Changes in Autopsy Rate in Japanese University Hospitals During the Past 34 Years

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Objective: We aimed to reveal the declining status of autopsy rate in Japanese university hospitals during the last 34-year period, to draw attention to the importance of autopsy.

Methods: Autopsy related data from 1979 to 2012 in all Japanese university hospitals were collected and analyzed on annual basis under categories of Juntendo University Hospital, Japanese university hospitals, public university hospitals and private university hospitals separately. Trends of changes in autopsy rate from 1979 to 2012 were plotted and compared between the groups.

Results: The autopsy rate in Juntendo University Hospital was maintained at the levels of 50–60% until 1986, then started to decline steadily and reached to 9.7% in 2012. Regression coefficient of the autopsy rate during the 34-year period was -0.0173 . The mean autopsy rate of all university hospitals in Japan was maintained at 45% until 1983, then started declining steadily and reached to 6.8% in 2012. Of these hospitals, the mean autopsy rate in public hospitals was still kept at 45% in 1985 but continued declining to 9.3% in 2012, while in private hospitals it reached to 45% in 1983 and kept declining to only 5.6% in 2012.

Conclusion: The steady decline of the autopsy rate in university hospitals in Japan began early 1980'; this trend still continues, and the autopsy rate declined to 6.8% in 2012. We should work to prevent the decline of autopsy rate furthermore in Japanese university hospitals.

Key words: number of deaths, autopsy rate, Japanese university hospitals, public university hospitals, private university hospitals

Introduction

For university hospitals, the importance of the postmortem examination is without doubt. In 1992, all main university hospitals in Japan were authorized as "the Special Functioning Hospitals". Recording of autopsy conditions, i.e. annual autopsy numbers and rates, is required for the assessment of advanced medical care ability in these hospitals. That is to say that the autopsy rate has become one of the important indexes to the medical standard and quality for the Special Functioning Hospitals^{1) 2)}.

However, over the past few decades, with the development of surgery and diagnostic techniques such as imaging and biopsy, the pre-mortem clinical diagnostic accuracy kept increasing even without the postmortem examination. Inversely, the autopsy rate has continually declined in Japan^{3) 4)}, which is also the general trend seen worldwide^{5)–9)}.

To better understand the autopsy rate condition in Japan and figure out the reasons of its decline, we have published a series of papers from 1996 to 1999 on changes of autopsy rate in Japanese university hospitals based on a 16-year retrospective

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study^{1) 2) 10)-13)}. Data were collected from Juntendo University Faculty of Medicine-affiliated main hospital (mentioned as Juntendo University Hospital hereafter) and all university hospitals in Japan from 1979 to 1994. Autopsy rates were analyzed annually for the 16-year period. We showed that the decline of the autopsy rate started from the beginning of 1980' in Japan and continued to drop to 24% in 1994^{1) 2)}. To prevent the autopsy rate decline and reverse this trend, the investigation on factors responsible for the decline is very important. A survey was performed by us using the questionnaire that was administered to the clinicians and pathologists in Juntendo University Hospital and to the councilors of "Japanese Society on Hospital Administration". The results suggested that the first cause for the decline of autopsy rate was the improvement of diagnostic technique (81%), as we expected. The problem of anatomical pathologist system was the second reason (67%), and the medical system problem (61%) and the change of the submissive attitude of patients to medical doctors (51%) followed as the main factors¹⁰⁾. Meanwhile as there was a similar decline trend in the length of hospital stay before death in university hospitals, we further examined whether the stay length played any role in the decrease of autopsy rate. Data analyses from Juntendo University Hospital showed that there was no direct relation between the hospital stay length and the autopsy rate¹¹⁾. We also studied other possible factors that might cause the decrease of autopsy rate. Quantifiable medical evaluation criteria such as sex, disease type, age at death, number of biopsy, number of imaging diagnoses etc., from Juntendo University Hospital were annually collected and analyzed. Advanced aging of dead patients was revealed as one of the factors that caused the decline of the autopsy rate. Correlation between the decrease of autopsy rate and the dramatic increase of the numbers of biopsy and diagnostic imaging was confirmed¹³⁾.

In this paper, we added autopsy data collected from 1995 to 2012 in university hospitals in Japan, on the earlier 16-year period data from 1979 to 1994, to present a 34-year retrospective study (1979–2012) of changes in autopsy rate in Japanese university hospitals, and we compared autopsy rates in Juntendo University Hospital, all Japanese

university hospitals, Japanese public university hospitals and Japanese private university hospitals.

