

Unsuspected Exposure to Drugs of Abuse in Children

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Abstract

Background: In the last decade, the consumption of drugs of abuse has been steady for most of substances, with a significant increase in the consumption of cannabis and cocaine.

The aim of the study was to investigate the prevalence of unsuspected exposure to drugs of abuse (cocaine, cannabis, amphetamines, opiates, MDMA) in children attending to an urban paediatric emergency department without signs or symptoms suggestive of exposure.

Methods: Hair samples were collected from children between 10 and 14 years of age attending the Paediatric Emergency Department of Hospital del Mar in Barcelona during months of January to April 2014. Intervention was developed based on a brief advice and motivational interview for children. We analyzed the presence of drugs of abuse in hair samples by validated methodologies in liquid chromatography-mass spectrometry. Data were compared to previous studies in the same scenario.

Results: From 114 hair samples we obtain 15 positive results (13.5%) for any drugs of abuse, 5 positive results (4.38%) for cocaine (concentration range 0.8-3.97 ng/mg of hair), and 8 positive results for cannabis (7%) (Concentration range 0.10-1.11 ng/mg of hair), 1 positive result for MDMA (0.8%) (0.66 ng/mg of hair) and 1 positive result for amphetamines (0.8%) (1.10 ng/mg of hair).

Conclusions: The most important result of this investigation is the maintained and unsuspected high prevalence of paediatric exposure to drugs of abuse in children from low socioeconomic environment in a Mediterranean city during more than a decade. These figures justify the implementation of bio analytical screening protocols; follow up schedules, and preventive strategies. In order to prevent the exposure and consumption of drugs of abuse in children, we recommend interventions of public health and social services to raise consumer awareness of the risks occurring to children, and to push for avoiding consumption in places where adults interact with children.

Keywords: Drugs of abuse; Children; Hair; Emergency Room; Unsuspected exposure

Introduction

The consumption of drugs of abuse has been steady for most of substances during the last decade. Cocaine has reached, after cannabis, the highest consumption rate in Spain among people between 15 to 64 years of age, becoming the most commonly used illicit stimulant drug of abuse [1]. Although there has been a downward trend in Europe since reaching its highest prevalence of 3.0% by 2007, the last decade has been marked by a significant increase on the consumption of cannabis and cocaine with a current prevalence of 2.3% in Spain [2]. This proportion shows an important rate in the age group of 15 to 34 years: 3.6% of this age group in Spain consumed cocaine in the previous year (1.7% in Europe) [2], with slightly higher rates in males. In the age group of 15 to 24 years the results are even more alarming: 7.1% consumed cocaine ever in life, with 3.5% of them in the last 12 months and 1.6% in the previous month. Compared with data from

other European Union member states, Spain is placed first in cocaine consumption with a prevalence of 8.8% during lifetime in adults [2,3]. Cannabis is the illegal drug consumed by a higher percentage of students in Spain: 16% the last year and an alarming 2.7% of daily consumption [4].

The postnatal use of cocaine by mother or other adults in the infant's environment exposes infants and young children to crack/cocaine smoke during critical periods of brain development and physical growth [5]. Exposure to crack smoke may increase the risk for sudden infant death syndrome (SIDS). Among children who have been apparently passively exposed to cocaine, there is a significant increase in the incidence of upper and lower respiratory symptoms (may be related to airway mucosa irritation and paralysis of the mucosal cilia) from exposure to cocaine smoke [5]. In childhood and adolescence, use of recreational drugs such as cocaine and tobacco poses cardiovascular risks. Cardiovascular complications related to cocaine abuse include myocardial ischemia and infarction, myocarditis, cardiomyopathy and sudden death [6]. Prenatal methamphetamine exposure alone and in combination with postnatal

drug exposures, was associated with behavioral and executive function deficits at 6.5 years [7].

There have been previous studies using different cohorts in our environment which demonstrate exposure to drugs of abuse among paediatric population by hair testing [3,8,9]. High percentage of drugs of abuse was also found in the hair of accompanying parent. As reported by international literature, even if the routes of children passive or active exposure to drugs of abuse cannot be easily established, contact occurred as proved positive hair testing with possible risk of severe deleterious effects. It is unlikely that a single exposure could have occurred in children whose parents in the majority of cases were active consumers [3,8,9].

Prenatal exposure to drugs of abuse has been studied previously, but it is of the most importance to know if this exposure is maintained through childhood [8].

The aim of the study was to investigate the prevalence of unsuspected exposure to drugs of abuse (cocaine, cannabis, amphetamines, opiates, MDMA) in children attending to an urban paediatric emergency department without signs or symptoms suggestive of exposure, to prove the maintenance of this exposure in children in order to justify the implementation of screening protocols and preventive strategies.

