Cerebral Vasculitis Associated With Cocaine Abuse

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Background: Earlier reports of cocaine-associated cerebral vasculitis have been based primarily on angiographic findings without pathological verification.

Case Description: We present a case of acute encephalopathy following intravenous and intranasal administration of cocaine. Brain biopsy revealed vascular changes involving primarily small arteries. Findings included lymphocytic infiltration, endothelial thickening, and deposition of proteinaceous amorphous material within and around vessel walls.

Conclusions: These abnormalities are consistent with pathological features of arteritis previously reported in association with amphetamine and multiple-drug abuse. Vasospasm-induced changes are an alternative explanation for the vascular picture seen in this case. The patient made modest improvement with high-dose intravenous steroids. (Stroke 1991;22:1437–1439)

Cerebral vasculitis has been attributed to cocaine abuse in two reports on the basis of angiography1,2 and on pathological grounds in two other patients.3 Cerebral vasculitis has been demonstrated pathologically in two additional cases with multiple drug abuse, including cocaine and methamphetamines.4-5 We present a case of histologically verified cerebral vasculitis temporally related to cocaine use and not confounded by concurrent abuse of recreational drugs other than ethanol.

Case Report

A 24-year-old right-handed female presented to an outlying emergency room for evaluation of inappropriate behavior. She had been found attempting to light a fire on a kitchen floor shortly after using intravenous and intranasal cocaine. She was currently using 4–6 ounces of ethanol daily and had used marijuana in the remote past. She was discharged from the emergency department with a diagnosis of panic disorder. She continued to exhibit bizarre behavior and was committed to a psychiatric facility, where she was noted to be dysphasic, responding inappropriately, ataxic, and hypertonic in all extremities. Three days after the onset of symptoms, she was transferred to our institution for further evaluation. She had no history of a recent intercurrent illness, hypertension, diabetes, or previous vascular disease.

On physical examination, her blood pressure was 110/80 mm Hg and pulse was 72 and regular. She was arousable, but her speech was slurred and her answers inappropriate. She was globally confused and combative. Right-left disassociation was present. Cranial nerves were intact. Motor exam was difficult to assess, but there were no asymmetries of strength, and tone was increased throughout. Appendicular ataxia was noted. Deep tendon reflexes were 3+/4 in the arms and 4+/4 in the legs with ankle and patellar clonus bilaterally. There were bilateral extensor plantar responses. Gait could not be evaluated.

Normal laboratory tests included complete blood cell count; prothrombin time; partial thromboplastin time; electrolytes; erythrocyte sedimentation rate; human immunodeficiency virus titers; toxoplasmosis, other viruses, rubella, cytomegalovirus, herpes (TORCH) titers; antinuclear antibody; latex and sheep cell agglutination tests for rheumatoid factor; immune complexes; hepatitis screen; and blood cultures. Urine drug screen performed at the psychiatric facility the day after onset of symptoms was positive only for cocaine. Lumbar puncture revealed clear, colorless fluid under normal pressure with 10 mononuclear cells/mm³, normal glucose, and a protein of 185 mg/dl. Cerebrospinal fluid cultures and gram stain were negative. Chest roentgenogram and echocardiogram were normal. Electroencephalography revealed diffuse delta activity. Computed cranial tomography was normal. T₂-weighted magnetic resonance imaging revealed multiple foci of increased signal in the deep white matter and basal ganglia.
bilaterally. Gadolinium-diethylenetriamine pentaaetic acid infusion disclosed small punctate enhancing lesions in the deep white matter of both cerebral and cerebellar hemispheres. Cerebral angiography performed 4 days after the ictus was normal.

A right frontal brain biopsy was performed 10 days after admission in an area of white matter change on magnetic resonance imaging. Cortical neurons and glia were normal. Lymphocytes were noted in perivascular collections and within the walls of several small arteries (Figure 1, panels A and D). Some of the lymphocytes within the vessel wall stained positively for leukocyte-common antigen (Figure 1B). There were foci of interstitial edema in the immediate vicinity of small arteries and, in other areas, the perivascular spaces were enlarged and contained proteinaceous material. There was endothelial swelling of some small arterioles (Figure 1, panels C and D). These findings were not located near any zone of infarction. Meninges were noted to contain sparse lymphocytes. No foreign material was noted with polarized light. Special stains for microorganisms, amyloid, and fibrin were negative. There was no necrosis, leukocytoclasia, giant cells, granulomas, or positive immunoglobulin G immunofluorescence.

