

Fatal intoxications in the age group 15–34 years in Denmark in 1984 and 1985

A forensic study with special reference to drug addicts

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Summary. This survey deals with the Danish part of a study on fatal intoxications conducted in the Nordic countries in 1984 and 1985 with special reference to drug addicts. There were 315 cases of fatal intoxications in people 15–34 years of age. These were examined at the Forensic Institutes in Denmark and described with reference to cause of death, sex, age and drug addiction. Of the deceased, 194 were drug addicts according to a specific definition of this term. Women accounted for 28% of all the fatalities investigated in the study and 24% of those in addicts. More than 90% of the deaths were caused by drugs, with ethanol as a contributory factor in approximately 40% of cases. Deaths caused by heroin/morphine predominated, causing 50% of the deaths among drug addicts, but legal drugs, such as dextropropoxyphene, methadone and ketobemidone were also frequent causes of death in this group. In half the cases the concentration of morphine in blood following injection of heroin/morphine was found to be equal to or less than 0.5 µmol/kg, and in only about one-tenth of cases was the blood concentration above 2.0 µmol/kg.

Key words: Drug addicts – Drug deaths – Heroin/morphine – Methadone – Dextropropoxyphene – Ketobemidone

Zusammenfassung. Diese Übersicht stellt den dänischen Beitrag zu einer nordischen Studie hinsichtlich tödlicher Vergiftungen in den nordischen Ländern zwischen 1984 und 1985 dar, wobei speziell auf Drogenabhängige Bezug genommen wird. Insgesamt werden 315 tödliche Intoxikationen bei Jugendlichen zwischen 15 und 34 Jahren hinsichtlich Todesursache, Geschlecht, Alter und Drogenabhängigkeit beschrieben. Die Untersuchungen wurden in den forensischen Institutionen in Dänemark durchgeführt. 194

der Verstorbenen waren Drogenabhängige im engeren Sinne der Definition. 28% der insgesamt untersuchten Fälle betrafen Frauen, davon 24% bei den Drogenabhängigen. Mehr als 90% der Todesfälle wurden durch Arzneimittel verursacht, wobei in etwa 40% der Fälle auch Alkohol eine Rolle spielte. Todesfälle mit Beteiligung von Heroin/Morphin dominierten und machten etwa 50% der Todesfälle bei Drogenabhängigen aus. Aber auch legale Drogen wie etwa Dextropropoxyphen, Methadon und Ketobemidon waren regelmäßig als Todesursache festzustellen. In etwa der Hälfte der Fälle lag die Morphinkonzentration im Blut nach Injektion von Heroin/Morphin im Bereich um 0,5 $\mu\text{mol/kg}$ oder darunter, nur in etwa einem Zehntel der Fälle lag die Konzentration im Blut über 2,0 $\mu\text{mol/kg}$.

Schlüsselwörter: Drogenabhängige – Drogentote – Heroin/Morphin – Methadon – Dextropropoxyphen – Ketobemidon

Introduction

Following the increase in drug abuse in many western countries during the 1970s, an increasing number of deaths caused by narcotics has also been seen in Denmark [1–6]. To get an impression of the problem in Denmark we found it relevant to investigate all cases of fatal intoxications in the age group 15–34 years examined at the forensic institutes, with special attention paid to drug addicts. The survey is part of a Nordic comparative study on fatal intoxications in younger people, with special reference to drug addicts [7].

Materials and methods

The study includes 315 autopsy cases of fatal intoxication in persons 15–34 years of age, some analysed at the Institute of Forensic Chemistry in Copenhagen and some in the Department of Forensic Chemistry, Institute of Forensic Medicine in Aarhus, thus representing the whole country in the period 1984–1985. The institutes in Copenhagen and Aarhus represent populations of approximately 3 and 2 million, respectively.

Cases in which the immediate cause of death was aspiration, hypothermia or bronchopneumonia, but where the underlying cause was considered to be intoxication, have been included. Carbon monoxide poisonings caused by fire are not included.

