

Comparison Between Predicted Cause of Death and Cause of Death Found at Autopsy in Medicolegal Autopsy Material

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Summary. The question whether an autopsy could have been omitted without adversely affecting diagnostic accuracy in cases in which an unnatural death was not suspected, was investigated by evaluating data from the files of cases handled in 1977 at the Government Department of Forensic Medicine in Uppsala in which the police had requested a simple medicolegal examination. The police report and the result of an external examination were evaluated blindly and cases divided into three groups. In 95 cases (12%) no autopsy, in 360 cases (45%) a partial autopsy, and in 346 cases (43%) a complete autopsy was considered necessary. In three of the 95 cases and in four of the 360 cases a wrong diagnosis was made. In 59 cases (7%) a complete medicolegal examination was performed. In 21 of the latter the circumstances of death were obscure and in 11 of these an unnatural cause of death was found.

The investigation confirms that all cases must be handled by skilled medicolegal experts, that the extent of the medicolegal examination can well be assessed by the physician in charge, and that the autopsy procedure can be simplified in many cases and omitted in some, especially in a situation where resources are limited, without significantly affecting diagnostic accuracy in the individual case. However this policy adversely affects scientific studies on larger autopsy material.

Key words: Medicolegal autopsy – Postmortem diagnosis – Diagnostic accuracy – Cause of death

Zusammenfassung. Anhand der Fälle, bei denen die Polizei eine einfache rechtsmedizinische Untersuchung am Staatlichen Rechtsmedizinischen Institut in Uppsala verlangt hatte, wurde die Frage untersucht, ob man auf eine Obduktion in Fällen ohne Verdacht auf unnatürlichen Tod ohne Verlust diagnostischer Zuverlässigkeit verzichten kann. Polizeiberichte und Resultate der äußeren Besichtigungen bewertete man pauschal und teilte die Fälle in drei Gruppen ein. In 95 Fällen (12%) wurde keine Obduktion, in 360 Fällen (45%) eine begrenzte Obduktion und in 346 Fällen eine vollständige Obduk-

tion als notwendig erachtet. Bei drei der 95 Fälle und vier der 360 Fälle wurden Fehldiagnosen gestellt. In 59 Fällen (7%) wurde eine vollständige rechtsmedizinische Untersuchung durchgeführt. In 21 dieser letzteren Fälle waren alle Umstände unklar; man stellte einen unnatürlichen Tod in 11 Fällen fest.

Das Untersuchungsergebnis zeigt: 1. Alle Fälle müssen von erfahrenen rechtsmedizinischen Sachverständigen untersucht werden. 2. Der Umfang der jeweiligen rechtsmedizinischen Untersuchung kann vom verantwortlichen Arzt bestimmt werden. 3. In besonderen Fällen kann die Obduktion vereinfacht werden. In einigen individuellen Fällen kann man sogar von ihr ohne Verlust der diagnostischen Zuverlässigkeit absehen. Dieses Vorgehen wirkt sich jedoch auf wissenschaftliche Untersuchungen an größerem Obduktionsmaterial nachteilig aus.

Schlüsselwörter: Leichenöffnung, Korrektur der Ermittlungsergebnisse – natürlicher Tod, Fehldiagnosen

Every area of qualified medical activity requires continuous feedback to assess whether the primary objectives are fulfilled. This is important to ensure progressive constructive changes in practice and for continuous evaluation of the need for qualified service. Such feedback is also essential in forensic routine autopsy practice.

Many countries demand the opinion of a medically qualified person with regard to the cause of death prior to burial or cremation. This opinion is usually expressed in a "death certificate", often based on clinical data, if available, or otherwise on autopsy findings.

According to Swedish law, a death certificate may be issued by a physician under only three circumstances (provided there is no reason to suspect an unnatural cause of death): (1) after treatment of a patient for a disease which led to his death; (2) after assistance at a childbirth with death of the mother or child, and (3) after examination of the dead body as in the case of a simple medicolegal examination.

