

Stroke Mimic Secondary to IV Fentanyl Administration

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Abstract

Fentanyl is a potent opioid used commonly in acute care because of its rapid onset and short duration of action. It has fewer side effects when compared with commonly available opioids, such as morphine and hydromorphone. We report an unusual side effect of transient aphasia following fentanyl administration. A 61-year-old female presented for an elective embolization of a periorbital artery aneurysm. She developed immediate episodes of aphasia on two separate occasions following administration of intravenous (IV) fentanyl. The high lipid solubility explains the rapid onset of action of fentanyl as it rapidly passes through the blood–brain barrier and through cell membranes. Immediately following the administration of fentanyl, the patient developed aphasia. There were no other clinical or neurological imaging findings that could account for these symptoms. We believe that aphasia may be an unusual side effect of fentanyl, and it is something clinicians should be aware of.

Introduction

Fentanyl is a potent opioid receptor agonist used commonly in critical care due to its rapid onset and short duration of action. It has also been shown to have fewer side effects than morphine and hydromorphone. Reported side effects of fentanyl include nausea/vomiting, sedation, pruritus, and urinary retention.² We report a case of aphasia, an unusual side effect, following fentanyl administration.

Case Summary

A 61-year-old right-handed Caucasian female presented for elective embolization of a left periorbital artery aneurysm. Her past medical history included hypertension, diabetes, hypothyroidism, hyperlipidemia, myocardial infarction, and coronary artery disease. Her periorbital internal carotid artery aneurysm had been diagnosed two years earlier following imaging after a fall from a vasovagal syncopal episode. Followup imaging showed a significant increase in size of the aneurysm, and she was scheduled for an elective embolization. During the procedure, the patient received general anesthesia. Following the procedure, the patient was fully interactive and followed commands before being trans-

ferred to the Neurocritical Care Unit (NCCU) for close observation. She subsequently complained of headaches and was given Fentanyl 25-mcg IV. Immediately following this administration of fentanyl, the patient became aphasic (receptive and expressive), confused, and agitated. Her NIHSS was six. The patient was taken back to the intervention suite because of the sudden onset aphasia. Repeat cerebral angiogram did not demonstrate any thrombosis or occlusion. She received intra-arterial tissue plasminogen activator and was admitted to the NCCU for close observation. Her symptoms gradually resolved. The next day, the catheter sheath was removed and 25 mcg of IV Fentanyl was given for analgesia. Immediately after this injection, the patient again developed aphasia. MRI of the brain did not reveal any abnormalities that could explain the patient's symptoms. The aphasia again resolved and was thought to have been most likely caused by the fentanyl injection. On discharge, the patient's NIHSS was zero.

Discussion

Fentanyl is an opioid that was first synthesized in 1960. It is a phenylpiperidine, which is 100 times more potent than morphine and 500 times more lipid soluble.^{6,8} The high lipid solubility explains the rapid onset of action of

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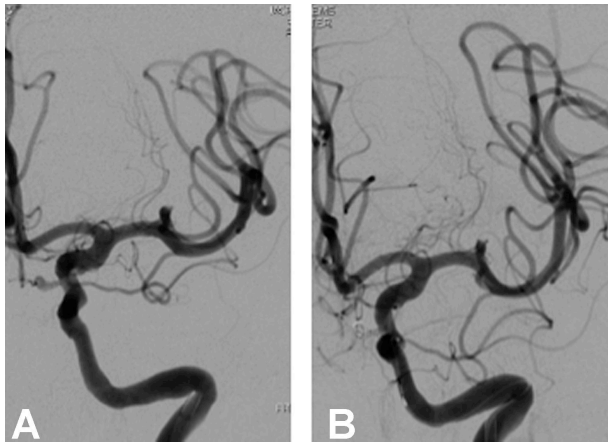


Figure 1. Cerebral angiogram of the left internal carotid artery showing a periphthalmic artery aneurysm (a) pre and (B) post embolization.



