

## Analysis of Suicide in Legal Autopsy During the Period of 1981~1984

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= Abstract = In order to evaluate the death structure of legal autopsy cases of suicide, a total of 291 cases of suicide out of 4,367 legal autopsies performed in the Department of Pathology, the National Institute of Scientific Investigation during 1981-1984 were analyzed with emphasis on the poisons used as suicidal measures.

The results obtained and conclusions drawn were as follows:

1. The male to female sex ratio in the legal autopsy cases of suicide was 1.53. As compared with that of general suicide statistics, it is believed that the autopsy rate has been lower in male suicides than in female ones.

2. Male cases were rather widely distributed over the age group of 10's to 50's, whereas in female predominantly within the 10's to 30's. The age distribution of the legal autopsy cases in either sex seemed to be similar to that of general suicides.

3. As for the cause of death, poisoning was 72.9%, hanging 25.4%, and cut of blood vessels 1.7%. The structure of cause of death was different from male to female; poisoning was more frequently observed in male cases.

4. In poisoning, the major agents were potassium cyanide (57.1%), agricultural drugs (23.1%), and carbon monoxide (8.5%).

5. Males used more predominantly potassium cyanide than females as a suicidal poison, especially in male 10's and 20's.

6. In 1930's, sodium hydroxide was used exclusively, in 1960's sodium hydroxide and other agents in half and half, and in early 1980's potassium cyanide (57.1%) and agricultural drugs (23.1%).

7. With the above findings, it is speculated that the availability and accessibility play a great role in choosing specific poison as a suicidal measure. It is highly recommended to carry out toxicological study on the oncoming available and accessible poisons in aspect of legal medicine.

**Key Words:** *Suicide, Legal autopsy, Death structure*

### INTRODUCTION

Suicide has been treated as one of the major social problems in many countries, as it reflects the socio-economic profile and psychological well being of the inhabitants of community. In the "Cause of Death Statistics" published by Economic Planning Board of Korea in 1983, suicide was the ninth cause of death, and Cho (1985) suggested a

possibility that Korea ranks all the other countries of the world in the suicidal death rate. Therefore, considerable attention has been focused on suicidal problems in many fields, especially in psychiatry and public health.

As for suicidal attempters, psychiatric and epidemiological aspects have been well investigated and described in several reports (Kim 1963; Yoo 1978; Hong and Lee 1980; Suk *et al.* 1980) as well

as the detailed description about the methods employed. In case of committed suicide, a few papers are available in Korea, illustrating the socio-environmental background of the deceased and the epidemiology with the gross profile of the cause of death in suicide (Kang 1962; Won 1963), but detailed analysis on the poisons used is lacking, or sampling of the cases is very limited in regard to the residential place (Yoo and Kim 1981).

The structure of the cause of death and the detailed measure employed in suicide have been known to be quite different from nation to nation, from a community to another, and to be altered with the changes of the time in a community (Cho 1985). This trend was also documented by Suk *et al.* (1980) in suicide attempters and the author also noticed this changing pattern in autopsy case analysis (Lee *et al.* 1984), but there is very little information available to understand the present status of this trend.

Very limited cases of suicide have been autopsied or inspected by medical examiners or legal medicine-oriented physicians in Korea, either when the cause of death can not be detected by the external examination of the deceased or not determined by the investigation of the death circumstances, or when the death is related to a certain legal problem. So it can be estimated that the structure of cause of death in legal autopsy cases of suicide would be somewhat different from that of general suicide. In most of suicide, the information about the death circumstances is usually uncertain, or of no use, or even misleads the medical examiner, because the relatives of the suicide are prone to conceal or to distort the real information, or to deny his or her commitment of suicide. Thus, it is very important and valuable to understand the death structure of the legal autopsy cases of suicide, and it would be very helpful, when facing, as a medical examiner, an autopsy case of pre-

sumptive suicide.

The author analyzed the legal autopsy cases of suicide in order to evaluate the death structure of this specifically conditioned status with emphasis on the changing pattern of the poisons used.

