

Section of Epidemiology and Preventive Medicine

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Meeting February 16 1962

Accuracy of Death Certification

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An investigation was suggested about 1954 to try to find out what effect autopsies might have on the statistics of cause of death. Several other workers (e.g. James *et al.* 1955, Pohlen & Emerson 1943) had carried out similar investigations, but this was believed to be the first done on a large scale in England and Wales. The initial investigation was carried out in ten hospitals and its results reported by the Registrar General (1958). The results gave reason to believe that a larger investigation would be worth while. This paper presents a few of the more interesting findings of the second investigation. They should be regarded as preliminary until the publication of the full report.

Method

The hospitals which took part were supposed to carry out post-mortem examinations as a routine on every death that occurred – provided that relatives did not object. This may have been the case in the preliminary investigation, but it was almost certainly not so in the larger one, for the percentage of deaths on which a post-mortem examination was performed varied from 100 to just over 30. It was decided nevertheless to include data from all hospitals.

The clinicians at the participating hospitals were asked to complete a 'dummy' death certificate on all patients dying. They were also asked to give any differential diagnoses and, in the second investigation, to say whether the recorded cause of death was 'fairly certain', 'probable' or 'uncertain'. A post-mortem examination was then performed and the pathologist and clinician were asked to prepare another death certificate, which took into account both the clinical and autopsy findings. The pathologist was also requested to add any other brief details. A space was provided to record any disagreement between clinician and pathologist but it was used only once. Despite this it is doubtful if consultation between clinician and pathologist was achieved in every case. Thus, although the pathologist's certificate was almost

certainly more right more often than the clinician's it would be wrong to assume that the pathologist's certificate was free from error. The completed forms were sent to the General Register Office where they were coded in the normal fashion for death certificates using the International Classification of Diseases and the International Rules of Assignment. Where there was any disagreement between the assigned or underlying cause on the clinician's and pathologist's certificate an attempt was made to decide how the disagreement arose.

Basically, the 'disagreements' were divided into two groups: those in which they appeared to be due to differences of fact, and those in which there were differences of opinion or wording. In the case of differences of 'fact' only the assigned underlying cause was considered and a difference of fact was recorded if the pathologist's underlying cause either revealed something not mentioned on the clinician's certificate or differential diagnosis, or alternatively the clinician's underlying cause was not found on the pathologist's certificate or notes of his findings. For example, a clinician gave a cause of death as tuberculosis but the pathologist found instead a carcinoma of lung.

Differences of opinion or wording took several forms. The first was an apparent error in the completion of the form which need not be considered further. The second – where the clinician's and the pathologist's underlying causes differed but both were aware of the other's choice. For example, a man died with both ischaemic heart disease and carcinoma of the colon. The clinician attributed the underlying cause to the first mentioned, the pathologist to the second, but both were aware of the presence of both diseases. In the third type, there occurred a difference in wording. The clinician and pathologist appeared to be saying the same thing but their way of saying it resulted in a different assignment. For example, 'hypertensive heart failure' by a peculiarity in the coding rules goes to a different code number from that for 'hypertensive heart disease'. It is possible to read different shades of meaning into these two terms but it is not thought that the majority of doctors mean them to be different.

It must be made quite clear at this stage that where there was a new finding at post-mortem there is no suggestion that blame attached to the clinician. The 'new findings' group varied widely and included examples of what was suspected to be incorrect completion of the form and cases where the autopsy diagnosis was obviously unknown to the clinician. In these last cases it was usually evident that nothing could have been done to save the patient. In fact, it is surprising how rare it was to find what appeared to be a serious mistake in the sense that a correct diagnosis might have saved the patient's life.

General Results

Table 1 shows that, even if post-mortem examinations were performed as a routine, greater efforts were made to obtain permission from the relatives when the diagnosis was uncertain; i.e. the cases in which post-mortem examinations were performed were probably the more difficult ones.

Table 2 shows that there were 9,501 autopsies and that the clinical and pathological diagnoses agreed in only 45.3% of cases. Of the disagreements half were questions of fact and half of opinion or wording. It shows, not surprisingly, that the percentage of cases in which the clinician's and pathologist's certificates agreed was higher when the clinician was 'fairly certain' of his diagnosis than when he was 'uncertain'. Also, the percentage of cases in which new facts were found was greater when the clinician's diagnosis was uncertain.

