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Short Communication

Screening of medicinal drugs, drugs of abuse and alcohol in clinical and forensic specimens

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Forensic and medical toxicology are the two sides of the same medal. Let's understand this with this case. At seven o'clock in the morning, a young man is controlled by a police patrol because of erratic driving behavior. The police officer decides to do urine and blood analysis of the driver, who is brought to the hospital. The screening result of urine is positive for THC-COOH (the inactive metabolite of THC). In blood, the results indicate a concentration of 18 µg/l for THC (active substance of Cannabis), 13 µg/l for 11-OH-THC (the active metabolite of THC) and 170 µg/l for THC-COOH. In a forensic consideration, the Swiss law (i) has defined a 1.5 µg/l as a per se value for THC in blood. In our case, with 18 µg/l for THC the driver will consequently be pursued. This is one side of the medal. But on the other side, from a medical point of view, the value of THC-COOH is interesting as well. Indeed, in a study, published by Fabritius M, et al. (2013), the authors observed a: significantly high differences in THC-COOH concentrations between two groups of smokers." They write that a free THC-COOH concentration below 3 µg/L suggests an occasional consumption (≤ 1 joint/week) while a concentration higher than 40 µg/L corresponds to heavy use (≥ 10 joints/month) [1]. They indicate that: The decision threshold of 40 µg/L could be a cut-off for possible disqualification for driving while under the influence of cannabis. A further medical assessment and follow-up would be necessary for the reissuing of a driving license once abstinence from cannabis has been demonstrated. Moreover, they write that: A THC-COOH level below 3 µg/L would indicate that no medical assessment is required. Thus, a blood concentration of THC-COOH as a biomarker could help a regular smoker to be treated for Cannabis addiction. In our case, the driver, with a measured value of THC-COOH as high as 170 µg/l is undoubtedly an addicted smoker. In a not published epidemiological study, we observed that between 2015 and 2019, in the Valais, a region of Switzerland, among the 1820 drivers suspected by the police to drive under influence of Drugs of Abuse or medication, 989 (54 %) had consumed cannabis before driving. Among these cannabis consumers, 853 (86 %) presented a concentration of THC equal or higher than 1.5 µg/l and 516 (60 %) presented a THC-COOH blood concentration equal or higher than 40 µg/L. These results show the importance of THC and THC-COOH screening not only in forensics situations but in the medical context as well.

Another interesting situation is alcohol screening. Like other countries, driving under the influence of alcohol is not allowed in Switzerland. The per se limit in Switzerland is equal to 0.25 mg/l in-breath, and 0.5 g/kg in blood. Moreover, a second cut-off (0.8 mg/l or 1.6 g/kg) is defined by law for people considered as regular alcohol drinkers. Between 2108 and 2019 in the Valais, considering only the blood alcohol test made in our laboratory, among the 649 drivers suspected by the police to drive under influence of alcohol, 420 (64 %) had consumed presented a blood alcohol concentration equal or higher than 0.5 g/kg. In this population, 190 (45 %) presented a blood alcohol concentration equal to or higher than 1.6 g/kg.

For these cases, like for drivers with more than 40 µg/L of THC-COOH in blood, a medical assessment and follow-up is required to retrieve the driving license.

Cannabis and alcohol present different metabolisms. On the one hand, the half-life [2] of THC depends on the regularity of smoking cannabis and is roughly 40 hours (20 to 57 hours) in occasional consumers and 10 days (3-14 days) in regular consumers. Due to their longer window of detection,

occasional blood or urine screening allows them to determine if a person consumes cannabinoids products or not. On the other hand, alcohol is eliminated with a rate of about 0.15 g/k per hour (0.10 – 0.20 g/kg). Consequently, after some hours, no more alcohol is detectable in neither blood nor in the urine. In forensic and medical cases as well, new biological markers have been developed to control and help people with difficult or a slave relationship with alcohol: CDT (Carbohydrate Deficient Transferrin), EtG (Ethylglucuronide) and a new indicator of alcohol consumption, the Phophatidylethanol [3].

Alcohol remains the most consumed drug in the world. Because of this observation, the WHO has decided, a few years ago, to propose a new 'acceptable' quantity of alcohol which can be consumed by people. The new ''guidelines" suggest that 20 g of pure alcohol for men, and 10 g of pure alcohol for women per day is acceptable. Moreover, it is and considered as wise not to consume 2 days a week. To follow an alcohol consumption, CDT measured in blood indicates consumption of about more than 210 g of pure alcohol per week (21 standard glass of alcohol) and a test is useful about each month. EtG, measured in hair, detects alcohol with consumption of about more than 140 g of pure alcohol a week. Analyse of hair could be enough every 2 or 3 months. Phophatidylethanol (PEth) seems to be more sensitive and detects a consumption of about 2 to 3 glass of pure alcohol a week. Studies realized with regular consumers [4] show that the phosphatidyl ethanol is detectable 28 days after the end of the consumption of alcohol with a mean half-life of elimination situated between 3 and 5.3 days. Neither sex, age nor BMI have any influence on the elimination of PEth. Moreover, an experiment was done during 3 weeks of abstinence of 11 'social drinkers' exposed 5 days with 1 g/kg ethanol a day (about 67 and 107 g/pure alcohol/day, so about 7 to 10 glasses a day) show a half-life of PEth situated between 4 and 10 days the first week and 5 to 12 days the second week. The used specimen PEth is a Dried Blood Spot device [5].

Forensic and medical toxicology are the two sides of the same medal: Here is a reflection on that: Sometimes drivers forget that a driving license is not a 'license to kill' and that driving requires a fully operational brain. After alcohol or cannabis intake, some parts of the brain switch off and the driver becomes a weapon on the road. In forensic toxicology, our mission sounds like the police, ''to serve and protect". Indeed, our laboratory analyses serve law enforcement to determine if a person was under influence and not able to think and decide to drive or to think. The knowledge from explanation reports goes beyond law enforcement and can be seen as a protection, to save lives in the long-term. And here comes the medical world, with its original motto: 'Primum non-nocere' [6]. Indeed, in the expression ''under influence", we can conceive that the human being lost his freedom to act and become just a slave. To cure somebody lost in drugs, analysis of these products could be used as a therapeutic tool that could help patients.

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