FORENSIC MEDICAL ASPECTS OF EXAMINATION OF DECEISED WITH DATA FOR DRUG ADDICTION

Alexandar Alexandrov*, Vesela Ivanova, Ilina Brainova*, Todor Todorov**, Alexandra Anastasova*, Valja Dzabarska*, Teodora Kiryakova*, Stanislav Hristov***

**Department of Forensic Medicine and Deontology, Medical Faculty, Medical Universisy - Sofia*

***Department of General and Clinical Pathology, Medical Faculty, Medical Universisy – Sofia*

***Corresponding author**:*
Alexandar Alexandrov, MD, PhD,
Sofia, 1431 Street "Zdrave" № 2
e-mail: sashko_forensic@yahoo.com

ABSTRACT

A statistical and morphological study of forensic medical aspects of deaths related to drug abuse in the period 2006-2009 is presented. Materials and methods: complete forensic medical examination – collecting anamnestic and criminological data, examination of the crime/accident scene, autopsy, histological examination, toxicological analysis. The research is based on data of the Department of Forensic Medicine and Deontology, Medical University, Sofia. Results: there is a tendency of a relatively stable level of deaths among drug addicts, mainly due to acute poisonings with illicit substances, pathological complications as a result of drug abuse and different traumatic causes of death, including accidents, suicides and homicides under the influence of drugs. Toxicological results showed that the prevailing drug of abuse in the period remains heroin alone or in combinations with other illicit substances, alcohol and medicines. The pathological changes due to drug abuse established in the present research are mainly in the skin and underlying tissues, lungs, cardiovascular system, liver and kidneys and are result of the direct and indirect effects of illicit drugs and their impurities.

Key words: *drug abuse; drug addiction, cause of death, toxicological analysis*

INTRODUCTION

In the last decade there is an increase in the number of deaths due to drug abuse, especially among young people. Based on the assessment of the European Monitoring Centre for Drugs and Drug Addiction, in the European Union there are 6500-9000 drug related deaths per year due to acute poisonings. According to the official European Union statistics 4.2 (between 1 and 7) persens per 1000 in the age group of 15-64 years abuse opioids (4).

THE AIM of this study is to make statistical and morphological analysis with a comprehensive forensic medical evaluation of cases of deceased drug addicts - subject to forensic medical examination in the Department of Forensic Medicine and Deontology (DFMD) at University Hospital "Alexandrovska" EAD – Sofia, for the period 2006 to 2009.

MATERIAL AND METHODS

4516 autopsies were performed in the DFMD for the period 2006 - 2009. The toxicological analysis of biological samples (blood, urine, cerebrospinal fluid and standard primary and secondary tissue and organ samples, including stomach and small intestine with contents, lung, brain, liver and kidney) in 169 of the autopsies demonstrated the presence of various illicit drugs and their metabolites.

The stepwise analysis of the following data was used in each case: 1. Investigation of the crime scene (scene of death, evidence of drug use - syringe preparations, empty drug packs); 2.

Initial examination of the cadaver focusing on the predilection areas for drug administration; 3. Evidence for reactions to the drug (vomited stomach contents, etc.); 4. Collecting data from relatives, friends, witnesses and forensic medical information; 5. Morphological findings from the autopsy and histological examination of target tissues and organs compared with the results of the toxicological analysis.

Toxicological analysis was performed by the methods of thin layer chromatography, UV spectrophotometry, gas chromatography, and immunological screening tests.

RESULTS

Causes of drug related deaths subject of forensic medical examination are as follows:

For the year 2006 - 39 cases, including 35 males and 4 females. Acute poisonings - 31 cases. Violent causes of death - 5 cases: motor vehicle accident - 1 case, falls from heights (suicides) - 3 cases, acute blood loss - 1 case due to cutting of the femoral blood vessels during surgery for phlegmon of the left inguino-femoral area. Diseases associated with prolonged use of illicit drugs - 3 cases: 1 case of pneumonia, 1 with fibrocavernous tuberculosis with pneumonia, 1 with phlegmon localized in the area of drug injecting with fistula and erosion of the femoral artery.

For the year 2007 - 43cases, including 32 males and 11 females. Acute poisonings - 34 cases. Violent causes of death - 9 cases: 1 motor vehicle accident, hangings (suicides) - 2 cases, fall from height (suicide) - 1 case, firearm (gun) injury of the head (suicide) - 1 case. Morbid cause of death - 0 cases.

For the year 2008 - 39 cases, including 35 males and 4 females. Acute poisonings - 37 cases. Violent causes of death - 2 cases: one by hanging (suicide) and one due to fall from height (suicide). Morbid cause of death - 0 cases.

