Process and Outcome

Necropsy: a yardstick for clinical diagnoses

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Summary and conclusions

An attempt to obtain necropsies on all deaths from a selected group of clinical units resulted in a necropsy rate of 65% (compared with a normal of 30% in these units). The effect of increasing the necropsy rate was to produce a higher rate of confirmation of clinical diagnoses; nevertheless, 15% of main diagnoses and 42% of causes of death were not confirmed. A large proportion of these were deemed by clinicians in consultations with pathologists to be clinically significant. Of main diagnoses considered certain, 10% were not confirmed. The proportion of diagnostic discrepancies was virtually identical in two groups—those in which the clinician believed he would normally have requested necropsy, and those in which he would not. Thus clinical confidence in the diagnosis is not an adequate assurance of its accuracy.

Although in this survey necropsy was requested on almost all cases, permission was refused in many which may be attributed either to resistance by relatives or to an inadequate approach by the medical staff. The proportion of permissions secured by individual units varied from 50% to 92%. This indicates that the nature of the approach to relatives is the more important factor. As present practices do not adequately allow for the detection of a wide range of misdiagnoses and missed diagnoses it is proposed that a "partial audit" would provide a valuable yardstick; clinicians would be asked to obtain permission for necropsy on an agreed proportion (say, 20%) of deaths over and above those cases in which they are particularly interested and would normally request a necropsy.

Introduction

In a prospective survey of more than 1000 routine hospital necropsies we found that main clinical diagnoses were not confirmed in 39% of cases.[1] A more detailed analysis of the same material showed that it contained a wide variety of diseases in which both overdiagnosis and underdiagnosis were more or less common.[2]

It was suggested that we should not be surprised to find such a high proportion of diagnostic discrepancies among cases selected for necropsy; many cases are selected for examination precisely because there are doubts about the diagnosis.[3] By inference, one would not expect many discrepancies among those cases for whom necropsy is not sought because the clinicians are satisfied with their diagnosis. In our previous survey, however,[1] we found that even when a main diagnosis was considered "fairly certain" it was not confirmed in about one-quarter of cases. Consequently, we are not convinced that the clinician is always well placed to judge the potential value of a necropsy—even when he is "certain" or "fairly certain" of his diagnosis. We therefore decided to test this by mounting a further survey in which we attempted to obtain necropsies on all deaths from several clinical units.

Methods

Fifteen consultants from six units*—four medical and two surgical—instructed their staffs to ask permission for necropsy on every death for a period of six months. When permission had been obtained—and before necropsy was performed—a proforma was completed by one of us with the help of the medical staff of the ward. This recorded the diagnoses as:

Main diagnosis—The principal condition for which the patient had been admitted to hospital.

Cause of death—This might be a complication of the main diagnosis, or some more or less unrelated terminal event—for example, a main diagnosis of bronchial carcinoma with bronchopneumonia as the cause of death; or a main diagnosis of chronic lymphatic leukaemia with cerebral infarct as the cause of death.

The proforma also recorded the clinician's degree of confidence in his diagnosis: "certain," "fairly certain," "possible," and "uncertain." Additional information indicated whether or not the patient had been fully investigated; whether necropsy would normally have been sought; reasons (when appropriate) for failure to obtain permission; and data on the approach to relatives for permission—for instance, the time of approach and the kinship of the relative. In each case the consultant or a senior deputy certified the data as correct.

Necropsy diagnoses were added to the proforma when the histological findings were complete. We discussed discrepancies between the two diagnoses with the clinical consultants; the final diagnoses were agreed on; and a joint assessment was made of the clinical importance of discrepancies.

Results

During the period of study, there were 252 deaths in the participating units. In nine instances necropsies were required by the Procurator Fiscal. Permission was requested in 241 of the 243 remaining cases, and was granted in 154, giving a necropsy rate of 65%. The results of the medicolegal cases are not available to us and are not considered further.

NECROPSY POPULATION

Table I summarises the main differences between this survey and the previous one[1]; the figures for the relevant units in this survey are

*The following clinical consultants participated along with their staffs in this investigation: Mr D C Carter, Dr B F Clarke, Dr A Doig, Dr A C Douglas, Professor A P M Forrest, Dr J Innes, Mr A M Jenkins, Dr A T Lambie, Dr R M Marquis, Dr H C Miller, Dr A L Muir, Mr B Nolan, Dr A C Parker, Dr R F Robertson, and Professor J S Robson.