Table 1

Number and percentage of post-mortem examinations performed by clinician's opinion

Clinician's opinion	Post-mortem performed	No post-mortem	Total	Percentage with no post-mortem
Fairly certain	5,284	3,964	9,248	42.9
Probable	2,824	870	3,694	23.6
Uncertain	1,130	152	1,282	11.9
Not stated	263	130	393	33.1
Total	9,501	5,116	14,617	35.0

Table 2

Percentage of cases in which clinician and pathologist agreed, and in which new facts were found according to degree of certainty of diagnosis

Clinician's opinion	Percentage agreement	Percentage new facts found	Other cases	No. of post-mortems performed
Fairly certain	55.7	15.7	28.6	5,284
Probable	35.4	32.8	31.8	2,824
Uncertain	23.0	50.0	27.0	1,130
Not stated	41.1	28.1	30.8	263
Total	45.3	25.2	29.5	9,501

Table 3

The effect of age and certainty of diagnosis on post-mortem findings and practice

No autopsy All cases	Clinician's opinion	Age at death				
		1-14	15-44	45-64	65-74	75+
%	Fairly certain	27	31	38	46	56
	Probable	10	13	19	25	32
	Uncertain	12	5	10	12	17
Cases with new facts found All post-mortem cases	Fairly certain	3	7	12	20	27
	Probable	11	24	30	38	43
	Uncertain	47	36	45	58	56
Cases with A.M./P.M. agreement All post-mortem cases	Fairly certain	61	63	62	54	43
	Probable	54	42	40	33	28
	Uncertain	20	35	27	19	20

Table 3 shows the effect of age and 'certainty' on the proportion of autopsies held and of the findings at autopsy. The frequency of post-mortem examinations fell with increasing age and increasing certainty of diagnosis. The percentage of cases in which new facts were found at autopsy was seen to rise with age, although if the diagnosis was uncertain age had relatively little effect. The proportion of cases in which there was agreement between clinician and pathologist showed the opposite trends, i.e. less agreement at the older ages and with less certain diagnoses. Of course, certification becomes more difficult with increasing age and it becomes accordingly more difficult to decide whether questions of fact are involved in deciding the cause of disagreements.

If it can be assumed that diagnoses in those cases with no post-mortem were as accurate as those with a post-mortem for the same certainty of diagnosis then it is possible to standardize for certainty of diagnosis and produce a table showing the increase of new facts expected with increasing age. This is shown in Table 4.

Although the accuracy of a death certificate decreases with increasing age, this does not necessarily mean that the statistics for individual causes are less accurate at the upper end of the age range, for the effect of the errors may be to cancel each other out. This can only be seen by

Table 4

New facts expected at post-mortem by age at death after standardizing for certainty of diagnosis

Age at death	Percentage with new facts found at post-mortem
1-14	6
15-44	11
45-64	17
65-74	26
75 and over	33

Table 5

Number of assignments to individual causes of death before and after autopsy

I.C.D. No.	Assigned cause of death	Before autopsy	After autopsy	Autopsy not performed
001-019	Tuberculosis (all forms)	58	95	25
020-029	Syphilis	31	31	7
092	Infectious hepatitis	22	14	4
	Malignant neoplasms:			
150	Stomach	253	234	195
153, 154	Large intestine, rectum	288	264	226
155	Biliary passage and liver (stated to be primary site)	28	69	15
162, 163	Lung, bronchus and trachea	450	534	225
199	Other and unspecified sites	147	31	47
200	Lymphosarcoma and reticulosarcoma	49	82	31
204	Leukæmia, aleukæmia	153	147	71
140-205	All malignant neoplasms	2,283	2,378	1,418
260	Diabetes	94	69	59
330	Subarachnoid hæmorrhage	165	171	55
331	Cerebral hæmorrhage	539	377	337
332	Cerebral embolism and thrombosis	351	310	339
334	Other and ill-defined vascular lesions of C.N.S.	41	28	92
352	Other cerebral paralysis (including hemiplegia)	9	1	11
490-493	Pneumonia	459	365	324
500-502	Bronchitis and bronchiectasis	244	381	183
526	Ulcer of stomach and duodenum	210	257	60

studying individual causes and, in fact, it is seen to vary with cause. In tuberculosis and cancer of the lung there is little difference; with cerebral hæmorrhage and coronary thrombosis there are marked changes with age.

It will be remembered that the main purpose was to see whether post-mortem examinations improve mortality statistics. The conclusion reached in the initial investigation was that with certain exceptions they did not. The proportion of 'error' or at least 'differences between clinician's and pathologist's certificates' was considerable - but on the whole these differences tended to cancel one another out. There were, however, one or two conditions where it was evident that the published statistics are very much in error.