Methods

Juntendo University Hospital clinical details were obtained from the hospital annual report "the Annual of Discharged Patients" in the medical record library. Annual mortality number, autopsy number and autopsy rate were abstracted and analyzed, and other types of autopsy-related information were also collected from the database covering from 1979 to 2012, i.e. 34 years. Relevant hospital mortality and hospital autopsy numbers in all Japanese university hospitals during the 34-year period were also retrospectively reviewed from the "Table of total autopsy number, monthly autopsy number, and the number of deaths in hospitals in separate institutes" published in "Annual of Pathological Autopsy Cases in Japan" by Japanese Society of Pathology¹⁴⁾. The number of Japanese university hospitals and their subsidiaries included in the data (dental surgery was excluded) was 82 in the beginning of 1979, then gradually increased to 113 in 1994, and reached to 117 in 2012. Among them, the number of national or public university hospitals (referred to as public university hospitals hereafter) was 48 in 1979, 49 in 1994, and 53 in 2012, while that of the private university hospitals was 34 in 1979, 54 in 1994, and 63 in 2012.

The mean autopsy rates were analyzed in each case respectively, and the trends of change were described by plotting. The Student's *t*-test and linear regression analysis were used, and the regression coefficients were analyzed and compared between different groups. The "annual" mentioned in this paper refers to the calendar year (from the 1st January to the 31st December). Data analysis was performed by using Statistical Analysis System (SAS) software.

Results

Annual numbers of deaths and autopsies, and the autopsy rate in Juntendo University Hospital during the 34-year period (1979–2012) were summarized in Figure-1. During this period, the number of deaths increased by 15.6% from 463 to 535. However, the autopsy cases stayed unchanged until 1988, and then dramatically declined year by year, from 252 to 52 during the 34-year period.

Figure-1 Autopsy rate in Juntendo University Hospital

Figure-2 Autopsy rate in university hospitals in Japan

Correspondingly, the autopsy rate reached to a peak of 62% in 1981, maintained at the levels of 50–60% until 1986, and went down steadily to the levels of 50% in 1987, 40% in 1991, 30% in 1994, and 20% in 2000, reaching to the lowest peak of 9.5% in 2009. Thereafter, the autopsy rate became relatively stable and marked 9.7% in 2012. Regression coefficient of the autopsy rate during the 34-year period was -0.0173 ($p < 0.001$).

Annual numbers of deaths and autopsies, and the autopsy rate in all Japanese university hospitals during the 34-year period (1979–2012) were

summarized in Figure-2. The number of deaths kept increasing from 1979 (24,071 cases) until 1989, and then entered in a stable period from 1990 until 2000. Thereafter, the number of deaths showed again a trend of increase from 2001 and reached to 48,588 cases in 2012. The number of autopsies showed an increase from 1979 (11,123 cases) to 1983, while it started decreasing from 1987 and dropped to 3,293 cases in 2012. Correspondingly, the autopsy rate reached to a peak of 49.2% in 1981, maintained at the levels of about 45% until 1983, and kept going down steadily thereafter, with

Figure-3 Autopsy rate in public university hospitals in Japan

Figure-4 Autopsy rate in private university hospitals in Japan

the levels of about 40% in 1987, 30% in 1992, 20% in 1998, 10% in 2007, and only 6.8% in 2012. Regression coefficient of the autopsy rate during the 34-year period was -0.0142 ($p < 0.001$).

Annual numbers of deaths and autopsies, and the autopsy rate in Japanese public university hospitals during the 34-year period (1979–2012) were summarized in Figure-3. The number of deaths increased from 11,757 to 16,095 (36.9%) during the 34 years. On the contrary, the number of autopsies dramatically decreased by about 73.3% from 5,626 in 1979 to 1,504 in 2012. The autopsy

rate reached to a peak of about 51.4% in 1981, maintained at the levels of about 45% until 1985, and then went down continuously to the levels of 40% in 1988, 30% in 1994, 20% in 2003, and 9.3% in 2012. Regression coefficient of the autopsy rate during the 34-year period was -0.0138 ($p < 0.001$).

Annual numbers of deaths and autopsies, and the autopsy rate in Japanese private university hospitals during the 34-year period (1979–2012) were summarized in Figure-4. The number of deaths increased from 12,314 to 27,678, i.e. 2.25 times increase during the 34 years. However, the number

Figure-5 Comparison of autopsy rates between public and private university hospitals in Japan.

