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Screening for Abused Drugs in Donated Blood

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ABSTRACT

Donor blood represents one of the most important sources of therapeutic preparations required for various cases necessitating transfusions of plasma or erythrocytes. While, thorough screening tests for, for example, syphilis and other infectious agents are conducted (as a routine test), other analytical tests aiming at the detection of drug residues are rare (if at all) performed. The present study was designed-as a preliminary study-to discover drugs of abuse in blood in donating King Abdul-Aziz Hospital (Makkah, Saudi Arabia). A total of 300 EDTA plasma samples (approximately 1.5 mL each) was obtained from a King Abdul-Aziz Hospital blood bank from voluntary blood donors after regular whole blood donation. Immediately after sampling, the plasma was separated in a centrifuge, transferred to a 2 mL Eppendorf tube and frozen until analysis. All donors were males; in the preliminary test, 28 cases (9.3%) were positive for one of screened substance (1 case; 0.3% were positive for amphetamine, 7 cases (2.3%) were positive for tricyclic antidepressants TCA and 20 cases (6.7%) were positive for tetrahydrocannabinol (THC). On the second screen, confirmed cases were 20 cases (6.7%), 1 case (0.3%) was positive for amphetamine, 2 cases (0.7%) were positive for TCA and 17 cases (5.7%). Positive cases were significantly younger than negative cases (25.80±2.58 vs. 27.34±3.08 years, respectively). The present study sheds light on the importance of screening blood and blood products in blood banks for commonly abused drugs, besides regular checkup for infectious diseases. It is advised to put this step as a routine in blood screening as much as the facilities permit to do so.

Key words: Abused drugs, screening, blood

INTRODUCTION

The term substance use disorders (DSM-V criteria) refer to the use of one or more substances, leading to a clinically significant impairment or distress (APA., 2013). The DSM-V recognizes ten separate classes of drugs that can lead to substance use disorders. These classes include: alcohol, caffeine, cannabis, hallucinogens, inhalants, opioids, sedatives, hypnotics, anxiolytics, stimulants and other or unknown substances (Sweileh *et al*., 2014).

Donor blood represents one of the most important sources of therapeutic preparations required for various cases necessitating transfusions of plasma or erythrocytes. According to the World

Health Organization (WHO) survey of 2008, approximately 92 million blood donations are collected annually (WHO., 2012) for which national health care policies apply concerning adequate collection, storage, testing and processing.

In order to minimize the risks associated with transfusions concerning the transmission of blood-borne infectious agents, several analytical measures as well as (anti-viral) preventive treatments are common practice (FDA., 2001), which however vary considerably between high-and low-income countries (WHO., 2012).

Human plasma can be utilized as a therapeutic product (referred to as clinical plasma or fresh-frozen plasma) or is subjected to plasma fractionation processes to obtain desired sub-fractions for specific indications (Burnouf, 2007; De Silvestro *et al*., 2007).

While, thorough screening tests for example, syphilis, hepatitis and the Human Immunodeficiency Virus (HIV) are conducted (as a routine test), other analytical quality controls, for instance aiming at the detection of drug residues are rarely (if at all) performed but could be relevant for individuals being hyper-responsive concerning certain types of therapeutic agents (Thevis *et al*., 2013).

Thus, the present study was designed-as a preliminary study-to discover drugs of abuse on donating blood in King Abdul-Aziz Hospital (Makkah, Saudi Arabia).

MATERIALS AND METHODS

A total of 300 EDTA plasma samples (approximately, 1.5 mL each) was obtained from a King Abdul-Aziz Hospital blood bank; from voluntary blood donors after regular whole blood donation. Immediately after sampling, the plasma was separated in a centrifuge, transferred to a 2 mL Eppendorf tube and frozen until analysis. The study was conducted with the approval of the local ethics committee. All samples were from male donors. Screening was done for the following compounds (benzodiazepines, alkaloids, amphetamine and its substitutes, phenothiazines, barbituric acid, tricyclic antidepressants, ethyl alcohol, cannabis, tramadol and opium). The analysis was done by Abbott Architect c4100 (A fully automated system), as a preliminary test and positive results were confirmed by GcMs-QP2010 by SHIMADZU.