For the year 2009 - 48 cases, including 43 males and 5 females. Acute poisonings - 36 cases. Violent causes of death - 8 cases: positional asphyxia - 1 case; stab-incised injuries (homicides) - 2 cases; firearm injury (homicide) - 1 case; motor vehicle accident - 1 case; hanging (suicide) - 1 case; acute poisonings with medicines - 2 cases. Morbid causes of death associated with prolonged drug abuse - 4 cases, including 2 cases with cachexia and bilateral lobular pneumonia, 1 case of Mendelson's syndrome and 1 case of pulmonary embolism.

According to the toxicological analysis for the period, death is due to heroin intoxication in 92% of cases: 56% - heroin; 31% - heroin combined with ethanol; 5% - heroin and stimulants. Cases of poisonings with other drugs in this study represent a total of 8%, which include poisonings with methadone in combination with ethanol and/or stimulants.

During the forensic medical examination macroscopic morphological and histological changes were found in various tissues and organs. The morphological characteristics and severity of the changes are related with several factors: the duration and frequency of use, route of administration, purity of drugs and type of impurities, lack of aseptic administration of injection drugs.

The prolonged intravenous use of drugs results in macroscopic morphological changes of varying severity in the predilection areas of drug application involving the skin, subcutaneous soft tissues, mucous membranes and blood vessels. In the cases of deaths due to acute poisonings with heroin or its derivatives, "fresh" and "old" needle stitches of the skin are most commonly found in the elbow well, the upper surface of the hands, forearms, the dorsal surface of the wrist and foot. In some cases there are "hidden" applications in areas such as the venous plexus under the tongue, inguinal area (**Fig. 1A, B, C, D**), popliteal wells or penis. In the majority of cases in these areas there were bruises, calcification along the veins, and secondary scarring from healed abscesses or surgical manipulations associated with them. The application in the inguinal areas leads to development of fibrous tissue, abscesses of different size and depth of involvement of the soft tissues, and phlegmones in the inguino-femoral region (**Fig. 1B**). In two of the cases, the cause of death was acute blood loss - one case with erosion of the femoral artery due to fistulated phlegmone

(**Fig. 1B**), and another with complication of arterio-venous anastomoses as a result of multiple injections. Often in the areas of administration there were big, irregular and cone-shape cicatrices (**Fig. 1A, C**). By dissection fibrosis of the underlying soft tissues and blood vessels was found. Sometimes within the fibrous tissue, suffusions from superimposed "fresh" applications of drugs were found (**Fig. 1D**).

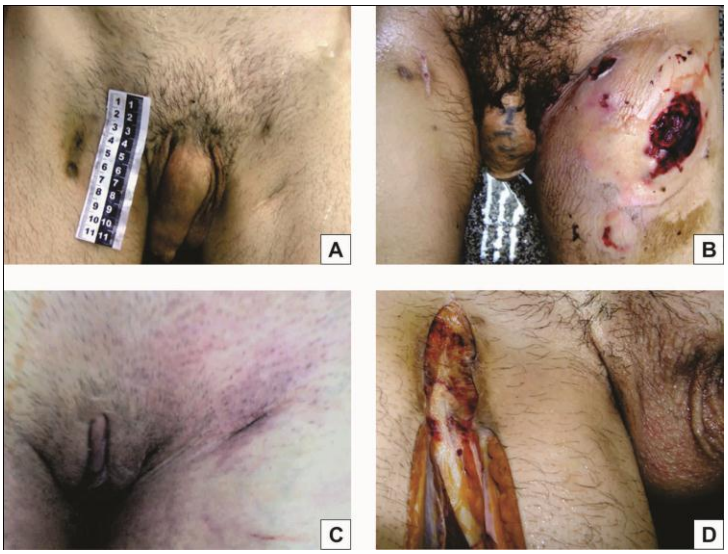

Figure 1. A – cicatrices in the inguino-femoral areas with "fresh" needle stitches. **B** – phlegmone with fistula and erosion of the femoral artery. **C** – cone-shaped cicatrix in the left inguino-femoral area. **D** – fibrous tissue in the right inguino-femoral area with superimposed "fresh" needle stitches.

