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Internally Concealed Cocaine: Analytical and Diagnostic Aspects

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ABSTRACT: Thirty persons arrested at Frankfurt airport for smuggling internally concealed cocaine in 1993/1994 were investigated. An X-ray examination (in all 30 cases), immunochemical examination of urine (in 27 cases) and of saliva (in 20 cases) was performed in parallel. An X-ray examination gave positive results in all examined persons. EMIT® cocaine metabolite assay (cut off 300 ng benzoylecgonine (BE)/mL) was positive in eight urine samples. After reducing the cut off to 150 ng BE/mL urine, eleven samples were classified as positive. The results were confirmed by means of chromatographic determinations. These findings showed limited role of immunological examination of urine as a screening test in suspected smuggling of internally concealed drugs. All saliva samples showed negative immunochemical results.

The number of concealed containers ranged from 44 to 135 per person. The amount of cocaine hydrochloride found in particular cases ranged from 242 to 1050 g net weight, divided into containers weighing from 5.7 to 13.8 g. Drug packages were obviously machine-made. The packages smuggled by a particular person were uniform. However, a distinct interpersonal variability in drug packages was observed, in regard to the number of protective layers (4–7), size, weight, and cocaine purity. This may be helpful for the identification of production site.

The leaching of cocaine from selected containers was investigated in a stirring bath and was independent of the conditions applied.

KEYWORDS: toxicology, cocaine, body packing, immunological diagnostics, chromatography

The transport of illicit drugs of high purity in internally concealed containers, so-called "body packing," increased dramatically over the last years [*1*]. This method of drug smuggling concerns mainly airline transport and is associated with a high toxicological hazard [*2–5*]. X-ray examinations of various kinds and ultrasonography are most frequently used for detection of drug packages in gastrointestinal tract [*5–10*].

Internally concealed drugs are usually packed in several layers of latex (for example, condoms). Latex membranes are permeable to heroin and cannabis oil [*11*]. It was therefore assumed, that immunological examination of urine may be used as a simple and noninvasive preliminary method of screening for "body packing" [*1,11*]. The reports on practical application of immunochemical urine examination concern the cases of heroin, cocaine, and cannabis smuggling [*12,13*]. In the last few years, however, the production of "body packs" has obviously been refined. New packages were more leakproof and more difficult to detect in X-ray examination as well [*14,15*].

The purpose of this study was to examine the diagnostic reliability of urine and saliva immunoassay for detection of internally concealed cocaine. Only authentic samples were used for this study.

Material

Drug packages and urine samples from 27 persons (20 males and 7 females, aged 22 to 61) arrested for smuggling internally concealed (swallowed) drugs were obtained from the Customs Service at Frankfurt-Main Airport. In 20 of these cases, saliva samples were also sent. In three other cases, only drug packages were obtained (without body fluids).

All smugglers, who came from South American countries were arrested during the preliminary control in the arrival hall at the airport. Two diagnostic procedures were then performed in parallel: X-ray and urine examination. Urine samples were collected and EMIT® st cocaine metabolite assay was performed in the facilities of Customs Service. Irrespective of this assay, each suspect was subjected to X-ray examination in the Airport Clinic. The result

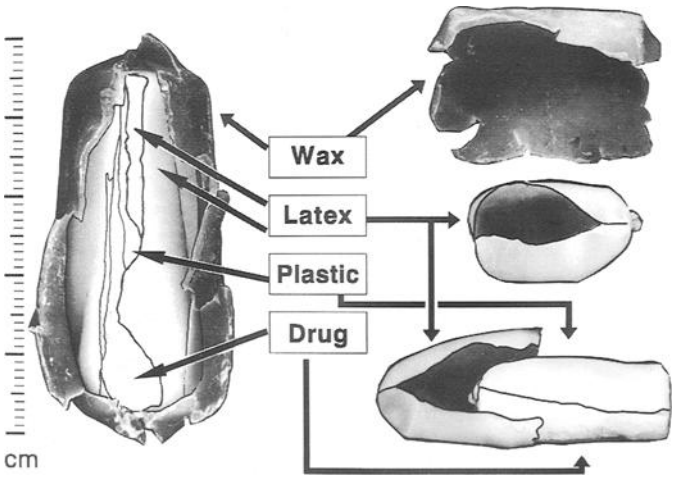

FIG. 1—*The "anatomy" of typical internally concealed cocaine package, showing several protective layers.*