Principle of preliminary assay: The multiagent assay is a homogenous enzyme immunoassay using ready to use liquid reagents. The assay use polyclonal antibodies that detect most drugs in serum or plasma. The assay is based on competition between an enzyme-labeled drugs and the drug from the serum or plasma for a fixed number of specific antibody binding sites. When the drug is absent from the sample, the specific antibody binds to the drug labeled with G6PDH and the enzyme activity is inhibited. This phenomenon creates a direct relationship between the drug concentration in the serum or plasma and enzyme activity. The G6PDH enzyme activity is determined spectrophotometrically at 316 for C4100 by measuring its ability to convert NAD to NADH.

Gas chromatography mass spectrometry: Gas Chromatography Mass Spectrometry (GC-MS) is a technique for the analysis and quantitation of organic volatile and semi-volatile compounds. It was used in separates mixtures into individual components using a temperature-controlled capillary column. Smaller GC-MS, gas chromatography mass spectrometry analysis molecules with

lower boiling points travel down the column more quickly than larger molecules with higher boiling point. Mass Spectrometry (MS) was used to identify the various components from their mass spectra. Each compound has a unique or a near unique mass spectrum that can be compared with mass spectral databases and thus identified.

Statistical analysis of data: The collected data organized, tabulated and statistically analyzed using the Statistical Package for Social Science (SPSS) version 16 (SPSS Inc., USA). Categorical data were represented as relative frequency and percentage; while, quantitative data were represented as mean, standard deviation, minimum and maximum. For comparison between two means, the independent samples (t) test was used and p value≤0.05 was considered significant.

RESULTS

The present study included 300 blood samples; all donors were males; in the preliminary test, 26 cases (9.3%) were positive for one of screened substance (1 case; 0.3% was positive for amphetamine, 7 cases (2.3%) were positive for tricyclic antidepressants (TCA) and 20 cases (6.7%) were positive for tetrahydrocannabinol (THC). In the second screen, confirmed cases were 20 cases (6.7%); 1 case (0.3%) were positive for amphetamine, 2 cases (0.7%) were positive for TCA and 17 cases (5.7%) for tetrahydrocannabinol (The flow chart in Fig. 1 represented these results).

Regarding age, it ranged from 20-39 years with mean age of 27.24±3.07 years and positive cases were significantly younger than negative cases (25.80±2.58 vs 27.34±3.08 years, respectively) (Table 1).

Table 1: Age distribution in studying cases

Parameters	N	Mean	S. D	Minimum	Maximum	t	p
Positive	20	25.80	2.58	20.00	30.00	2.18	0.030*
Negative	280	27.34	3.08	21.00	39.00		
Total	300	27.24	3.07	20.00	39.00		

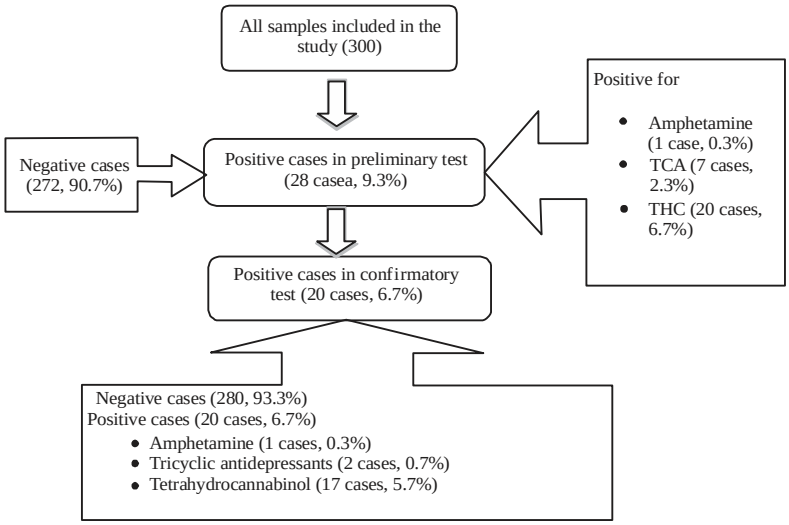

Fig. 1: Flow chart of the present study steps

DISCUSSION

Screening of blood and blood products are very important job in every day healthcare practice. However, it is essentially directed to infectious agents such as hepatitis or human immunodeficiency viruses. As donor blood represents one of the most important sources of therapeutic preparations required for various cases necessitating transfusions of plasma or erythrocytes, the screening process is vital for blood banks. According to the World Health Organization (WHO) survey of 2008, approximately 92 million blood donations are collected annually (WHO., 2008).

In many countries throughout the world, various drugs have long been abused for their effects especially euphoria they produce. Such substance includes hypnotics, stimulants and opiates. Each country has its own regulations to control illegal sale, synthesis, transfer and use of these drugs, with an ultimate goal to stop drug abuse. However, the problem of abused drugs still grows every year. Drug abuse is usually associated with dangerous intoxications and death (Toubou *et al*., 2014).

