

Motherisk Drug Testing Newsletter for Children's Aid Societies

No. 1 - DECEMBER 2005

Dear Colleagues:

During the last year we have met many of you in training sessions and conventions from coast to coast, and thought it would be useful to update you on new aspects and discoveries of drug testing in hair and meconium. I am pleased to share with you this first newsletter developed especially for Canada's children's aid societies. On behalf of Motherisk and The Hospital for Sick Children I wish to thank you for your help in finding answers to some very complex questions. As you will see, your cases and our research, are helping to develop critical new knowledge and solutions.

Dr. G. Koren, Director, The Motherisk Program

SCREENING FOR FETAL ALCOHOL SPECTRUM DISORDER

Joey Gareri, Daphne Chan, Julia Klein, Gideon Koren

Q. I have several patients whom I suspect are drinking during pregnancy. How can I find out for sure if they are?

A. You can use one of the validated tools to screen for problem drinking. Motherisk uses the TWEAK test, but others are just as good. Following birth, you can test infants' meconium for metabolites of ethanol to detect whether they were exposed in utero to excessive drinking.

Q. Je soupçonne quelques-unes de mes patientes de boire de l'alcool durant leur grossesse. Comment savoir si c'est vraiment le cas?

R. Vous pouvez utiliser l'un des outils de dépistage validés des problèmes d'alcoolisme. Motherisk utilise le test TWEAK, mais d'autres sont tout aussi efficaces. Après la naissance, le méconium du nouveau-né peut être analysé pour détecter des métabolites d'éthanol et savoir ainsi s'il a été exposé à une consommation d'alcool excessive dans l'utérus.

Fear and embarrassment can prevent alcohol-dependent women from sharing their problem drinking with their physicians, so appropriate help cannot be sought. Just as important, many clinicians do not ask their patients about drinking habits or problems as part of routine history taking. Fetal alcohol spectrum disorder is a new term that encompasses the range of disability caused by gestational exposure to alcohol, from full-blown fetal alcohol syndrome to its partial presentation as alcohol-related neurodevelopmental delay.¹

During the past few decades, several simple questionnaires that identify problem drinkers with high sensitivity and specificity have been validated.² These questionnaires probe very similar characteristics. Two tests, the TWEAK (tolerance, worry, eye-opener, amnesia, cut down) and the T-ACE (tolerance, annoyed, cut down, eye-opener), have been extensively validated for use during pregnancy (Figures 1 and 2).^{2,3} The T-ACE is similar to the Woman Abuse Screening Tool developed by family physicians. Family physicians should also

investigate physical and laboratory characteristics of problem drinking, most notably abnormal liver function test results.

FIGURE 1 - THE TWEAK TEST Scores of 2 or higher are predictive of problem drinking

TWEAK	QUESTION	POINTS
Tolerance	How many drinks does it take to make you feel the first effect (before pregnancy)? (Three or more = 2 points)	_____
Worry	Have close friends worried or complained about your drinking in the past year? (Yes = 2 points)	_____
Eye-opener	Do you sometimes take a drink in the morning when you first get up? (Yes = 1 point)	_____
Amnesia	Has a friend or family member ever told you about things you said or did while you were drinking that you could not remember? (Yes = 1 point)	_____
Cut down	Do you sometimes feel the need to cut down on your drinking? (Yes = 1 point)	_____

FIGURE 2 - THE T-ACE SCREENING TEST

How many drinks does it take for you to feel high? (Tolerance)
Have people Annoyed you by criticizing your drinking?
Have you ever felt you ought to Cut down on your drinking?
Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover? (Eye-opener)

When there is no information on maternal drinking, physicians can test for alcohol metabolites in meconium, the first fecal excretion of newborns. Several recent studies, including our own, have shown high levels of fatty acid ethyl esters (FAEE) in meconium of babies born to mothers who admitted drinking.^{4,5} The FAEE test has been validated and can be used to establish maternal problem drinking. Because

meconium begins to form at about 14 weeks' gestation, positive test results indicate maternal drinking during the second and third trimesters of pregnancy, typically after women have become aware of their pregnancies. This in itself is a strong indication of alcohol dependency; mothers are unable to change their priorities and abstain from drinking. Motherisk currently considers cumulative levels above 2 nmol/g to be a positive meconium FAEE test result.

The Motherisk Alcohol Helpline (1-877-327-4636) or drug laboratory ([416] 813-5925) can help physicians access this new test.

Recent placental perfusion studies by Motherisk have shown that FAEEs found in newborns were formed in the fetus because they do not cross the placental barrier. They represent true fetal exposure to alcohol.⁶

Results of meconium tests offer a unique opportunity to record gestational exposure to ethanol. Missing this opportunity can leave many children impaired by alcohol at risk of being undiagnosed: evidence of maternal drinking is a prerequisite for diagnosis of fetal alcohol spectrum disorder in cases where pathognomonic facial features are not apparent.