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TABLE 1—*Quantity and mass of cocaine containers found among particular smugglers and results of X-ray and immunochemical urine examinations. Δt = time elapsed between the ingestion of packages and urine sampling.*

Case	Number of containers	Total gross weight [g]	X-ray results	Δt [hrs]	Emit®-st cutoff 300	Emit® ETS cutoff 300	Emit® ETS cutoff 150
1	73	730	pos	unknown	neg	neg	neg
2	75	500	pos?	36	neg	neg	neg
3	115	900	pos	36	pos	neg	pos
4	44	400	pos	37	pos	pos	pos
5	79	900	pos	56	neg	neg	neg
6	99	900	pos	39	neg	neg	neg
7	75	861	pos	unknown	neg	neg	neg
8	85	1070	pos	ca.24	neg	neg	neg
9	120	900	pos	ca.24	neg	neg	neg
10	106	1200	pos	ca.24	pos	pos	pos
11	67	650	pos	26	neg	neg	neg
12	135	600	pos	38	pos	pos	pos
13	75	600	pos	63	pos	pos	pos
14	102	1200	pos	46	neg	neg	neg
15	88	900	pos	34	neg	neg	neg
16	80	800	pos	unknown	pos	pos	pos
17	71	800	pos	ca.48	pos	pos	pos
18	90	1141	pos	42	pos	neg	pos
19	92	1050	pos	27	neg	neg	neg
20	82	900	pos	27	neg	neg	neg
21	127	1100	pos	unknown	neg	neg	neg
22	74	640	pos	unknown	pos	pos	pos
23	90	1130	pos	ca.48	neg	neg	neg
24	97	1340	pos	ca.48	neg	neg	neg
25	46	550	pos	unknown	neg	neg	neg
26	90	1000	pos	ca.72	pos	neg	pos
27	107	954	pos	35	pos	pos	pos
28	104	1250	pos	unknown		urine not available	
29	127	1009	pos	unknown		urine not available	
30	95	1234	pos	unknown		urine not available	

TABLE 2—*Individual features of examined cocaine packages.*

Case	Layers 1	2	3	4	5	6	7	Net [g]	Cocaine [%]
1	wax	latex	latex	latex	plastic foil	/	/	10,3	57,0
2	wax	latex	latex	plastic foil	latex	latex	/	6,4	35,5
3	wax	latex	latex	plastic foil	latex	latex	/	7,0	30,7
4	wax	latex	latex	plastic foil	latex	/	/	8,6	60,4
5	wax	latex	latex	plastic foil	/	/	/	10,5	42,3
6	wax	latex	latex	latex	plastic foil	plastic foil	/	7,8	74,0
7	wax	latex	latex	latex	latex	/	/	8,2	68,0
8	wax	latex	latex	latex	latex	/	/	10,0	23,6
9	wax	latex	latex	latex	latex	latex	plastic foil	5,9	43,8
10	wax	latex	latex	plastic foil	latex	latex	/	9,9	69,0
11	wax	latex	latex	plastic foil	latex	latex	/	7,7	35,6
12	wax	latex	latex	latex	latex	/	/	4,5	33,9
13	wax	latex	latex	latex	plastic foil	/	/	6,2	66,2
14	wax	latex	latex	latex	plastic foil	/	/	10,4	64,0
15	wax	latex	latex	plastic foil	latex	latex	/	10,1	72,8
16	wax	latex	plastic foil	latex	/	/	/	7,8	80,4
17	wax	latex	latex	plastic foil	latex	latex	/	10,7	63,2
18	wax	latex	latex	latex	plastic foil	/	/	10,1	90,6
19	wax	latex	latex	latex	latex	plastic foil	latex	9,6	82,1
20	wax	latex	latex	latex	latex	plastic foil	latex	10,1	72,7
21	wax	latex	latex	plastic foil	latex	latex	/	6,9	36,6
22	latex	latex	latex	plastic foil	latex	/	/	7,1	74,4
23	wax	latex	latex	plastic foil	latex	latex	/	10,3	63,5
24	wax	latex	latex	latex	plastic foil	/	/	9,6	51,4
25	wax	latex	latex	plastic foil	/	/	/	9,5	44,1
25 a	wax	latex	latex	latex	plastic foil	/	/	9,4	56,2
26	wax	latex	latex	plastic foil	latex	latex	/	7,2	47,5
26	wax	latex	latex	latex	plastic foil	latex	/	9,9	64,2
28	wax	latex	latex	plastic foil	latex	latex	/	10,1	51,5
29	wax	latex	latex	latex	/	/	/	7,3	83,5
30	wax	latex	latex	latex	plastic foil	/	/	10,3	53,1

