

Review

The current significance of autopsies

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Key words: autopsy, pathology, autopsy imaging

Introduction

Examination by autopsy is one of the most important methods for determining cause of death and for auditing the accuracy of clinical diagnoses. Sometimes even careful autopsies reveal no clues related to the cause of death nor to the condition of diseases. However they have contributed to clarification of the pathogenesis of many diseases, and to the education of doctors, co-medical staff and students who study medicine and medical care. Recently autopsies have also played a critical role in maintaining the quality of hospital management. In spite of these factors the number of autopsies has been decreasing—not only in Japan but also worldwide. This is also demonstrated in the declining autopsy rate from the author's former hospital, decreasing from 30% to 10% in the last 20 years. Here I discuss the current role of the autopsy based upon data from the literature and from Aino Hospital.

I. The present state of the autopsy—a review of the literature

1. The global decline of autopsy rates, and the situation in Japan

Although there were more than one million deaths in Japan in 2005, the number of autopsies was fewer than 20,000. As shown in Fig. 1, the Japanese autopsy rate has been decreasing for the last 20 years. A report by the US National Center for Health Statistics (2001) also mentions a decline in the number of autopsies over the past three decades. Although newer data about autopsy rates are unavailable in this public re-

port, the autopsy rate is shown to have decreased from 41 percent of hospital deaths in 1961 to 5 to 10 percent in the mid-1990s. Burton and Underwood (2007) examined the worldwide decline in the autopsy rates of six countries. Fig.2 with Table 1 was made from their data, with the addition of the Japanese rate. They examined the fall in autopsy rates from the perspectives of the attitudes of the general public, clinicians and pathologists, as well as the legal and religious aspects of each country. All things considered the reasons were multifaceted and complex. Progress in medical imaging such as CT and MRI, which is usually pointed out as a significant reason, was just one of these factors. The others were vested interests of both the general public and medical professionals, the requirement to obtain valid consent from the bereaved, as well as insufficient training of

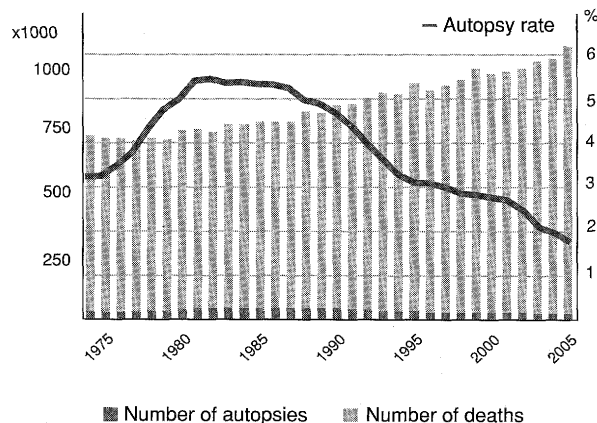


Fig. 1 Change of the autopsy rate in Japan
Calculated from the data by the Japanese Society of Pathology and by the Ministry of Health, Labour and Welfare

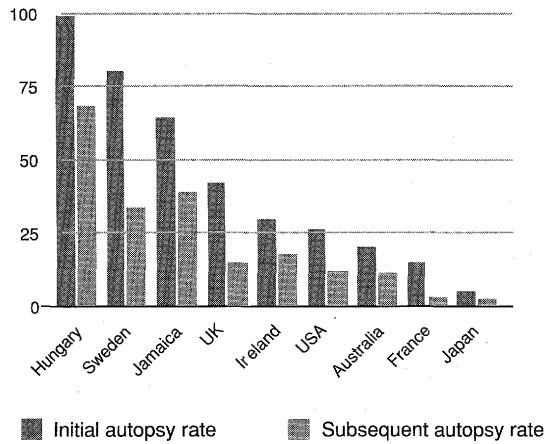


Fig.2 Comparison of the autopsy rate between initial and subsequent periods. The initial and subsequent periods are shown in Table 1