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TABLE I—*Comparison of necropsy populations in 1978 and 1975-7 series*

	1978 Series No (%)	1975-7 Series* No (%)
Necropsies	154 (65)	326 (30)
Elderly subjects (>75 years)	60 (39)	63 (19)
Acute deaths (within 24 hr of admission)	4 (3)	39 (12)
Long-stay patients (>4 weeks)	32 (21)	52 (16)
Main diagnosis: certain or fairly certain	144 (94)	168 (52)
Confirmation of main diagnosis	131 (85)	182 (56)
Causes of death: certain or fairly certain	119 (77)	Not available
Confirmation of causes of death	90 (58)	60 (18)

*Figures abstracted for the relevant units from the 1975–7 series.

abstracted from the data in the paper for the 1975-7 series. The present series contained a larger proportion of elderly and long-stay patients; there were fewer acute deaths; and the clinical consultants were more often confident of their diagnoses. The range of diseases was similar but in the present survey there was a greater proportion of necropsy diagnoses of cerebrovascular disease (18% compared with 8%) and a smaller percentage of cardiovascular disease (30% compared with 41%).

The consultants' greater confidence in their main diagnoses was reflected in the raised rate of confirmation at necropsy (85%); confirmation of the cause of death was also higher (58%).

CASES NOT FULLY INVESTIGATED

In 44 cases (29%) clinical investigation was deliberately limited (table II). In this group main diagnoses were confirmed in 30 (68%) cases and causes of death in 24 (55%).

TABLE II—*Cases incompletely investigated: reasons given for limitation of investigation*

	No of cases	Average age
Advanced age	11	83
Poor state of health	21	74
Other	12	63

CONFIRMATION IN RELATION TO TIME IN HOSPITAL

Main diagnosis—Confirmation of main diagnosis was high (28 out of 30 cases, 93%) in those dying within three days of admission; it was lower (25 out of 33 cases, 76%) in those surviving for up to one week, rose thereafter (53 out of 59 cases, 90%), but fell (25 out of 32 cases, 78%) in patients who were in hospital for more than four weeks.

Cause of death—There was no clear relation between the frequency of confirmation of cause of death and time in hospital.

CONFIRMATION IN RELATION TO AGE

Main diagnosis—Confirmation of the main diagnoses (table III) fell with increasing age. All 19 cases aged under 55 were correctly diagnosed, but the proportion confirmed in the oldest group (75 and over) was 75%.

TABLE III—*Confirmation of main diagnosis in relation to age (154 cases)*

Age (yr)	No of cases	% Confirmed
<55	19	100
55–64	25	88
65–74	50	90
⩾75	60	75

Cause of death—Confirmation of cause of death ran at a lower level, between 46% and 68% in the various decades; the figures were rather random and showed no clear relation to age.

CONFIRMATION IN RELATION TO CLINICAL CERTAINTY

Main diagnosis (table IV)—The clinicians declared themselves certain or fairly certain in 144 of 154 main diagnoses (94%); 127 of these were confirmed—that is, 17 (12%) were not confirmed. The consultants were asked (before necropsy) whether in the absence of the survey they would have requested necropsy. They considered that permission would not have been sought in 44 (29%); almost half of these were aged under 75. In this group the confirmation rate was 86%; in the group for whom necropsy would in any case have been asked, the rate was almost identical—85%.

Cause of death—The causes of death were considered certain or fairly certain in 119 cases (77%) and were confirmed in 74 (62%) of these.

TABLE IV—*Confirmation of main diagnoses in relation to clinical certainty*

Main diagnoses	No of cases (%)	No confirmed (%)
Certain	121 (79)	109 (90)
Fairly certain	23 (15)	18 (78)
	144 (94)	127 (88)
Possible	3 (2)	0 (–)
Uncertain	7 (4)	4 (57)
Necropsy would not normally be requested	44 (29)	38 (86)
Necropsy would be requested	110 (71)	93 (85)

CONFIRMATION IN RELATION TO CLINICAL UNIT

Confirmation of main diagnoses was higher in surgical (93%) than in medical units (83%). The physicians, however, diagnosed causes of death more accurately (medical wards 60%; surgical wards 48%).

IMPORTANCE OF DISCREPANT DIAGNOSES

Main diagnosis—The main diagnosis was not confirmed in 23 cases. It was agreed with the clinicians that in 16, even if the correct diagnosis had been suspected in life, clinical management would have been substantially the same; in three further investigation might have led to different treatment; and in a further four the condition would probably have been treated.

Cause of death—The cause of death was not confirmed in 64 cases. In 48 no different management would have been called for; in eight further investigation might have led to different treatment; and in a further eight the condition, if correctly diagnosed, would probably have been treated.

In total, therefore, 23 patients (15% of the whole series) would have had further investigation or different treatment or both. Table V gives examples of some of the more important diagnostic discrepancies.

Discussion

The objectives and methods of the present investigation differed from those of the previous survey. It was based on certain clinical units whose consultants were willing to collaborate in an objective assessment of the role of the necropsy in modern hospital practice; the high level of their co-operation is attested by the fact that permission was requested in all but two cases. The collection of clinical data was the direct responsibility of the investigators and in each case was authenticated by the responsible clinical consultant. To avoid the pathologists being cast in the role of final arbiters, the assessment of the importance of diagnostic discrepancies was made jointly by the pathologist and the responsible clinician.

