Prospective study of necropsy audit of geriatric inpatient deaths

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Abstract

*Aims:*To evaluate the accuracy of clinical diagnosis by specialists in geriatric medicine and to compare this with a previous study involving non-specialists.

Method: Clinical and necropsy diagnoses from consecutive hospital inpatient deaths from the University Department of Geriatric Medicine were analysed for discrepancies at regular audit meetings. Three main categories of diagnosis were considered and any therapeutic implications discussed.

Results: Between 1987 and 1989 necropsies were performed on 100 patients (38 men, 62 women, aged 63 to 99 years) from a total of 207 deaths, a necropsy rate of 50%. There was complete agreement between necropsy and clinical diagnoses in 32% of cases. Disagreement involved the main diagnosis in 28%, contributory conditions in 32%, and cause of death in 34%. In 10% of cases the diagnostic discrepancy was considered therapeutically important. Specialist geriatricians correctly diagnosed the main diagnosis in 72% of cases; non-specialists in the previous study were correct in only 47% of cases.

Conclusion: Specialist geriatricians diagnose elderly people more accurately than non-specialists. But rates of misdiagnosis are still significant and necropsies continue to be a useful form of audit.

Numerous studies have detailed discrepancies between necropsy findings and clinical diagnoses, with levels of misdiagnosis ranging from 10% to 39% for the main clinical diagnosis.[1-10] Such discrepancies have been shown despite a high level of confidence in the clinical diagnosis;[1] and one study found that 15% of such missed diagnoses were of clinical importance as they would have led to substantially different patient management.[11]

Achieving an accurate clinical diagnosis is especially difficult in elderly patients, many of whom will have multiple pathology and in whom presentation of disease may be atypical. Compliance with clinical assessment and subsequent investigations may be hindered by confusion and frailty. A previous large necropsy study in Edinburgh established that the accuracy of clinical diagnosis declined with increasing patient age, so that only 47% of clinical main diagnoses were confirmed at necropsy in 295 patients aged more than 75.[12]

That study, however, was based on necropsies from acute medical and surgical wards served by the University Department of Pathology and did not include patients dying under the care of specialists in geriatric medicine.

Methods

Data were collected on a two part proforma. In part A the clinical diagnoses were recorded before necropsy and confirmed by the consultant geriatrician responsible for the patient. Diagnostic confidence was graded as certain, fairly certain, or uncertain. Four categories of clinical diagnoses were recorded:

1 The main diagnosis—that is, the most important condition underlying the patient's last illness and death (similar to the last diagnosis listed in Part I of the current death certificate).

2 The contributory conditions, both related and unrelated to the main diagnosis (Parts Ia, Ib, and II).

3 The final cause of death (Part Ia).

4 Other diagnoses unrelated to the final illness or death.

Part B was completed by the pathologist performing the necropsy, and comprised a simple list of necropsy findings.

At a subsequent clinico-pathological meeting geriatricians and pathologists discussed each case and made a joint decision as to whether or not the necropsy diagnoses could be reconciled with the clinical diagnoses as outlined in Part A. Clinical diagnoses unlikely to result in diagnostic morphological features at necropsy were accepted where they were supported by appropriate investigations. Where a necropsy diagnosis was listed clinically but assigned to a different diagnostic category, then the necropsy allocation was taken as correct, but these were not recorded as clinically important misdiagnoses. Where misdiagnosis was identified a decision was made as to whether this would have led to different investigations or treatments. The feasibility of achieving the correct diagnosis in life was discussed and recorded.

The subjects reviewed came from 38 acute assessment and 93 long stay beds at the University Department of Geriatric Medicine Unit the City Hospital, Edinburgh. In the study period from November 1987 to March 1989 there were 207 deaths and necropsies were requested in all cases. Permission was granted for 104 cases, an overall necropsy rate of 50%. From these, 100 satisfactory proformas were completed. The age and sex

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Table 1 Distribution of 100 cases by sex and age

	Age (years)					
Sex	55–64	65–74	75–84	85–94	95+	Total
Male	1	2	19	15	1	38
Female	0	4	28	27	3	62
Total	1	6	47	42	4	100

Table 2 Agreement of clinical diagnoses with equivalent necropsy diagnoses

Diagnostic category	Agreement	Disagreement	Total
Main diagnoses	72	28	100
Contributory condition	68	32	100
Cause of death	66	34	100
Others	77	23	100
All diagnoses	32	68	100