### MATERIALS AND METHODS

A total of 291 cases were proven to be suicides among a total of 4,367 legal autopsies performed in the Department of Legal Medicine, the National Institute of Scientific Investigation (NISI) from 1981 to 1984 (Table 1). Those cases had been referred to the NISI for autopsy in order to determine the cause of death or to clarify an uncertain legal problem by public attorneys or detectives, when the information gathered at the scene investigation was not sufficient to assure the commitment of suicide, or the circumstantial evidences collected by the detectives were not satisfactory to support the commitment of suicide. In another cases some of the stated homicides and stated accidents were proven to be suicides by legal autopsy.

These cases were analyzed in relation to the distribution of age, sex, cause of death, and poisons in case of poisonous suicide.

In order to evaluate indirectly the changing pattern of poisons used, suicide cases of the 1930's and the 1960's were also analyzed. A total of 29 cases was of suicidal death out of 862 cases which were autopsied during 1929~1941 (1930's) in the Department of Pathology, Faculty of Medicine, Keijo Imperial University. A total of 37 suicidal cases were obtained from 1,540 autopsy cases admitted to the National Medical Center during the period of 1958~1967 (1960's).

### RESULTS

#### 1. Age and Sex Distribution

During the period of 1981~1984, out of legal autopsy cases of suicide, 176 were male and 115,

Table 1. Number and percent of suicidal cases in legal autopsy during 1981-1984

Year	Male		Female		Total		M:F Ratio of Suicide
	TA	Suic.(%)	TA	Suic.(%)	TA	Suic.(%)	
1981	601	38(6.3)	336	24(7.1)	937	62(6.6)	1.58:1.00
1982	708	44(6.2)	293	29(9.9)	1,001	73(7.3)	1.52:1.00
1983	769	48(6.2)	373	33(8.8)	1,142	81(7.1)	1.45:1.00
1984	906	46(5.1)	381	29(7.6)	1,287	75(5.8)	1.59:1.00
Total	2,984	176(5.9)	1,383	115(8.3)	4,367	291(6.7)	1.53:1.00

TA; total autopsy cases

Suic.; suicide cases

**Table 2.** Age and sex distribution of suicidal cases, 1981-1984

Age Group	Male		Female		Total		M:F Ratio
	No.	(%)	No.	(%)	No.	(%)	
10-19	16	(9.1)	14	(12.2)	30	(10.3)	1.14:1.00
20-29	81	(46.6)	52	(45.2)	133	(45.7)	1.56:1.00
30-39	37	(21.0)	36	(31.3)	73	(25.1)	1.03:1.00
40-49	25	(14.2)	6	(5.2)	31	(10.7)	4.17:1.00
50-59	16	(9.1)	5	(4.3)	21	(7.2)	3.20:1.00
over 59	1	(0.6)	2	(1.7)	3	(1.0)	0.50:1.00
Total	176	(100.0)	115	(100.0)	291	(100.0)	1.53:1.00

female. Suicide autopsy was 5.9% in male, 8.3% in female, and 6.4% in total, among the total legal autopsy cases. The number of male suicides were 1.5 times as many as female ones (Table 1).

In the age distribution of legal autopsy cases of suicide during 1981~1984 (Table 2), the most prevalent age group was the 20's (45.7%), followed by the 30's (25.1%), the 40's (10.7%) and the 10's (10.3%).

In male, most of the cases (81.8%) were within the age group of the 20's to 40's, and a considerable number of cases were observed in the 10's and 50's. On the other hand, 88.7% of female cases were within the age group of 10's to 30's, and few cases were observed after these age groups. The male to female ratio was 1.14 in the 10's, 1.56 in the 20's, 1.03 in the 30's, 4.17 in the

40's, and 3.20 in the 50's.