REFERENCES

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2. O'Connor MJ, Whaley SE. Alcohol use in pregnant low-income women. J Stud Alcohol 2003;64:773-83.
3. Chang G, Goetz MA, Wilkens-Haug L, Berman S. Identifying prenatal alcohol use: screening instruments versus clinical predictors. Am J Addict 1999;8:87-93.
4. Koren G, Nulman I, Chudley AE, Loock C. Fetal alcohol spectrum disorder. CMAJ 2003;169:1181-5.
5. Chan D, Caprara D, Blanchette P, Klein J, Koren G. Recent developments in meconium and hair testing methods for the confirmation of gestational exposures to alcohol and tobacco smoke. Clin Biochem 2004;37:427-38.
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Frequently Asked Question

Can you tell based on a hair test how much of a drug an individual has used?

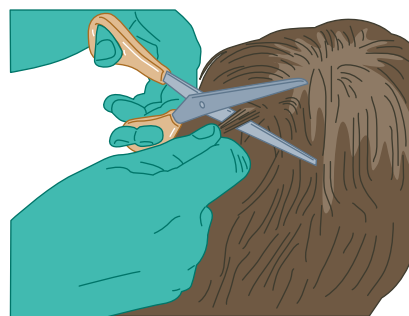
A. No we cannot, because there is huge variability among people. If two people use the same amount of drug their bodies can handle it very differently.

HOWEVER, we can tell you where the individual is in the OVERALL range of results seen by us.

RANGES OF DRUG CONCENTRATION IN HAIR - INFANTS

	Cocaine ng/mg	Opiates ng/mg	Cannabis ng/mg
Trace	<0.15	<0.10	<0.10
Low	0.15-0.55	0.10-0.50	0.10-0.30
Med.	0.55-2.00	0.50-1.00	0.30-0.60
High	2.00-5.00	1.00-5.00	0.60-1.50
Very High	>5.00	>5.00	>1.50

Here are the ranges of common drug concentration in mom's hair, baby's hair and baby's meconium.



RANGES OF DRUG CONCENTRATION IN HAIR - ADULTS

	Cocaine ng/mg	Opiates ng/mg	Cannabis ng/mg
Trace	<0.20	<0.10	<0.10
Low	0.20 – 2.00	0.10-1.00	0.10-0.50
Med.	2.00- 10.00	1.00-5.00	0.50-1.00
High	10.00- 35.00	5.00- 10.00	1.00-3.00
Very High	>35.00	>10.00	>3.00

RANGES OF DRUG CONCENTRATION IN MECONIUM

	Cocaine ng/mg	Opiates ng/mg	Cannabis ng/mg
Trace	<80	<100	<50
Low	80-300	100-300	50-100
Med.	300- 2,000	300- 1,000	100-1,000
High	2,000- 10,000	1,000- 10,000	1,000- 5,000
Very High	>10,000	>10,000	>5,000

Eye on Research

The following is a sneak peek at some of the research currently underway in the Motherisk lab. Each research project is approved by the Hospital for Sick Children's research ethics board, and conducted according to strict research protocols. When it is complete, this study will be published in a peer-reviewed scientific journal where it will become one of over 300 Motherisk research articles published since 1985.

METHAMPHETAMINE DETECTION IN MATERNAL AND NEONATAL HAIR

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Methamphetamine abuse has been gathering momentum as a serious public health problem. Evidence of chronic use, particularly during pregnancy, is very hard to obtain.

Methamphetamine accumulates in hair and can be detected several months after exposure. Drugs that cross the placenta can be detected in hair of the newborn.

The aim of the study was to find evidence of methamphetamine exposure during pregnancy using hair measurements of the drug.

Methods

A hair immunoassay for methamphetamine was developed at the Motherisk laboratory in Toronto. Clinical results were collected in a database, and data for exposure to methamphetamine, as well as other drugs of abuse, in hair were analyzed. Individuals positive for methamphetamine were studied for co-exposure to other drugs of abuse.

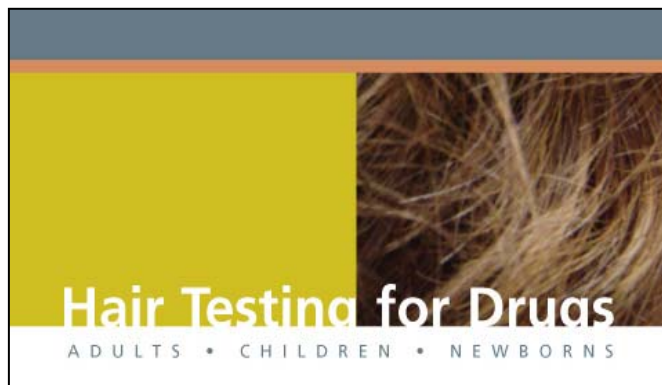
Results

Out of 398 positive methamphetamine results, we identified 10 mother-child pairs who had methamphetamine positive hair.

None of pairs identified included mothers with negative results, but there were 2 (20%) neonates who had a negative methamphetamine result even though the mother was positive. Mean methamphetamine values were 2.38 ng/mg of hair in the mothers and 1.64 ng/mg in the neonates. There was a correlation between maternal and fetal methamphetamine levels. Almost 90% of positive methamphetamine samples had at least one other drug of abuse.

Conclusion

To our knowledge, this is the first report that shows transplacental passage of methamphetamine, with accumulation in the fetal hair. We believe this provides the basis for studies to define pharmacokinetics of this drug in the mother-child couple. We have also shown that hair measurement of methamphetamine in neonates is a useful screening method to detect intra-uterus exposure. As fetal hair grows in the last trimester of pregnancy, a positive result may indicate maternal addiction.



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