

Research Paper: Determining the Cause of Death Among Drug Addicts in Residential Rehab Campuses in Tehran



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ABSTRACT

Background: Determining the cause of death among drug addicts in Residential Rehab Campuses (RRCs) is of paramount importance, since it may prevent and reduce morbidity and mortality rates. Therefore, the present study was done to investigate the cause of death among drug addicts in RRCs in Kahrizak Dissection Hall, Tehran Province, Iran, from September 2011 to September 2019.

Methods: In this descriptive cross-sectional study, a total number of 166 drug addicts, who had died in the RRCs located in Tehran, Iran were examined, and the findings were analyzed using the SPSS v. 26. Moreover, the Chi-square test was utilized to compare the results.

Results: In this study, the most important causes of death, were infections, drug side effects, Myocardial Infarction (MI), and drowning, respectively. The highest frequency of death had occurred in the 31-40-year-old age group and was mostly observed in unmarried individuals. The most common causes of death were infection among the single and divorced ones and were MI for married cases. Toxicological results were generally negative in 60.84% of the cases. Also, 86.74% of the cases were non-pathological with regard to the brain tissue samples and 65.66% of the individuals had no pathological cardiac lesions. Besides, the most common microscopic findings of the lungs were associated with pulmonary edema. In the trauma group and also drug side effects and drowning groups, the most frequent pathological findings were pulmonary hemorrhage and pulmonary edema, respectively. As a whole, 69.87% of the deaths had occurred in the RRCs and 55.42% of them were assumed natural in terms of mode of occurrence.

Conclusion: The majority of the deaths in the RRCs should not have occurred if the given centers were authorized and the illegal centers were closed. Moreover, these centers should have proper management with the presence of resident physicians and trained medical staff as well as necessary medical equipment, proper nutrition, no access to drugs and other illicit substances, along with adherence to hygienic principles to minimize mortality rates among the drug addicts living in the RRCs.

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1. Introduction

Addiction, as a scourge, has many adverse effects on societies. This important health problem, with a prevalence rate of 6-15% in some western societies can reduce efficiency in the workplace among active working groups and lead to huge economic costs of health care services for affected individuals and consequently, losses due to their inactivity. The magnitude of this issue has been accordingly redoubled as addiction is witnessing a growing trend in different societies across the world [1, 2]. On the one hand, cutting access to substances and diminishing supply in societies, and on the other hand, taking effective measures to treat drug addicts and moderate demands can play key roles in keeping addiction under control in different societies [3]. Drug dependence, as a stage beyond addiction, can accordingly produce more complications for individuals and societies, thus, more comprehensive programs and preventive interventions are needed [3, 4]. Drug addiction can also have adverse effects on various systems of the human body and multiply morbidity and mortality rates [5].

Concerning the inappropriate conditions of Residential Rehab Centers (RRCs) and a large number of drug addicts in Iran, there is a dire need to have the strict observance of hygienic and therapeutic principles. Given uncertainties among families and human rights bodies about rehabilitation and treatment of drug addicts in such centers, provision of necessary health care and psychotherapy services for these clients following international standards is vital. Along with careful consideration of psychosomatic disorders and individual/group care for these individuals, paying attention to other diseases and causes of death in these people also seems to be of utmost importance. Alternatively, responsibilities for analyzing or, in other words, resolving claims related to causes of death among drug addicts in RRCs are assigned to the judiciary system and the Legal Medicine Organization (LMO). Unfortunately, there are no accurate statistics on unauthorized centers, and most of these RRCs are anonymous. The bulk of them are located in faraway gardens or complexes and they provide unfavorable conditions for their clients. Therefore, the present study was done to elucidate and establish the exact cause of death to help tackle possible defects in RRCs and promote health care status and other necessary services for drug addicts.

2. Materials and Methods

This descriptive cross-sectional study was conducted on drug addicts who died in the RRCs located in Tehran Province, Iran, referring to the LMO in the city of Tehran undergoing an autopsy with complete medical records. The data were extracted from the medical history of individuals presented in their information file and also the autopsy findings. The individuals who had died in such centers, had been referred to the LMO, had not received autopsies, or their medical records had been left incomplete, were also excluded. Therefore, of the existing 365 cases from September 2011 to September 2019, only 166 cases were reviewed corresponding to inclusion and exclusion criteria.

The information checklist was correspondingly developed based on the existing variables and the data were analyzed using the SPSS v. 26 software. First, descriptive statistics were presented and then, the Chi-square test and also t-test were employed to compare the results, and a significance level of 0.05 was considered for interpreting the relationships between the given variables.