Table 5 gives some examples of the number of assignments resulting from the clinician's and pathologist's certificates, particularly emphasizing some of those conditions where autopsies tend to alter mortality statistics.

Cancer of the Lung

In Table 5 it will be seen that there was considerable underdiagnosis of this condition, amounting in fact to 18.7%, and it was mentioned earlier that this appeared to be unaffected by age. The accuracy of diagnosis on the part of the clinician

increased with his certainty but the effect of this, after including cases with no autopsy and standardizing for certainty of diagnosis, was only to reduce the underdiagnosis to 17.4%. If one can say this is a fairly reasonable estimate of the amount of underdiagnosis in hospital and one can guess that the accuracy of diagnosis in general practice is about the same as in hospital, probably the total underdiagnosis is 15-20%.

It is not disputed that a large part of the increase in recorded mortality from cancer of the lung has resulted from improved diagnosis. These data show that there is still considerable room for further improvement and it is conceivable that this sort of investigation might be repeated and an estimate obtained of how much of the increase has been spurious.

Table 6 shows the alternative diagnosis for cases of lung cancer in which differences of fact were found. The greatest single cause of underdiagnosis was quite clearly other neoplasms. Of the 76 other neoplasms 29 were pre-autopsy 'carcinomatosis' and 4 were secondary carcinoma of the liver. One particular site that is worth mentioning: 8 brain tumours - pre-autopsy - in fact turned out to be carcinomata of the lung, and so did 7 cerebrovascular accidents. There was some give and take between other systems with the balance in favour of underdiagnosis of lung cancer.

One point should be underlined. There have been efforts in the past to make allowances for the amount of underdiagnosis, notable among these being the Registrar General (1957) and Gilliam (1955). These authors have made the assumption that the mis-diagnosis arose from other respiratory diseases. There is little doubt that this was to a certain extent true in the past, but it is certainly not true now. Table 6 shows quite clearly that the mis-diagnosis occurs firstly with other cancer sites and secondly with cerebro- and cardio-vascular lesions.

Referring to the more general picture, of 105 cases, in which the pre-autopsy diagnosis was given as carcinomatosis and the autopsy came out with a clear diagnosis, 27 showed no growth at all,

Table 6

Alternative diagnoses in cancer of lung cases

Alternative diagnosis	Pre-autopsy diagnosis cancer of lung	Post-autopsy diagnosis cancer of lung
Tuberculosis	2	2
Other neoplasms	27	76
Cerebrovascular accident	1	7
Cardiovascular disease	11	17
Influenza and respiratory disease	19	24
Others	12	9
Total	72	135

Table 7
Certification accuracy and practice: cerebrovascular disease

Diagnosis before autopsy	Diagnosis after autopsy				Other assignments	Total
	Subarachnoid haemorrhage	Cerebral haemorrhage	Cerebral embolism and thrombosis	Other and ill-defined vascular lesions of C.N.S.		
Subarachnoid haemorrhage	112	34	2	0	17 (13)	165
Cerebral haemorrhage	40	257	65	2	175(127)	539
Cerebral embolism and thrombosis	3	36	159	8	145(126)	351
Other and ill-defined vascular lesions of C.N.S.	0	5	8	9	19 (10)	41
Other assignments	16(6)	45(30)	76(51)	9(5)	—	146
Total	171	377	310	28	356	1,242

Figures in brackets are the numbers of 'other assignments' when differences of fact were apparently involved.

29 had cancer of the lung, 9 of the stomach, 9 of the pancreas and 31 of other sites.

Cerebrovascular Disease

Table 5 shows considerable evidence of over-diagnosis of cerebrovascular disease (up to 25%), with cerebral haemorrhage up to 43%.

Table 7 shows something of what has happened. The clinician has diagnosed cerebral haemorrhage in 539 cases. In only 257 of these was his diagnosis confirmed. In 48 cases disagreement was a matter of opinion rather than fact. Thus he was wrong in 234 cases or 43%. For subarachnoid haemorrhage the clinician did rather better, the chief error being cerebral haemorrhage. He was wrong in only 30% of cases, but for cerebral thrombosis he was wrong in 49%.

Table 8 shows the non-cerebrovascular diagnoses where the difference between clinician and pathologist was one of fact. For example, 27 cases thought to have died of cerebral haemorrhage were found at autopsy to have had coronary disease; and 4 cases thought to have died from coronary disease were found to have had cerebral haemorrhage. In all the groups with reasonable

numbers the non-cerebrovascular diseases were found more often at post-mortem.