TABLE 3—*Drug leaching (measured as cocaine and benzoylecgonine [mg/l]) from three selected packages under experimental conditions.*

Case		0,9 % NaCl			Pepsin + HCl			Trypsin + buffer		
		6 h	24 h	48 h	6 h	24 h	48 h	6 h	24 h	48 h
26	Cocaine	...	1,19	3,95	...	0,21	1,47	0,10	0,21	0,63
	BE	...	...	0,15	...	...	0,99	0,14	0,26	0,55
27	Cocaine	5,12	9,75		3,59	4,90	13,70	0,53	2,89	5,68
	BE	...	4,06	10,78	1,28	1,29	19,72	0,33	1,36	4,60
29	Cocaine	6,36	21,21	29,08	2,68	7,49	13,05	10,77	12,64	27,76
	BE	3,31	6,54	7,32	0,61	1,33	1,88	1,14	2,38	5,66

of this examination was of decisive value. Drug packages were then evacuated in a natural way in a special toilet and collected. The control X-ray examinations were then performed until negative. Collected urine and saliva samples were sent to our laboratory within 4 hours after apprehension, along with drug packages (5 in each case).

Cocaine was the only drug involved in all the cases. According to the information from the Customs Service, the number of packages ranged from 44 to 135 pieces per person. Total gross weight was between 400 and 1340 g, and the quantity of cocaine hydrochloride ranged from 242 to 1034 g per case.

Methods

Drug Packages

The size, shape, weight, type, and number of layers were documented. The packages were then subjected to chemical examination by means of gas chromatography-mass spectrometry and high-pressure liquid chromatography for identification and quantitation of the components.

Seven packages were examined on permeability in three incubation medias:

0.9% saline;
0.1 N HCL with pepsin (corresponding to the conditions in stomach); and
phosphate buffer, pH 8.0 with trypsin (corresponding to the conditions in intestinal tract).

The packages were incubated in a volume of 100 mL over 48 hours at 37°C, under continuous stirring. At the beginning of experiment and after 6, 12, 24 and 48 hours samples of the incubation fluid (20 mL each) were taken and extracted according to Needleman et al. [*16*]. Cocaine (CO) and benzoylecgonine (BE) were determined by means of GC and HPLC.

TABLE 4—*Emit® ETS absorbance values observed in examined urine samples along with drug-free urine and calibrators (300 ng/mL BE).*

Case	Absorbance blank urine	Absorbance calibrator (300 ng/mL BE)	Absorbance sample
1	412	517	415
2	439	523	465
3	439	523	503
4	295	400	527
5	308	414	325
6	335	439	337
7	364	478	373
8	402	529	411
9	402	529	412
10	284	415	416
11	284	415	364
12	284	415	440
13	324	443	493
14	324	443	346
15	324	443	381
16	324	443	566
17	314	419	469
18	314	419	417
19	314	419	350
20	314	419	367
21	366	468	366
22	366	468	616
23	329	442	307
24	376	482	382
25	376	482	397
26	376	482	472
27	357	487	660

Urine Samples

Urine samples were examined by means of EMIT® st-Cocaine Metabolite Test already at the Frankfurt-Main Airport. The immunological examination on cocaine metabolite was repeated in our lab using EMIT® ETS procedure. Then CO and BE in urine samples were determined by means of GC and HPLC as above.

Saliva Samples

Saliva samples (0.2 to 1 mL each) were collected using Salivette® collecting pads, centrifuged and examined by means of Emit®-ETS Cocaine Metabolite Assay.

Results and Discussion

Drug Packages

Table 1 shows data concerning the quantity of smuggled drug in each case and the results of X-ray and immunological examination as well.

