

Forensic Neuropharmacological Consultation:

Multiple Homicides Occuring During a Time of Abnormally Low Drug Concentration in the Hair of a Treated Paranoid Schizophrenic

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Forensic drug analysis of hair is a relatively new pharmacological tool, enabling the historic capture of drug-taking behavior. Conventionally applied by toxicologists to the detection of drugs of abuse, it is presently undergoing evaluation by pharmacologists for assessment of prescription drug compliance, the subject of this present report, as this relates to a criminal forensic case. Some of the findings reported here have been previously presented at a scientific meeting. (McMullin et al, 1994).

Neuropharmacology is the science dealing with drugs that act on nerve and brain. In the pharmaceutical industry, neuropharmacologists are the individuals who research and develop new psychoactive drugs. Bearing some relationship to toxicology on the one hand and experimental psychology, physiology and psychophysics on the other, practitioners of the field commonly conduct pharmacokinetic and pharmacodynamic studies on individuals taking neuropharmacological drugs of either therapeutic or recreational types. Pharmacokinetics is the science of measurement of levels and changes of levels of a drug in tissue. Pharmacodynamics is the measurement of drug effects. In the case of psychotherapeutic drugs, the measured pharmacodynamics include both changes in the condition being treated (hopefully, these are therapeutic effects) and the untoward (or side-) effects that the drug engenders. The following forensic consultation was sought by defense counsel representing Subject LP, charged with multiple counts of murder, attempted murder and aggravated assault.



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LP, a 39-year-old white male was arrested following a homicidal shotgun attack on his neighbors, wherein he rampaged through their apartment during a Halloween party repeatedly firing a shotgun. Two died and four were seriously injured. LP then telephoned the police to report that there had been "an incident." He stated to this writer at interview that he was surprised that the police arrested him, since he felt sure that his neighbors were going to homosexually rape him and that he had no choice but to shoot them all.

Clinical History:

LP had begun to abuse drugs, marijuana and amphetamines at age 16, later including LSD, mescaline and psilocybin. His marriage at age 20 was rapidly followed by divorce and by age 21, LP had

been diagnosed as suffering paranoid schizophrenia during compulsory hospitalization following the second of two unsuccessful suicide attempts. These attempts occurred during periods of hallucinogen use. He was held on remand for one year before release into the community. Four years later, feeling threatened by a colleague at work whom he suspected of being a member of the "Mafia," LP brought a gun to work and fired five shots at the man, seriously injuring him. LP then reported the shooting to his supervisor. Arrested, LP was tried, sentenced to time served and returned to the community one year after his arrest. The next year he threatened a relative with a machete and was forced to flee the community to escape arrest. Living as a transient for a year, he was eventually apprehended and served thirty days in jail for the incident with the machete, before being released into the community once again. For the next several years, LP drifted transiently throughout the USA and Canada, eventually stowing away on a ship bound for Europe, where he continued his peripatetic life, engaging in several violent confrontations over the course of his travels, always when he "felt threatened." He was ultimately forcibly repatriated to the US from Britain at age 30. Shortly after his return to the USA he was rejected from a homeless hostel at which he arrived late at night and he slashed the proprietor with a knife, fleeing arrest but being apprehended some weeks later after assaulting a woman who he thought was insulting him. At age 33 LP returned to his home community by bus and was collected from the bus station by his sister who drove him to their parents home. A disagreement immediately ensued between LP and his sister and he laid her head open with an axe. Arrested after a brief flight he was found "Not Guilty by Reason of Insanity" and spent the next several years incarcerated in the state psychiatric hospital. His sister was morbidly brain damaged but survived the attack. Released once again into the community he was judicially placed on a Mandatory Order of Treatment and was required to attend an outpatient clinic to receive counseling and pharmacotherapy, comprising monthly depot injections of Haloperidol decanoate, 25 mg, a slow release depot formulation of this antipsychotic drug. He was reportedly still receiving these injections at the time of the incident. In addition, his schizophrenia was judged by the state health agency to warrant his being listed as "permanently disabled" and he was enrolled on the Social Security Disability rolls at the time of the offense.

Since his arrest on present charges LP had experienced one additional psychotic exacerbation while in custody which had resulted in his haloperidol dose being increased.

At the time of the offenses that led to his present forensic neuropharmacological evaluation, LP had

long hair extending below his shoulders, in conformity with his delusion or belief that he was a Nordic avatar and a descendant or member of one of the original tribes of Israel (he regarded the Jews as being pretenders to this title). Forensic hair analysis was thus considered warranted in working up this case to determine what drugs, if any, he had historically been consuming in the months prior to and following the attack. It was of neuropharmacological interest to determine whether he had been abusing prescription or non-prescription stimulant drugs, which are known to exacerbate schizophrenic symptomatology, and also to confirm that he had been receiving his antipsychotic medication as ordered. At the time that the hair was sampled, an adjacent region was bleached for a hair growth rate study.

Bleached hair was harvested 42 days later and by means of a digitizing videomicroscope an average growth rate (n=102 hairs) for LP was established as being 0.433 +/- 0.0488 mm per day (=3.03 mm/week). The Coefficient of Variation of growth was 11.1%.

Within the financial constraints of the study, a length of hair corresponding to 18 months of the patient's life could be captured by harvesting duplicate segments at 3 mm (approx. 1 week) intervals. Segmented hair aliquots were rinsed 4X and incubated in 0.1N HCl overnight, the extracts neutralized, then L/L extracted for quantitative analysis of Haloperidol and stimulants of abuse. Haloperidol was measured by GC/MS with 3-ion SIM identification and internal standard (Chloro-Haloperidol) quantitation. Quantitation was effected with a 5-point Haloperidol standard curve (1 to 100 ng) using spiked normal hair. Stimulant assays were performed using a dual column GC-NPD/FID screen with GC-ion trap confirmation.