Drug testing and substance abuse have increased throughout the past decade. Common areas for drug testing include the workplace (e.g, preemployment and random testing), the military, athletics, legal and criminal situations (e.g, post accident testing, rehabilitation testing of ex-convicts) and health care (e.g, treatment, compliance monitoring, cause of death) (Moeller *et al*., 2008).

Two types of drug and substance abuse testing are typically used, immunoassay and Gas Chromatography-Mass Spectrometry (GC-MS). Immunoassays use antibodies to detect the presence of specific drugs or metabolites, are the most common method for the initial screening process. Advantages of immunoassays include large-scale screening through automation and rapid detection. The main disadvantage of immunoassays is obtaining false-positive results, when detection of a drug in the same class requires a second test for confirmation. Results of immunoassays are always considered presumptive until confirmed by a laboratory-based test for the specific drug (e.g, GC-MS or high-performance liquid chromatography) (Fenton, 2001).

The present study was designed to screen drugs and substance abuse in donating blood bank in Saudi Arabia to shed light on the incidence of-and the most commonly abused substances.

The results of the present study revealed that, cannabis (tetrahydrocannabinol) are the most common detected abused substance, followed by tricyclic antidepressants and finally amphetamine. These results are in accordance with report of UNODC (2003) where this report identified that, cannabis was the most commonly abused substance worldwide, with an estimated annual prevalence of about 163 million or about 3.9% of the global population aged 15 years or above in 2000/2001.

In addition, recent EMCDDA (2013) estimated that 15.4 million young Europeans (aged 15-34) (11.7% of this age group) used cannabis in 2012, with 9.2 million of them aged 15-24 (14.9%). Cannabis use is generally higher among males. Furthermore, Beck *et al*. (2013) reported that, In France during 2010, approximately one-third (33%) of adults aged 18-64 stated that they had been consumed cannabis during their life. They added, of people aged 18-64, current use (i.e., use in the last 12 months) ranges between 4 and 8% (the current study 5.7%). This use was mainly in younger generations: 18% of males and 9% of females aged 18-25 are general users, 9 and 4%, respectively, are regular users.

In the present study, 8 cases out of 28 positive cases in the first screen were falsely positive. It had been reported that, immunoassays are subject to false positive test results. For example, amphetamine immunoassays suffer from more interferences than any other immunoassays used for screening of abused drugs. Many over-the-counter cold and cough medications containing ephedrine or pseudoephedrine can produce false positive test results. In addition, many sympathomimetic amines found in over-the-counter medications can also cause false positive test results. Furthermore, other drugs such as bupropion (its metabolites), trazodone, labetalol and doxepin can also cause false positive test results. Finally, available data confirmed results of the present work, where it was reported that non-steroidal anti-inflammatory drugs, pantoprazole and efavirenz can give false positive immunoassay results for tetrahydrocannabinol (Dasgupta and Wahed, 2014).

Interestingly, the present study included TCA in the screen, although assays for drugs of abuse do not routinely test for TCAs. However, rapid screening for TCA is often valuable in emergency situations, such as intentional overdose or toxicity. Results of screening for TCA have an important role in determining the early management of patients; however, many commonly prescribed and over-the counter medications can lead to false-positive results from TCA assays (Moeller *et al*., 2008).

In a review article, Bassiony (2013) did a PubMed search and reviewing national journals, the United Nations Office on Drug and Crime (UNODC) reports, World Health Organization (WHO) reports and conference presentations over the last two decades. They reported that, among Saudi patients in addiction treatment centers, the most commonly abused substances were amphetamine (4-70.7%,), heroin (6.6-83.6%), alcohol (9-70.3%) and cannabis (1-60%). Over the last decade, there was an increase in the use of cannabis and amphetamine and decrease in the use of heroin and volatile substances. They explained these finding by peer pressure and psychosocial stresses as risk factors for initiation as well as relapse of substance abuse. They added, anxiety, depression and hepatitis were the most common co-morbid disorders among the Saudi patients. It is clear the sample size is quite different between our and their study. However, the results of the present study revealed a comparable situation of the general population when compared to patients in addiction treatment centers.

CONCLUSION

In short, the present study sheds light on the importance of screening blood and blood products in blood banks for commonly abused drugs, besides regular checkup for infectious diseases. It is advised to put this step as a routine in blood screening as much as the facilities permit to do so.

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