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Use of Forensic Investigations in Anti-Doping

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Abstract

Possession, administration, trafficking or administration of prohibited substances are part of the World Anti-Doping Code definition. Despite this, the fight against doping is mainly focused on direct detection of forbidden compounds. As these above mentioned issues correspond closely to criminal cases under forensic investigation, relying on a similar approach may improve the fight against doping. In the context of a rowing competition, a bag containing different types of medical equipment was found by a local resident in a waste container. As the WADA Prohibited List proscribes the use of intravenous infusions, genetic analyses were conducted on biological samples collected in infusion apparatus in order to obtain DNA profiles. Because there is no database of athletes DNA profiles, a forensic approach has been applied to select athletes which could have used this material. This approach was based on evidences coming not only from the infusion systems but also from other objects found in the dustbin like drug packaging. Analysis of samples from infusion systems provided eight different DNA profiles. The comparison between these profiles and eight reference profiles from suspected athletes could not be distinguished. This proved the use of the infusion systems by these athletes and led to a violation of the WADA Code. For the complete paper, please, see the following reference: Jan N, Marclay F, Schmutz N, Smith M, Lacoste A, Castella V, Mangin P. (2011) Use of forensic investigations in anti-doping, Forensic Science International 213, 109-113.

Introduction

Nowadays the fight against doping is mainly focused on the detection of prohibited substances or its metabolites in biological samples using analytical methods. These techniques are based on the first definition of doping given by the World anti-doping agency (WADA) in the World anti-doping code [1]. Noteworthy, other definitions of doping are also given in this code, like the use, tampering, possession, trafficking or administration of prohibited substances. These definitions are barely investigated because traditional ant-doping methods cannot really provide relevant informations about these kinds of violations. In the other hand, as these issues closely correspond to criminal cases under forensic investigation, similar approaches can be a powerful investigative tool. This kind of approach is based on the Locard's Exchange Principle [2] which states that everywhere you go, every action you do, you will take something with you and you will leave something behind you. Knowing that, the investigation will be focused on the detection of these traces left on a crime scene as well as taken by the criminal. Afterward, these evidences will be used to draw links between the crime and the criminal or, in anti-doping cases, between doping materials and the user of these equipments.

Experimental

The definition of evidence is really wide. Indeed, all elements can be considered as evidence as long as it can draw a link between the suspect and the traces. For example, the most used in the forensic investigation field are the fingerprints, shoemarks, fibers, paint chips, toolmarks or the biological traces, etc. Due to this huge amount of possible evidences, a Forensic Approach has been developed to make a selection among these traces to focus on the most relevant traces, in other words, the traces which seem to be related to the criminal action.



The first step of this proposal is the detection of traces. Visible or non-visible traces have to be highlighted, sometimes with the use of physico-chemical techniques or special lighting (UV, raking light). This step is one of the most important because most of the time, a missed trace cannot be recovered later. As quite everything can be an evidence, a selection has to be done to focus only on relevant traces. This is done with the pre-evaluation: location information and contextual information will be used to determine if an evidence can be related to the criminal action or not. This will permit to focus on the most informative evidence. The next step is the exploitation of evidence. It can be a chemical analysis of DNA profiles or narcotics, or the characterization of a trace like a shoeprint or a fingerprint. Most of these "results" could be differentiated from anti-doping analyses since they are by themselves useless. Indeed, this data must be compared to reference. For this purpose, there are different national and international Databases (for fingerprints, DNA, shoemarks,...). If there is no opportunity to use that kind of database, a comparison with reference samples has to be done. These references can come from seizure or from a search of the suspect's premises. For this comparison, a Baysian inference is used to evaluate the strength of evidence. This theorem allows expressing the probability of observing this evidence under two alternative hypotheses, through a likelihood ratio [3,4]. In other words, it will express how many times more likely the data are under one hypothesis than the other.



Results and Discussion

These techniques have a great potential in the fight against doping, especially regarding the use, administration, possession or trafficking of prohibited substances or methods. This case study will illustrate how these investigation methods can take place in the anti-doping field. In 2007, during an international competition, a plastic bag containing different types of medical equipment was found in a waste container. Considering the probability that elite rowers were involved in the use of these equipments, this material was transmit to the Swiss Laboratory for Doping Analyses (LAD) for investigations.