3. Results

In this study, a total number of 166 dead drug addicts, including 18 women (10.84%) and 148 men (89.15%) in five age groups, including 21-30, 31-40, 41-50, 51-61, and older than 60 years old with a mean age of 10 ± 41 years and a median age of 37 years were studied.

The most important causes of death in the given RRCs were respectively infections (34%), drug side effects (27%), and myocardial infarction (MI: i.e., heart attacks) (21%). On the other hand, the lowest important cause of death was related to drowning (6%) (Table 1).

Concerning the cause of death based on age, most of the death cases had occurred in the age group of 31-40 years (31.3%), but no significant difference was observed with the cause of death and the 50-60-year-old age group ($P=0.066$). Also, in cases aged over 60 years, no significant differences were found regarding the causes of death ($P=0.497$). Alternatively, deaths due to infections and MI were higher compared to those induced by drug side effects, traumas, and drowning.

Considering the cause of death according to gender, the highest percentage in both genders was related to infections (%28.91 of males and %5.42 of females), and a significant difference was accordingly reported in general between the cause of death in both genders ($P=0.001$).

Table 1. Frequency of the causes of death

Cause of Death	No.(%)
Infection	57(34)
Drug side effect	44(27)
Myocardial infarction	36(21)
Multiple trauma	19(12)
Immersion side effect	10(6)

International Journal of
Medical Toxicology & Forensic Medicine

Regarding the frequency of cause of death according to marital status, the highest frequency of death cases was related to unmarried individuals (46.38%). In addition, in the single and married groups, a significant difference was spotted between the causes of death, but this difference was not significant in the divorced cases ($P=0.488$). In single and divorced individuals, infections were the most common cause of death (16.86% and 7.22%, respectively), while the most significant cause of death (11.44%) was MI in married people.

In terms of the cause of death based on the type of substance used, the majority of the individuals were in the group using mixed opiates (59.03 %). Also, significant differences were reported between the causes of death in all three groups, including amphetamine-methamphetamine, opioid, and mixed-opiate users. Moreover, the most common cause of death was due to drug side effects in amphetamine-methamphetamine users, while

it had been induced by infections in opioid and mixed opioid users (Table 2).

Regarding the incidence of death, according to toxicological results, they were generally negative in 60.84% of the cases. In the positive ones, only the causes of death had been reported to be significant in the toxicological screening of the urine samples ($P=0.001$) (Table 3).

Considering the frequency of microscopic findings of the brain-based causes of death, the majority of the cases (86.74%) had no pathological lesions in tissue samples. In the case of multiple traumas, the highest percentage of total brain lesions was related to hemorrhage (5.42%). With respect to the complications of drowning, hypoxia and cerebral edema (2.40%) were similarly reported.

Regarding the incidence of death regarding microscopic cardiac findings, no pathological lesion was observed in the tissue samples of the majority of the deceased cases

Table 2. Evaluation of the cause of death regarding the substance *

Cause of Death	Substance, No.(%)		
	Amphetamine	Methamphetamine	Opioid(Mixed)
Infection	12(7.22)	14(8.43)	31(18.67)
Drug side effect	15(9.03)	2(1.20)	27(16.26)
MI ¹	6(3.61)	11(6.62)	19(11.44)
MT ²	5(3.01)	2(1.20)	12(7.22)
Immersion side effect	1(0.60)	0(0)	9(5.42)
Total	39(23.49)	29(17.46)	98(59.03)
P	0.003	0.001	0.001

The results are prepared statistically using a t-test at a significance level of 0.05.

International Journal of
Medical Toxicology & Forensic Medicine

¹MI: Myocardial Infarction; ²Multiple Trauma.

Table 3. Evaluation of the cause of death regarding toxicology tests*

Cause of Death	Substance, No.(%)			
	Positive			Negative
	Stomach	Bile	Urine	
Infection	1(0.60)	2(1.20)	14(8.43)	40(24.09)
Drug side effect	4(2.40)	1(0.60)	17(10.24)	22(13.25)
MI ¹	3(1.80)	0(0)	12(7.22)	21(12.65)
MT ²	2(1.20)	2(1.20)	3(1.88)	12(7.22)
Immersion side effect	0(0)	2(1.20)	2(1.20)	6(3.61)
Total	10(6.02)	7(4.21)	48(28.91)	101(60.84)
P-value	0.572	0.934	0.001	0.0001

The results are prepared statistically using a t-test at a significance level of 0.05.

