HIV-1 Infection of the Central Nervous System

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Summary

The forensic pathologist frequently is confronted with human immunodeficiency virus (HIV-1) infection, especially in the context of drug abuse. After involvement of the lung, the brain is the second most frequently affected organ in HIV-1 infection. Because HIV-1 rarely is the cause of focal macroscopical lesions, even in severely infected patients, the systematic sampling of specimens for histological examination is required. If focal lesions are present, they are almost always attributed to opportunistic infections, cerebrovascular complications, or neoplasms. Changes primarily attributed to HIV-1 include HIV-1 encephalitis, HIV-1 leukoencephalopathy, and HIV-1 myelitis. Early changes in the course of the infection are characterized by meningeal lymphocytic infiltration and perivascular lymphocytic infiltration. Changes probably attributed to HIV-1 include vacuolar myelopathy and vacuolar leukoencephalopathy. Opportunistic infections seen in the course of HIV-1 infection include a broad spectrum of viral, parasitic, fungal, and bacterial infections. Furthermore, ischemic stroke and intracranial hemorrhage, as well as lymphoma and Kaposi sarcoma, may be encountered. Despite the introduction of antiretroviral therapies with a greater life expectancy of HIV-1-infected individuals, epidemiological data suggest that involvement of the brain in acquired immunodeficiency syndrome subjects continues to be a frequent autopsy finding. In the brains of HIV-1-infected children, the most common findings are vascular mineralization/calcification, myelin pallor, and gliosis of the white matter as well as inflammatory infiltrates and/or multinucleated giant cells. In contrast to adults, opportunistic infections are comparatively uncommon. The pathogenetic mechanisms induced by HIV-1 infection and leading to the multiple facets of brain damage are not yet clearly understood. The development of brain lesions caused by opportunistic infections and lymphomas might be explained by the lack of a competent immunological defense system. In contrast, changes caused by direct or rather indirect effects of HIV-1 are more controversially discussed. HIV-1 enters the brain mainly by being passively carried by T lymphocytes and monocytes. Thereafter, perivascular macrophages spread productive HIV-1 infection to neighboring microglia. These are the major cell populations in the brain that are productively infected with HIV-1. They serve as a reservoir for persistent viral infection and replication, a vehicle for viral dissemination throughout the brain, and a major source of neurotoxic products that affect glial function, the blood–brain barrier and neuronal function and finally lead to cell death.

Key Words: Central nervous system; forensic pathology; HIV-1 infection; opportunistic infections; pathogenesis.