Autopsy rates in public university hospitals (black circles) and private university hospitals (white circles) during the period of 1979–2012 are plotted. The straight lines show the regression fit in the two groups respectively.

Figure-6 Comparison of autopsy rates between Juntendo University Hospital and university hospitals in Japan

Autopsy rates in Juntendo University Hospitals (black circles) and university hospitals in Japan (white circles) during the period of 1979–2012 are plotted. The straight lines show the regression fit in the two groups respectively.

of autopsies dramatically decreased from 5,497 to 1,553 (71.7% decrease). The autopsy rate reached to a peak of 46.9% in 1981, maintained at the levels of about 45% until 1983, and then went down continuously to the levels of 40% in 1985, 30% in 1990, 20% in 1995, 10% in 2004, and only 5.6% in 2012. Regression coefficient of the autopsy rate during the 34-year period was -0.0139 ($p < 0.001$).

The autopsy rates in Japanese public and private university hospitals from 1979 to 2012 were compared in Figure-5. The average autopsy rate during the 34 years was 29% in public university

hospitals and 23.1% in private university hospitals respectively, which indicated a 5.9% higher in public university hospitals than in private hospitals ($p < 0.001$). On the other hand, by linear regression analysis, regression coefficients (slope of the regression line) of the autopsy rate in public and private university hospitals were almost the same; i.e. -0.0138 ($p < 0.001$) and -0.0139 ($p < 0.001$), respectively. It means that the autopsy rates in both public and private university hospitals decreased nearly by the equal pace and that the difference between the two groups remained almost stable

Figure-7 Comparison of autopsy rates between Juntendo University Hospital and private university hospitals in Japan. Autopsy rates in Juntendo university hospitals (black circles) and private university hospitals in Japan (white circles) during the period of 1979–2012 are plotted. The straight lines show the regression fit in the two groups respectively.

during the whole 34-year period.

The autopsy rates in Juntendo University Hospital and all Japanese university hospitals from 1979 to 2012 were compared in Figure-6. The average autopsy rate in Juntendo University Hospital during the 34 years was 31.4%, while in all Japanese university hospitals it was 25.4%. There was a 6.0% higher rate in Juntendo University Hospital than in all Japanese university hospitals ($p < 0.001$). By linear regression analysis, regression coefficients of the autopsy rate in Juntendo and all Japanese university hospitals were -0.0173 ($p < 0.001$) and -0.0142 ($p < 0.001$), respectively. It indicates that with the relatively higher mean annual decreasing rate (1.73%) in Juntendo University hospital, the autopsy rate difference between the two groups gradually decreased during the 34 years.

The autopsy rates in Juntendo University Hospital and Japanese private university hospitals from 1979 to 2012 were also compared (Figure-7). The average autopsy rate in Juntendo University Hospital during the 34 years (31.4%) was 7.7% higher than in Japanese private university hospitals (23.1%) ($p < 0.001$). By linear regression analysis, regression coefficients of the autopsy rate in Juntendo and Japanese private university hospitals were -0.0173 ($p < 0.001$) and -0.0139 ($p < 0.001$), respectively. With the relatively higher mean annual decreasing rate (1.73%) in Juntendo

University Hospital, the autopsy rate difference between these two groups seemed to narrow. However, there was still a 4.1% higher autopsy rate in Juntendo University Hospital (9.7%) than private university hospitals (5.6%) in 2012, reflecting the fact that 7.7%, the difference of the average autopsy rate between Juntendo University Hospital and private university hospitals, was 1.7% higher than 6.0%, the difference of that between Juntendo University Hospital and all university hospitals.

Discussion

The Japanese Society of Pathology has started collecting and publishing autopsy information of all Japanese hospitals every year in their annual report “Annual of Pathological Autopsy Cases in Japan” in 1958¹⁴⁾. We are the first to systematically analyze the autopsy condition in Japanese university hospitals (public and private hospitals separately) for a 34-year period.

