A 12-month review of autopsies performed at a university-affiliated teaching hospital in Hong Kong

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Objective. To review the autopsies performed at a university-affiliated teaching hospital over a 12-month period.
Data sources. Records of autopsies performed at a university-affiliated teaching hospital during 1997, and *Medline* literature search (1966-1998).
Study selection. The key words used in the literature search were 'autopsy' and 'audit'.
Data extraction. Data were extracted and analysed by the authors. Any discrepant cases (in which the final diagnoses were either unexpected or not made before death) were identified from the hospital records.
Data synthesis. Interest in autopsy results has increased, owing to the greater emphasis on medical audit and quality assurance procedures. Of the yearly total of 403 autopsies, 332 cases were reviewed; the discrepancies found were classified as either major or minor, according to their effect on the clinical outcome. The major and minor discrepancy rates were 23% and 9%, respectively. In 2% of cases, the cause of death was due to complications resulting from surgical intervention. These discrepancy rates were comparable to the figures quoted in the literature.
Conclusion. Autopsy is a valid medical quality-assurance mechanism in Hong Kong.

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Key words: Autopsy/standards; Coroners and medical examiners; Diagnostic errors; Quality assurance, health care

Introduction

With the current emphasis on the cost-effectiveness and quality assurance of health care, autopsy results can help evaluate the medical treatments or interventions that a patient receives, and whether or not those interventions are appropriate. The relative number of autopsies performed over recent decades has been declining globally.[1,2] The reasons for this decline are many, with financial considerations and the fear of potential litigation being cited.[1] The number and scope of publications in the literature dealing with the topic of autopsy have been limited, and those relating to the Asian medical scene are lacking. In the United States, studies have assessed the role of autopsy in various settings, its use as an educational modality for physicians in certain specialties[2] and for pathologists,[3] and its use as an instrument of quality assurance for the medical treatments offered.[4] The value of autopsy in clinical audit has been highlighted, and discrepancies between autopsy findings and clinical diagnosis may be used to improve diagnostic accuracy.[5]

Given the different cultural background and practices that prevail among Asian populations and their attitude towards autopsy, it would be useful for pathologists and clinicians to know the autopsy rate, the pattern of distribution, and the rate and nature of discrepant cases. These figures could be used to:
(1) Serve as baseline figures against which future autopsy rates will be compared and which will enable a trend to be established;
(2) Allow comparison with the discrepancy rates found at other centres, helping to identify areas where diagnostic accuracy needs to be improved;
(3) Provide a basis for the objective measurement of misdiagnosis and to access any improvement made (ie a reduction in the discrepancy rate); and
(4) Provide a basis for comparison between Asian and western autopsy results and to explore the value of including autopsy in quality assurance programmes in Asian medical centres.

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Table 1. Annual autopsy case numbers at the Prince of Wales Hospital, 1985 to 1997

Year	Deaths No.	Autopsies No. (%)	Coroner's cases No. (%)	Clinical cases No. (%)
1985	1138	278 (24.4)	90 (32.3)	188 (67.6)
1986	1573	386 (24.5)	123 (31.9)	263 (68.1)
1987	1764	424 (24.0)	143 (33.7)	281 (66.3)
1988	1946	439 (22.6)	149 (33.9)	290 (66.1)
1989	2055	450 (21.9)	169 (37.6)	281 (62.4)
1990	2113	400 (18.9)	172 (43.0)	228 (57.0)
1991	2049	432 (21.1)	180 (41.7)	252 (58.3)
1992	2288	524 (23.0)	227 (43.3)	297 (56.7)
1993	2310	531 (23.0)	306 (57.6)	225 (42.4)
1994	2159	473 (21.9)	292 (61.7)	181 (38.3)
1995	2416	477 (19.7)	342 (71.7)	135 (28.3)
1996	2542	484 (19.0)	348 (71.9)	136 (28.1)
1997	2274	403 (17.7)	291 (71.5)	112 (28.5)

Methods

Reports of all the autopsies performed in 1997 at the Prince of Wales Hospital—a tertiary teaching hospital affiliated with The Chinese University of Hong Kong—were reviewed. Cases that had been reported to the coroner and subsequently waived were excluded from the study. These cases accounted for a very small percentage (4/403; 1%) of the total. Also excluded from this review were traumatic cases and instances of unnatural or accidental death (n=41; 10%). Stillbirths were also excluded (n=25; 6%), while limited autopsies (n=28; 7%) were included. In each case, the clinical history and summary were assessed and the major clinical diagnoses noted.

