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REVIEW PAPER

Postmortem toxicology findings from medicolegal investigations of drug-related deaths among the rich and famous

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Summary This article presents a review of medicolegal investigations of drug-related deaths among various Hollywood celebrities and popular music icons. The movie stars included: Marilyn Monroe, River Phoenix, John Belushi, Chris Penn, Heath Ledger and Philip Seymour Hoffman. The musicians are exemplified by Elvis Presley, Janis Joplin, Jimi Hendrix, Keith Moon, Sid Vicious, Kurt Cobain, Amy Winehouse, Michael Jackson, Whitney Houston and Prince. The tragic drug-related death of Anna Nicole Smith, a sex-symbol and Playboy model, is also included. The illicit drugs mainly responsible for the fatalities were heroin and/or cocaine or a mixture of the two narcotics. Some of the celebrity deaths were caused by inappropriate use of prescription medications, mostly combined influences of one or more benzodiazepine together with an opiate or opioid pain medication. Polypharmacy increases the risk of adverse drug events and this sometimes causes a sudden and unexpected death. As tolerance to the pharmacological effects of drugs develop, the amounts taken (the dose) are increased, which enhances the risk of a fatal drug-drug interaction. Ethanol was implicated in some of the celebrity deaths, which underscores the dangers of excessive drinking when taking centrally acting drugs. In the case of Amy Winehouse, a talented jazz singer, she died from acute alcohol poisoning, because ethanol was the only psychoactive drug identified in postmortem blood.

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Introduction

Whenever a well-known person, such as a Hollywood celebrity or a popular music icon, meets a sudden and unexpected death, this invariably triggers a media frenzy and speculation about the cause and manner of death [1]. The circumstances and events leading to the person's demise make headlines in newspapers and magazines worldwide. In today's society, social media is very much involved and many bloggers express their opinion and speculations on-line. Television networks and news media strive to document the person's lifetime and this usually focuses on the deceased's drinking and drug habits.

Sudden and unexpected deaths among celebrities are of interest to the general public, which probably motivates close scrutiny by the news media. However, conspiracy theories often develop and the celebrity death becomes fertile ground for speculation and rumor, mostly without any substance. Sudden deaths among the rich and famous attract interest from the paparazzi, who spare no efforts to obtain compromising photos of the deceased. It seems that Hollywood movie stars and pop music icons are the equivalent of European Royalty and attract unprecedented media attention, especially when they meet a tragic death.

All sudden out-of-hospital deaths should be reported to the police authorities so that a medicolegal investigation is initiated including a forensic autopsy and the collection of biological specimens for toxicological analysis. An unremarkable or negative autopsy shifts attention towards the possibility that death was caused by overdosing with drugs. However, this needs to be verified by laboratory analysis of blood, urine, hair and/or other materials for a broad spectrum of licit and illicit drugs and poisons.

The present article gives background information and the circumstances that resulted in the death of a number of famous people. The focus of the article is the toxicology results in a number of drug-related deaths among the rich and famous, namely Hollywood movie stars and popular music icons. Information used to write the article came from various journal articles, newspaper reports, books about the deceased, as well as Wikipedia and other on-line resources.

Fig. 1 shows photographs, names and dates of birth and death of the people discussed in this article. Table 1 presents more details and circumstances of the death investigation and the results of the toxicological analysis.

Marilyn Monroe

Few celebrity deaths have attracted so much media attention and conspiracy theories as that of the Hollywood movie star and sex-symbol Marilyn Monroe (1926–1962), whose real name was Norma Jeane Mortenson. Several biographies have been written about her life and times and also her tragic death, which was immortalized in the Elton John song "Candle in the wind."

Marilyn came from a humble background and when her parents got divorced, she spent most of her childhood in foster homes. Her biological mother suffered from mental health problems and was hospitalized for long periods because of this condition. Marilyn married three times, first at the age of 16 to James Dougherty, then to Joe DiMaggio

(famous baseball player) and finally Arthur Miller (playwright). As a teenager, Marilyn took odd jobs and even worked as a photo model, including posing nude for a famous calendar. She eventually signed a contract with one of the Hollywood film studios and became a successful actress, although she was often typecast in romantic roles as a busty blonde.

In the early morning of 5 August 1962 at about 3 am, Marilyn Monroe was found dead in bed at her Brentwood home in Los Angeles by a housemaid. The police were notified at 4.25 am and a medicolegal autopsy was done the same day by the Los Angeles deputy coroner, who at the time was Dr Thomas Noguchi (born 1927). The media later christened him "the pathologist to the stars," owing to the many famous people he had autopsied [1,2].

At the time of her death Marilyn Monroe suffered from psychiatric problems including anxiety, panic attacks, mood swings and depression and she had tight contact with her private physician and psychiatrist. Several prescription drugs were found at the death scene including sulfathalidine (narcotic analgesic), Librium® (chlordiazepoxide), Phenergan® (antihistamine, promethazine), sleep-aids chloral hydrate and Nembutal® (pentobarbital). A prescription for Nembutal® was filled just a few days before her death and an empty pill bottle found at the scene speaks towards recent usage of a large amount of this barbiturate sleep medication.

The forensic toxicology report from the investigation of Marilyn's death was signed by Ray Abernethy (1894–1986). The first report was dated 6th August and the second on 13th August 1962. Ethanol was absent from blood (negative), and chloral hydrate was reported as 80 mg/L. However, the latter result probably refers to the sum of any remaining parent drug, trichlorethanol (active metabolite), and trichloacetic acid as determined by the Fujiwara test for chlorinated hydrocarbons, which was in common use in toxicology at the time. The report from 6th August stated that autopsy blood contained 45 mg/L barbiturates (but not phenobarbital), a result probably derived from UV analysis under acid and alkaline conditions, which could exclude presence of phenobarbital. On August 13th, Abernethy analyzed a specimen of liver tissue, probably by paper chromatography, and identified pentobarbital at a concentration of 130 mg/kg. The analytical methods available to the forensic toxicologist in the 1960s were very primitive compared with those in common use today.

Whether Marilyn Monroe's overdose death was accidental, a suicide or murder has become the stuff of legend, although according to the death certificate it was classified as "probably a suicide." However, there was no farewell message or suicide note found in the apartment, which supports an accidental overdose or undetermined manner of death.

Jimi Hendrix

Jimi Hendrix (1942–1970) was born in Seattle, USA and became famous in the 1960s for his style of playing the electric guitar and flamboyant on-stage live performances. Like many of his contemporaries in the pop music business, Hendrix was known to drink heavily and he was a

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