FORENSIC TOXICOLOGY, AUTOPSY, AND THE CAUSE OF DEATH IN “LEN BIAS” HOMICIDES

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Milwaukee County Medical Examiner’s Office
Population – just under 1 million

- 10,000 deaths annually
- 6000 investigations
- 1000 autopsies
  - 2013 – 123 homicides
  - 2013 – 113 suicides
  - 2013 – 575 accidents
  - 2013 – 181 narcotic deaths
  - 2014 – 144 narcotic deaths, so far
Milwaukee County Medical Examiner’s Office

“Huge” staff
- 3 forensic pathologists
- 1 forensic pathology fellow
- 4 autopsy assistants including a supervisor
- 12 medicolegal death investigators
- 3 admin
- 4 full time laboratory staff
- 24/7/365 – but autopsies generally Monday - Saturday
Forensic Autopsy

- Investigation / history
- Additional studies (X-ray, CT, etc.)
- External examination
- Internal examination
- Additional studies (toxicology, histology, microbiology, etc.)
- Cause of death – the physiologic condition leading to death
- Manner of death – how the cause arose
Manner of Death

- Natural
- Accident
- Homicide
- Suicide
- Undetermined
- (Pending)
Drug Overdose

- National Association of Medical Examiners (www.thename.org)
  - “Mind Your Manners”
- Convention – MOD = Accident
  - Unless there is evidence of suicidal intent
    - Note
    - “Suicide note equivalent”
    - Past attempts
- ?Homicide – “Angel of Death” type case
Evidence of suicidal intent
“Toxic” is the ability of a material to injury a living organism by other than mechanical means.

- Exposure via a number of routes
- Suicide, homicide, accident – often based on local custom and practice
Drug overdose

- Common features
  - Pulmonary congestion and edema
  - "Foam cone"
Recreational agents such as EtOH
Medication
Chemical agents such as cyanide, arsenic
Body packing; concealment swallowing of drugs
Intravenous exposure

- Recreational drug use
- Therapeutic administration
- Suicide in those with professional access to appropriate “hardware”
Subcutaneous / intramuscular exposure

- Therapeutic injections, including insulin
- Occasional recreational drug use, particularly heroin or cocaine ("skin popping")
Appropriate physical findings depend on agent and route of exposure
Toxicology results must support cause of death
One may die with, vs. of drugs
Roles of PhD toxicologist vs. M.D. forensic pathologist
Reference levels
Where it all began...
1986 Drafted by Boston Celtics
Congress passed the “Len Bias Law”

So, here we are....
Forensic Toxicology

- Heroin
  - Routes of administration
  - Therapeutic/toxic/lethal levels
  - Metabolism
Heroin Data

- **NFLIS data:**
  - 2013 – Midwest - 45,602 reports (12%)
    - #2 drug between Cannabis and Cocaine
  - National data - 12% and #4

Heroin death trends

Figure 1.14 Regional trends in heroin reported per 100,000 persons aged 15 or older, January 2001–December 2013

Oxycodone and Hydrocodone drop after 2010

**Figure 1.5** Regional trends in oxycodone reported per 100,000 persons aged 15 or older, January 2001–December 2013

**Figure 1.6** Regional trends in hydrocodone reported per 100,000 persons aged 15 or older, January 2001–December 2013

![Graphs showing regional trends in oxycodone and hydrocodone](image-url)
Prescription Drug Formulation Changes

- Physical/Chemical barriers
- Pharmacologic - Agonist/Antagonist combinations
- Aversion
- Prodrug
- Delivery System
- Combination Mechanisms
Milwaukee County Data

- Heroin Related Deaths
- Totals
- Total OD Deaths

Graph showing the increase in deaths from 2008 to 2014.
Heroin Deaths by Ethnicity

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Heroin as a Function of Total Opioid Deaths

- % Heroin as a Function of Total Opioid Deaths
- % Heroin as a Function of Total ODs
Number of Heroin vs. Other Opioid Related Deaths
How did we get here and how do we fix it?

- Regulation?
- Physicians?
- Pharmaceutical Companies?
- Drug Dealers?
- Increase in pain in this Country?
- Simply just a trend in drug choice?
Testing for Heroin Usage

- Testing is very robust
- Never see Heroin
- Screening
- Confirmation/quantitation
Analytical Testing

- Opioid screen, targeting Morphine
- Confirmation, GC-MS, very specific
- Quantitation
Heroin Metabolism

- Heroin: 2 - 6 min
- 6-MAM: 6 - 25 min
- Morphine: 2 - 3 hrs
Metabolism observed with chronic morphine administration at high doses

OXYCODONE (OXYCONTIN, PERCOCET)

OXYMORPHONE (NUMORPHAN, OPANA)

HEROIN

6-MAM

MORPHINE

HYDROMORPHONE (DILAUDID)

HYDROCODONE (VICODIN)

CODEINE
Morphine

- MS Contin™,
- Primary constituent of opium
- Moderate to severe treatment of pain
- T ½ 2-3 hours
- Therapeutic 10-100 µg/L
- Toxic 100 µg/L
- Comatose-lethal 100-4000 µg/L
MS of Heroin
MS of 6-monoacetylmorphine
Acknowledgements

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