Table 3 Over- and underdiagnosis of main diagnosis by ICD codes with diagnoses

ICD Code	Category	Number	Clinical main diagnosis
Overdiagnoses:			
I	Infective	4	Septicaemia (4)
II	Neoplasia	2	Lung (1), carcinomatosis (1)
VI	Nervous system	1	Cervical compression (1)
VIIa	Cardiovascular	9	Pulmonary embolus (4), congestive cardiac failure (1), acute myocardial infarction (2), deep venous thrombosis (1), chronic myocardial ischaemia (1)
VIII	Respiratory	4	Bronchopneumonia (4)
Total		20	
Underdiagnosis:			Necropsy main diagnosis
II	Neoplasia	3	Bile duct (1), liver (1), colon (1)
VIIa	Cardiovascular	10	Acute myocardial infarction (3), aortic stenosis (2), pulmonary embolus (2), left ventricular failure (2), arteritis (1)
VIIb	Cerebrovascular	2	Cerebral infarction (2)
VIII	Respiratory	2	Aspiration pneumonia (2)
IX	Digestive	2	Gastric ulcer (1), diverticular disease(1)
X	Genitourinary	1	Acute pyelonephritis (1)
XIII	Musculoskeletal	1	Septic arthritis (1)
Total		21	

Table 4 Over- and underdiagnosis of contributory conditions by ICD code with common diagnoses

ICD Code	Category	Number	Clinical contributory condition
Overdiagnosis:			
II	Neoplasia	4	Stomach carcinoma (2), colon carcinoma (2)
VIIa	Cardiovascular	1	Ischaemic heart disease (1)
VIIb	Cerebrovascular	1	Cerebral infarction (1),
VIII	Respiratory	2	Bronchopneumonia (1), pulmonary fibrosis (1)
IX	Digestive	1	Peptic ulcer (1)
Total		9	
Underdiagnosis:			Necropsy contributory condition
I	Infective	1	Psoas abscess (1)
II	Neoplasia	6	Lung (1), prostate (2), oesophagus (1), Hodgkin's disease (1), metastases (1)
VIIa	Cardiovascular	25	Hypertension (7), ischaemic heart disease (5), pulmonary embolus (4), aortic stenosis (2), others (7)
VIII	Respiratory	3	Pulmonary fibrosis (1), emphysema (1), acute bronchitis (1)
IX	Digestive	5	Gastrocolic fistula (2), gastric ulcer (1), others (2)
X	Genitourinary	5	Renal calculus (2), pyelonephritis (2), hydronephrosis (1)
Others		1	Plastic bag bezoar (1)
Total		46	

distribution of the cases is presented in table 1.

CODING

For ease of analysis and data presentation both clinical and pathological diagnoses were coded using the Ninth Revision of the *International Classification of Diseases* (ICD). Diseases of the circulatory system were divided into VIIa (cardiovascular) and VIIb (cerebrovascular). As the "other" diagnoses unrelated to death had no clinically relevant effect on the clinical management of the patients a detailed analysis of these is not presented.

Results

DISTRIBUTION OF DIAGNOSES

Cardiovascular diseases, including congestive cardiac failure, ischaemic heart disease, acute myocardial infarction and pulmonary embolus, were both the most common main diagnoses and contributory conditions. Respiratory disorders, in particular bronchopneumonia, were the most common cause of death.

COMPARISON OF CLINICAL AND NECROPSY DIAGNOSES

The rate of agreement of clinical diagnoses with necropsy diagnoses is shown in table 2. There was complete agreement on all categories of diagnosis in 32 cases. In 10 of the 68 cases of disagreement the discrepancy was regarded as of no clinical relevance as it involved only disorders unrelated to the main diagnosis. The discrepancies were of greater importance in the remaining 58 cases and were of two sorts—overdiagnosis, in which clinical diagnoses were not confirmed at necropsy; and underdiagnosis, in which there was no clinical suspicion of the necropsy diagnosis (tables 3–5).

CLINICAL RELEVANCE OF THE DISCREPANCIES

Of the 68 cases in which all diagnoses were not concordant, there were 10 in which the correct diagnosis, if achieved, would have led to changes in treatment. In six of these 10 correct diagnosis, if suspected, would have led to different investigations. In two of the 10 cases it was felt that the correct diagnosis could not have reasonably been achieved in life. Three examples of cases with clinically important discrepancies are presented in table 6.

DIAGNOSTIC CONFIDENCE, AGE, AND DURATION OF HOSPITAL STAY

The correlation of diagnostic certainty recorded by the clinician with agreement of clinical and necropsy diagnoses is presented in table 7. There was a significantly higher proportion of correct diagnoses where clinical confidence was high. However, even in this category, 6% of main diagnoses, 22% of contributory conditions, and 12% of causes of death were incorrect.

No clinically important differences in diagnostic accuracy were found in relation to patient age and duration of hospital stay.

