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An Epidemic of Illicit Fentanyl Deaths in Cook County, Illinois: September 2005 through April 2007

ABSTRACT: Between September 2005 and April 2007, 350 fentanyl intoxication deaths were investigated and certified by the Cook County Medical Examiners Office. Investigations revealed that the majority of these fatalities were by intravenous injection of a white powder followed by a rapid collapse. The fentanyl was clandestinely produced in a lab in Toluca, Mexico and sold by the Mickey Cobra street gang. The term "Drop Dead" was coined for this "tainted heroin." Postmortem samples were screened by ELISA and confirmed by standard GC-MS methods. Fentanyl fatalities peaked at 47 per month in May and June 2006. Fifty-two percent were single fentanyl intoxications, with the remainder accompanied by either cocaine, morphine from heroin, or alcohol. This epidemic stressed the limited resources of the toxicology laboratory and autopsy service of the Medical Examiners Office. The clandestine lab was terminated, distributing gang members and leaders arrested, and the epidemic ceased in April 2007.

KEYWORDS: forensic science, fentanyl intoxication, drug abuse, Cook County, IL

Fentanyl is a synthetic narcotic, between 50 and 100 times more potent than morphine with a half-life of 3–12 h, depending on the individual (1). Fentanyl is most commonly recognized and used medically as a transdermal delayed-release patch for the treatment of chronic pain in an outpatient or hospital setting (2). These adhesive-backed patches are placed on the skin and are designed to deliver between 12.5–100 μg per hour of fentanyl over 72 h. Fentanyl is also manufactured as a liquid for intravenous use in the hospital or clinic setting as an adjunct to anesthesia for invasive medical procedures. Abuse of fentanyl patches have been previously described, with patches swallowed, smoked, and applied in excess to attain a narcotic euphoria (3–6).

Prior to this epidemic from 1995 through October 2005 the Cook County Medical Examiners Office certified approximately four deaths per year from the abuse of fentanyl, predominately through patches, and occasionally from abuse of the injectable medical liquid by physicians who had access to the drug. In December 2005, clusters of nonfatal and fatal opioid intoxication deaths began to present to emergency rooms and the Medical Examiners Office from fentanyl purchased from the Mickey Cobra street gang synthesized in a clandestine laboratory in Toluca, Mexico, unrelated to the previous abuse of pharmacological fentanyl. As of May 1, 2007, there were 350 confirmed fentanyl-related deaths from this now concluded epidemic in Cook County. This is the first detailed

pathological and toxicological report of these fatalities occurring in Cook County, Illinois.

Study Methods and Procedures

Fentanyl intoxication deaths were retrospectively analyzed for the years 1995 through November 2005 from our Office's computerized database to obtain baseline fentanyl intoxication data. As clusters of deaths from fentanyl intoxication appeared in late 2005, data were collected and analyzed prospectively for entry into a real-time Cook County Medical Examiners (CCME) Fentanyl Intoxication Database. The database collected the name, age, race, and sex of the deceased, place of residence, location of death, the responsible medical examiner, toxicology testing results, and any significant anatomic findings contributing to the death. Investigation into the circumstances surrounding all drug intoxication deaths were followed by standard autopsies with toxicologic and microscopic analyses, as per office protocol. Peripheral blood was analyzed in all suspected drug and fentanyl intoxications, when available. In some cases, decomposition necessitated testing of substitute fluids or tissues. The forensic pathologist routinely collects samples of peripheral and central blood, liver, brain, kidney, spleen, vitreous humor, bile, and urine when a drug intoxication is suspected to correlate with blood results and evaluate possible postmortem redistribution, if necessary (7). Autopsy findings generally were pulmonary and cerebral edema, and occasionally coronary atherosclerosis or enlargement of the heart in older victims. Recent and healed needle injection marks were commonly seen.

Criteria for the determination of a fentanyl-related death are similar to our Office's criteria for other drug intoxication deaths. Criteria include death scene circumstances of possible intoxication (history of drug abuse or presence of drug paraphernalia), nonspecific autopsy findings without a specific cause of death, presence of fentanyl in the peripheral blood with or without other drugs or

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alcohol, and no other obvious competing cause of death (i.e., multiple gunshot wounds or strangulation).