For all instances where a disagreement arose between the clinical and autopsy diagnoses, the discrepancy was classified as either 'major' or 'minor', according to its effect on the clinical outcome.[6] Major discrepancies were considered to be those in which the discovery might have altered the patient's management and resulted in cure or prolonged survival. Missed diagnoses that were not directly related to death or that were unrelated important diagnoses were categorised as minor discrepancies. Two additional categories were included: cases in which death was the direct result of an invasive (investigative or treatment) procedure and cases in which after the autopsy, a definite diagnosis could not be reached by macroscopic examination alone.

Results

The total yearly number of autopsies performed in the department since 1985, when the hospital gained full function, are listed in Table 1. The proportion of coroner's cases and clinical cases are also shown. Coroner's cases were cases that fulfilled a certain set of criteria[7] and had been referred to the coroner's court, after a preliminary police investigation.

In 1997, the total number of autopsy requests received was 403. The total number of hospital deaths for the same year was 2274. Of the 403 cases, 291 were coroner's cases and 112 were clinical cases. Of the coroner's cases, four were waived by the coroner at the request of relatives. The majority of the 399 autopsies performed in the department were complete, with only 28 (7%) being limited to the relevant systems or organs. Paediatric cases amounted to 56 (14%). After excluding stillbirths, traumatic cases, and cases with an unnatural cause of death (drowning and suicide), 332 cases were available for review. Major discrepancies were found in 78 cases (23%), which included 18 cases in which no ante-mortem diagnoses were forwarded; 29 (9%) cases showed minor discrepancies. In 12 (4%) cases, the cause of death was iatrogenic or procedure-related and in six (2%) cases, no pathological diagnoses were made on macroscopic examination alone, with the diagnosis being deferred for microscopic examination. The distribution is summarised in Table 2.

Of the 78 cases that involved a major discrepancy, the majority (86%) were due to diseases of the gastrointestinal tract, the respiratory tract, or the cardiovascular system. The organ systems involved and the diseases found are shown in Table 3. Of the 29 cases in which a minor discrepancy was found, approximately

Table 2. Categorisation of autopsy cases, 1997

Category	Cases No. (%)
Concordant	207 (62)
Discrepant (major)	78 (23)
Discrepant (minor)	29 (9)
Complication of procedure	12 (4)
No pathological diagnosis	6 (2)
Total	332

Table 3. Distribution of major discrepant cases

System	No (%)	Disease entity/location (n)
Gastro-intestinal	25 (32)	Perforation of peptic ulcer (7), carcinoma of colon (2), gall bladder carcinoma (1), colon diverticulum (1), duodenum (2), colon volvulus (1), colitis (1), hepatoma (1), small bowel (1), spleen (2) non-specific colitis (2), pseudomembranous colitis (1), carcinoma of gall bladder(1), pancreas (1), genito-urinary bleeding (1)
Respiratory	25 (32)	Bronchopneumonia (13), tuberculosis (4), carcinoma of lung (3), pulmonary embolism (2), bronchopulmonary dysplasia (2), aspiration pneumonia (1)
Cerebrovascular	17 (22)	Acute myocardial infarction (8), ischaemic heart disease (5), rupture of aortic aneurysm (4)
Central nervous	6 (8)	Subdural haemorrhage (2), cerebral haemorrhage (2), cerebellar haemorrhage (1), glioma (1)
Renal	4 (5)	Pyelonephritis (4)
Haematological	1 (1)	Malignant lymphoma (1)
Total	78	