International Journal of
Medical Toxicology & Forensic Medicine

¹MI: Myocardial infarction; ²Multiple trauma

(65.66 Also, ischemia with 16.26% was found in the clients who had died due to MI, which was predictable according to the criteria for tissue diagnosis in this disease.

Concerning the cause of death based on microscopic findings of the lung, pulmonary edema was the most common symptom in all cases (34.93%), but pulmonary hemorrhage was not significantly correlated with the cause of death (P=0.264). Correspondingly, in the group with multiple trauma, the highest percentage was associated with pulmonary hemorrhage (3.01%). Considering the side effects of drowning, the highest percentage was related to pulmonary edema.

Regarding the frequency of the cause of death based on locations, the deaths had occurred in the RRCs in most cases (69.86%) and there was a statistically significant difference in general in the cause of death in both groups in the RRCs or hospitals (P=0.0001). The biggest difference between the frequency of deaths in the RRCs and hospitals was related to the cases, losing their lives because of trauma.

Concerning the frequency of causes of death based on the mode of occurrence, most death cases (55.42%) were natural and mainly due to infections and MI. These findings were in line with the statistics of the causes of death in this

Table 4. Evaluation of the cause of death regarding the type of death *

Cause of Death	Type of Death			
	Accidental	Natural	Homicide	Suicide
Infection	1(0.60)	56(33.73)	0(0)	0(0)
Drug side effect	44(26.50)	0(0)	0(0)	0(0)
MI ¹	0(0)	36(21.68)	0(0)	0(0)
MT ²	3(1.80)	0(0)	14(8.43)	2(1.20)
Immersion side effect	0(0)	0(0)	10(6.02)	0(0)
Total	48(28.91)	92(55.42)	24(14.45)	2(1.20)
P-value	0.0001	0.037	0.414

The results are prepared statistically using a t-test at a significance level of 0.05.

International Journal of
Medical Toxicology & Forensic Medicine

¹MI: Myocardial Infarction; ²Multiple Trauma

society, so that providing health care and specialized medical and nursing services in the RRCs could line up the mortality rate with that reported in the given society (Table 4).

4. Discussion

In the present study, in agreement with the one conducted in 2019 on the causes of death among drug addicts [6], the findings indicated infections, drug side effects, MI, multiple traumas, suicide, and homicide, especially through drowning, as the most common causes of death in these individuals. Since infections in most cases could be attributed to disease complications, environment, health status, and poor nutrition [7], appropriate hygienic management of the RRCs could lead to control and prevention of a significant percentage of the concerns mentioned. Regarding drug side effects and MI, reported as the most frequent causes of death in this study next to infections, unprincipled prescription of medications by non-physicians, lacking qualifications and knowledge, as well as improper supervision and care, were also effective in most cases. Although MI could occur due to side effects, such as the use of stimulants or withdrawal, fewer causes of death in this study were related to drowning, which could be due to the seizures induced by the complications of tramadol use or the effects of taking phenothiazine. They might have also come about following life-threatening arrhythmias.

Considering that ischemia was observed in microscopic cardiac findings in most cases in this study, it seems that appropriate and timely treatment and control of drug side effects, non-use of stimulants, as well as controlled withdrawal [8, 9] can minimize the number of deaths in the RRCs. Concerning the significant percentage of trauma prevalence along with suicide and homicide by drowning, physical conflicts and beatings were considered very effective [10].

Some other important findings in the present study were that deaths due to infections and MI were higher compared to those induced by drug side effects, traumas, and drowning. These findings reflected the weightier likelihood of physical involvement leading to traumas and the use of stimulants resulting in drug side effects at a younger age. Regarding the frequency of cause of death according to marital status, the highest frequency of deaths was reported in unmarried individuals. Moreover, in the single and divorced people, infections were mentioned as the most noticeable cause of death, while in the married cases, the most common cause of death was MI and the highest cause of death due to trauma was seen in the young and single individuals who could natu-

rally get into more fights due to the use of stimulants. In addition, in amphetamine-methamphetamine users, the most common cause of death was due to drug side effects, while in the opioid and mixed opiate users, it was caused by infections. Amphetamine-methamphetamine use could thus cause fatal arrhythmias, malignant hypertension, and life-threatening cardiac complications. However, opiates could induce more respiratory depression as well as pulmonary aspiration and infections. Therefore, the results were as might be expected.