Drug addicts, according to the following definition, were regarded as a special group. In this study – as in the entire Nordic study – drug addicts were defined as persons who, according to information from the police reports and/or autopsy reports, were known to have abused drugs administered i.v. and/or were abusers of drugs listed in schedule I of The Single Convention on Narcotic Drugs 1961 (dextromoramide, heroin, ketobemidone, cocaine, methadone, morphine etc.) and/or schedules I and II of The Convention on Psychotropic Drugs 1971 (amphetamine, tetrahydrocannabinol, etc.).

General drug screening was usually performed only when no information on the drug(s) taken was available or when the suspected drug(s) was (were) absent or present in non-fatal concentrations. In nearly all cases a blood ethanol determination was performed.

The morphine concentrations were analysed by the same method at both institutes [8].

Results

During the 2-year period, 315 fatal intoxications in the age group of 15–34 years were examined in the forensic toxicological laboratories in Denmark. Drug addicts accounted for 194 (62%) of these cases (Table 1). In 92% (290 cases) death was caused by drugs, and ethanol was a contributory factor in about 40% of the cases (blood ethanol concentrations > 0.5 mg/g). Of the 290 drug intoxications, 257 were caused by a single drug and only in 33 cases were two or more drugs considered of equal importance for the occurrence of death. Ethanol alone caused 13 deaths, while death attributable to carbon monoxide was ascertained in 7 cases.

Figure 1 shows the distribution by sex and age among the 315 fatal intoxications. Women accounted for 28% of all cases, and for 24% of the addict cases. The age distribution, showing an increasing number of intoxications with age, was similar in the total study sample and in the drug addict group. The average age of the drug addicts was 28 years for both men and women.

Table 2 shows the intoxicants in single-drug intoxications. The most frequent cause of death was morphine/heroin (39%), and almost all such deaths were found in the drug addict group. Other strong analgesics, such as dextropropoxyphene, methadone, ketobemidone and dextromoramide, accounted for

Table 1. Fatal intoxications in the age group 15–34 years investigated in the forensic toxicological laboratories in Denmark in 1984 and 1985

Intoxicant	Drug addicts		Total
	<i>n</i> ^c	Percent of total	<i>n</i> ^c
Single drug	169 (67)	66	257 (95)
Multiple drugs	22 (4)	67	33 (9)
Ethanol alone	3 (3)	23	13 (13)
Carbon monoxide ^a	0	0	7 (4)
Various ^b	0	0	5 (0)
Total	194 (74)	62	315 (121)

^a Carbon monoxide intoxications from fires are excluded

^b Parathion, fluoride, cyanide, fluorocarbon and chloroform

^c Figures in parentheses indicate numbers of cases with blood ethanol concentrations over 0.5 mg/g

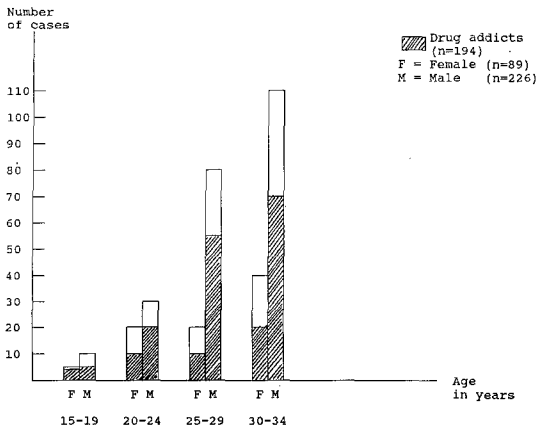


Fig. 1. Distribution by sex and age among 315 cases of fatal intoxications in the age group 15–34 years investigated in the forensic toxicological laboratories in Denmark in 1984 and 1985

Table 2. Fatal single-drug intoxications in the age group 15–34 years

Intoxicant	Drug addicts		Total
	<i>n</i>	Percent of total	<i>n</i>
Heroin/morphine	97	98	99
Dextropropoxyphene	23	34	67
Methadone	25	96	26
Ketobemidone	11	73	15
Dextromoramid	1	100	1
Barbiturates	4	22	18
Cyclic antidepressants	0	0	8
Neuroleptics	0	0	3
Other analgesics	1	14	7
Hypnotics/sedatives	3	75	4
Various drugs	4	44	9
Total	169	66	257

42% of the fatal intoxications. Apart those resulting from dextropropoxyphene, the great majority of these deaths were seen in the drug addict group. Barbiturates caused death in 7% of all cases, but only one-fifth of these were in the drug addict group. Cyclic antidepressants (mainly amitriptyline) and neuroleptics together caused 4% of the deaths, with no deaths in the drug addict group. Other analgesics (paracetamol and salicylic acid) accounted for 3%, and hypnotics/sedatives (methaqualone and chloral hydrate) for 1.5% of the deaths.