All packages were cylinder-shaped and most probably machine made. Cocaine was pressed to a hard core that was wrapped in four to seven layers of latex and plastic foil, knotted on both ends and sealed with wax (Fig. 1). The external wax shell was present in all but one package. The packages, extracted from particular smuggler, were uniform and seemed to originate from one production line. However, the packages found in various cases showed different appearance. The length of packages varied from 3.5 to 5.5 cm, the outer diameter from 1.4 to 2 cm. Also, the number and order of layers, size, weight and cocaine content showed large variability (Table 2). Among 30 examined packages, only six of them (three pairs) showed matching parameters. This diversity may be of criminalistic relevance for possible tracing and identifi-

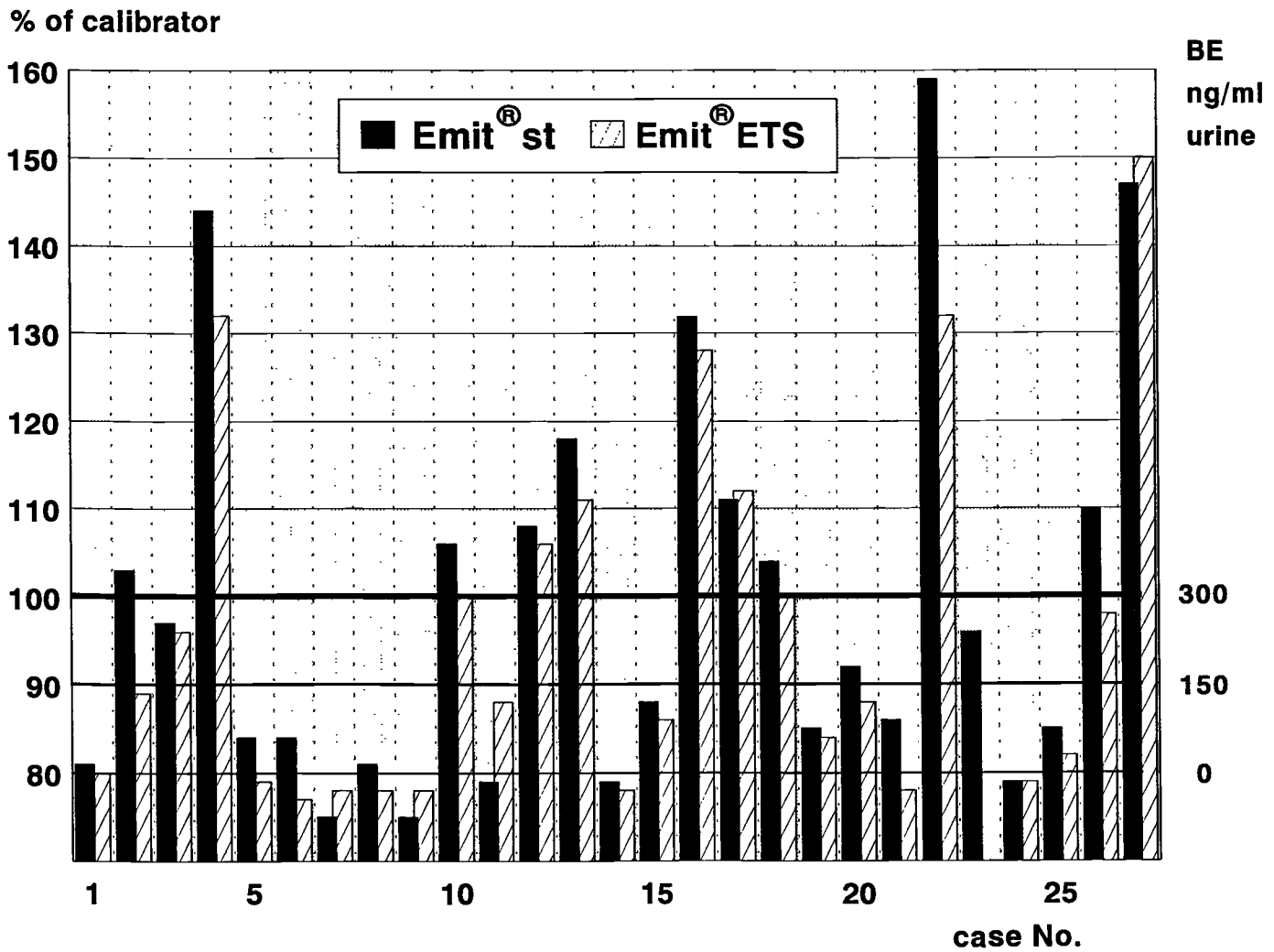

FIG. 2—*Comparison of results of immunochemical urine examinations by means of Emit® ETS and Emit® st procedures. The results are expressed as percent values of cutoff 300 (left ordinate axis). On the right ordinate axis the corresponding benzoylecgonine concentrations are marked.*

cation of the origin of the packages. This was not pursued further, however, for obvious geographical reasons. Seven selected drug packages were examined on leakage. In two cases very distinct leaching was detected, in one case moderate amounts of BE and CO in the incubation bath were found. The remaining four packages were almost completely tight under applied experimental conditions. The leaching was in the same order in all of the experimental conditions (Table 3). The results of urine examinations in these cases correlated well with the quality of packages. Only urine samples from smugglers who transported leaking packages showed positive immunochemical results.

