

# Adulteration in the Drug of Abuse: An Autopsy Study on the Prevalence and its Role in Natural Death



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## Abstract

**Introduction:** The number of post mortem cases with positive toxicology is increasing in number at our center. We aim to study the prevalence of adulterants and their role in natural deaths.

**Methods:** This was a retrospective study of all autopsy cases with positive toxicology results from the year 2014-2016 at Forensic Medicine Department of Hospital Kuala Lumpur. Cases that died at ward, resuscitated, decomposed and were excluded. Data for this study was retrieved from the autopsy reports which include toxicology report. The positive toxicology cases were grouped into morphine group, amphetamine group and methadone group. The prevalence and relatedness using statistical analysis were computed.

**Results and Discussion:** Morphine (18.36%) were the highest prevalent drug of abuse detected from the post mortem cases. The commonest adulterant seen in our study was chloroquine followed by paracetamol and lidocaine. A significant difference obtained in cross tabulation between respective adulterant and drug of abuse,  $\chi^2 (1, N=80)=14.159, p < 0.05$  which proves that chloroquine is preferred adulterant in all the drug groups especially morphine group. Highest number of chloroquine were seen in cases with lung infection and perforated gastric ulcer. Lidocaine alone were present in highest number in death related to the heart pathology.

**Conclusion:** Adulterants in drug of abuse is becoming common which mainly acts as diluent or debulking agents. The effect of adulterants is not negligible. It has role in the development of natural disease and even deaths.

**Keywords:** Adulterants; Drug of Abuse; Post mortem

## Introduction

The number of post mortem cases with positive toxicology is increasing in number at our center. The cause of death might not due to the drug of abuse intoxication, but we start to wonder whether the adulterant of the drugs could have played role in the death. As we aware, chloroquine had been one of the common adulterants used with heroin. The use with heroin is to create bitterness and respiratory rush. Adverse effect associated with chloroquine such as acute renal failure, thrombosis, hypotension and even death had been reported. Common adulterants besides chloroquine that was reported were paracetamol, lidocaine, dextromethorphan, phenobarbital, diphenhydramine, and caffeine. These adulterants can act as diluents, debulking agents or cause a synergistic effect. The use of these adulterated drugs is more dangerous and could be fatal. Poisoning has been associated with the use of adulterant. There were many cases lead poisoning as a result of adulteration in the drug of abuse that led to deaths reported [1-5]. Besides that, bacterial infection has also been reported in several cases. Among the infections were *Clostridium sordellii*, *Clostridium botulinum*, and *Bacillus*

*cereus* [6-9]. The source of the infections was believed to be from the tools or the unhygienic methods of drugs preparation. In view of many complications of the adulterants in the drug of abuse, we studied the common adulterant discovered in our autopsy from the year 2014 to 2016. We also have analyzed the possible interaction between adulterants and the cause of death.

## Methods

This was a retrospective study of all autopsy cases with positive toxicology results from the year 2014-2016 at the Forensic Medicine Department of Hospital Kuala Lumpur. The Inclusion criteria are cases that brought in dead to the mortuary for which their blood and/or urine were sent for toxicology analysis at Chemistry Department, Malaysia. Cases that died at ward or was resuscitated were excluded. Decomposed and skeletal remains were also excluded. The toxicology samples were collected in a bottle that containing Sodium Fluoride which acts as the preservative. The specimen security seal from the Forensic Medicine Department, Hospital Kuala Lumpur were

affixed before the samples were sent to an accredited laboratory at the Chemistry Department, Malaysia. Data for this study were retrieved from the autopsy reports which include the toxicology report. The positive toxicology cases were grouped into three categories of the drug of abuse, which is the morphine group, amphetamine group, and methadone group. Morphine type drugs include heroin, 6-monoacetyl-morphine, morphine, codeine. Amphetamine type drugs include amphetamine, methamphetamine, MDA, MDMA. The results were analyzed using descriptive statistics and the relatedness using statistical analysis were computed.