This subject has been considered because modern treatment of cerebrovascular disease relies on accurate diagnosis. Even taking into account the many shortcomings of death certification methods, this study shows how difficult accuracy is to obtain.

Conclusion

This paper gives briefly a few of the results of a large investigation which will be described in greater detail elsewhere. The need for brevity made it necessary to gloss over some of the complicated questions of 'correctness' of diagnosis and of single cause mortality statistics. It is hoped, however, that enough has been said to show the need for care in the interpretation of mortality data and the difficulties of arriving at an accurate diagnosis of cause of death.

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Table 8
Alternative diagnosis for cases of cerebrovascular disease

Diagnosis (before) after autopsy	Diagnosis before (after) autopsy				Total
	Subarachnoid haemorrhage	Cerebral haemorrhage	Cerebral thrombosis or embolism	Other and ill-defined	
Neoplasms	2(-)	12 (7)	19 (5)	2(1)	35(13)
Coronary disease	-(-)	27 (4)	31 (9)	4(1)	62(14)
Other diseases of heart	-(-)	8 (-)	8 (5)	-(-)	16 (5)
Hypertension	1(-)	11 (2)	6 (-)	1(1)	19 (3)
Pneumonia	2(-)	9 (1)	13 (7)	-(-)	24 (8)
Injury	1(1)	19 (6)	4 (4)	-(-)	24(12)
Other	7(5)	41(10)	45(21)	3(1)	96(37)
Total	13(6)	127(30)	126(51)	10(5)	276(92)

Dr J D J Havard (*British Medical Association*)

Medico-Legal Aspects

Dr Heasman has dealt with the problem of accuracy of death certification from the point of view of the mortality statistician, and, to a lesser extent, from the point of view of the clinician. My paper will deal briefly with the problem from the point of view of the safeguards which accurate death certification can afford the community against the inadvertent or surreptitious disposal through normal channels of deaths which ought

properly to be the subject of medico-legal investigation, e.g. deaths from crime, or accident, or from unsuspected public health, industrial or domestic hazards, and deaths in which pension or insurance claims may be involved. In this country the coroner is required to investigate any death which appears to be violent or unnatural, or sudden and of unexplained cause (Coroners Act 1887). This paper will be concerned chiefly with the way in which accurate death certification can ensure that such deaths are, in fact, notified to the coroner. In this connexion it must be remembered that there is no enforceable duty upon doctors to notify deaths to the coroner and that the law in this country relies on the system of death certification and registration to ensure that such deaths are notified (Coroners 1936).

Prior to 1836 there was no registration of deaths in this country, only registration of burials. The information contained in the Bills of Mortality depended upon the returns of the 'searchers', who were the two old women appointed in each parish to view the bodies of deceased persons, a duty which they gladly dispensed with upon being provided with a suitable fee by the household and a generous helping of the liquor which used to play such a prominent part on these occasions. Their inflated returns of deaths from epidemic disease such as cholera gave rise to unnecessary states of panic in the population and provided one of the main reasons for the introduction of death registration. Historically death certification and registration were introduced for the purpose of improving mortality statistics and facilitating proof of death for legal purposes. It was not expected that they would in any way act as a safeguard to the community against the disposal through normal channels of deaths which ought to be investigated. It came as somewhat of a shock to discover after the first year of operation of death registration that only 290,000 of nearly 340,000 deaths had been registered as having been buried. As the mean figure for registered burials for the decade 1821-1830 was less than 250,000 it was clear that there had been no adequate record of the disposal of deaths in the community (Registrar General 1839). A few years later Dr Farr, Dr Heasman's illustrious predecessor, persuaded the medical profession to certify the cause of death of their patients on a voluntary basis and 10,000 books of certificates were sent out to doctors (Registrar General 1845). The immediate result of these measures was an increase in the number of deaths reported to the coroner. In Middlesex, where the justices were notoriously active in preventing inquests from being held, the increase was as much as 43%. The subsequent history of these events has been considered elsewhere (Havard 1960) and it was

not until 1926 that the Government finally recognized the principle that no death should be registered without reference to the coroner unless a certificate of death from natural causes had been given by a doctor who had been in attendance upon the deceased person during his last illness. It is because a death certificate from natural causes provides a passport to a smooth passage through the registration formalities to disposal of the body that it is most important from the medico-legal point of view that the certificate should be founded upon adequate information. Bearing this in mind, there are four main points to consider in relation to existing procedure.