As a result of the growth of the General Health Service and an increase in the number of doctors available, the individual physician's knowledge of his patients and his responsibility toward them have decreased. In an increasing number of situations the physician, as an individual, can no longer be considered to have treated his patient for the disease causing death in the sense demanded by law. This function now rather rests with the hospital or the Health Service leading to a situation whereby, increasingly, no "individual" is obliged to issue a death certificate on clinical grounds. Consequently, the authorities have to request a medicolegal examination in a large number of "benign" deaths. This has led to a dramatic increase in the number of medicolegal examinations during the last decade. The increase is greater than the actual expansion of the medicolegal organization and has resulted in a situation in which time and effort for more complicated medicolegal examinations constantly compete with the heavy and time-consuming routine work of simple medicolegal examinations in which no specific question is at issue or suspicion of criminality exists.

The simple medicolegal examinations¹ are requested by the police if in their own investigation nothing contradicts a natural cause of death. At the simple medicolegal examination merely the "probable cause of death" need to be established and thereby the basis for the issue of a death certificate.

The aim of the present investigation was to evaluate the necessity for the every increasing number of simple medicolegal examinations.

Material and Methods

The evaluated data were from the files of 863 cases autopsied in 1977 at the Government Department of Forensic Medicine, Uppsala, Sweden, in which the police authorities had requested a simple medicolegal examination.

The documentary material was divided into two, each part consisting of the autopsies of approximately every alternate month. For each case one author supplied the other with the police report and that part of the autopsy report dealing only with the external examination of the body. After studying the police report and without knowing the result of the complete autopsy or having seen the death certificate, the other author classified each case into one of the following groups:

Group I. Deaths which in all probability occurred from a natural cause as established without an autopsy. From a medicolegal point of view an autopsy was thus regarded unnecessary and a death certificate could, in fact, have been issued without it.

The cases falling into this group were by and large persons who died in the presence of a relative or in an ambulance with a history of arteriosclerotic heart disease with terminal symptoms of typical myocardial infarction or cardiac insufficiency.

Group II. Deaths in which the facts presented were such that only a partial autopsy was considered necessary for establishing the probable cause of death.

The cases of this group generally had a history of arteriosclerotic cardiac disease with circumstances surrounding the death not as clear as in Group I, but with no indication of the possibility of an unnatural cause of death. A putative diagnosis was made at least as far as the organ system responsible for death was concerned.

Group III. Deaths in which the circumstances surrounding death were either obscure, i.e. unknown to the police, or not described in the police report.

Cases with minor ecchymoses or skin abrasions on the head were included in this group, even if the circumstances were such that they could have been placed in Groups I or II. A conventional autopsy was considered necessary for the issue of a death certificate.

At our department no differentiation is made between the simple medicolegal examination and a complete autopsy. In all examinations the viscera including the brain are removed and examined. Exceptions to this rule are the unequivocal causes of death, such as myocardial or aortic rupture or massive pulmonary embolism. Microscopic investigations are not performed routinely in all cases. When a more extensive investigation is indicated (i.e., when an unnatural cause of death is suspected) or when such need becomes apparent at the autopsy, the police authorities are always contacted and a complete medicolegal examination is performed.

Results

The results are presented in Tables 1-4.

In 59 (7%) of the cases (Table 1) information was obtained by the physician in charge before or at the autopsy indicating the necessity for a complete medicolegal

¹ Apart from the *simple medicolegal examination* there are two more extensive forms of post mortems in the Swedish medicolegal system. The *complete medicolegal investigation* is performed when an unnatural cause of death is suspected and the *medicolegal autopsy proper* when there is suspicion that death is the result of criminal offense or when the identity is unclarified

Table 1. Distribution of the investigated material on the basis of our selection procedure

	Number of cases	Simple investigations (%)	Total material (%)
Group I	95	12%	
Group II	360	45%	
Group III	346	43%	
No record available	3		
Simple medicolegal autopsies performed in 1977	804	100%	93%
Cases where a simple examination was originally requested but where a complete medicolegal examination was found necessary	59		7%
Total number of simple medicolegal examinations requested in 1977	863		100%