By collecting and analyzing the autopsy data from 1979 to 2012 in all Japanese university hospitals, we clarified that: 1) during the 34 years, the number of university hospitals and the number of deaths steadily increased in Japan, while the autopsy number reached to a peak between 1983 and 1986, and then steadily decreased. The autopsy rate decreased from the peak 49.2% in 1981 to 6.8% in 2012; 2) the autopsy rate in public university hospitals was 5.9% higher than that in private

university hospitals, and this difference was maintained stably during the 34-year period. It is generally thought that there are differences in medical standards between private and public university hospitals in Japan. The above difference seen in the autopsy rate might be considered as one such example; 3) although the autopsy rate in Juntendo University Hospital (the private university hospital) was relatively higher than the average of all Japanese university hospitals, the difference seemed to narrow recently; 4) however, in any case, the long term decrease of autopsy rate is beyond dispute.

The autopsy rate continues to decline not only in Japan; it became a worldwide trend the last few decades and drew much attention. Duband *et al*⁽⁵⁾ reported that in a 1,000-bed Paris university hospital, the autopsy rate decreased from 15.4% in 1988 to 3.7% in 1997; in the United States, during a 40-year period (1964–2003), it decreased from 41.6% to 11%. Wittschieber *et al*⁽⁶⁾ showed that in Berlin, the autopsy rate in university hospitals dropped from 44.5% in 1988 (West Berlin) to 20.1% in 2008, differing by 55% during the 20 years. A 10-year study (1991–2000) from a university hospital in Spain presented a drop of autopsy rate from a peak level of 20% in 1993 to 9.1% in 2000⁽⁷⁾. All these studies from different countries showed a clear and persistent decrease of autopsy rate in university hospitals, which indicates that the marked fall of autopsy rate has become a worldwide phenomenon.

In the world today, as the medical technologies improved rapidly, it is increasingly believed that patients could be accurately diagnosed without postmortem examination. As regards clinicians who are already busy in daily medical cares and various hospital meetings, it is not surprising if they think that they would gain not much for the time they have to spend to attend in autopsy and clinico-pathological conferences (CPC).

However, considering the discrepancy rate between clinical and autopsy diagnosis, there had been little improvement from 1960s to 2004, in spite of the progress of medical technologies. About a third of death certificates were likely to be incorrect, and about 50% of autopsies produced findings unsuspected before death, as reported in “Recommendation of autopsy”⁽¹⁵⁾. Wittschieber *et*

al.⁽⁶⁾ reported that with randomly selected 1,800 autopsy cases in Berlin from 1988 to 2008, the discrepancy rate (modified Goldman criteria⁽¹⁶⁾ Class I) decreased from 25.8% to 10.7% during the 20 years, in 2008 there were 5.4% and 14.7% discrepancies in university hospitals and community hospitals respectively.

“The standard criteria in the Postgraduate Education Hospitals” issued by the head of the Health Policy Bureau of the Ministry of Welfare in Japan (1993) is the public standard applied to the autopsy rate in Japan⁽¹⁷⁾. According to the criteria, a 300-bed hospital with 200 deaths per year, for example, is required to perform at least 30 autopsies per year. Nevertheless, the mean autopsy rate in Japanese university hospitals was only 6.8% in 2012 and the autopsy number is 52 in Juntendo University Hospital in 2012. This low value seen even in university hospitals indicates that in clinical research hospitals, i.e. so-called “community hospitals”, meeting the criteria provided by the Health Policy Bureau is not a realistic issue. The “steady downward shift” of the autopsy rate in Japan is thus alarming, which points to the possibility that the rate might reach to almost “0%” one day.

Now, autopsy is performed to examine whether the revealed patho-morphological observations can justify diagnosis of clinicians, thus providing a function of medical inspection. No matter how the pre-mortem diagnostic techniques develop, autopsy can be regarded as a collaborative scientific work of clinicians and patients, and it provides observations which are not possible to gain through clinical diagnosis. We urge that the autopsy ratio in university hospitals in Japan, authorized as the Special Functioning Hospitals, should not decline further than what we see currently. For this purpose, appropriate steps to set regulations are urgently needed.

Conclusions

In the present study, we analyzed the change of the autopsy rate on the basis of the data collected from 1979 to the present in our as well as other university hospitals in Japan. It was found that the autopsy rate showed a steady decline from 1980 nationwide and that in 2012, the mean autopsy rate in Japan alarmingly showed 6.8%, a serious trend considering the future for the medical standard.

Autopsy is critical to maintain clinical qualities, serving as an important parameter to assess the standard of medical treatments. Autopsy provides the data and observations which even a developed pre-mortem diagnostic technique still cannot offer. We thus strongly suggest that we should prevent the decline of autopsy rate in Japanese university hospitals.

Conflict of interests

The authors declare no conflict of interest associated with this manuscript.

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