Methods

Subjects and samples

This pilot study was conducted in the Hospital del Mar of Barcelona, Spain, during months of January to April 2014. The hospital is located in an urban area with low socioeconomic status and a high percentage of immigrants (more than 40%). Hair samples, cut at the scalp, were collected from consecutive children between 10 and 14 years of age attending the Paediatric Emergency Department for a variety of medical complaints, without signs or symptoms suggestive of drugs of abuse exposure. Because hair grows 1 cm/month

approximately, a minimum of 4 cm hair was required to document possible repeated exposure. A survey of toxic habits background was also performed in these children before the collection. The study was approved by the Local Ethics Committee (CEIC-PSM) and was conducted in accordance with the Declaration of Helsinki and signed informed consent was obtained from the accompanying parent and from the child. Advice on drug cessation and healthy life was given at the Emergency Room.

Hair samples analysis

Hair testing for drugs of abuse provides a wide window of detection and sample collection is not invasive [10]. The hair samples from children were screened for the presence of drugs of abuse by ultra-performance liquid chromatography/tandem mass spectrometry (UPLC-MS/MS) methodology as reported elsewhere [12]. Children samples were considered positive or negative on the basis of cut-offs for screening and confirmation techniques recommended by the Society of Hair Testing [11]. They were considered positive when analyte concentration was equal or higher than the confirmatory analysis limit of quantification (LOQ). Specifically, LOQ was 0.1 ng/mg of hair for opiates and cocaine and 0.05 ng/mg of hair for benzoylecgonine and cannabinoids [12].

Results

A total of 115 hair samples were obtained, but the length was not enough in one case to confirm exposure to cocaine and other drugs of abuse in different periods. Of the 114 hair samples from children examined, 15 were positive for any drugs of abuse (13.15%). UPLC-MS/MS analysis disclosed 5 positive samples (4.38%) to cocaine (concentration range 0.8-3.97 ng/mg of hair), 8 positive samples to cannabis (7%) (concentration range 0.10-1.11 ng/mg of hair), one positive sample to MDMA (0.8%) (0.66 ng/mg of hair) and one positive sample to amphetamines (0.8%) (1.10 ng/mg of hair) (Table 1).

Sample ID	mg of hair	Amphetamines (ng/mg)	Cannabinoids (ng/mg)	MDMA (ng/mg)	Cocaine (ng/mg)	Opiates (ng/mg)
HM-1	33.12	0.06	0.00	0.00	3.04	0.00
HM-4	30.33	0.35	0.02	0.41	3.97	0.00
HM-103	33.39	0.35	0.11	0.66	0.00	0.00
HM-109	33.5	1.10	0.00	0.00	0.00	0.00
HM-119	32.72	0.00	0.20	0.00	3.83	0.00
HM-127	32.68	0.00	0.00	0.05	0.90	0.00
HM-135	34.3	0.06	0.82	0.16	0.00	0.00
HM-155	32.87	0.00	0.10	0.29	0.00	0.00
HM-183	32.93	0.14	1.11	0.21	0.00	0.00
HM-185	33.5	0.23	0.14	0.33	0.00	0.00
HM-187	33.3	0.03	0.64	0.06	0.00	0.00

HM-202	33.08	0.00	1.00	0.00	0.88	0.00
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Table 1: Drugs of abuse content in children hair samples.

Cut-offs: Amphetamine=1 ng/mg; Cannabinoids=0.1 ng/mg; MDMA=0.50 ng/mg; Cocaine=0.50 ng/mg; Opiates=0.50 ng/mg

Any statistical significance was found in self-declared parental sociodemographic and toxic habits for the 114 children according to hair analysis (Table 2).

	Children not exposed to any drug of abuse (n = 99)	Children exposed to any drug of abuse (n = 15)
Mother's nationality (%)		
Spanish	57.3	61.0
Non Spanish	42.5	37.0
Father's nationality (%)		
Spanish	62.2	65.5
Non Spanish	39.8	35.7
Employed mother (Yes/No) (%)		
No	33.4	34.0
Mother's profession (%)		
Managerial, Professional & Skilled (non-manual)	8.3	7.9
Skilled (manual) & Partly skilled	41.3	42.5
Unskilled	50.2	50.8
Employed Father (Yes/No) (%)		
No	2.9	3.4
Father's profession (%)		
Managerial, Professional & Skilled (non-manual)	11.6	10.9
Skilled (manual) & Partly skilled	26.9	30.2
Unskilled	62.5	59.7
Tobacco Smoking (%)		
Mother	28.2	29.6
Father	40.7	43.1
Children	0.0	0.0
Alcohol consumption (%)		
Mother	28.5	29.1
Father	37.3	41.9
Children	0.0	0.0
Cannabis Use (%)		
Mother	7.8	8.6
Father	10.5	11.2
Opiates and cocaine use (%)		
Mother	0.0	0.0
	0.0	0.0

Father		
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Table 2: Self-declared parental sociodemographic and toxic habits for the 114 children according to hair analysis, ** p > 0.05

Discussion

From an analytical point of view, hair testing for opiates, cocaine, amphetamines, methylendioxy derivatives, cannabinoids and methadone was provided using a highly specific and sensitive screening and confirmation methodology recently developed coupling an immunoassay specific for keratin matrix with last generation ultraperformance liquid chromatography tandem mass spectrometry [12]. Results in children hair samples were considered positive not on the basis of recommended cut-offs - which indeed do not exist for paediatric samples - but when analyte concentration was equal or higher than the confirmatory analysis limit of quantification. The reason was that the international cut-offs for positivity to drugs of abuse was established considering values for adult population of consumers and nonconsumers of those substances. The last generation UPLC-MS/MS allowed a greater sensitivity which permitted to disclose the maximum possible number of children exposed to drugs of abuse, including cannabinoids, whose hair concentration is extremely low even in active consumers.