Table 5 *Over- and underdiagnosis of cause of death by ICD codes with common diagnoses*

ICD Code	Category	Number	Clinical cause of death
Overdiagnosis:			
I	Infective	2	Septicaemia (2)
VIIa	Cardiovascular	11	Pulmonary embolus (7), acute myocardial infarction (3) congestive cardiac failure (1)
VIII	Respiratory	15	Bronchopneumonia (15)
X	Genitourinary	1	Chronic renal failure (1)
Total		29	
Underdiagnosis:			*Necropsy cause of death*
I	Infective	1	Septicaemia (1)
II	Neoplasia	2	Liver (1), cholangiocarcinoma (1)
VIIa	Cardiovascular	12	Pulmonary embolus (8), congestive cardiac failure (1), arteritis (1), acute myocardial infarction (1), left ventricular failure (1)
VIII	Respiratory	4	Bronchopneumonia (2), aspiration pneumonia (2)
Total		19	

Table 6 *Examples of cases of clinically important discrepancies*

	Clinical findings	Necropsy findings
Case 1:		
Main diagnosis	Bronchopneumonia	Aspiration pneumonia
Contributory condition	Cerebrovascular disease	Cerebral infarction Plastic bag bezoar
Cause of death	Bronchopneumonia	Aspiration pneumonia
Others		Cystitis Chronic myocardial ischaemia
Case 2:		
Main diagnosis	Carcinomatosis	Septic arthritis
Contributory condition	Septicaemia Bronchopneumonia Rheumatoid arthritis	Paravertebral and psoas abscess Rheumatoid arthritis
Cause of death	Septicaemia	Septicaemia
Others	Nil	Nil
Case 3:		
Main diagnosis	Pulmonary embolus	Acute gastric ulcer with haemorrhage
Contributory condition	Nil	Hypertension Bronchopneumonia
Cause of death	Pulmonary embolus	Acute gastrointestinal haemorrhage
Others	Senile dementia	Senile dementia Meningioma

Table 7 *Agreement of clinical diagnoses with necropsy diagnoses by diagnostic certainty, figures in parentheses are percentages in each diagnostic category*

Diagnostic confidence	Number	Disagreement on main diagnosis (%)	Disagreement on contributory conditions (%)	Disagreement on cause of death (%)
Certain	32	2 (6)	7 (22)	4 (12)
Fairly certain	48	15 (31)	15 (31)	18 (38)
Uncertain	20	11 (55)	10 (50)	12 (60)
Total	100	28	32	34

Discussion

Few recent studies have specifically investigated necropsy findings in the elderly.[12-15] The current necropsy rate of 50% compares favourably with one of 20% recorded in a previous United Kingdom study by Puxty *et al*, of necropsy findings in elderly patients from geriatric, general surgery, and orthopaedic wards.[15]

In the current series no satisfactory cause of death was found in 1% of necropsies. This contrasts with the 4·5% found by Puxty *et al* and the much higher rate of 26% found by Kohn *et al*[14] in a series of 200 necropsies performed on patients older than 85. This discrepancy may be due to an increased appreciation of the importance of minor findings in elderly patients with multisystem disorders. In both these studies the spectrum of disease was similar to the current series, with ischaemic heart disease, congestive cardiac failure, pneumonia, cerebrovascular disease and neoplasia accounting for most of the deaths.

Rates of diagnostic discrepancies between clinical and necropsy diagnoses for general series range from 4-39%. A previous review of necropsies from general medical and surgical wards in Edinburgh indicated a much higher rate of misdiagnosis in patients over 75 years of age, with 53% of main diagnoses not confirmed at necropsy. This contrasts with a significantly lower one of 28% for patients older than 75 from geriatric wards in the present series (χ^2 = 10·624; p = < 0·01). In Manchester Puxty and his colleagues identified a similar discrepancy in patients over 85 years with the rates of misdiagnosis from the general medical and orthopaedic wards being twice those from the geriatric unit.[15] Though a variety of explanations are possible, it is tempting to suggest that very old people are more likely to receive a detailed assessment in a geriatric unit where medical and nursing facilities are more geared to their needs.

The disease types giving rise to diagnostic difficulty were similar to those in the previous study, with ischaemic heart disease, congestive cardiac failure, pulmonary embolus, bronchopneumonia and neoplasia frequently being both over- and underdiagnosed. Two cardiovascular conditions were of particular interest. The first was undiagnosed hypertension as a contributory condition in seven cases; the second comprised two cases where senile calcified aortic stenosis was not diagnosed as the main diagnosis underlying left ventricular failure.

Necropsies are important in the accumulation of health care statistics, in undergraduate and postgraduate training, in research and in providing audit of clinical diagnosis and treatment. Despite these important contributions hospital necropsy rates have declined in the United Kingdom since the 1950s, and a recent study recorded a necropsy rate as low as 8·2%.[16] Several factors have been cited as contributing to this declining rate, including irrelevance of necropsy findings to clinical management, delay in issuing reports, a decline in clinicopathological conferences and overconfidence in the precision of modern investigative techniques.[3 17]

This series has shown that the prime factor in establishing higher necropsy rates is the level of clinical and pathological interest. Where necropsies were requested on all deaths then a satisfactory necropsy rate of 50% was achieved.

The results of this study indicate a greater accuracy of diagnosis in the elderly by specialist geriatricians compared with non-specialist units. The levels of misdiagnosis are, however, still high and are no cause for complacency. During the course of the study much was learned from the vigorous audit of cases at the

clinicopathological meetings. With the planned introduction of greater audit in clinical medicine[18] we feel that clinicopathological necropsy meetings have an important role to play in auditing the care of elderly patients.

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