Results:

No stimulant drugs of abuse were detected within the following reporting limits:

Ephedrine	0.57 mcg/g
Amphetamine	0.14 mcg/g
Methamphetamine	0.14 mcg/g
Benzphetamine	0.14 mcg/g
Chlorphenteramine	0.29 mcg/g
MDEA	0.14 mcg/g
Pheniramine	0.57 mcg/g
Phenylpropanolamine	0.29 mcg/g
Caffeine	1.43 mcg/g
MDMA	0.14 mcg/g
MDA	0.14 mcg/g

Haloperidol was detected in every segment of hair. Quantities, normalized for mass of hair, provided a fascinating profile in the weeks prior to and following the killings. Data are given in Fig 1.

It was clear that the killings occurred at a time when the haloperidol concentration in LP's hair was at its nadir, its lowest level, in the period of time represented by segment #65-66. Following his arrest, hair haloperidol concentrations increased although the dose level and dosing interval

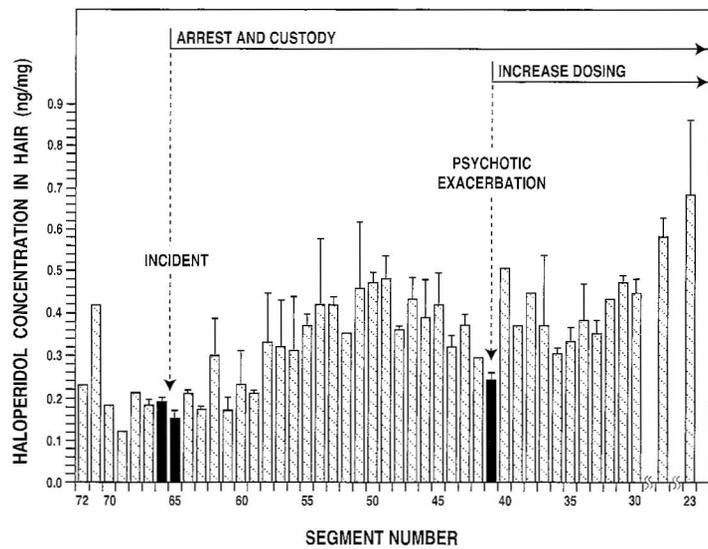


Fig 1: Mean +/-SD Haloperidol concentration (ng/mg) in 3mm segments (6 to 7 mg each) of hair sampled sequentially from subject LP, showing levels over the period before and following the incident.

administered in jail remained the same. A second nadir which occurred some months after his incarceration, in segment #41 was found to correspond to the psychotic exacerbation that occurred while he was undergoing residential psychiatric evaluation, leading to his haloperidol dose being increased. It can be seen that hair concentrations of the drug trend upward from this time, but do not double as the dose is doubled.

Conclusions:

Contemporary blood levels of the drug were not available to compare with measured hair levels, so that direct inferences regarding pharmacokinetic and biodistribution parameters of the drug cannot be drawn. Thus, the concentration of haloperidol bathing the brain in the period of interest could not be coincidentally computed from hair levels. Hair levels are undoubtedly a function of growth rate, drug absorption and biodistribution rates, plasma carrying rate capacity and, in the case of dopaminergic drugs such as Haloperidol, neuroendocrine functions. Without question, each of these components to the overall hair deposition rate of the drug is under the control of processes with complex infradian, diurnal and circadian periodicity and these rhythms are the subject of much pub-

lished research. The findings that the offense occurred during the period of lowest hair drug level is not without explanatory value, however, and is strongly supportive of the theory that deposition rates to brain and hair are related, albeit indirectly, in terms of pharmacodynamic response. This is supported by the finding that the second, later, nadir corresponded to a second period of psychotic exacerbation while in custody. The reasons for this variability in deposition rate remain to be investigated and may prove to be related to fluctuating bioavailability.

At trial the State argued that LP was sane at the time of the offense, despite his history. The jury's concurrence brought a verdict of guilt and a sentence of life imprisonment. LP was thus sent to a prison rather than a mental hospital.

References and Acknowledgment:

McMullin MM, Selavka CM, Wheeler MT, Wier KM, Werrell PL, Karbiwnyk CM and Lipman JJ. *Forensic Hair Testing for Haloperidol: A Tale of Two Cases*, presented at: Annual Meeting of the American Academy of Forensic Sciences, San Antonio, Texas, 1994, Abstract K 33. The statistical consultation of Dr. Barney E. Miller, Psychiatry Department, East Tennessee State University, is gratefully acknowledged.

About the Author

Dr. Jonathan J. Lipman, BCFM, BCFE, obtained his first degree from Hatfield Polytechnic, Hertfordshire, England, served his externship at the National Hospital for Nervous Diseases, Queen Square, London, and obtained his PhD in Neuropharmacology from the University of Wales Institute for Science and Technology, Cardiff, Wales. He is State Registered as a Medical Laboratory Scientific Officer in the United Kingdom and is Board Certified in the USA in the fields of Pain Management (ABPM), and Medical Psychotherapy and Psychodiagnostics (ABMPP) in addition to Forensic Medicine (ABFM) and Forensic Examination (ABFE). He conducts research and offers consultation in neu-

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