It is important to note that in 2005 fentanyl was not a standard component of our Office's routine illicit drug analysis testing panel, but was quickly added to the regimen as clusters of intoxication deaths increased. A labor-intensive fentanyl testing protocol was initiated by the Chief Toxicologist and her staff. Specimens were specifically analyzed for fentanyl by the Immunalysis Fentanyl Direct ELISA Kit (Immunalysis, Pomona, CA). Upon an initial positive fentanyl result, a second tissue of the same case was then screened via the same method. The assay has a reported sensitivity for fentanyl detection of 0.1 ng/mL; however, our laboratory utilizes a 1.0 ng/mL positive standard cut-off level. Quantitation and confirmation of fentanyl is performed by GC-MS (Agilent, Santa Clara, CA) after liquid-liquid extraction. Six fentanyl standard concentrations as calibrators range from 0.80 to 6.0 ng/mL and a negative and positive control is utilized. An internal standard of fentanyl-D5 (Cerilliant, Round Rock, TX) is carried with each standard, control and specimen. An administrative cut-off level of 0.80 ng/mL fentanyl is applied to each case as standard protocol. Any specimen with a result greater than 6.00 ng/mL is diluted and reextracted for GC-MS analysis.

Results

About 350 fentanyl-related deaths occurred during this epidemic in Cook County, peaking in May and June of 2005 (Fig. 1). Three fentanyl-related deaths were detected in September 2005, stabilized, then quickly jumped to 12 in December, 10 in January 2006, 9 in February, and 12 in March, but then doubled to 25 in April, and jumped to the highest points of the epidemic of 47 deaths in May and June. The deaths decreased through July and August, but surged to 38 in October, before tapering off to five in January 2007, and one per month after this until May, when there were no fentanyl deaths. Of these fentanyl-related fatalities, 295 were male and 55 female (84% vs. 16%); 208 were black and 142 were white (59% vs. 41%). The average and median age was 41 years, with a range of 17–68 years. The average concentration of fentanyl in all fatalities in postmortem peripheral blood was 22.8 ng/mL (median 16.6; range 0.8–164). The fentanyl epidemic deaths were further subcategorized as to the presence or absence of other drugs. This analysis shows the most deaths were fentanyl intoxication without other drugs or alcohol (50%), followed by fentanyl and cocaine intoxication (22%). Fentanyl deaths without the presence of opiate and cocaine in the blood (fentanyl and alcohol an isolated fentanyl)

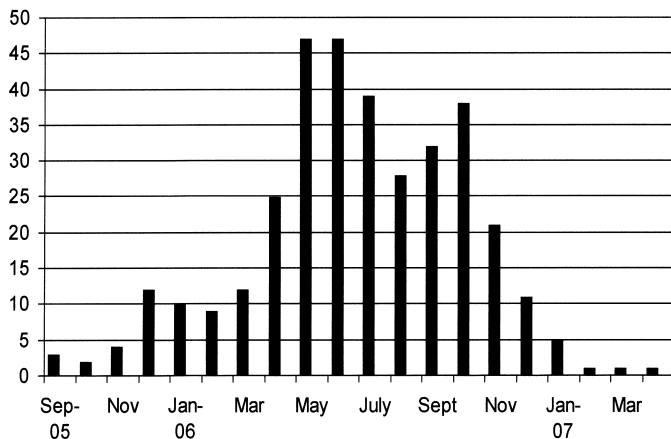


FIG. 1—Illicit fentanyl related deaths per month in Cook County, IL.

are 63%. The fentanyl deaths without morphine from heroin is 85%, highlighting the fact that the fentanyl was sold as a substitute product, not “tainted heroin.”

Discussion

An epidemic is an extensive or rapidly spreading occurrence affecting many individuals in a population at the same time. This definition is appropriate, since as from September 2005 through April 2007, 350 excess fentanyl-related fatalities had occurred in Cook County, IL in a relatively short period of time, where the expected number of fatalities was six for the same period for each of the preceding 9 years. Other epidemics of fentanyl and methyl-fentanyl deaths have occurred in major urban areas (8–12). The data from our Cook County, IL fentanyl epidemic shows that fentanyl was predominantly sold in Chicago as a single drug, not as the initially reported “tainted heroin” product. The cocaine and/or heroin detected with fentanyl represented the concurrent use of each individual drug. Cocaine and heroin are commonly packaged and sold separately by street gangs in Chicago as either “rocks” (cocaine) or “blow” (heroin). The Mickey Cobra gang sold this fentanyl from a south-side Chicago Housing Project. The purity of heroin in Chicago continues to increase and is now commonly insufflated, hence the term “blow” for heroin. The clandestine fentanyl manufactured in Mexico was a white granular powder similar in consistency to heroin, and sold on the streets in the expected quantity as heroin, in similar small square commercially available resealable plastic bags or foil packets. The relative increased potency of fentanyl can lead to a rapid and sudden respiratory arrest when the fentanyl powder thought to be heroin is injected or snorted. Because of the effect of the rapid death or unconsciousness seen immediately with injection of the fentanyl powder, chronic abusers of narcotics coined the term “Drop Dead” for this new product.