Table 3 shows the intoxicants referred to place of residence of the drug addicts: 81 (= 42%) deaths took place among drug addicts living in Copenhagen and 94 (= 48%) among drug addicts living in provincial towns in the country. In villages and rural districts only very few deaths were seen (6%). The “Other”

Table 3. Fatal intoxications among drug addicts 15–34 years of age, 1984 and 1985. Intoxicant referred to the residence of the addict

Intoxicant	Residence				Total (<i>n</i>)
	Copen- hagen	Provincial towns	Villages + rural districts	Other	
	(<i>n</i>)	(<i>n</i>)	(<i>n</i>)	(<i>n</i>)	
Heroin/morphine	47	36	8	6 ^a	97
Dextropropoxyphene	6	15	1	1 ^b	23
Methadone	10	14	1	0	25
Ketobemidone	6	5	0	0	11
Barbiturates	3	1	0	0	4
Miscellaneous	2	9	1	0	12
Multiple drugs	7	14	1	0	22
Total	81	94	12	7	194

^a Including 3 Norwegian citizens

^b Including 1 Norwegian citizen

group in Table 3 is made up of 4 foreigners, all Norwegians, and 3 cases in which no information was available as to the residence of the deceased.

More drug addicts died from an overdose of heroin/morphine in the metropolitan area than in the rest of the country, while the opposite is seen for fatal dextropropoxyphene intoxications.

Of the 194 drug addicts, 81 were unemployed at the time of death, 17 receiving disability pensions, 33 working in unskilled jobs and 17 in skilled jobs and 7 had some other kind of work; in 39 cases no information was available.

According to the police reports, information on attempts to treat the drug abuse was available in 56 cases, and in at least 17 of these cases methadone had been used in the treatment.

Most of the deaths among drug addicts were caused by injection of the drug. In 131 of the 194 cases the case history, needle marks revealed at the autopsy and/or findings of syringes near the body indicated injection as the most probable mode of administration. In 35 cases the deceased was found dead following injection of the drug in a public lavatory, staircase or similar, a further indication of a sudden death. In only 18 cases had the drug been taken orally, while in 45 cases the mode of administration could not be ascertained from the information available.

The concentrations of morphine found in the blood of drug addicts in 72 fatal cases following injection of heroin or morphine are shown in Fig. 2. Only morphine and, in 39 of these cases, ethanol (> 0.5 mg/g) were detected. It was not possible to demonstrate a difference in the distribution of the morphine concentrations in cases with or without ethanol in this material. In half the cases the morphine concentration was equal to or less than 0.5 µmol/kg and in 6 cases a morphine concentration above 2.0 µmol/kg was found. Most of the deaths

