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AIMS: The purpose of the present study was to explore the postmortem concentrations of opiates in various settings. Opiates are potent antinociceptive agents that are extensively used to reduce or relieve pain e.g. in patients with burns or advanced cancer. Many opiates are also popular among drug abusers because of strong euphoric and reinforcing properties. In heroin overdose deaths, 6-acetylmorphine (6-AM) and morphine are usually detected, often together with codeine. However, the levels are variable and difficult to interpret. We wanted to explore the variation in concentration of ten opioid drugs in certified intoxications, where opiates were held mainly or partly responsible for the fatal outcome. We further wanted to investigate the concentration range in cases where the cause of death was not related to intoxication.

METHODS: The Swedish national forensic medicine and toxicology databases were explored to identify cases where opiates were detected in postmortem femoral blood. The data sample, originally including all medicolegal cases in Sweden 1992-2005, was then further processed by a combination of additional computer-assisted selections and manual perusal regarding cause and manner of death (and circumstances surrounding death). Eventually, based on the cause of death the following groups were formed: 1) certified intoxications involving opiates, 2) suicides by hanging, 3) certain forms of traumatic deaths (excluding cases with severe abdominal and thoracic trauma), and 4) fatal burns. The concentrations in femoral blood were scrutinized, and the minimum, median and maximum values were calculated for each opiate drug in group. Opiates evaluated included morphine, 6-AM, codeine, methadone, buprenorphine, alfentanil, fentanyl, ketamine and ketobemidone. All analyses were performed at the Department of Forensic Chemistry, the National Board of Forensic Medicine, Linköping, with sensitive methods based on GC, GC/MS and LC/MS/MS.

RESULTS: The cases finally included were allocated to Groups 1-4, predominantly to Group 1 comprising “overdose” cases involving opiates. A substantial overlap in concentrations between groups was evident for most substances. The femoral blood concentrations (in µg/g) of morphine and 6-AM are displayed in Table 1.

TABLE 1		Group 1 (N=2,048)	Group 2 (N=53)	Group 3 (N=572)	Group 4 (N=57)
Morphine	Median	0.155	0.04	0.07	0.96
	Range	0.005 – 14.7	0.002 – 0.98	0.005 – 5.5	0.005 – 5.3
	N	1,582	24	154	19
6-AM	Median	0.01	0.02	0.01	-
	Range	0.002 – 0.35	-	0.005 – 0.16	-
	N	574	1	23	-

Wide concentration ranges were also found for most other opiates studied, but the number of cases was much lower. Alfentanil was analyzed in several cases, but only detected in one case in Group 1. In several cases, more than one opiate drug was detected. As evident from Table 1, whenever 6-AM is detected, it is very likely that the cause of death was intoxication. Generally higher concentrations of morphine, ketamine and ketobemidon were observed in patients with burns. These patients were almost exclusively respirator-treated at the time for their demise.

CONCLUSIONS: The present study corroborates the opinion that postmortem blood concentrations of morphine and other opiates rarely can be interpreted without circumstantial information. The values in Group 4 illustrate that morphine toxicity is mainly related to respiratory depression, since the patients obviously tolerate very high levels if given respiratory support.

KEYWORDS: *Heroin, Interpretation, Morphine, Opiates, Overdose, Postmortem toxicology, Respiratory depression*

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