Table 4. Distribution of minor discrepant cases

System	No (%)	Disease entity (n)
Respiratory	17 (59)	Bronchopneumonia (15), tuberculosis (1), chronic obstructive airway disease (1)
Gastro-intestinal	5 (17)	Peptic ulceration (2), hepatitis (1), infarction (1), colitis (1)
Renal	3 (10)	Pyelonephritis (3)
Cerebrovascular	2 (7)	Ischaemic heart disease (1), hydrops foetalis (1)
Central nervous	1 (3)	Meningitis (1)
Genito-urinary	1 (3)	Carcinoma of endometrium (1)
Total	29	

76% were either diseases of the respiratory tract or the gastrointestinal tract. The relevant organ systems and the diseases found are listed in Table 4.

In 12 patients, the cause of death was due to the following surgical complications: acute myocardial infarction after major non-cardiac surgery (n=5); faecal peritonitis after bowel resection (n=2); peritonitis due to bowel perforation after endoscopic retrograde cholangiopancreatography and colonoscopy (n=2); graft thrombosis after coronary artery bypass surgery (n=1); cardiac tamponade after mitral valve replacement (n=1); and bronchopneumonia after large bowel resection (n=1). Of these 12 cases, seven (58%) showed a discrepancy in the diagnosis, and of these, four (33%) had such rapidly deteriorating conditions that no diagnostic investigation could have been possible. The remaining three (25%) cases involved cardiac tamponade diagnosed as sepsis; faecal peritonitis diagnosed as gastro-intestinal bleeding of unknown cause; and bronchopneumonia diagnosed as tachypnoea.

In the six cases where no autopsy diagnosis was found at the macroscopic level, two cases showed only pulmonary oedema; the clinical diagnoses were hypotension and decreased general condition. A patient with a perforated peptic ulcer and renal failure after surgical repair showed an intact repair site at autopsy. A patient with pleural effusion had diffuse nodular lesions at autopsy and was thought to have a mesothelioma. Autopsy of a diabetic patient with metabolic disturbance showed only a fatty liver, and no anatomical lesions were found in another patient with sepsis. At the time of review, microscopic examination had been completed in three cases, and causes of death were established for two cases, with one case of pleural effusion being due to ischaemic heart disease and the suspected mesothelioma proving to be tuberculosis.

Discussion

There has been a general decrease in the relative number of reported autopsies in many countries,[1,2] and a similar trend has occurred in our department. An evaluation reveals that the proportion of coroner's cases has increased significantly, accompanied by a decrease in clinical cases. Possible explanations include the following:

(1) Certainty of clinical diagnoses has increased over the years, so requests for clinical autopsies have decreased;
(2) More cases are reported to the coroner by increasingly litigation-conscious clinicians;
(3) Departmental policy of not encouraging relatives to have an autopsy waived, such that waived cases only contributed to approximately 1% of all the reported coroner's cases; and

(4) The reluctance of relatives to give consent for an autopsy to be performed in clinical cases (in coroner's cases, the autopsy is ordered by the coroner).

A total of 78 cases were found to show a major discrepancy, with undetected perforation of the bowel being the most common, followed by undiagnosed bronchopneumonia and acute myocardial infarction. Other diseases that are known to be difficult to diagnose were found and included the presence of a pulmonary embolism and carcinoma of the gall bladder and pancreas. The overall figure of 23% for missed diagnoses is comparable to the figures quoted in the literature, which range from 7% to 29%.[8-10] The more commonly missed diagnoses include a pulmonary embolism, myocardial infarction, and systemic infection, such as tuberculosis.[6,11] The distribution of diseases in this study shows a similar pattern, with a possible exception being the smaller number of major pulmonary embolisms and a higher proportion of cases of tuberculosis, suggesting a higher disease prevalence of the latter.