The dramatic occurrence of multiple intoxication victims occurring in clusters with deployment of police hazardous materials units caught the attention of the media and bulletins were released with warnings to avoid buying drugs from areas where overdose clusters had occurred. Unfortunately, narcotic abusers came to these areas to purchase the reportedly more potent opiate. The main reason cited for this attraction to this obviously dangerous drug was that it was more value, or euphoric effect, for the money and the product could then be diluted and injected in a controlled manner by the purchaser.

Very early in the epidemic, fentanyl was isolated by the Illinois State Police Forensic Sciences Center within the hubs of the recovered syringes from these deaths. The Chicago Police requested expedited testing of the residual syringe fluid to ascertain if the intoxication clusters were from excessively concentrated batches of “uncut” heroin or addition of a toxic pharmacologic agent or poison, which has occurred in other clusters of heroin-related deaths (13). After the agent was identified as fentanyl, press bulletins warned of the dangers of this potent “substitute heroin.” Ironically, users of this fentanyl reported that it caused a rapid unconsciousness after injection and the user awoke hours later, never experiencing the intended euphoria.

Prior to this epidemic, fentanyl was not routinely tested for in our toxicology laboratory. After notification by the Chicago Police of the presence of fentanyl in the syringes, a fentanyl testing protocol was begun for all suspected drug intoxication deaths at the Medical Examiners Office. As the epidemic was occurring in 2006, suspected drug intoxication deaths from 2005 were tested retrospectively as a means of surveillance to try and identify the time period

when fentanyl first entered the Chicago area. The earliest fentanyl intoxication deaths occurred in September 2005. All suspected drug intoxication deaths are currently tested for fentanyl in addition to routine illicit drug screening.

One of the core functions of the medical examiner or coroner is protection of the public health. This epidemic has implications for public health in monitoring and quickly diagnosing clusters of sudden unexpected death in an urban population. Detection of new diseases, infections, or environmental poisons that can endanger the community requires vigilance, and a team approach, as illustrated here. Our toxicology laboratory is unequipped to test fluid from the hubs of used syringes, so the Illinois State Police Crime Lab was utilized for their expertise in testing confiscated illicit drugs. Prior to the identification of fentanyl as the agent, these multiple clusters of morbidity or mortality within a short time span could easily have been from an infectious organism or toxin placed within the imported drug. The origin of this illicit white powder fentanyl was traced to a clandestine laboratory in Toluca, Mexico, and was shut down in early 2007. Fentanyl can be efficiently manufactured through an SN-2 organic chemistry reaction from the *N*-phenethylpiperidone (NPP) precursor and other reagents within a clandestine laboratory (14). The Chicago area is a major hub for distribution of illicit heroin and cocaine in the Midwest. Other areas of the country reporting similar fentanyl deaths include Detroit, Philadelphia, and New Jersey. Counties surrounding Cook have reported several cases of similar fentanyl deaths (personal communications, Bryan Mitchell, M.D., and Jeffrey Harkey, M.D.). After the Toluca, Mexico lab was shut down and distributing gang members arrested the supply of fentanyl and the deaths ceased.

Conclusion

Fentanyl intoxication became a common cause of drug intoxication in the Chicagoland region since late 2005. This epidemic has peaked to 47 excess drug intoxication deaths per month in May and June of 2006, and drastically terminated in early 2007. This surge in fentanyl abuse, sold as a white powder substituted for heroin on the streets of Chicago, followed past patterns of fentanyl influx into urban areas, the rapid cocaine emergence in Miami, Florida in the 1970s, and heroin abuse in New York City in the past decades (15). Detection of these epidemics requires vigilance

by forensic pathologists and toxicologists and a team approach with supporting forensic and police agencies.

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