In the present study, toxicological results were generally negative in more than half of the cases. The incidence of death was accordingly due to factors other than drug overdose, including infections, Multiple Organ Failure (MOF), peritonitis, fatal cardiac arrhythmias, acute cardiac complications (i.e., strokes), traumas, etc. On the other hand, sometimes in deaths following a drug overdose, drug traceability was not measurable due to its short half-life or rapid conversion into relevant metabolites. In addition to the above concerns, laboratory errors and false-negative cases should be taken into consideration. In line with previous studies, the highest frequency of the cause of death among those whose toxicological screening results of their urine samples were positive was drug side effects [11-13].

In the present study, most of the cases had no pathologic lesions in their brain tissue samples, indicating that the deaths had occurred in less than 45 minutes and there was no chance to have cellular changes in the brain tissues. Also, no pathological cardiac lesions were observed in the tissue samples of the majority of the deceased, because these deaths had occurred in less than eight hours and changes in the heart tissues could often take more than this time. Moreover, based on the frequency of the cause of death in accordance with the microscopic examination of the lung, pulmonary edema was the most common one in all cases. It should be noted that lung functioning depends on the heart and the brain and damages to these two organs could often cause tissue changes in the lungs and more commonly, lead to pulmonary edema. Considering trauma groups and multiple trauma, the highest percentage was related to pulmonary hemorrhage. In the case of drug side effects and drowning, the highest percentage of pulmonary edema was not in line with the results of a study conducted in 2019 [14].

In this study, most cases of death had occurred in the RRCs. The biggest difference between the frequency of deaths in the RRCs and hospitals was also related to deaths because of traumas, reflecting the lack of proper and timely treatment for the affected individuals as well

as no immediate referrals to hospitals, resulting in the early death of those living in the RRCs.

With regard to gender, a significant relationship was observed with the cause of death among drug addicts. In this regard, in a study on 2100 women living in RRCs, in the city of Tehran, addiction had been kept secret in women compared to men due to a gender-specific dominating culture in Iran, which demanded further attention [15]. On the other hand, it has been recommended that people taking amphetamine and methadone required gastrointestinal examinations [16]. Moreover, in the present study on 166 cases, a significant difference was found in the toxicological screening of the urine samples, while this difference was not significant in the gastric and biliary ones. Considering the frequency of causes of death based on the mode of occurrence, most of the deaths were natural and often due to infections and MI. These findings were consistent with the statistics on the causes of death in this society so that providing health care and specialized medical and nursing services in the RRCs could line up the mortality rate with that reported in society.

In a study focused on challenges of improving the quality of RRCs, allocating necessary budgets and performing adequate monitoring of these centers has been emphasized in order to provide optimal, correct, and effective services [17]. In this regard, in a study in 1999 on illicit drug abuse and strategies of local RRCs in China, it has been established that rehabilitation was about 80% in the centers concerned during 12 months of training and treatment [18]. By implementing such programs, mortality rates in Iran could be also minimized particularly with regard to the fact that drug type could shape the causes of death in the present study in agreement with other investigations [19, 20]; therefore, most mortality cases could be prevented. Regarding the time of death, it seems that no access to resident physicians and medical staff to diagnose emergency cases, lack of ambulances to transfer the drug addicts in the RRCs to medical centers in acute medical conditions, the use of personal vehicles to transport the patients, as well as long-distance of the given centers from the medical centers located in the city center could be considered effective in justifying the high number of deaths in the RRCs in the present study.

Concerning the improper space of the RRCs and the overcrowded drug addicts as well as the need for strict adherence to hygienic principles and provision of necessary health care services in accordance with international standards, and attention to psychosomatic issues and individual/group care for drug addicts, determining the causes of death in these cases was very important. On the other hand, responsibilities for analyzing or re-

solving claims related to causes of death among drug addicts in RRCs are assigned to the judiciary system and the LMO. Unfortunately, there are no accurate statistics on unauthorized centers, and most of these RRCs are anonymous. Most of them are also located around far-away gardens or complexes, and of course, they provide unfavorable conditions for clients. Based on the findings of this study, mismanagements in the RRCs and neglect in terms of physical and mental health could be involved in the causes of death among these cases.

5. Conclusion

In this study, infections, drug side effects, MI, traumas, suicide, and homicide, especially through drowning, were cited as the most common causes of death among the drug addicts in the RRCs located in Tehran Province, Iran. For that reason, standardization of the RRCs, direct monitoring of the relevant bodies, correct management, recruitment of trained staff and health care professionals, including resident physicians, as well as the use of proper equipment, nutrition, and training to motivate these individuals to enter into society and to promote their cultural levels might be effective in the process of reducing deaths among drug addicts living in these centers.

Ethical Considerations

Compliance with ethical guidelines

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Author's contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no potential conflict of interest

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