The first aim was to establish if there was a violation of the anti-doping rules or not. As there were only products containing compounds used for faster recovery and none of them could be considered as a doping agent, traditional analytical methods could not provide relevant information on possible offenses. However, syringes, needles and used intravenous infusion equipments were found along these products and according to the World Anti-Doping Code, the use of an intravenous system constitutes a violation of the anti-doping rules. Knowing that, a forensic approach has been applied to investigate this case. After visual examination, fingermarks on drug ampoules and red residues in the infusion tubings have been highlighted.

Lecture





Figure 2: Overview of the material present in the dustbin

During the pre-evaluation phase, it was decided to focus on the red residues. Indeed, as these residues were located in perfusion systems the probability that it was blood was pretty high and the two main matrices for doping analyses, which are urine and blood, are compatible with DNA profiling [5,6]. Secondly, no database was available for fingerprints comparisons; it would have been really difficult to obtain reference fingerprints from athletes. Subsequently, DNA profiling was conducted on ten biological samples collected on the parts of perfusion systems. It had been possible to determine eight different DNA profiles and due to the presence of a gender marker, five of these profiles were determined as male and three as female. As these profiles could not provide any information by themselves, and since no database of athletes' DNA profiles was available, an evaluation of the contextual information was crucial to avoid profiling of all athletes who took part in this competition. Indeed this kind of indication will permit to determine which athletes should be targeted.



Figure 3: Traces highlighted on medical equipment



The first information used was the localization: the medical material was found in a rubbish bin located behind a hotel where two federations' teams were staying. The second information was coming from the packaging (medical packaging and plastic bag). Indeed the inscriptions on it were in Cyrillic alphabet. As only one of these two federations was from a country using this alphabet, the International Federation decided to target only athletes from this nation.



Figure 4: Cyrillic alphabet present on several drugs packaging

At the beginning only nine athletes from this federation were controlled and DNA analyses were conducted on their blood samples. After comparison, DNA profiles of two athletes among the nine ones could not be distinguished from the trace DNA profiles. Knowing that, twenty-one other blood doping controls were conducted on athletes from this federation and DNA profiles were established. Over these thirty different DNA profiles obtained from athletes who took part in the competition where medical equipment was found, eight were corresponding to the trace DNA profiles. Based on the positive DNA matches, the International Federation concluded that eight rowers had violated the anti-doping rules. As the team doctor and the staff admitted their implication in the doping offence, the hearing panel decided to ban not only the eight rowers for all competitions during two years but also the coaches and officials. If the team doctor had not admitted his implication in the doping offence, the presence of fingerprints of the doctor on the intravenous equipment may have been investigated. Indeed the presence of fingerprints of the doctor on the intravenous equipment would have shown that at a time they had been in contact with the doping materials and would thus demonstrated its involvement in the practice.

Conclusions

This case showed that the forensic approach might bring new perspectives to the anti-doping field. It demonstrates that DNA analyses can provide some crucial information which combined with traditional detection methods would enforce evidence of violation of the anti-doping rules. The use of other forensic areas such as fingerprints might also be interesting, but will need work to implement fingerprints techniques. Other techniques, like criminal analysis could also allow identification of networks of organized doping and highlight athletes who might be connected with this activity. Since that case, International Rowing Federation (FISA), International Cycling Union (UCI) and International Gymnastics Federation (FIG)) have collaborated to settle the, so called, "No Needle Policy".

References

[1] World Anti-Doping Agency. The 2012 Prohibited List. International Standard, Montreal (2012)

http://www.wada-ama.org/Documents/World_Anti-Doping_Program/WADP-Prohibited-list/2012/WADA_Prohibited_List_2012_E N.pdf (access date 31.08.2012)

[2] Locard E.(1931) Traité de criminalistique (T I et II), Les Empreintes et les traces dans enquête criminelle, Lyon.

[3] I. W. Evett, G. Jackson, J.A. Lambert, S. McCrossan. (2000) The impact of the principles of evidence interpretation on the structure and content of statements, Science & Justice 40, 233–239.

[4] L.A. Foreman, I.W. Evett. (2001) Statistical analyses to support forensic interpretation for a new 10-locus STR profiling system, Int. J. Leg. Med. 114, 147-155.

[5] W. Goodwin, A. Linacre, H. Sibte. (2007) An Introduction to Forensic Genetics, England, pp 17-25.

[6] I. Sołtyszewski, W. Pepiński, A. Dobrzyńska-Tarasiuk, J. Janica. (2006) DNA typeability in liquid urine and urine stains using AmpFISTR SGM Plus, Adv. Med. Sci. 51, 36-38.

Lecture