The significance of a negative hair test result

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Objective Establish the interpretation criteria to document a negative hair test result.
Introduction When using hair analysis as a specimen during investigative analysis, such as in workplace drug testing, doping confirmation, driving under the influence, or drug-facilitated crime, the question of importance is to know whether the analytical procedure is sensitive enough to identify traces of drug(s) in hair after exposure, even in single drug exposure. This is particularly important when the urine sample of the subject is positive and the corresponding hair test is negative. It has been accepted in the forensic community that a negative hair result cannot exclude the administration of a particular drug, or one of its precursors and that the negative findings should not overrule any positive urine result. Nevertheless, the negative hair findings can, on occasion, cast doubt on the positive urine analysis, resulting in substantial legal debate and various consequences for the subject and the final response to the police, lawyers, or judges.
Methods The concept of minimal detectable dosage in hair is of interest to document the negative findings, but limited data is currently available in the scientific literature. Such data includes cocaine, codeine, ecstasy, ketamine and some benzodiazepines or hypnotics. There is obviously a lack of data in the literature. As an example, the minimum detectable dosage in hair has not been established for common drugs of abuse, such as cannabis, heroin, morphine or amphetamines, most medicines or doping agents.
Results Several reasons can account for the absence of analytical response in hair after controlled administration. The drug may not be incorporated in hair. That is the case for large bio-molecules, such as hormones (growth hormone, insulin, erythropoietin…) which cannot be transferred from the blood capillaries to growing cells of hair. Although not supported by any data, it is the opinion of the authors that only compounds with a molecular weight lower than 1000 daltons may be incorporated in hair. It is also possible that the administered parent compound is not the target compound in hair, as highlighted with ethanol and ethyl glucuronide. However, given that drugs are incorporated into hair according to several parameters such as melanin affinity, lipophilicity and membrane permeability, some are well incorporated while others are poorly incorporated. The strategy to document any result will be presented, including which concentrations can be expected after single exposure and after repetitive / therapeutic use. It is accepted by the authors that some parameters have to be assessed: dose necessary to give a positive result, repeatability, robustness, contamination, carry-over, interferences, variable incorporation into hair, external factors that may have an impact, etc.
Discussion The difficulties in interpreting results of hair analysis for new drugs must be documented. In particular, little is known about the incorporation into the keratin matrix after intake and the correlation between dosage frequency of use and hair concentrations. The interpretation of any result must considered different scenarios such as passive exposure vs. active consumption, mindful vs. unaware intake, and sporadic vs. chronic use. Therefore, hair results for unusual drugs should be interpreted with caution by experienced forensic toxicologists.
Conclusion A negative hair result is also a result. However, this can be interpreted in two different ways: 1, the owner of the hair did not take or was not exposed to the specific drug, or

2, the procedure is not sensitive enough to detect the drug. Until laboratories will have sensitive enough methodologies to detect drugs following a single use, care should be taken to compare urine and hair findings

Conflict of interest : none