FREQUENCY OF CONFIRMATION OF CLINICAL DIAGNOSES

In this survey we examined the proposition that the high proportion of discrepant diagnoses in our previous survey was no more than a reflection of the selection of difficult or unsolved cases for necropsy. According to this view, one need not be

TABLE V—*Examples of discrepancies in diagnosis considered to be significant by clinician and pathologist*

	Main diagnosis	Cause(s) of death	Other diagnoses	Significance
		60-year-old woman: 29 days in hospital before death		
Clinical	Acute myeloid leukaemia	Bronchopneumonia	Alcohol abuse	Main diagnosis not confirmed: would have been treated
Necropsy	Tuberculosis	Miliary tuberculosis. Left ventricular failure	Alcoholic hepatitis. Alcoholic cardiomyopathy	
		88-year-old man: 43 days in hospital before death		
Clinical	Cerebrovascular disease	Acute myocardial infarction. Pulmonary oedema	Epilepsy. Benign prostatic hyperplasia	Main diagnosis and cause of death not confirmed: probably would have been treated
Necropsy	Bronchopneumonia	Extensive bronchopneumonia	Benign prostatic hyperplasia. Peptic ulceration. Pulmonary embolus. Renal carcinoma	
		41-year-old man: in hospital more than 24 h before death		
Clinical	Diabetes mellitus	Cardiac arrest		Cause of death not diagnosed clinically: would have been treated
Necropsy	Diabetes mellitus	Significant bronchopneumonia		
		*79-year-old man: in hospital 63 days before death**		
Clinical	Unknown—probably upper gastrointestinal tract malignancy	Chest infection		Main diagnosis not established: should have had further investigation and perhaps been treated
Necropsy	Gall stone obstruction of common bile duct	Bronchopneumonia. Ascending cholangitis		
		68-year-old woman: in hospital four days before death		
Clinical	Ascending cholangitis	Ascending cholangitis		Cause of death not established: further investigation required
Necropsy	Ascending cholangitis—apparently cleared with treatment	Acute myocardial infarction. Large cerebral infarction. Hepatic abscesses		
		39-year-old man: in hospital 45 days before death		
Clinical	Lymphoma—possibly Hodgkin's disease	Disseminated tumour. Renal + hepatic failure		Cause of death not established: further investigation required
Necropsy	Hodgkin's disease	Acute myocardial infarction. Left ventricular failure. Disseminated tumour		

*Investigation withheld because patient was considered unsuitable for operation.

concerned about cases for which necropsy is not requested since they have been adequately investigated and diagnosed. This is reflected in statements by some clinical colleagues—for instance, "We are not usually seeking more information, since the entire living disease process has often been fully documented."[4]

Although we did not achieve our target of necropsies on all deaths, the rate more than doubled. The proportion of confirmed diagnoses increased—main diagnoses from 56% to 85% and causes of death from 18% to 58%. We believe that the closer consultation between clinicians and pathologists before and after necropsy successfully eliminated some apparent discrepancies, thereby contributing to the increased rates of confirmation in the present series. In a sizable group (29%) clinical investigation was for various reasons incomplete, which is apparently reflected in a lower rate of confirmation of main diagnoses (68%) though not of causes of death (55% confirmed).

As one would expect, the clinicians were more often confident of their diagnoses: 94% of main diagnoses were certain or fairly certain compared with 52% in the previous survey. Nevertheless, even with such an increased necropsy rate, 15% of major diagnoses and 42% of causes of death were not confirmed; even when the major diagnosis was considered certain or fairly certain it was not confirmed in 12%; the corresponding figure for cause of death was 38%. In 29% of all cases the consultant was so sure of the diagnosis that he believed he would not ordinarily have asked for necropsy (table III). There were as many discrepant diagnoses in this group, however, as in those in whom he thought he would have wanted necropsy (14% and 15% respectively). Thus, although the higher necropsy rate confirmed the clinicians' view that it would be associated with fewer diagnostic discrepancies, a considerable proportion of their apparently "secure" diagnoses were shown to be wrong. The frequency of confirmation of diagnoses had much the same relationship to age and time in hospital as in our previous survey.

IMPORTANCE OF DIAGNOSTIC DISCREPANCIES

With a higher rate of confirmation of diagnoses a smaller proportion of discrepancies are clinically important. Nevertheless, there were discrepancies in 15% of major diagnoses and in 42% of the causes of death; the clinicians agreed that these had implications for investigation or treatment, or both, in 15% of the entire series.