Table 1

	Initial period	Subsequent period
Hungary	1938-51	1990-02
Sweden	1984	1993
Jamaica	1968	1997
UK	1979	2001
Ireland	1990	1999
USA	1967	1993
Australia	1992-93	2002-03
France	1998	1997
Japan	1982	2000

the clinicians required to obtain this consent. In some countries whose law allows autopsies to be done without consent for medical, scientific, or educational reasons, the autopsy rates were high, while after the law changed to requiring consent for autopsy, the rate then decreased. In the UK as well, the report linked the falling autopsy rate to public outcry over undisclosed tissue retention, leading to increasingly strict legislation such as the 2004 Human Tissue Act.

WHO data comparing the autopsy rate in 22 countries, while also not recent, shows that the Japanese rate is the lowest among the countries compared (Fig. 3).

However as is shown in the next session, autopsies are still the most accurate method of determining the cause of death and in auditing the accuracy of clinical diagnosis.

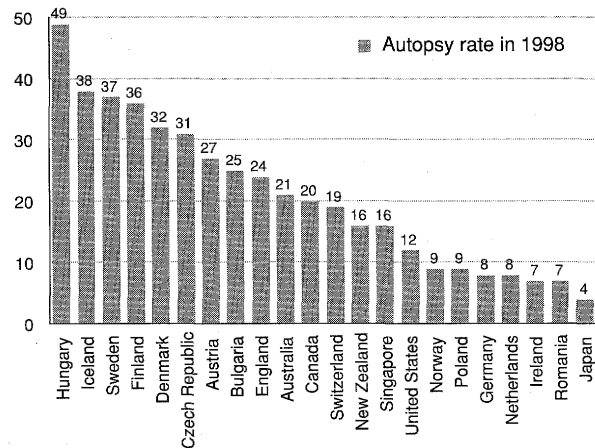


Fig.3 Worldwide autopsy rate in 1998 from WHO data

2. Discrepancies between clinical and autopsy diagnoses

One reason for the decline in the autopsy rate is that it is said that autopsies are less necessary than before. Admittedly, diseases such as brain embolism can be accurately diagnosed with advanced imaging techniques and other methods. However as with neurodegenerative disease, the number of diseases requiring autopsy for an accurate final diagnosis is significant.

The discrepancies between clinical diagnoses and autopsy findings have been discussed in many reports. In 1983, Goldman et al. classified these discrepancies (Table 2) into about 10% class 1 errors and 12% class 2 errors. Discrepancies occur not only with special diseases but also more common diseases.

Shojania et al (2003) examined 45 studies on MEDLINE from 1966 to April 2002, determining that the median error rate was 9.0% (range, 0%-20.7%) for class I errors, and that the median error rate was 23.5% (range, 4.1%-49.8%) for major errors, referring to clinically missed diagnoses involving a primary cause of death. They also showed that these error rates

Table 2

Class	categories
Class 1	a discrepant diagnosis with a potential impact on survival
Class 2	a discrepant major diagnosis but with equivocal or no impact on survival
Class 3	a discrepant minor diagnosis that could have been diagnosed before death
Class 4	a discrepant minor diagnosis that could not have been made before death

significantly decreased over time despite the reduction of the autopsy rate. From these data and the autopsy rate in these studies (12% to 100% median, 37%), they calculated that an institution with an autopsy rate of 5% could observe a major error rate from 8.4% to 24.4% and a class I error rate from 4.1% to 6.7% at that point in time.