Figure 2. Cerebral angiogram after the patient suffered aphasia and was taken back to the angiography suite (a) anterior-posterior and (B) Lateral views.

fentanyl as it rapidly passes through the blood-brain barrier and through cell membranes. It is also rapidly redistributed from the brain to other tissues, such as fat and skeletal muscles. The rapid redistribution accounts for the short duration of action of fentanyl observed after bolus administration.^{1,5}

Opioids exert their effects by binding to specific opioid receptors in the body. These receptors are subclassified into mu, kappa, and sigma. There are two subtypes of mu receptors: 1) mu1 thought to mediate analgesia and 2) mu2 thought to mediate respiratory depression, physical dependence, and bradycardia.⁵ Binding of opioids to the opioid receptors leads to the activation of a *G*-pro-

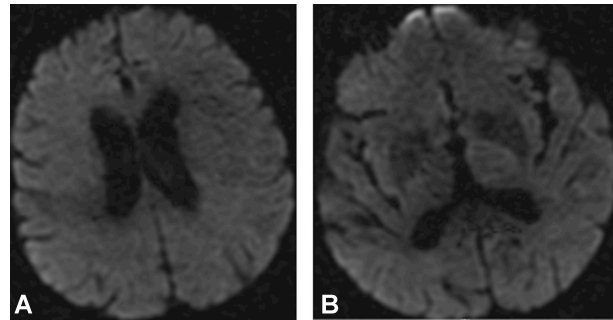


Figure 3. Negative diffusion MRI next day demonstrating no evidence of ischemic infarct.

tein second messenger system. These activated second messenger proteins subsequently lead to a series of intracellular events, including reduced opening of voltage-gated Ca^{2+} channels, stimulation of a K^+ current through several channels (including *G*-protein-activated inwardly rectifying K^+ channels), and inhibition of adenylyl cyclase activity.⁸ These changes in intracellular signaling result in the inhibition of neuronal activity that produces the opioid effects on the CNS. These effects include analgesia, euphoria, sedation, and respiratory depression.

Toxic CNS effects of opioids are extensions of their pharmacologic effects and include respiratory depression, agitation, paresthesia, abnormal coordination, and increased intracranial pressure.⁴ There have been several case reports of paresthesia following fentanyl administration. Muscular rigidity has also been reported. Weiwu et al. reported a case of severe transient hemiplegia after general anesthesia for prostatectomy.⁷ Fentanyl and Vecuronium were used for anesthesia maintenance in this case, and the patient's neurological deficits resolved completely in 7 h.

The American Heart Association/American Stroke Association Stroke Council defines a transient ischemic attack (TIA) as "a transient episode of neurological dysfunction caused by focal brain, spinal cord, or retinal ischemia, without acute infarction." It typically lasts less than 1 h but may last up to 24 h. Symptoms include focal weakness, numbness, paresthesia, aphasia, or altered consciousness. TIAs usually result from temporary reduction or cessation of blood flow to a specific neurovascular distribution with no associated tissue infarction. Causes of TIA include atherosclerosis, thromboembolism, hypotension, arthritis, and drugs. Sympathomimetic drugs, such as Cocaine, are the drugs most commonly known to cause TIA because of their induction of vasospasms. There has been no prior report

of transient aphasia following IV administration of fentanyl. Ray et al. described a case of TIA with symptoms, including transient aphasia in a patient who had an intrathecal injection of fentanyl and Bupivacaine for spinal anesthesia.³ A high sensory block was unlikely in that case given that the level of block was shown to be T4, and the CNS symptoms were transient. Their patient also did not have any symptoms or signs of preeclampsia. They postulated that rostral spread of the fentanyl to the CNS was likely explanation for the patient's symptoms.

Our patient had a strong association between the administration of fentanyl and the development of aphasia. This occurred on both occasions when she received fentanyl. The episodes of aphasia transpired immediately following the administration of fentanyl. The rapid development of aphasia can be attributed to the short duration of action of fentanyl. We believe transient aphasia is an unusual complication of fentanyl administration that clinicians should be aware of.

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