## 2. Cause of Death

Table 3 shows the cause of death in legal autopsies of 1981~1984. Poisoning was the most frequent cause of death, proved in 212 (72.9%) out of 291 cases, followed by hanging in 74 cases

**Table 3.** Distribution of cause of death in suicidal cases, 1981-1984

Cause of Death	Male	Female	Total
	No.(%)	No.(%)	No.(%)
Poisoning	133 (75.6)	79 (68.7)	212 (72.9)
Hanging	41 (23.3)	33 (28.7)	74 (25.4)
Cut of vessels	2 (1.1)	3 (2.6)	5 (1.7)
Total	176(100.0)	115(100.0)	291(100.0)

**Table 4.** Distribution of cause of death in each age group by sex

Cause of Death	Male					
	Age group (years)					
	10-19	20-29	30-39	40-49	over 50	Total
Poisoning	13(81.3)	68(84.0)	25(67.6)	17(68.0)	10(58.8)	133(75.6)
Hanging	3(18.7)	11(13.6)	12(32.4)	8(32.0)	7(41.2)	41(23.3)
Cut of vessels	—	2 (2.4)	—	—	—	2 (1.1)
Total	16(100.0)	81(100.0)	37(100.0)	25(100.0)	17(100.0)	176(100.0)

Cause of Death	Female					
	Age group (years)					
	10-19	20-29	30-39	40-49	over 50	Total
Poisoning	10(71.4)	37(71.1)	26(72.2)	3(50.0)	3(43.0)	79(68.7)
Hanging	4(28.6)	14(26.9)	9(25.0)	3(50.0)	2(28.5)	33(28.7)
Cut of vessels	—	1 (2.0)	1 (2.8)	—	2(28.5)	3 (2.6)
Total	14(100.0)	52(100.0)	36(100.0)	6(100.0)	7(100.0)	115(100.0)

(25.4%), and cut of blood vessels in 5 cases (1.7%). Poisoning was more prevalent in male (75.6%) than in female (68.7%), and hanging (28.7%) was slightly higher in female than in male (23.3%).

In male, poisoning was more common in the 10's (81.3%) and 20's (84.0%) than after the age of 30 (58.8%~67.6%). In female, the proportion of poisoning was 71.4%, 71.1%, and 72.2% in the 10's, 20's, and 30's, respectively. After the age of 40 in female, poisoning was less than 50% (Table 4).

Potassium cyanide was most commonly used in poisoning among legal autopsy cases of suicide. Out of 212 poisoning, potassium cyanide was used in 121 cases (57.1%), followed by agricultural drugs in 49 (23.1%), and carbon monoxide in 18 (8.5%). The distribution of poisons used was quite different in between male and female.

Male employed mostly potassium cyanide (69.9%), and then agricultural drugs (21.2%), carbon monoxide (3.8%) in descending order. On the contrary, several kinds of poisons were rather variably used in female; potassium cyanide 35.4%, agricultural drugs 26.6%, carbon monoxide 16.5%, rodenticides 3.8%, acids and therapeutic drugs.

In male, the majority of poisonings in the 10's and 20's age groups were of potassium cyanide, and after the age of 30 there was no evident difference in the age-specific distribution of poisons, though more than half were found to be of potassium cyanide poisoning. Agricultural drug poison-

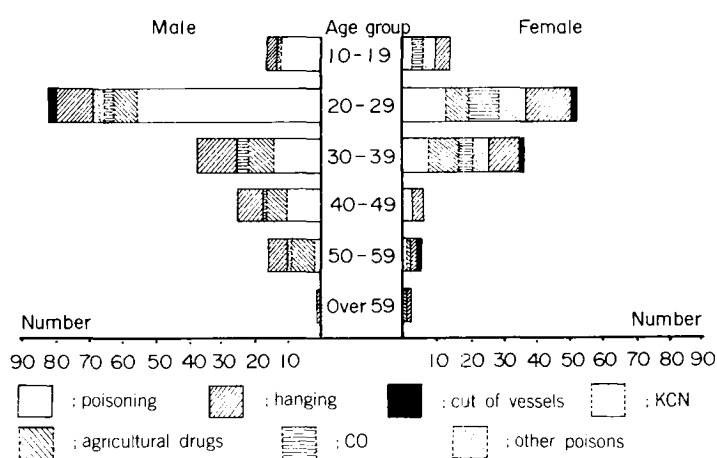


Fig. 1. Age and sex distribution of suicidal causes.

ing increased proportionally with advance of age (Fig. 1).

In female, there was no evident difference in the age-specific distributions of poisons. Proportion of potassium cyanide poisoning was around one-third in each age group (Fig. 1).