Microscopic examination revealed inflammatory changes in the airways and lungs, most often nonspecific (bronchitis, bronchiolitis, pneumonia), aspiration pneumonia (Mendelson's syndrome), Pneumocystis carinii pneumonia (**Fig. 2A**), actinomycosis (**Fig. 2B**), tuberculosis, vascular damage - arteritis, thrombosis and fibrosis of the pulmonary arteries, arterioles and capillaries. In four of the cases the histological examination revealed foreign crystal materials (particles undissolved tablets and impurities) injected with the drug reaching the blood vessels of the lung and heart (**Fig. 2C**). In the myocardium focal ondulation and fragmentation of cardiomyocytes, focal lipomatosis and fibrosis around the vessels were found (**Fig. 2D**). In one of the cases there were sclerotic changes of the tricuspid valve, as a result of past valvulitis. In the majority of drug addicts fatty liver associated with portal inflammation was observed. In the kidney there was tubule-interstitial damage. In the case with fibrous cavernous tuberculosis there was kidney amyloid deposition.

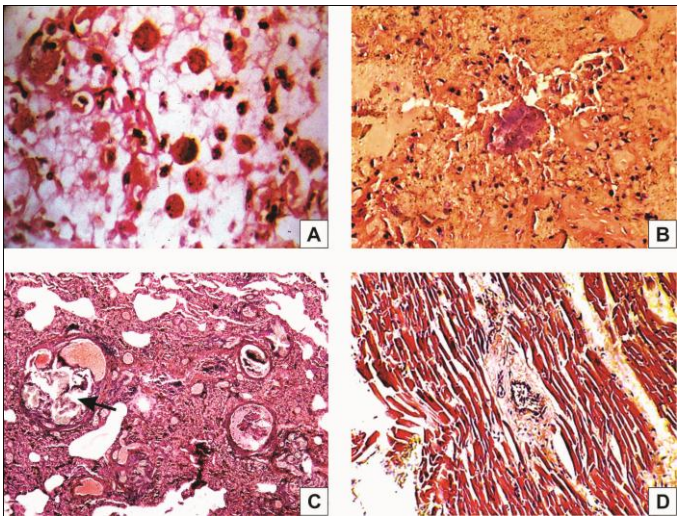

Figure 2. A – Pneumocystis carinii pneumonia, Hematoxylin&Eosin. **B** – actinomycosis, Hematoxylin&Eosin. **C** – crystalloid substances in the lumen of pulmonary artery brunch (arrow), Hematoxylin&Eosin. **D** – focal ondulation and fragmentation of cardiomyocytes, perivascular fibrosis, Hematoxylin&Eosin.

DISCUSSION

The study of the causes of death of deceased drug addicts, examined in the DFMD for the period 2006-2009, presented 169 such cases. Screening research from 1989 revealed only one case of deceased drug addict. In 1995 there were 13 cases and in the year of 2000 the number increased to 42 cases, which at the period up to 2009 formed a so called "plateau" of deaths due to drug abuse.

According to presented data in most of the cases the cause of death was acute poisonings with heroin and combinations of heroin with antidepressants and other drugs or ethanol which leads to potentiating and accumulation of effects. In other cases with traumatic cause of death, the accidents occurred under the influence of different illicit drugs. In some cases, the death was due to superimposition of direct effect of drugs combined with pathological changes in different tissues and organs as a result of prolonged drug addiction. These changes were observed in the skin and soft tissues, myocardium, lung, liver and kidneys and might be the cause of death in and of their selves, or they might be pathological background for development of inflammatory diseases with complications similar to those found in the literature (1, 2, 3, 5, 6).

According to morphological and immunohistochemical studies of Zaĭratiants&Gasanov (7) on the organs of the immune system of HIV-negative heroin addicts, in 98.6% of cases disturbances in the immune system were established, which depended on the duration of drug use and were characterized by the inversion of the T-helper / T-suppressor index, reduction of proliferation activity of the lymphocytes and the production of immunoglobulins. The described in the present study changes in the lung (tracheobronchitis, pneumonia, actinomycosis and Pneumocystis carinii pneumonia) are related with decreased immunity and are similar to those found in the literature. In the cardiovascular system, some authors (5) observed inflammatory and dystrophic changes in the myocardium and the heart valves (especially the tricuspid valve) as described in this study. The liver is one of the most commonly damaged organs, because of its metabolic function, manifested morphologically with fatty degenerated hepatocytes, as well as signs of toxic hepatitis in combination with splenomegaly. Because of the excretory function of the kidneys, they are target organs for toxic drug effects expressed with changes in tubule-interstitial system: interstitial fibrosis, mononuclear infiltration and deposition of amyloid (1, 2, 3, 6).

CONCLUSIONS

Knowledge about the morphological substrate of changes in different tissues and organs associated with drug abuse is a prerequisite for correct and rapid diagnosis in various cases of drug related deaths with positive effect both on clinical practice and criminological investigation. Heroin addiction has consequences directly result in criminal behavior. Therefore the data collected from forensic medical examinations should be included in a bulletin for the needs of criminology and the justice system.

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