Searching the MEDLINE database according to Shojania's method using Medical Subject Heading terms autopsy and postmortem changes, and the title words, autopsy, post-mortem, necropsy, and posthumous, almost 20 English-language articles were found after 2003. Eleven of these articles deal with the comparison between clinical and autopsy diagnosis generally (Tse GM 2000, Bombí JA 2003, Coradazzi AL 2003, Dimopoulos G 2004, Ong BB 2004, Spiliopoulou C 2005, Tavora F 2008), as well as in intensive care units (Silfvast T 2003, Combes A 2004), in pediatric intensive care units (Cardoso MP 2006) or with critically ill cancer patients (Pastores SM 2007). Among these articles, Roulson et al (2005) made a meta-analysis of the discrepancies between clinical and autopsy diagnosis among 11,948 cases in the literature, and revealed little improvement in the overall rate of discrepancies between the 1960s and the present. Despite the social, economical and technological differences in the world, this suggests that discrepancies between clinical and autopsy diagnosis is still unavoidable in a constant rate greater than 10% when minor discrepancies are included. That means that when fewer autopsies are performed, there are

fewer opportunities to identify the diagnostic discrepancies and to progress in medical service.

II. Autopsy cases at Aino Hospital

Table 3 shows 17 autopsy cases at Aino Hospital which were performed in the last five years. In our hospital the use of autopsies has just begun, so half of these were performed in the last year, and several cases are still under examination. However even just 17 cases made us reconfirm the importance of post-mortal medical verification. As one patient commonly has more than one disease, classifying all diseases according to the International Classification of Diseases (ICD-10) results in Table 4. All cases are valuable

Table 3 Main clinical diagnosis of Aino Hospital autopsy cases in alphabetical order since 2003

1	Alzheimer's disease
2	Amyloidosis
3	Amyotrophic lateral sclerosis
4	Diabetes melitus
5	DIC
6	Functional ileus, diabetes melitus
7	Gastric cancer
8	Lung cancer
9	Lung cancer
10	Malignant lymphoma
11	Myotonic dystrophy
12	Ischemic enteritis and colitis
13	Progressive systemic sclerosis
14	Pulmonary infarction
15	Rectal cancer
16	Relapsing polychondritis
17	Sigmoid volvulus

Table 4 Autopsy diagnoses classified by International Classification of Diseases (1)

Blocks	Titles		number
A00-B99	Certain infectious and parasitic diseases	Candidiasis	2 2
C00-D48	Neoplasms	Gastric cancer	1 9
		Lung cancer	3
		Rectal cancer	1
		Malignant lymphoma	1
		Leiomyoma of uterus	2
		Adenoma of adrenal gland	1
D50-D89	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	DIC	1 1
E00-E90	Endocrine, nutritional and metabolic diseases	Amyloydosis	1 3
		Diabetes mellitus	3
F00-F99	Mental and behavioural disorders	Schizophrenia	2
G00-G99	Diseases of the nervous system	Alzheimer's disease	2 4
		Amyotrophic lateral sclerosis	1
		Myotonic dystrophy	1
H00-H59	Diseases of the eye and adnexa		0
H60-H95	Diseases of the ear and mastoid process		0

Table 4 Autopsy diagnoses classified by International Classification of Diseases (2)

I00-I99	Diseases of the circulatory system	Old myocardial infarction Pulmonary infarction Atherosclerosis	1 1 9	11
J00-J99	Diseases of the respiratory system	Adult respiratory distress syndrome Interstitial pulmonary disease, unspecified Aspiration pneumonia Acute bronchitis, unspecified Emphysema	1 2 1 4 1	9
K00-K93	Diseases of the digestive system	Esophagitis Gastric ulcer Ileus Ischemic enteritis and colitis Sigmoid volvulus Fatty (change of) liver Peritonitis	1 4 1 1 1 1 2	11
L00-L99	Diseases of the skin and subcutaneous tissue			0
M00-M99	Diseases of the musculoskeletal system and connective tissue	Chronic arthritis Relapsing polychondritis Progressive systemic sclerosis	1 1 1	3
N00-N99	Diseases of the genitourinary system	Infarction of kidney Hyperplasia of prostate Urinary calculus	3 1 2	6
	Total			59

Some cases are still under examination.

educationally and some cases provide the possibility to investigate specific diseases or pathophysiology.

