

Original Article**Frequency of Pathological Changes in Lungs of Bodies with Positive Postmortem Toxicology Results for Narcotics and Psychotropic Substances***Babak Mostafazadeh¹, Reihaneh Ebrahimi¹, Vahid Titidej², Hossein Sanaei-Zadeh^{*3}**Received: 05.07.2016**Accepted: 14.08.2016***ABSTRACT**

Background: The pattern of drug abuse in Iran has dramatically changed in recent years, turning from the traditional opioids [opium, opium dross, and refined opium dross (Shireh)] into drugs with newer forms. The present study is aimed at investigating the frequency of pathological changes in the lungs of bodies with positive postmortem toxicology results for narcotics and psychotropic substances autopsied in the forensic dissection hall of Tehran, Iran [the Iranian Legal Medicine Organization (LMO)].

Methods: The present study is a cross-sectional descriptive study. The sample consisted of 153 bodies, which had been referred to the LMO with positive results in postmortem toxicology for narcotics and psychotropic substances.

Results: We found that narcotic drugs and psychotropic substances were used more in men than women. Moreover, the average age of death due to drug use was 36 years old. In addition, methamphetamine was the mostly-used type of substances, and smoking was the most widely used method to use the drugs. Besides, the dominant consistency and color of the lungs of half of the bodies investigated were elastic brown-gray. Moreover, the most common pathologic changes observed in the lungs of the bodies investigated were congestion and edema.

Conclusion: Given the prevalence of pathological changes in the lungs of the examined bodies and congestion, edema, and pulmonary hemorrhage, the results of the present study can be particularly effective in determining the drug use and the resultant death in the absence of any previous records and/or a negative result of toxicology.

Keywords: Forensic, Lungs, Narcotics, Pathologic Changes, Psychotropic Substances.

IJT 2017 (1): 49-54**INTRODUCTION**

Addiction is a social problem associated with physical and psychological factors, which imposes high costs upon the society in many ways. Those who are addicted to injected drug use are at a high risk of death due to overdose [1]. Drug abuse, accompanied by two other mechanisms of increased rate of accidents and crimes and the direct effect of toxic substances on vital organs of the body, has increased the morbidity and mortality rate. Postmortem diagnosis of substance abuse is of utmost importance in determining the direct cause of death or studying the factors involved in fatal accidents or the deceased diseases [2].

Thus, far the pattern of drug abuse in Iran has changed significantly, turning from the traditional opioids [opium, opium dross, and refined opium dross (Shireh)] into substances with newer forms [Iranian crack, Iranian crystal,

methamphetamine (Shisheh), heroin, methadone, tramadol, etc.] [3-10]. While the analgesic effects of opioids are undeniable, abusing these substances can damage the society in numerous ways. In point of fact, the side effects of drug abuse have gone beyond medical boundaries, the epitomes of which are injecting drug users who suffer from the immediate effects of heroin injection, secondary infections [localized abscess, endocarditis, hepatitis B, and acquired immune deficiency syndrome (AIDS)], and other side effects (addiction and withdrawal syndrome). The physiological effects of opioids result from the interactions between each of these drugs and numerous receptors. Such interactions primarily show their effects on central nervous, respiratory, cardiovascular, and digestive systems. The impacts of opioids on central nervous system include analgesia through changes in pain tolerance, euphoria, and drowsiness [1].

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Cardiovascular effects are observed in very low doses and include peripheral vasodilatation, which lead to orthostatic hypotension. Some of the effects of opioids on respiratory system indicate that respiratory inhibition, non-cardiogenic pulmonary edema, hypoxia, severe asthma, and pneumonia could occur [11].

The aim of this study was to investigate the frequency of pathological changes in the lungs of the bodies with positive postmortem toxicology results for narcotics and psychotropic substances autopsied in the forensic dissection hall of Tehran, Iran [the Iranian Legal Medicine Organization (LMO)] [12]. We hope that our research could increase the society's awareness of the serious side effects of opioids and psychotropic substances. Moreover, by considering these side effects, the medical community would be able to manage the patients when the toxicity of these drugs occurs.

MATERIALS AND METHODS

The present study is a cross-sectional, retrospective study conducted on all of the deceased people having been referred to the forensic dissection hall of Tehran (the Iranian LMO) for postmortem examination for any possible reasons from 2009 to 2014. The sample consisted of 153 bodies referred to the LMO and whose results of postmortem toxicology for narcotics and psychotropic substances were positive. We studied the dead bodies' results of toxicology and pathological examination of lungs and their clinical records or criminal history in order to determine whether the cases were poisoned with narcotic drugs and psychotropic substances. The data of lung samples, being sent to Pathology Department were collected through a checklist, including the demographic data, the

type and method of drug use, and the pathological changes in the lung.

Statistical analysis of the data collected was conducted by SPSS software (Chicago, IL, USA) in the form of frequency tables for the number and percentage of the data and a Chi-square test. We considered all the ethical and legal issues in research involving human dead bodies.