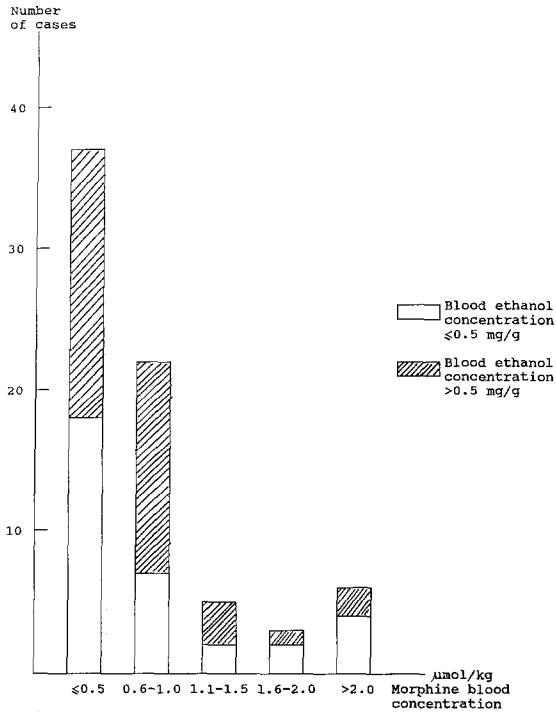


Fig. 2. Morphine blood concentrations in drug addicts in fatal cases after injection of heroin/morphine when only morphine (and ethanol) were detected. (No correction was made for losses in extraction. Recovery was 50%–60%)

were accidental, but in 2 suicide cases blood concentrations of 14 and 22 $\mu\text{mol/kg}$ were seen. The corresponding liver values in these 2 cases were 2.5 and 4.0 $\mu\text{mol/kg}$, respectively. The results have not been corrected for losses in extraction. Recovery was 50%–60%.

Discussion

According to Danish law, all deaths related to abuse of narcotics must be investigated by medicolegal autopsy and toxicological examination. Apart from the deaths occurring in drug addicts, medicolegal autopsy and toxicological analysis are performed in far from all cases of fatal poisoning in Denmark. This may be one of the reasons why the addicts account for 62% of the cases in this survey, as against 33%, 16%, and 5% in the corresponding surveys conducted in Norway, Sweden, and Finland, respectively [7]. In addition, however, Denmark is known to have the most severe drug problem of any of the Nordic countries, with an estimate of about 6000–10000 heavy misusers. This is in agreement with the results of this investigation, which revealed that in 1984 and 1985 the number of fatal intoxications in drug addicts per 100000 inhabitants was 3–5 times higher in Denmark than in Norway and Sweden [7].

Half the deaths among drug addicts were caused by morphine and heroin, but legal drugs such as methadone, dextropropoxyphene and ketobemidone were the cause of death in a total of 31% of fatal intoxications among the drug

addicts (13%, 12%, and 6%, respectively). Nearly all fatal intoxications caused by methadone were found among drug addicts. In Denmark methadone is used in the treatment programmes for drug addicts.

Dextropropoxyphene fatalities were seen in 12% of the drug addict group and in 21% of the total material. The preponderance of dextropropoxyphene deaths among non-addicts is in accordance with previous studies of fatal poisonings in Denmark, in which dextropropoxyphene was found to be the third most frequent intoxicant in the metropolitan area and the most frequent in Jutland when all ages were included [5, 6, 9].

Ketobemidone is an analgesic that is often used and abused in Denmark, and fatal intoxications are seen mostly among drug addicts, but also in the non-addict group. Previous studies on fatal intoxications in East Denmark [6] have shown this drug to be one of the ten most frequent causes of poisoning.

The dominance of single-drug deaths in this study is not synonymous with single-drug addiction. An investigation from a Contact Centre for treatment of drug addicts concluded that 73% of the drug addicts practised multiple-drug abuse and that the incidence of mixed addiction had increased since the beginning of the 1970s [10]. It was also concluded that legal drugs were a very important part of the abuse, which is in agreement with the results of this investigation.

The findings of few multiple-drug intoxications in this study is most probably due to the fact that the forensic chemical investigations were stopped in most cases when one drug was found present in fatal concentrations.

None of the fatal intoxications examined in this study was caused by amphetamine or any other psychoactive drugs, including cocaine. In the Nordic comparative study only one death due to amphetamine and one due to ephedrine were seen, both in Sweden [7], where the abuse of amphetamine and other centrally stimulating amines has been a problem for many years [11]. In recent years an increasing amount of illicit amphetamine has been seized in Denmark [12], and amphetamine is also detected in an increasing number of cases in the forensic toxicological laboratories in Denmark, in specimens both from living persons and from autopsy cases.

The number of drug addicts dying of an overdose increases with age, and 26 deaths in drug addicts older than 35 years in 1984 and 1985 were not included in this study. In a prospective study on deaths of drug addicts in the five Nordic countries the age group up to 40 years will therefore be included.

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