In the 1930's, all the cases committed suicide by ingestion of sodium hydroxide (NaOH). All cases of the 1960's were also of poisoning of sodium hydroxide in 51.4%, therapeutic drugs in 16.2%, acids in 13.5%, agricultural drugs in 10.8%, and carbon monoxide in 5.4% in descending order. Sodium hydroxide poisoning was more frequent in female (56.5%) than in male (42.9%). In therapeutic drug poisoning, 3 cases were barbiturate, 2 cases chloroquine, and 1 case INH poisoning (Table 6).

Table 5. Poisons used in suicide, 1981-1984

Poisons	Male	Female	Total
	No.(%)	No.(%)	No.(%)
Potassium cyanide(KCN)	93 (69.9)	28 (35.4)	121 (57.1)
Agricultural drugs(AD)	28 (21.1)	21 (26.6)	49 (23.1)
Organic phosphate(OP)	10 (7.5)	11 (13.9)	21 (9.9)
Organic chloride(OC)	5 (3.8)	4 (5.1)	9 (4.2)
Inorganic phosphate	3 (2.3)	3 (3.8)	6 (2.8)
OP+OC	8 (6.0)	3 (3.8)	11 (5.2)
Unknown AD	2 (1.5)	0	2 (0.9)
Carbon monoxide	5 (3.8)	13 (16.5)	18 (8.5)
Acids	1 (0.8)	2 (2.5)	3 (1.4)
Rodenticide(fluoroacetate)	0	3 (3.8)	3 (1.4)
Therapeutic drugs	0	2 (2.5)	2 (0.9)
Formalin	1 (0.8)	0	1 (0.5)
Unknown intoxication	5 (3.8)	10 (12.7)	15 (7.1)
Total	133(100.0)	79(100.0)	212(100.0)

**Table 6.** Poisons used in suicide, 1958-1967

Poisons	Male	Female	Total
	No.(%)	No.(%)	No.(%)
Sodium hydroxide(NaOH)	5 (35.8)	13 (56.5)	19 (51.4)
Therapeutic drugs	3 (21.4)	3 (13.0)	6 (16.2)
Acids	3 (21.4)	2 (8.7)	5 (13.5)
Agricultural drugs	1 (7.1)	3 (13.0)	4 (10.8)
Carbon monoxide	0	2 (8.7)	2 (5.4)
Other chemicals	1 (7.1)	0	1 (2.7)
Total	14(100.0)	23(100.0)	37(100.0)

## DISCUSSION

The data used in this analysis were strictly confined to those of legal autopsy. So it is quite true that they can not represent the general pattern of suicide. However, since this analysis was aimed to figure out the characteristics of the suicide which was referred to legal autopsy, it is not considered that the non-representativeness of the data does play a significant role in interpretation of the results.

According to the nationwide statistics of EPB, Korea, the male to female ratio of suicides was 2.49 in 1981, and 2.18 during 1977~1979 in Yoo and Kim's report (1981), while the ratio was 1.53 during 1981 to 1984 in the legal autopsy cases of this study. It can be deducible that the male autopsy rate might be lower than female one. Quite similar pattern was also observed in hospital autopsy case of suicide. In the 1960's, its ratio was 0.61 in the hospital autopsy cases, and the ratio of the nearly corresponding era was reported to be 0.92 (Won 1963) to 1.13 (Kang 1962). In other words, the lower sex ratio in this analysis means that referral rate of male suicide to autopsy might have been generally lower than that of female, whether the autopsy be legally related or of hospital origin.

Although suicide prevailed mostly in the 20's age group of either sex in legal cases, age distribution was somewhat different from male to female. In male, cases were rather widely distributed over the age group of 10's to 50's, whereas in female, predominantly within the 10's to 30's. The age distribution of the legal autopsy cases of suicide seemed to be of no considerable difference from that of general suicide, since the nationwide suicide statistics (EPB 1981, 1983) showed a similar pattern.

Analysis of the cause of death revealed that more than one quarter of the autopsy cases were of hanging and cutting blood vessels, of which the proportion increased with advance of the age. In general, the causes of death of hanging and cutting blood vessels could be easily detectable only by external examination, though in a few cases, it may be somewhat difficult to determine the manner of death, that is, whether it is suicide, or homicide, or accident. It is very hard to explain at this moment the reason why those cases were to be autopsied. These necessitate further analysis on the referral background to autopsy.