RESULTS

Demographic data analysis of the dead bodies revealed that 132 (87.4%) of them were male. 9.2% of the dead bodies were in the age group of 20-25 yr old, 7% in 25-30 yr old, 23% in 30-35 yr old, 20.4% in 35-40 yr old, 9.9% in 40-45 yr old, 8.6% in 45-50 yr old, and 8.3% in the age group of 50 yr old and older. The average age of the subjects was 36.1 yr.

Five percent (n= 60) of the subjects had used methadone, 61.1% (n=198) methamphetamine (Shisheh), 8.3% (n=27) opium, 4.3% (n=12) tramadol, 2.2% (n=7) heroin, and 1.2% (n=4) Iranian crack. Some of the subjects had been using more than one type of drug. In addition, 46.7% of the subjects used drugs through smoking, 31% through oral consumption, 21.1% through injection, and 1.2% through inhalation. Some subjects had had more than one method for using the drugs. Overall, 94.9% of the subjects had a history of cigarette smoking, 81.2% had no history of the disease, and 87.5% had no history of drug use. Furthermore, 12.1% of the subjects had been using the drugs for less than one year, 12.1% for a year, 7.7% for two years, 9.9% for three years, 13.2% for four years, 8.8% from five to eight years, 18.7% from eight to ten years, and 17.6% for more than ten years.

Macroscopic changes of the lungs consist of three subcategories of color, consistency, and presence or absence of hyperemia (Table 1).

Table 1. Frequency distribution of macroscopic changes of the lungs.

Variable	Components	Frequency	Percent
Color of the lungs	Brown-gray	76	53.9
	Gray	23	16.3
	Cream-brown	20	14.2
	Brown	16	11.3
	Cream-gray	6	4.3
Consistency of the lungs	Elastic	65	42.5
	Spongy	38	24.8
	Fleshy	40	26.1
	Spongy-to-elastic	8	5.2
	Elastic-to-fleshy	1	0.7
	Spongy-to-fleshy	1	0.7
Hyperemia	No	140	91.5
	Yes	13	8.5

Microscopic examination of the lungs revealed that 19.3% of the cases had congestion and edema, 16.2% had hemorrhagic edema, 12.5% had atelectasis, 10.2% had bronchopneumonia, 9.9% had collapsed vessels, 4.7% had enlargement of the alveolar spaces, and 1% had hemorrhage.

Statistical analysis demonstrated that gray lungs had been observed more in men and brown lungs in women ($P=0.009$) (Table 2). Bronchopneumonia had also been observed more in men than in women ($P\leq 0.05$). In addition, people using inhalation and smoking methods, as compared to those using other methods of drug use, had bronchopneumonia ($P=0.003$ and $P=0.049$, respectively). Brown-gray lungs had been observed more in subjects who had used methamphetamine ($P=0.04$). Furthermore, there was a statistically significant correlation between congestion and edema and methamphetamine use ($P=0.01$), lobar pneumonia, and methamphetamine and heroin uses ($P=0.015$ and $p=0.002$, respectively), hemorrhagic edema, and fibrosis in the lungs ($P=0.048$). There was also a significant correlation between the presence of morphine in dead bodies and microscopic bronchitis ($P=0.002$). Besides, the consistency of the lungs was more of a spongy type in subjects with fibrosis of the lung, and it was more of an elastic type in those without fibrosis ($P=0.05$) (Table 3).

Table 2. The changes in the color of lungs in autopsies of subjects with positive results for narcotics and psychotropic substances.

Color of the lungs	Gender		Total
	Male	Female	
Brown-gray	66 54.5%	9 50.0%	75 54.0%
Brown	11 9.1%	4 22.2%	15 10.8%
Cream-brown	18 14.9%	2 11.1%	20 14.4%
Gray	23 19.0%	0 .0%	23 16.5%
Cream-gray	3 2.5%	3 16.7%	6 4.3%
Total	121 100.0%	18 100.0%	139 100.0%

Table 3. Changes in the consistency of the lungs in autopsies of subjects with positive results for narcotics and psychotropic substances based on the presence or absence of fibrosis.

Consistency	Fibrosis		Total
	No	Yes	
Elastic	29 56.9%	36 35.3%	65 42.5%
Spongy	4 7.8%	34 33.3%	38 24.8%
Fleshy	15 29.4%	25 24.5%	40 26.1%
Spongy-to-elastic	2 3.9%	6 5.9%	8 5.2%
Elastic-to-fleshy	1 2.0%	0 0.0%	1 0.7%
Spongy-to-fleshy	0 0.0%	1 1.0%	1 0.7%
Total	51 100.0%	102 100.0%	153 100.0%

DISCUSSION

The present study was conducted to investigate the frequency of pathological changes in the lungs of the bodies with positive postmortem tests for opioids and psychotropic substances autopsied in the dissection hall of Tehran, Iran (the Iranian LMO). Male sexual dominance in the current study in the drug use can be due to many reasons, including the men's easier access to drug dealers in the city as well as their ability to afford the substances. The average age of the bodies examined was 36 yr old. This indicates that the age of drug use has decreased over time, and this may result from easier access to street drugs than the past.