Table 2. Causes of death in cases subjected to simple medicolegal examinations in Uppsala in 1977

	Group I		Group II		Group III	
	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)
Coronary disease	78	(82.1)	302	(83.9)	269	(77.7)
Other cardiac disease			6	(1.7)	6	(1.7)
Cardiac and other diseases	7	(7.4)	3	(0.8)	14	(4.0)
Pulmonary disease	2	(2.1)	13	(3.6)	5	(1.4)
Pulmonary embolism	2	(2.1)	12	(3.3)	7	(2.0)
Aortic disease	1	(1.1)	6	(1.7)	14	(4.0)
Abdominal disease	1	(1.1)	4	(1.1)	9	(2.6)
Cerebral disease			8	(2.2)	13	(3.8)
Neoplasn.	4	(4.2)	5	(1.4)	6	(1.7)
Others			1	(0.3)	3	(0.9)
	95	(100)	360	(100)	346	(100)

examination. In 88% of the remaining cases an autopsy, partial or complete, was considered necessary (Groups II and III) for medicolegal reasons to establish the cause of death. In the other 12% no autopsy was deemed necessary (Group I).

Table 2 shows the cause of death as indicated by autopsy. As expected, there was a slightly higher frequency of cardiac deaths in Groups I and II than in Group III.

Upon comparison of the records with the autopsy result it was found that an erroneous diagnosis was made in three cases in Group I. One case of pulmonary embolism, one of rupture of the abdominal aorta, and one bleeding gastric ulcer in combination with coronary disease were diagnosed as coronary deaths.

Table 3. The 59 cases subjected to complete medicolegal examinations as they appeared before the autopsy was performed

Group	
A. Sudden unexpected death in early infancy	1
B. Suicide	13
C. Drowning	4
D. Traffic accident	3
E. Probable chronic alcoholism	17
F. Obscure cases	21
	59

Table 4. Final diagnosis (after autopsy) in deaths regarded as "probable alcoholism" and "obscure" (Groups E and F in Table 3)

	Probable alcoholism	Obscure cases
Intoxication	8	4
Chronic alcoholism	6	1
Coronary death	2	8
Epilepsy		1
Bronchopneumonia		1
Subdural hematoma	1	5
Ictus electricus		1
Total	17	21

In Group II an erroneous diagnosis was made in four cases. Three of them were intracerebral hemorrhages and one was a spontaneous subarachnoid hemorrhage. The intracerebral hemorrhages were located in the posterior cranial fossa. In two of the four cases only mild coronary atherosclerosis would have been diagnosed with a partial autopsy which excludes the examination of the brain. The two other cases had coronary disease sufficient in itself to explain death. The intracranial pathology would have remained undiscovered if a partial autopsy only had been performed. No unnatural deaths were found in Groups I or II.

Table 3 includes 59 cases (see Table 1) in which a complete medicolegal examination was deemed necessary and was performed. All these were originally assigned to Group III in this study. According to the police report, 17 of the 59 were chronic alcoholics (Group E) and in 21 cases no information of the circumstances surrounding death was available (Group F). In the remaining 21 cases (Groups A–D) the original presumption of the police regarding the cause of death was correct in all cases. Table 4 shows the final diagnoses for the 17 cases in which "probable alcoholism" was originally given as the cause of death and for the 21 initially obscure cases. Half of the former 17 cases were found at autopsy to have died of acute intoxication with ethanol, methanol, or drugs. One case of traumatic death was found (a subdural hematoma). Eight of the 21 obscure cases were of cardiac origin, five were due to a head injury, and four resulted from intoxication.

Discussion

Several investigators have discussed and attempted to elucidate the role of and need for autopsies on diagnostic grounds [1-8].

The purpose of the present investigation was to examine the question of whether a simple medicolegal examination as practiced in Sweden is necessary in all cases in which such examination is requested and, if not, whether some of the cases can be eliminated without loss of diagnostic accuracy and within the scope of the legal requirements.