For example the Alzheimer's disease cases are important to examine, because histology is still necessary to determine the diagnosis. Non-invasive detection using MRI, CT and PET is being established as a method of early diagnosis, yet it can only be confirmed with certainty by examining tangles and β -amyloid plaques in brain tissue at post-mortem. At the Alzheimer's Association International Conference on Prevention of Dementia, in Washington, D. C in 2007, it was also reported that currently 26.6 million people worldwide have Alzheimer's disease and that the number could grow to more than 100 million people by 2050. Finding its treatment is an urgent subject, and Japan as an aging society should take an active part in the investigation. The verification of clinical diagnosis must be one of the most important processes for further research. Aino Hospital, which takes care of many patients, may have the duty to do this verification.

III. The future of the autopsy

1. The current state of Japanese medical services

In the last 10 years the number of medical lawsuits has doubled in Japan. In 2006 an

obstetrician was arrested because his patient died during delivery, and although other obstetricians testified that there were no technical mistakes made, the trial is still continuing as of the end of 2007. Under these circumstances doctors may not want autopsies which may reveal discrepancies and perhaps cause troubles with the bereaved. On the other hand since the bereaved may want an autopsy to clarify the cause of death, hospitals must still be prepared to perform autopsies for these cases. Doctors can become reluctant to recommend autopsies when findings of diagnostic discrepancy can then be used in judicial proceedings against them. While reckless and inept medical mistakes must be handled appropriately by society, including the court system when appropriate, the current legal system in Japan does not provide a reliable separation between handling cases of this type and cases where patients' illnesses simply exceed the limits of the current medical knowledge. It may be necessary to educate the public regarding the inevitability of death, that human bodies are too complex to be understood in their entirety, and that sometimes even an autopsy cannot determine the final diagnosis.

2. The potential of using autopsy imaging for post-mortal medical examination

As reviewed here, the autopsy rate has been decreasing for some time and circumstances do not favor its increase, so some new system must be readied in hospitals for general post-mortal examination.

Burton and Underwood (2007) introduce needle, endoscopic, echopsy, imaging and verbal autopsy as methods of minimally- or non-invasive autopsy, and discuss their advantages and disadvantages. They report that there is as yet insufficient evidence to recommend these techniques as full replacements for the standard autopsy.

In Japan, to overcome the decreasing trend in the frequency of autopsies, Autopsy imaging (Ai) is recommended to be included in the classic autopsy procedure by the Japan Society of Autopsy imaging (JSAi). JSAi was founded on July, 2003, and defined Ai as follows:

Widely, Ai is defined as an imaging diagnosis performed in relation to autopsy. Ai has two characteristics and dimensions. Narrow definition of Ai is almost equal to postmortem imaging (PMI). And probably almost equal to Virtopsy. The general definition of Ai is proximate to Ai-autopsy. The information of Ai is passed along to the pathologist before autopsy. Thereafter, the diagnosis obtained by macroscopic findings is returned to the imaging diagnosis section, and Ai is checked again more strictly in accordance with the rapid pathological report.

To avoid misunderstanding about "incorrect diagnosis" it is necessary to make well known the uncertainty of diagnosis, while on the other hand decrease this uncertainty by postmortem examination using autopsy and autopsy imaging. In Aino Hospital it is our intention to set up a system where Ai is performed either before autopsy or in lieu of autopsy.

It will take time before this enhanced system will work well enough to exhibit a consistent number and quality of examinations. But striving to increasing the number of autopsies and/or Ai, and studying each case thoroughly will help to enhance the quality of the hospital and return these benefits to the patients.

In conclusion, although the autopsy rate has been decreasing, the use of the new Ai

technology will help the classic method to clarify the cause of death, and it is the author's opinion that the trial of using Ai exclusively will ultimately lead to an increase in the autopsy rate, by demonstrating the necessity of post-mortal examination.

Acknowledgments

I wish to express our gratitude to the all doctors who obtained permission for the autopsies, and the all the nurses who assisted with the autopsies.

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