This investigation has been undertaken with the co-operation of a highly competent, experienced clinical staff; it is therefore significant that even a high degree of clinical confidence in diagnoses at the time of death does not guarantee accuracy. Necropsy shows important discrepancies, sometimes when least expected; on occasions, lessons could be learnt. Hence necropsy should be an integral part of medical audit.

TO SELECT OR NOT TO SELECT?

Medical audit, to be satisfactory, would require necropsies on all deaths in hospital: a proposal that would be favoured by about half of all the clinical consultants of this district.[4] This would, however, add a load that would be insupportable in pathology departments unless additional staff were provided.

Is there then no alternative to the present selection of cases that the clinician favours because they are puzzling or specially interesting, or because they fall within his unit's particular interest?

Is there any way to allow for the apparently mundane case that gives little promise of significant findings? The pathologist's dilemma is that the latter cannot be excluded, because they conceal, under respectable clinical aliases, diseases that are often missed. A random sample of all hospital deaths might seem a possible solution, but no sample could be random when permission for necropsy depends on relatives' compliance. Such a system would also pre-empt the clinician's right to have examinations on cases that he has found particularly interesting or puzzling. One possible answer that would preserve the clinician's right to select "special" cases for examination would be to ask that he should *in addition* obtain permission on a proportion (say 20%) of other deaths in his wards—that is, cases on which he would not normally ask for necropsy. A "partial audit" of this order would provide a useful yardstick for the large group of clinical diagnoses that at present pass unexamined post mortem.

PERMISSION FOR NECROPSY

Failure to obtain permission in 35% of this series of deaths may be explained by (1) a high level of resistance by relatives, or (2) an inadequate approach by medical staff.

In a sample inquiry (HW) we found that female relatives were more ready to grant permission than male relatives, and

that there was a higher success rate where the subject was male, young (less than 50 years), had been in hospital for a short time, and when the request was made between six and 24 hours after death.

We also found that some clinical units were more successful than others; the necropsy rates varied from one unit to another from 50% to 92%. Apparently the nature of the approach made is of greater importance than reluctance on the part of relatives.

Consideration of this would be essential in any attempt to introduce the partial audit. That the answer lies with the clinicians is indicated by comments we have had from some of our consultant colleagues: "We put less pressure on relatives than we used to" and "pressure is brought to bear on the reluctant, because I believe the necropsy is of fundamental importance."[4]

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Scientifically Speaking

Iodide

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Washington, DC—The legacy of the nuclear power plant accident at Three Mile Island is more than huge clean-up costs, tighter government regulations, and regional psychological stress. That mishap in the spring of 1979, although not yet proved to have injured anyone, has inspired a clinical debate of apparently growing proportions. The question is whether potassium iodide should be distributed to people living in the neighbourhood—in order to reduce thyroid uptake of radioactive iodine-131—after a nuclear reactor leaks appreciable amounts of its fission products.

The topic was the basis for an entire evening's symposium at the recent annual meeting of the Endocrine Society here. "We're willing to stay 'til midnight," said Joseph E Rall in his chairman's introduction to the session. Scientific director of the National Institute of Arthritis, Metabolism, and Digestive Diseases, Dr Rall said the debate had never before been aired in a "public forum," which in this case consisted of several hundred of the society's members, followers, and spouses. Although the discussion did not run to an hour when anyone's taxi was threatened with becoming a pumpkin, it generated some clear-cut differences of opinion.

The format of the evening gave Dr Rall the task of describing how much of a carcinogenic problem radioiodine is, followed by Herbert J C Kouts, chairman of the division of nuclear energy at Brookhaven National Laboratory, telling of the pertinent physical aspects of reactor accidents. They established a context for an exchange of views between Jan Wolff, medical director in the endocrinology branch of the arthritis institute, who sees a distinct place for prophylactic potassium iodide, and Rosalyn S Yalow, Nobel Laureate for the radioimmunoassay and sceptic about the worth of potassium iodide as weighed against the potential for adverse reactions to it.

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Potassium iodide prophylaxis

Concern about the effects of ionising radiation on the thyroid has created a considerable body of scientific published reports over the years, but it is only since the Three Mile Island event that there has been cause for much dispute about potassium iodide prophylaxis. Government actions in sending hundreds of thousands of doses of potassium iodide to Pennsylvania storage facilities around the fulminating reactor called new attention to the potential for mass pretreatment. The doses were never distributed, but their preliminary deployment was widely noted in news reports.

No one on the Endocrine Society programme was questioning the efficacy of potassium iodide to block thyroid uptake of radioiodine, or was denying the existence of circumstances in which such blockage could be desirable. The question is, as Rosalyn Yalow put it, "the advisability of general distribution of potassium iodide to a population which is alarmed by fear of radiation at any level and is poorly informed concerning the potential hazards of taking or not taking the drug."

As it turns out, that is not the only question. There seems to be considerable uncertainty about the thyroid consequences of