Urine Samples

In each case the diagnosis was made on the base of X-ray examination. Therefore, the study concentrated on the evaluation of the frequency of false-negative immunochemical results. It should be stressed, that the diagnostic value of an X-ray examination depends very heavily on the personal experience of the radiologist.

The urine samples were examined by means of two immunochemical methods: EMIT® st (at the airport Frankfurt-Main) and EMIT® ETS (in the Institute of Forensic Medicine in Aachen). Only nine EMIT®-st and eight EMIT® ETS tests (cutoff 300 ng BE/mL urine) showed unequivocally positive results.

For the sake of comparability, the results from both methods were expressed as percent values of calibrator 300. The comparison of both methods showed a very good agreement of the results and a slightly higher sensitivity of the EMIT® st procedure (Fig. 2).

The application of an assay based on one cutoff value gives no information on the values, which may probably approach the critical concentration and qualify as "almost positive." To clarify this, drug-free urine samples were examined with EMIT® ETS assay along with the urine samples taken from drug smugglers. The comparison of results revealed three groups: eight urines gave definitely positive results (i.e., absorbance higher than calibrator 300), nine were definitely negative (i.e., absorbances identical or close to those of drug-free urines) and ten urine samples showed inconclusive results (that is, definitely higher than those of drug free urine, but lower than the cutoff value) (Table 4).

The existence of a pretty large group of inconclusive results indicated that the cutoff 300 of EMIT® ETS might be too high. Hallbach and Guder [*17,18*] proposed to use detection limits of immunochemical tests as decisive levels instead of cutoff values for screening purposes in clinical toxicology. EMIT® ETS and

EMIT® st tests were recalibrated with spiked urine standards. For this purpose drug free urine samples (five in each series) were spiked with BE to the concentration of 50, 100, 150 and 300 ng/mL and the absorbance values were measured. On the base of these experiments the cutoff 150 ng/mL urine was applied. This allowed to classify three additional urine samples as positive. The presence of BE in these samples was confirmed by means of GC and HPLC examination in two of these three cases.

In general, only some 30% urine samples (using the cutoff 300) or some 40% samples (using the cutoff 150) showed positive immunochemical reaction with EMIT® cocaine metabolite test despite large quantities of internally concealed drug packages, containing highly pure cocaine. This shows the quality of contemporary drug packages and the limitations of immunochemical urine examination as a screening method in the cases of suspected body packing. On the contrary, in all examined cases the X-ray examination gave unequivocally positive results.

The results of urine examination were independent upon the number of protective layers of the drug packages. These findings, together with the results of leakage study may suggest that cocaine was liberated through the knot and did not originate from the external contamination of drug containers. On the other hand, the possibility of cocaine use by drug smugglers may not be totally excluded. This could be elucidated through repeated examination of urine without extraction of drug packages. In the case of cocaine use the concentration of eliminated cocaine metabolite would show a decreasing trend, whereas the leaching drug package would keep the steady, or even increasing level of drug in urine. Such a procedure, however, would be obviously unacceptable from the ethical point of view.

Saliva

All 20 saliva samples examined by means of EMIT® ETS assay gave negative results.

Conclusions

1. Cocaine drug packages used recently for body transport showed a high degree of sophistication and were obviously machine made. Differences in the number and order of sheaths, size, weight and cocaine quality may be helpful for identification of the source and production site.

2. Some examined cocaine containers showed extensive leaching under experimental conditions. The leaching was independent on the number of protective layers and most probably occurred through the knotted ending of the package.

3. Twenty-seven urine samples taken from arrested body packers may be divided into three groups:

- one-third of samples showed no detectable immunochemical traces of cocaine metabolite,
- one-third was immunochemical definitely positive (using cutoff 300 ng BE/mL),
- one-third showed immunochemical inconclusive results (that is, below cutoff 300 but higher than negative). After lowering the cutoff value to 150 ng BE/mL urine, about 40% of all urine samples were classified as positive.

4. The examination of saliva samples revealed no positive immunochemical results.

5. High quality of actually used drug packages makes the diagnostic usefulness of immunochemical urine screening in suspected body transport questionable. Negative results of immunochemical test is of no decisive value in such cases.

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