After a 5-day course of high-dose intravenous steroids, the patient was more coherent and was oriented to person, place, and situation, but not to time. Neuropsychological evaluation before and after steroid therapy documented a marginal, but measurable, improvement in alertness and clinical behavior with evidence of qualitative improvement in memory performance. The patient has been followed on an outpatient basis at 3-month intervals. Her ataxia has slowly improved and now, 37 months after the insult, she walks unassisted.

Discussion

Neurological complications of cocaine include cerebral and spinal cord infarction, transient cerebral ischemia, ischemic optic neuropathy, partial and generalized seizures, and intracerebral and subarachnoid hemorrhage. Approximately 80% of cerebrovascular complications are hemorrhagic, and the majority of these are associated with underlying vascular lesions, such as aneurysms and arteriovenous malformations. Transient hypertension, vasospasm, migraine, and vas-
vasoconstriction in patients receiving pharmacological
demonstrated α-adrenergic-mediated coronary artery
coronary artery smooth muscle.18,19 Lange et al.18 have
induced myocardial ischemia and infarction empha-
sed previously in patients with drug abuse. 4–5
Two previous cases of cerebral vasculitis as-
cribed to cocaine abuse, one with intracerebral hem-
orrhage1 and the other with ischemic infarction,2
were diagnosed exclusively on the basis of the non-
specific angiographic finding of segmental constrict-
ion or beading. There are two reports of pathologi-
cally proven cerebral vasculitis in patients with
concurrent abuse of intravenous cocaine, heroin, and
amphetamine, in whom vasculitis was attributed to
the amphetamines.4,5 Only two published cases with
biopsies verified that small-vessel vasculitis existed
in patients with cocaine abuse who had no history of
concomitant drug use.3

Our patient presented with multifocal ischemia
shortly after using intravenous and inhaled cocaine.
She had no history of concurrent use of heroin or
amphetamine, nor were these agents present on a
drug screen performed within 24 hours of the event.
The pathological changes in the small arteries and
arterioles in her brain biopsy are similar to those
previously reported by Citron et al11 and Kessler et al12
in patients with multidrug-induced vasculitis, by
Rumbaugh et al10 in experimental animals given
methamphetamine, and by Krendel et al13 in patients
with cocaine abuse. The sparing of capillaries and
veins, amorphous eosinophilic deposits, and intimal
thickening seen in our patient have also been described
previously in patients with drug abuse.4,5

We speculate that the vascular changes described
in the brain biopsy may be secondary to hypersensitivity
angiitis or angiospasm. Despite the absence of fibrinoid
necrosis, leukocytoclastic infiltration, and immunofluo-
rescent material, the morphological changes may re-
fect the stage of the disease during which the biopsy
was obtained. Hypersensitivity angiitis has been noted
in endomyocardial biopsies from cocaine abusers.17 It
is also conceivable that these findings represent a re-
spose to vascular spasm. The literature on cocaine-
induced myocardial ischemia and infarction empha-
sizes the pharmacological effects of cocaine on
coronary artery smooth muscle.18,19 Lange et al18 have
demonstrated α-adrenergic-mediated coronary artery
vasoconstriction in patients receiving pharmacological
doses of intranasal cocaine. However, no such evidence
exists to support the occurrence of cerebrovascular spasm
due to cocaine. Intraluminal thrombosis has been
found in some cases with cocaine-related myocardial
infarction.17 In vitro studies indicate that cocaine
increases thromboxane synthesis and platelet reactivity
to arachidonic acid.1 The presence of lesions at various
stages makes direct toxicity a less plausible explanation
for these findings.

In conclusion, this case supports the existence of
a nonnecrotizing, nonleukocytoclastic small-vessel ar-
teritis associated with lone cocaine use. One should
consider a diagnosis of cerebral vasculitis in the
cocaine abuser with signs of focal or diffuse central
nervous system dysfunction. The incidence and etio-
logy of this disorder remain speculative. The role of
steroid therapy warrants further investigation.

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