Many factors can be responsible for inaccurate pre-mortem diagnoses. It has been suggested that one factor is the nature of the diagnosis.[12] While fatal pulmonary emboli give rise to a discrepancy in 47% of cases, leukaemia almost never causes a discrepancy. A second possible cause of diagnostic inaccuracy is the changing diagnostic acumen and awareness of a disease entity by physicians. When a disease is endemic in a particular locality, diagnosticians tend to be more alert to it and miss the diagnosis less. The overall missed diagnosis rate for tuberculosis has increased from the 1930s to the 1970s, presumably due to the decreased prevalence of the disease and to falling physician awareness.[13] The perceived certainty of a clinician for a particular diagnosis has also been cited as a factor. The more certain the physician is of a diagnosis, the chance of a discrepancy occurring diminishes.[12,14] Anderson[15] concluded that a bigger community hospital and an in-patient setting tend to generate fewer diagnostic discrepancies than does a smaller hospital with no house-staff or fewer consultants. In the cases in which minor discrepancies were found, bronchopneumonia and chronic ischaemic heart disease were the most common diagnoses that were overlooked.[15] This again, is in agreement with the published literature.[11]

In this study, acute myocardial infarction accounted for most of the fatal complications that followed surgery; perforation of the bowel after endoscopy involving the gastro-intestinal tract also contributed. There remained, however, a small number of cases in which no firm anatomical diagnosis could be furnished after the autopsy. This group accounted for 2% of autopsy cases. At the time of review, microscopic examination had been completed in three cases, and firm diagnoses had been reached in two (67%) cases. While the practice of performing a non-diagnostic autopsy is not frequently discussed in the literature, some authors[16] cite an incidence of 4%. The routine microscopic examination of all autopsies could reduce the number of non-diagnostic cases performed. Using ancillary procedures such as preparing frozen sections, making microbiological cultures, or performing immunostaining techniques on autopsy materials may further reduce the number of indeterminate autopsies performed.

If the autopsy is to be used as a quality assurance mechanism, certain prerequisites have to be fulfilled. Firstly, the autopsy rate has to be reasonable for the exercise to be scientifically and statistically sound. Secondly, the autopsy has to be able to provide an accurate diagnosis to be used as the standard against which all other clinical diagnoses are compared. Thirdly, for the autopsy diagnosis to be significant, the reports have to be issued in a timely fashion and contain sufficient and relevant information to be useful. The causes of the decline in autopsy rates are many. The risk of infection (eg acquired immunodeficiency syndrome, hepatitis), the fear of potential litigation, the difficulty encountered in obtaining consent, the perceived insult to the patient's dead body and the beliefs of some religions are all important factors. Studies investigating the thoroughness of autopsy reports are few,[17-19] but those that have been done show that many autopsy summary sheets do not contain adequate information, and clinical questions are not answered after autopsy in 9% of cases.[16] The issue of timeliness is a particular problem in the hospital setting, as the pathology department is usually run on a tight schedule with biopsy materials from living patients always being given priority over autopsy cases. The accreditation guidelines of the American College of Pathologists recommend that in most uncomplicated cases, provisional reports should be issued within two working days and a final report within 30 working days of the autopsy.[20]

Conclusion

This review of the annual autopsies performed in a tertiary level, university-affiliated centre in Hong Kong shows substantial major (23%) and minor (9%) discrepancies between pre- and post-mortem diagnoses.

While the cultural background of the population in this study differs from that in many studies in western countries, the findings such as the trend of autopsy rate, percentage of discrepant cases, and organ systems affected are similar. This concurrence is a good indication that the autopsy, as a medical quality assurance mechanism, is equally valid in our locality. However, there are several problems associated with the use of the autopsy in medical audit procedures. These problems include a diminishing number of autopsies, the sometimes less than adequate autopsy reports, and a long turn-around time. Pathologists should try to revive the autopsy procedure by overcoming and rectifying these shortfalls. One final word of caution is in order; the aim of quality assurance is to improve the health care outcome by learning from the failures and determining why they happened, rather than to apportion blame. Keeping this goal in mind might encourage health care personnel to participate in quality assurance activities and may help to reverse the indifference that currently exists towards autopsy results.

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