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Short Communication

Detection of Drug of Abuse (Morphine) in Hair

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Abstract

Hair analyses have become an important tool in forensic toxicology for investigation of the drug related crimes. Drugs can be detected months after the last intake; it can be considered as a proof of the past exposure to drugs. In this study 40 hair samples of opium addicts were taken from de-addiction center in Delhi. GC-MS is used for quantification of drug in hair for 90 days. Results indicate that morphine is detected in hair till 90th day. This method has application in forensic toxicology as drug facilitated sexual assault complaints are made to police long after any drugs would have been eliminated from the conventional samples such as blood or urine.

Keywords: Forensic toxicology, gas chromatography, mass spectrometer, opium.

Introduction

Detection of abused drugs in hair samples has been an important tool in forensic toxicology for investigation of the drug addiction history^{1,2}. Drugs can be detected several months after the last intake, since they enter the hair roots from the capillaries and are embedded in the hair stalk, which grows at a rate of approximately 0.9 –1.2 cm per month³. Therefore, hair can be used as a "calendar" of the past exposure to drugs⁴. Opiates are the most abused group of chemicals and morphine is the most member Opiates, important among them. cocaine, amphetamines and other drugs in hair have been found at higher concentrations than their metabolites⁵. The objective of the present study was to detect morphine and its retention period (max. 90days for this study) in human hair by GC-MS.

Material and Methods

40 hair samples of opium addicts were taken from de-addiction center in Delhi (10-12 scalp hair strands will be plucked 3 times during the period of study i.e. on the day of admission then after 45 days and finally after 90 days).

Procedure includes the following steps: i. Sample decontamination: Washing the hair specimen with 1 ml methanol for 15 minutes at 37° C follow by three 30-minute washes with phosphate buffer (pH 6) at 37° C to remove any externally bound drug^{6,7}. ii. Digestion or Extraction of the hair sample: As digestion and extraction solvent a mixture of Methanol triflouroacetic acid in ratio of 9:1 was added, and was heated for 20 hrs at $40-45^{\circ}$ C⁸. iii. Quantification of the various analysts: quantification was performed with a GCMS-QP2010 Plus model (EI mode with a High accuracy quadrupole with pre-rods and Secondary electron multiplier tube as detector in SIM mode).

Results and Discussion

GC-MS chromatogram of Morphine (RT 14.10) in methanolic solution (figure 1) and GC-MS Chromatogram of an Opium Abuser (figure 2). LOD of morphine was 0.26 ng-mg of the hair (till the 90th day) which is consistent to other reported values of 0.1-0.5 ng-mg hair⁹. The range for the concentration of morphine in hair was 0.26 ng-mg to 2.3 ng-mg.

Conclusion

The results indicate that with the help of simple, sensitive and reliable techniques like GC-MS, morphine can be detected up to 90 days (at least after the last intake) in human hairs. This method has application in forensic toxicology as drug facilitated sexual assault complaints are made to police long after any drugs would have been eliminated from the conventional samples such as blood or urine. Accordingly, hair analysis has found applications in drug treatment programmes, workplace testing, criminal justice cases and child custody disputes.

Abbreviations: GC-MS- Gas chromatography Mass spectrometry, EI- Electron Impact, SIM- Selected Ion Monitoring.

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Sample No.	Age (Yrs.)	Hair Color	Daily Dose	Duration	Presence of Morphine in Hair		
	0 . ,		(g)	(Yrs.)	1 st Day	45 th Day	90 th Day
1	25	Brown	4	2	Positive	Positive	Positive
2	20	Black	5	3	Positive	Positive	Positive
3	20	Black	1.5	4	Positive	Positive	Positive
4	20	Black	3	3	Positive	Positive	Positive
5	22	Black	3	1	Positive	Positive	Positive
6	20	Black	5	2	Positive	Positive	Positive
7	23	Black	5	3	Positive	Positive	Positive
8	25	Brown	4	4	Positive	Positive	Positive
9	20	Black	5	1	Positive	Positive	Positive
10	20	Black	1.5	3	Positive	Positive	Positive
11	22	Black	3	3	Positive	Positive	Positive
12	20	Black	5	2	Positive	Positive	Positive
13	23	Black	5	3	Positive	Positive	Positive
14	21	Black	3	3	Positive	Positive	Positive
15	20	Black	3	1	Positive	Positive	Positive
16	20	Brown	2	3	Positive	Positive	Positive
17	20	Black	2	2	Positive	Positive	Positive
18	20	Brown	4	3	Positive	Positive	Positive
19	21	Black	2	2	Positive	Positive	Positive
20	20	Black	3	3	Positive	Positive	Positive
21	20	Brown	2	4	Positive	Positive	Positive
22	20	Brown	2.5	2	Positive	Positive	Positive
23	21	Black	3	3	Positive	Positive	Positive
24	20	Black	4	4	Positive	Positive	Positive
25	22	Black	1	3	Positive	Positive	Positive
26	20	Black	3	1	Positive	Positive	Positive
27	21	Brown	2	5	Positive	Positive	Positive
28	22	Brown	2	3	Positive	Positive	Positive
29	20	Brown	3	4	Positive	Positive	Positive
30	20	Black	2	3	Positive	Positive	Positive
31	20	Black	2.5	2	Positive	Positive	Positive
32	20	Black	1.5	3	Positive	Positive	Positive
33	21	Brown	2	2	Positive	Positive	Positive
34	21	Brown	2	3	Positive	Positive	Positive
35	20	Black	1.5	2	Positive	Positive	Positive
36	23	Brown	2	3	Positive	Positive	Positive
37	20	Black	3	1	Positive	Positive	Positive
38	23	Brown	2	3	Positive	Positive	Positive
39	22	Brown	1	4	Positive	Positive	Positive
40	20	Black	1.5	2	Positive	Positive	Positive

Table-1						
Details of Individuals from De-addiction Center						

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Figure-1 GC-MS chromatogram of Morphine (RT 14.10)