Results

From a total of 1832 autopsy cases done at our center during our study period, there was a total of 290 cases were positive for adulterants or drug of abuse. Adulterants were present in combination with the drug of abuse in 50 cases. Morphine (18.36%) were the highest prevalent drug of abuse detected from the post mortem cases. This is followed by a combination of morphine group and amphetamine type stimulant group (11.22%) and methadone group (8.16%). The combination of all the groups of drugs was the lowest with only 1.2% (Figure1).

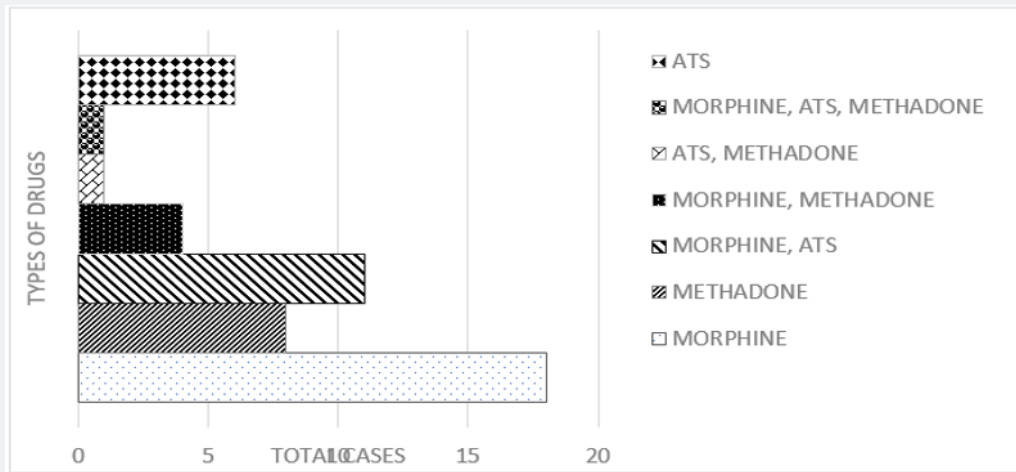


Figure 1: Total cases categorised by drug of abuse

The commonest adulterant seen in our study was chloroquine which was present in 35 cases (Figure 2). The second commonest was paracetamol and followed by lidocaine. Chloroquine was present in combination with other drugs such as paracetamol, lidocaine, tramadol, diclofenac, metoclopramide, chlorpheniramine, and theophylline. The most common

combination seen with theophylline, lidocaine or tramadol. A significant difference obtained in cross tabulation between respective adulterant and drug of abuse,  $\chi^2 (1, N=80)=14.159, p<0.05$  There is a preference of chloroquine present together with morphine group (Table 1).

