibrous dysplasia and encephalocele. The diagnosis was not certain in one patient (see astericised items in table 1.) Table 2 summarises the clinical features and Cranial CT findings. Two patients had lesion that suggested immunosuppression; one of this had ring enhancing basal ganglia mass, the differential diagnoses include toxoplasmosis and lymphoma. The other patient had solitary uniformly enhancing mass in the basal ganglia. We considered lymphoma and thalamic glioma as likely diagnoses. Four patients showed features suggesting direct effect of the HIV. Two of these had loss of grey-white differentiation, cerebral oedema, and irregular contrast enhancement probably as a result of breakdown in blood brain barrier. The differential diagnosis in these cases was cerebritis. Atrophy of brainstem structures and the cerebellum were seen in two patients. The differential diagnosis was olivopontocerebellar atrophy. Six patients had features that were not currently linked to HIV infections. Disproportional mass effects from extensive oedema as well as diffuse breakdown in blood brain barrier were found in three of the patients. These were seen in patients with cerebritis and basal ganglia toxoplasmosis as differential diagnoses.

Table 3 summarizes the locations of the lesions demonstrated on the cranial CT

Discussion

There are two categories of CNS involvement in HIV infection. The first group includes CNS pathologies arising from the direct effect of the organism, for example HIV encephalitis[1]. The second group includes those arising as a result of immunosuppression caused by the HIV[1]. The latter category includes opportunistic infections such as toxoplasmosis, which often affect the basal ganglia and primary CNS lymphoma. CNS pathologies like meningioma, which are not currently linked to HIV infections,

can also be found in patients with HIV infection.

Neuroimaging studies including CT and MRI have improved the diagnoses of intracranial lesions. In patients with HIV infection where unnecessary exposure to infection should be avoided, the importance of making accurate diagnosis non-invasively cannot be overemphasized.

Three of our patients had chronic subdural haematoma. We think these were due to previous head injuries. However, it should be noted that vasculitis and thrombocytopaenia are common in HIV patients and these may account for this lesion[10,11,12]. Adeloye et al also reported chronic subdural haematoma occurring spontaneously in two patients with HIV infection[13]. They did not ascertain the pathogenesis of these, though thrombocytopenia and microaneurysms were considered. It is difficult to attribute the cause of the subdural haematoma to any of these factors and further studies will be needed to ascertain the link between subdural haematoma and HIV infection.

Two of our patients presented with atrophy of the posterior cranial structures including the pons and the medulla. These patients presented with features suggestive of olivopontocerebellar atrophy (OPCA) including intact sensorium, multiple cranial nerve deficits, ataxia and progressive quadriparesis. The hypodensities are similar to changes in HIV encephalopathies but because cerebral cortical involvement and dementia were absent, these patients may not fit into the category of HIV encephalopathies or AIDS dementia. There are different causes of OPCA and we think the cause in this case could be from the direct effect of the virus on the atrophic structures seen on the CT. Furthermore, these lesions may represent progressive multifocal leukoencephalopathy but as the name denotes, this often represent progressive multifocal leukoencephalopathy but as the name denotes, this often affects other parts of the CNS as well, though the brainstem may be predominantly involved in about 10% of cases[14].

Four of our patients showed lesions that we thought were tumours. One of these was located in the thalamus (Figure 1). Other authors have reported that the thalamus and basal ganglia lesions with contrast enhancement on CT in HIV patients are often due to lymphoma[4]. Thus, this lesion may represent CNS lymphoma. Other differential diagnoses include toxoplasmosis; however, this is often multiple with peripheral enhancement with contrast[15,16,17,18].

One patient had ring enhancing basal ganglia lesion on CT. Previous reports have related this appearance to toxoplasmosis[1,17]. (Figure 3a and b)

Two patients had features suggestive of cerebritis (Fig 2a and b). We think this is due to direct effect of the virus. Disproportional mass effects from extensive oedema as well as diffuse breakdown in blood brain barrier were found in three of the patients. These were seen as loss of gray-white matter differentiation and multifocal ill defined pattern of enhancement. These have not been previously reported. The pathogenesis is also not certain but we think this may be direct effect of the organism or from opportunistic infection resulting in cerebral oedema. High resolution CT and the use of MRI will be more helpful to define the observations more clearly.

Apart from a patient who had transnasal biopsy of an extensive skull base squamous cell carcinoma, none of our patients had laboratory confirmation of our suspicion for so many reasons. One of these is apathy to invasive procedures in HIV patients. In addition to this, the protective materials like eye protectors and shin length aprons are not often available and when they are available, many patients in the developing countries like Nigeria cannot afford them. These also apply to postmortem biopsies. The policy at our center at the time of the study was that of non-operative intervention for HIV positive patients; this has since been reviewed and patients who can provide the necessary protective measures are now being operated.

Some of the findings in keeping with previously reported cases. Further studies will be needed in our environment to correlate the findings with histology.

We advocate minimally invasive procedures for ante mortem cases when this is indicated; stereotaxic biopsy will be very useful for this.

Conclusions

We have not been able to confirm primary HIV infection in the CNS using the cranial CT in our patients. Our findings in patients with CNS lesions from immunosuppression secondary to HIV infection correlate with other report. However, diffuse breakdown in blood brain barrier reflected in multiple and extensive white and grey matter contrast enhancement and mass effect, disproportional to the enhancing lesion, are not common finding in these other reports. When such lesions are seen, especially with corroborative clinical features, we suggest further evaluation to determine the patient's HIV status.

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