The most important result of this investigation is the maintained alarming prevalence of unsuspected exposure to drugs of abuse in children from a low socioeconomic environment in a Mediterranean city. The results of the present study are in complete agreement with a previous study made in 2008, collecting children between 18 months and 5 years of age. That time we found 23.3% children with a positive result for cocaine, 1.1% for MDMA and 1% for opiates [3]. It was observed that the exposure to these drugs of abuse was related to the sociodemographic characteristics of population since in 88% of the positive cases cocaine was also found in their relatives [3]. This showed that parents of cocaine-exposed children present, to a significantly higher extent, behavioral patterns with potential harmful effects for the children health. The same result was obtained in a different cohort of children from Barcelona, from ages between 2 and 10 years, attending the same Emergency Department at Hospital del Mar of Barcelona in 2013. It was observed a 20.1% children positive for cocaine and 11% for cannabis [9] and also parents of cocaine-exposed children presented behavioural patterns with potential harmful effects for children's health. These outcomes show the magnitude of the problem of exposure to drugs of abuse among children in this environment.

The results of our study demonstrate not only exposure in early childhood, but also in adolescence when the consumption starts. According to ESTUDES study (by questionnaire), the average age for first use of cocaine is 15.5 years old, while the first use of cannabis is at the age of 14.9 [4].

The long term effects of a repeated postnatal exposure to cocaine have not been clarified yet. The passive exposure to crack/cocaine smoke occurs in much the same way that secondhand cigarette smoke,

and it has been found to be a risk factor to infant's and children's health. It is associated with neurological manifestations, such as focal and generalized seizures in children, alteration in mental status, including delirium stupor and coma in older children [2,3]. Lustbader et al., 1998 concluded that this exposure had clinical association with lower respiratory symptoms, and may increase the risk for chronic and acute respiratory illnesses, with significant effects on children younger than 1 year [2].

Children exposed to cannabis were reported to suffer from developmental delay, hyperactivity, lethargy ataxia and respiratory insufficiency, but no information on the effects of paediatric chronic exposure to that drug is known [9].

Hair test for cocaine and other drugs of abuse should be considered to document previous or chronic exposure [13]. Since drugs and their metabolites are permanently deposited in the protein matrix of the hair, they can be detected several months after its use, which provides an advantage over other biological markers [10]. Measurement of cocaine hair concentrations can allow estimation of the degree of environmental drug exposure in young children. Infants seem to have a disproportionately increased risk for systemic exposure compared with older children [14]. The differentiation between systemic exposure and external contamination for certain drugs groups is not a limitation of drug testing in hair [13,15]. Even if the routes of children passive or active exposure to drugs of abuse cannot be easily established, contact has occurred as proved by hair testing, with possible risk of severe intoxication [9].

Taken together, all these alarming outcomes demonstrate that, when occurring, passive exposure to drugs of abuse is likely maintained throughout childhood. In contrast to tobacco smoking, at present a restrictive legislation on environmental exposure of children to psychoactive drugs is needed [8].

These confirmed occurrences let us hypothesizes that these children could receive poor familiar attention, in a country like Spain where drug exposed children are not protected by any specific law promoting foster care or programmed social intervention. Also, consumer parents are not aware of risk of passive environmental exposure in children living in the same environment.

Inside the public health system, there is not a regular checking to general population and adolescents for drugs of abuse consumption using self-reported questionnaires surveys [4,8,16], and no screening inquiries or interventions to reduce prenatal or postnatal exposure have been ever put in place.

Since hair testing for drugs of abuse is still an expensive test due to the required specific skills and instrumentation, unfortunately it cannot be proposed as a general screening for the paediatric population. As maximum cost benefit ratio, we advocate performing this test in the paediatric population attending emergency wards or general hospital for any complaint when there is an evidence of a risky environment around the child: the hospital is located in an area of very high percentage of drug consumption and socioeconomic difficulties, a clinical suspicion of acute or chronic intoxication from any possible drug exist in the child, or there is a suspicion or evidence of drug addiction in the accompanying parent.

Conclusions

Our study corroborates the maintained unsuspected high prevalence of exposure to drugs of abuse during childhood in the last 15 years in a risky environment.

These figures justify implementing bioanalytical screening protocols, follow up schedules, and preventive strategies. In the light of these results we advocate for a general hair screening for drugs of abuse in children from risky environments.

In order to prevent the exposure and consumption of drugs of abuse in children, we recommend interventions of public health and social services to raise consumer awareness of the risks occurring to children, and to push for avoiding consumption in places where adults interact with children. Uniform guidelines should be provided for health and social service professionals to be followed when confronted with documented drugs of abuse exposure in asymptomatic children.

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