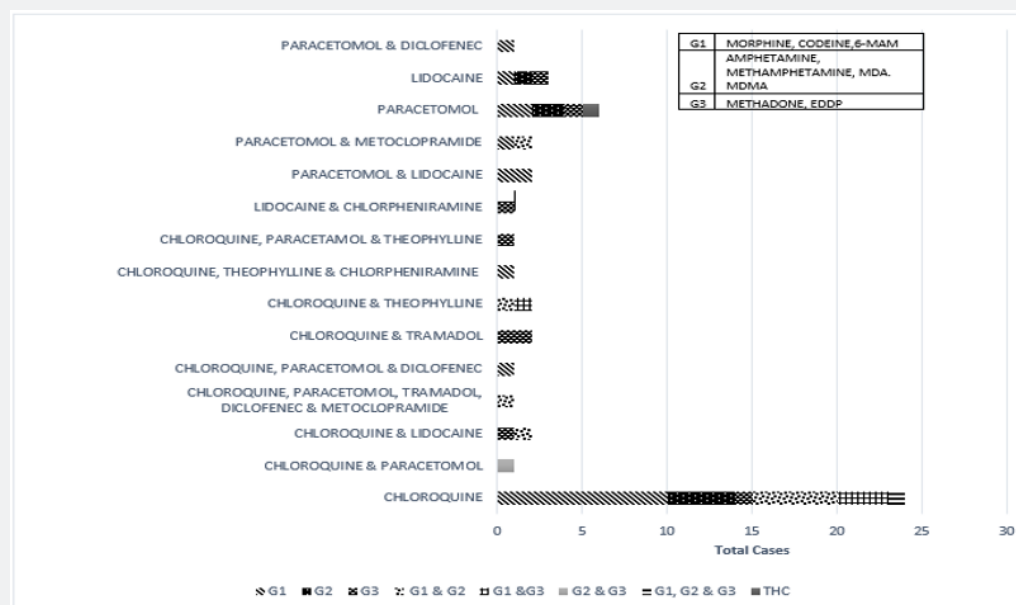


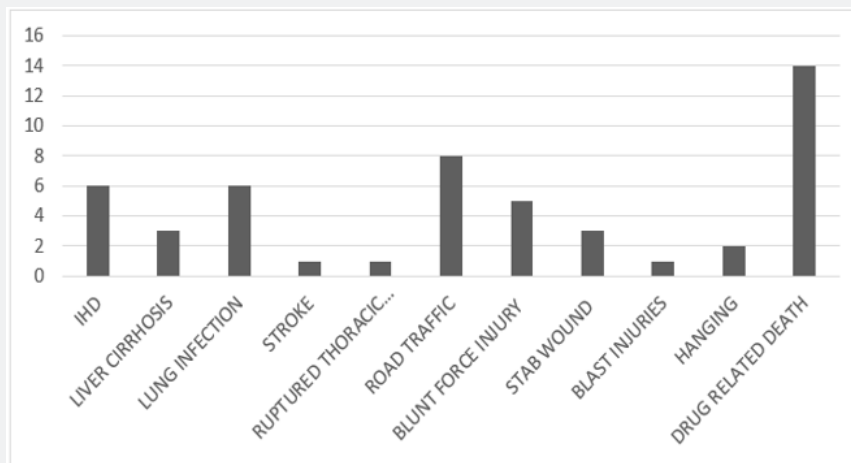
Figure 2: Types of Adulterants in Post mortem cases from the year 2014 - 2016

**Table 1:** Adulterant Drug Group Crosstabulation

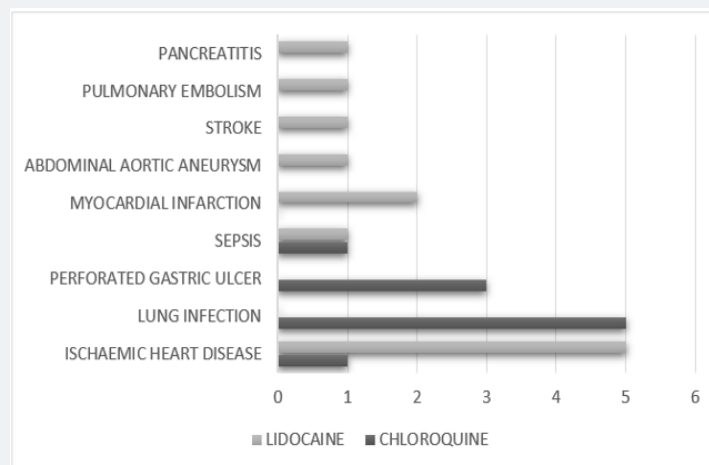
			Drug Group				Total
			No Drug of Abuse	Morphine Group	Amphetamine Group	Methadone Group	
Adulterant	Chloroquine	Count	10	25	14	11	60
		% of Total	12.50%	31.20%	17.50%	13.80%	75.00%
	Lidocaine	Count	12	4	2	2	20
		% of Total	15.00%	5.00%	2.50%	2.50%	25.00%
Total	Count	22	29	16	13	80	
	% of Total	27.50%	36.20%	20.00%	16.20%	100.00%	

Lidocaine present almost equally in all the three categories. Overall, we deduce that chloroquine is preferred adulterant in all the drug groups especially morphine group. The cause of death in cases of adulterants with drugs of abuse was solely related to the drug of abuse in 14 cases. Road traffic deaths recorded 8 cases under the influence of the drug of abuse. It was also surprising that 17 cases of positive for toxicology were natural. 6 of them died due to ischaemic heart disease and another 6 died due to lung infection. Homicide cases accounted 8 cases comprising of blunt trauma (5 cases), stab wound (3 cases)

and 1 due to blast injuries. 2 cases of suicidal hanging also had positive toxicology (Figure 3). There were also cases in which adulterants were present in blood and/or urine without drug of abuse. Chloroquine alone recorded in 10 cases and lidocaine in 12 cases (Figure 4). The highest number of chloroquine were seen in cases with the lung infection and perforated gastric ulcer. Lidocaine alone were present in highest number in death related to the heart pathology. Five ischaemic heart disease and two myocardial infarction cases were associated with lidocaine in blood and/or urine.