Ingestion of poisonous chemicals or drugs was reported to be the most popular method of suicidal deaths in Korea (Kang 1962; Won 1963; Yoo and Kim 1981). It was observed that 73% of legal autopsy cases of suicide were of poisoning. It is uncertain that the findings reflect the general pattern of the suicide in early 1980's. The proportion of poisoning suicide was reported to be 74.2% in urban area in 1958~1962 (Won 1963) and 51.6% in general population in 1960 (Kang 1962).

Among the poisons potassium cyanide has been traditionally stated to be one of the important drugs for suicide (Cho 1985). In the legal autopsy cases of suicide potassium cyanide was presented as the most popular agent used especially in the male 10's and 20's. When facing a legal autopsy case of presumptive suicide, especially of young man, poisoning should be firstly considered because suicidal poisoning was very common in age of the male 10's and 20's.

In fact, there are some limitations to compare the patterns of suicidal poisoning in between the 1930's, the 1960's, and 1981~1984. The cases of the 1930's and the 1960's were of hospital autopsy, while those from 1981 to 1984 were of legal

cases. These limitations are also pointed out even in the hospital autopsy cases of the 1930's and the 1960's (Lee *et al.* 1984). However, it might be practically implicated to compare a specifically conditioned status, e.g. choosing a specific poison. In the chronological comparison of the suicidal poisoning, sodium hydroxide was the exclusive agent in the 1930's. And in the 1960's chemicals other than sodium hydroxide such as therapeutic, agricultural drugs, and acids, had been used considerably (about 50%). In the early 1980's potassium cyanides, acids, and agricultural drugs were the major agents, whereas there was no case of sodium hydroxide poisoning.

In suicidal poisoning, it can be speculated that the availability and accessibility may play a great role in choosing a specific poison, which can be supported by the findings of this study, that is, the chronological changing pattern, the predominant use of potassium cyanide in the male 10's and 20's, and the different sexual distribution pattern of agents. Therefore, it would be necessary to carry out toxicological study of oncoming available and accessible poisons in an aspect of legal medicine.

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### 법의부검 자살예의 분석(1981~1984)

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법의부검 자살예의 사망구조를 밝히기 위하여 1981년부터 1984년까지 국립과학수사연구소 법의과에서 시행된 부검 4,367예중 291 자살예의 성별, 연령별, 사인별 사망구조에 대해 분석하고, 특히 사용 중독물 종류를 1930년대 및 1960년대와 비교하여 다음과 같은 결과를 얻었다.

1. 남녀의 비율은 1.53으로 일반 자살예보다 낮았고 남자자살자의 부검율이 낮았다.
2. 연령분포상은 남자예는 10대에서 50대까지 비교적 넓게 분포되어 있으나 여자예는 거의 10대에서 30대이었다. 이와 같은 분포는 일반 자살자의 연령분포상과 유사하였다.
3. 사인별로는 중독사가 72.9%, 의사(hanging)가 25.4%, 혈관자창이 1.7%였고 중독사예는 남자에서 더 많았다.
4. 중독사의 주요소재는 KCN(57.1%), 농약(23.1%), CO(8.5%)였으며 남자예에서 KCN의 사용빈도가 높았고 특히 10대 및 20대에 많았다.
5. 1930년대의 병원부검자살예는 모두 NaOH(양잿물)중독이었으나 1960년대의 병원부검자살예는 NaOH와 기타중독물에 의한 중독이 반반 정도였으며 1980년대 초의 법의부검예는 KCN(57.1%), 농약(23.1%)의 비율이었다.
6. 이상의 소견을 종합분석하면 중독물 자살자가 중독물을 선택할 때는 중독물의 접근 용이도와 이용 용이도에 따라 결정됨을 짐작할 수 있었다. 따라서 법의학적 측면에서는 앞으로 쉽게 이용될 수 있고 쉽게 접근될 수 있는 독물에 대한 연구가 필요하다고 생각되었다.