The mostly-used type of substance in this study was methamphetamine (Shisheh) and other substances were ranked lower than that. However, in the study performed by Towfighi, the mostly-used type of substance was heroin and opium [13]. The mostly-used types of narcotic substances found in the dead bodies were morphine, opium, and methadone in a descending order [14]. On the other hand, the highest percentage of poisoning with drugs in South Africa had been found in methadone consumers [15].

In addition, smoking was the most widely used method to use the drugs in this study. Approximately 35% of the cases had used the

drugs for eight years and more. In contrast, injection was used more than other methods of drug use in other studies [13, 14, 16, 17]. However, oral consumption and intravenous injection were the most and the least common methods of drug use, respectively [18].

About 95% of the cases had had a long history of smoking. Additionally, more than 80% of the bodies examined did not have any history of a particular disease and had not been taking any particular medications. Moreover, around 67% of these bodies had been reported to have sudden death. The majority of drug-induced deaths had been sudden and unexpected, being consistent with the results of the present study [17].

In our study, the color of lungs in half of the bodies was brown-gray with elastic consistency. In 91% of the bodies, no lung hyperemia was observed. The results of the microscopic examination of the lungs demonstrated that the majority of pulmonary changes in the autopsied bodies had been congestion of the lung and edema (49%). In line with the results of our study, the most common change in the lungs of the bodies examined was the congestion of the lung and edema (36.5%) [1]. Considering the fact that smoking had been used more than other methods, it can be regarded as the leading cause of the congestion and edema.

Hemorrhage in the lung will lead to the accumulation of hemosiderin in macrophage cells, which can decrease or terminate the function of these cells. Such hemorrhages are not often diagnosed due to their hidden nature and the life style of the addicts who cannot see a doctor as often as needed. They are often studied in autopsy after the patients' death. Therefore, in the obscure and sometimes important cases in which it is difficult to determine the cause of death; we can use this marker as a definite index to prove the use of narcotic drugs and psychotropic substances, which can contribute to determining the cause of death. Moreover, in our study, the results of the microscopic examination of the lungs showed that hemorrhage was observed in approximately 38% of the bodies investigated. Ninety percent of the cases had had pulmonary hemorrhage, confirming the results of our study [19]. Pulmonary hemorrhage had been observed in 90% of drug-

induced deaths [17]. The lowest pulmonary hemorrhage was observed in old addicts' bodies (50 years or older), while the amount of hemorrhage in the age group of 40 to 45 was more than those of other age groups. The most dangerous age for poisoning with drugs and psychotropic substances is the middle age [20].

Our study revealed that pulmonary edema was reported in 41% of bodies. The prevalence of smoking among the people and their smoking history suggests that pulmonary edema can be regarded as resulting from smoke inhalation. This finding is consistent with the results of other studies [17, 19].

The results of the macroscopic examination of the lungs indicated that there was a statistically significant correlation between the color of the lungs and the gender: brown lungs were observed more in females compared to males. This shows that drug use had a greater impact on the color of the lungs in women compared to men. In addition, the macroscopic examination of the lungs indicated that bronchopneumonia had been observed more in men than in women, which is likely to be owing to the reduction in body resistance and the poor nutrition. Bronchopneumonia had been observed in 30% of drug-poisoning cases and 60% of non-narcotic poisoning cases, which do not match our findings [17]. In other words, the presence of bronchopneumonia in non-narcotic cases questions its prevalence in the bodies investigated under the influence of methamphetamine.

Our study confirmed that the lungs of those who had used methamphetamine had been more related to congestion and edema compared to the lungs of those having used other drugs. Furthermore, lobar pneumonia had been observed more in bodies with a history of methamphetamine use, and the prevalence of bronchitis was significantly higher in the bodies of addicts who had used heroin.

There was a significant correlation between the hemorrhagic pulmonary edema, whose cause has not been clearly defined yet. Moreover, the fibrosis in the lungs of the bodies examined was another finding of this study.

It can also be concluded that drug use and drug-induced deaths are more prevalent among

men. However, because a higher percentage of drug use was allocated to women in previous investigations, the problem of drug use and drug-induced deaths among women cannot be ignored. This fact can be accounted for by the results of the present study indicating that the use of methamphetamine could have a great impact on the color of the lung in women's bodies. Furthermore, changes that are more emphysematous have been observed in women. By considering the average age of 36 years old for the sample in this study, it can be concluded that younger age groups are at greater risks.

Given the prevalence of pathological changes in the lungs of the bodies examined and congestion, edema, and pulmonary hemorrhage, the results of the present study can be particularly influential in determining the drug use and the resultant death in the absence of any previous records of drug use and/or a negative result of toxicology.

CONCLUSION

By considering the prevalence of pathological changes in the lungs of the bodies examined with no previous records of drug use and/or a negative result of toxicology, it is recommended that the lungs be sent for pathologic examinations. In addition, noticing the hidden nature of pulmonary hemorrhage and considering the need for reducing the rate of morbidity and mortality, it is crucial that lung examinations be done either during the addicted patients' life time or in postmortem examination of their dead bodies.

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The researchers declare no conflict of interest.

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