**Figure 3:** Cause of death with positive toxicology from the year 2014-2016



**Figure 4:** Causes of death and types of adulterants.

## Discussion

The rise in the drug of abuse over the years is clearly evident from our autopsy cases. In 2014, 68 cases of the drug of abuse detected and it was almost two fold in 2016 despite no rise in the autopsy numbers. The commonest drugs of abuse were morphine group and amphetamine type stimulants. This is consistent with Malaysian drug agency report published in 2016 which recorded 85.29% of total drug abusers [10]. There was also no case of cocaine abuse was detected in the particular years. United Nations Office on Drugs and Crime (UNODC) in 2007 mentioned in their report that there was a potential for 735 tonnes of heroin to be produced globally [11]. Afghanistan, Pakistan, Myanmar and Lao People's Democratic Republic are where the majority of opium poppy crops are cultivated and manufactured heroin in Asia. In 2014, 0.5 tonnes of heroin and morphine were seized in Malaysia [12]. Morphine is produced from *Papaver somniferum* L and then synthesised and purified to produce diamorphine (heroin).

During the production of heroin, a number of other substances are typically used which includes ethanol, diethyl ether, concentrated hydrogen chloride, activated charcoal, sodium carbonate, ammonium chloride and acetic anhydride. Chloroquine is known adulterant in heroin [13,14]. It gives bitter taste similar to heroin and may be used as a diluent besides mimics the respiratory rush felt by injecting heroin users shortly after administration. The use of chloroquine in medicine is to treat malaria infection. Several complications have been implicated with this drug. Among them are the acute renal failure, cinchonas, gastric disturbances, thrombosis and hypotension with intravenous use, blindness and even death. In our study, chloroquine has been present in a higher number of cases with the lung infection. The likely cause for lung infection is due to contamination from the morphine preparation. Unhygienic preparation and contaminated tools are among the possible factors. In addition to lung infection, chloroquine also has been detected in a number of cases of perforated gastric ulcer.

Gastric ulcer has been reported among people who take quinine [15]. Laboratory experiments using rats have demonstrated that quinine delays ulcer healing by prolonging the inflammatory phase of healing, increasing oxidative stress, reducing antioxidant activity and gastric mucus secretion. This could be one of the reasons why 3 of our cases associated with chloroquine died due to perforated gastric ulcer. Lidocaine functions as a local anesthetic that works by causing temporary numbness in the skin and also as antiarrhythmic. It was reported as an adulterant in heroin, cocaine, and amphetamine [17-19]. In cocaine, it was believed that lidocaine gives similar but stronger anesthetic effect as cocaine and gives the impression of higher quality cocaine. From our study, we found that lidocaine was present with either morphine group or amphetamine group. In total, 8 cases died due to either ischemic heart disease or

myocardial infarction associated with the presence of lidocaine in blood and/or urine.

Although lidocaine clearly prevents ventricular fibrillation that occurs during and shortly after myocardial infarction but there was a meta-analysis study suggested that prophylactic lidocaine administration might increase mortality due to pump failure or asystole [20]. Supratherapeutic concentrations of lidocaine may also produce non-specific effects in the heart. Increased sodium channel blockade may affect cardioprotection. Blockade of these channels by lidocaine can reduce ischemic sodium accumulation and sodium-dependent calcium loading [21]. Therefore, a higher level of lidocaine could actually worsen the heart condition in which we presumed that could have happened in our cases. There was some limitation of this study. The adulterants in the blood and/or urine was not quantified. Therefore, we were not able to study the direct toxicity of the adulterants. Also, cases which came through the Emergency Department were excluded. Adulterants might be present in these cases, but we were not able to distinguish them. In conclusion, adulterants in the drug of abuse are becoming common which mainly acts as diluent or debulking agents. The effect of adulterants is not negligible. It has a role in the development of natural disease and even deaths.

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