An investigation similar to the present one was performed by Virkkunen et al. [8]. It was based on unselected material comprising 600 deaths submitted to medicolegal autopsy at the Department of Forensic Medicine in Helsinki, Finland. They found that the mode of death was wrongly predicted in 10% of all cases and in 5.9% in the cases of natural death. No information is given regarding the possibility of excluding some cases from autopsy without adversely affecting the diagnostic accuracy.

A wrong predicted diagnosis only occurred in less than 1% of our selected cases in which no autopsy was regarded necessary or where a partial autopsy was considered sufficient. This diagnostic error had no legal implication as no unnatural deaths were missed.

The discrepancy between the Finnish investigation and ours in the diagnostic accuracy is mainly attributable to our selection procedure. In doubtful cases we made no attempt to establish any diagnosis without autopsy and, when necessary, included microscopic and chemical investigations. The investigations by others give the false impression that a high proportion of cases will be wrongly diagnosed in the absence of a medicolegal investigation.

The result of our investigation does not imply that medicolegal knowledge and experience are unnecessary in the examination of the types of cases discussed. The necessity for the participation of medicolegal expertise is strengthened as no fewer than 7% of the originally requested simple examinations (59 cases) required a complete medicolegal examination, and of the 21 of those cases where the circumstances were obscure to the diagnosis an unnatural cause of death was found in 11 cases.

It is important to stress that the decision regarding the necessity for an autopsy was based upon a complete police report of the circumstances and a complete external examination of the dead body in a well-equipped autopsy room by, or supervised by, a physician with adequate forensic pathology experience.

From the present results it seems reasonable to conclude that:

1. these deaths must be handled by specialists in forensic medicine;
2. the extent of the investigations can well be assessed by the physician in charge of these cases;
3. after a thorough external examination and study of a clear and complete police report, the routine autopsy procedure can be simplified in many cases and omitted in some;
4. the adoption of a more flexible policy as suggested above would make more time available for more thorough examinations of cases posing specific medicolegal problems or for scientific studies on cases of interest.

The medicolegal institutes and departments play an important role in research on sudden and unexpected death and the development of new forensic-pathologic diagnostic tools and techniques. It is hence desirable that as many of the cases discussed as possible are subjected to forensic investigations. It is therefore desirable that those investigations are performed under such forms and with such carefulness that they can be utilized to further scientific endeavor.

It must be stressed that the possibility of a wrongly predicted diagnosis of the type of case under review, and the consequences thereof, must be seen in the light of the fact that less than half of all deaths in Sweden, and even fewer in many other countries, are subjected to a post mortem. The probability of diagnostic errors is much higher in cases where clinical examinations form the sole basis for the issue of a death certificate than in those subjected to at least a partial autopsy. It therefore seems illogical to require a relatively detailed investigation of non-hospitalized patients dying at home or elsewhere, while others both die and are buried without even a guarantee that they have had a complete external examination after death.

References

1. Turkel HW (1953) Merits of the present coroner system. *J Am Med Assoc* 153:1087-1092
2. Paton BC (1957) The accuracy of diagnosis of myocardial infarction: a clinicopathologic study. *Am J Med* 23:761-768
3. Heasman MA (1962) Accuracy of death certification. *Proc Roy Soc Med* 55:733
4. Wikland B (1971) Medically unattended fatal cases of ischemic heart disease in a defined population. *Acta Med Scand Suppl* 524
5. Patel NS (1972) Study on suicide. PhD Thesis, University of London
6. Britton M (1974) Vad händer när anhöriga underrättas om planerad obduktion och hur viktiga är obduktionerna (What happens when relatives are notified of intended autopsy and how important are autopsies?) Academic Thesis, Karolinska Institutet, Stockholm (summary in English)
7. Britton M (1974) Diagnostic errors discovered at autopsy. *Acta Med Scand* 196:203
8. Virkkunen M, Penttilä A, Tenhu M, Huittinen VM, Lehti H, Rissanen V, Uotila U (1975) Comparative study on the underlying cause and mode of death established prior to and after medicolegal autopsy. *Forens Sci* 5:73-79

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