(1) *Certainty of Cause of Death*

A doctor who has been in attendance upon a deceased person during his last illness is required to sign a death certificate in the prescribed form stating 'to the best of his knowledge and belief' the cause of death and to deliver it to the registrar (Births and Deaths Registration Act 1953). The first point to note is that the cause of death need not be 'definitely ascertained' as in cremation procedure but need be given only to the best of the doctor's knowledge and belief. If he has been in attendance upon a deceased person during the last illness he must give a certificate provided he can state the cause of death to the best of his knowledge and belief. He can refuse a certificate only when he has no idea whatsoever as to the cause of death, but under modern conditions there can be few cases where a doctor who has been in attendance during the last illness finds himself in such a position. It follows that certificates of death from natural causes will be given even though the doctor is uncertain about the cause of death. Unless his uncertainty is communicated on the death certificate by some qualification, such as 'probably' or a question mark, the local registrar will not refer the case to the coroner.

(2) *View of the Body after Death*

The doctor is required to certify only the cause of death and not the fact that death has occurred. He is not required to see the body after death, let alone to examine it, and, provided he has attended the deceased within fourteen days before death, the fact that he has not seen the body after death will not be referred to the coroner (Registration Consolidated Regulations 1954). In other words he can certify death on the basis of information received from a third party that his patient has died. This accounts for the number of distressing cases in which persons have been certified dead who are very much alive, having procured a death certificate in order to disappear conveniently, or to defraud insurance companies. And sometimes the wrong person is certified dead.

(3) *Necessary Period of Attendance*

It is nowhere stated what is the requisite period of attendance before a certificate can be given. Last illnesses may last a very long time and it may be weeks or months since the certifying doctor last saw his patient. The local registrar is required to notify the coroner where the doctor has not seen the deceased person within fourteen days before death, but this applies only where the doctor has not seen the body after death. It is essential that a death certificate should be founded upon a sufficient period of recent attendance.

(4) *The Meaning of the 'Cause of Death'*

The introduction to books on death certification issued to doctors directs them to remember that 'the international classification of causes of death is based, not upon terminal clinical states, but upon the antecedent and underlying pathological causes'. The footnote to each death certificate reminds them that it is this cause of death which is required and not the mode of dying. The reason for this is that terminal clinical states and modes of dying are of no great statistical medical importance, but they are, of course, of considerable medico-legal importance in ascertaining any intervening events which may have taken place before death. The statistician is interested primarily in the fatal condition from which the deceased person was suffering, but this paper is concerned chiefly with the way in which death occurred. In this respect it should be noted that the incidence of violent death amongst persons suffering from chronic disease is very much higher than amongst the general population (Turkel 1955). A simple example will illustrate this point:

Mrs J— has been suffering for years from chronic bronchitis or some other chronic and potentially fatal illness. Her doctor is told by a relative that she has died and he is asked for a certificate. He gives a certificate of death from chronic bronchitis because that is what he had been treating her for, and from which he was expecting her to die. It is some time since he last saw her, and he does not bother to see or examine her body before giving the certificate. Now, for all he knows the terminal event may have been death from suffocation through a pillow having been held over her face till she expired. This need not concern the statistician unduly because he has got the information he really needs which is the nature of the fatal disease from which Mrs J— was suffering; but from the point of view of medico-legal investigation of deaths in the community the situation is far from satisfactory as Mrs J—'s death will be registered and her body disposed of in the usual way on the basis of a certificate of death from natural causes issued with either insufficient attendance or with no examination of the body after death.

Again, Dr Heasman has stated that the preliminary 1954 A.M./P.M. investigation suggested

that with certain exceptions post-mortem examinations did not improve mortality statistics, since errors, or differences in opinion, between clinicians and pathologists tended to cancel one another out. Reduced to its simplest terms I take this to mean that it does not really matter to the statistician if 100 deaths from pneumonia in infants are certified as from mechanical suffocation, provided 100 deaths from mechanical suffocation are certified as from pneumonia. This, of course, can reassure only the statistician.

Conclusions

The Registrar General is primarily concerned with providing accurate statistics of mortality. Provided the returns from death certification give an accurate overall picture the way in which the figures are arrived at need not concern the statistician unduly. The purpose of this short paper has been to show that the mere existence of accurate mortality statistics affords the community no safeguard against the surreptitious or inadvertent disposal of deaths which ought to be the subject of medico-legal investigation. A recent paper by Emery & Irvine (1958) suggests that clinicians are also concerned about the accuracy of mortality statistics. Any measures designed to improve the accuracy of clinical diagnosis of the cause of death are bound to result in the more efficient medico-legal investigation of deaths in the community.

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Certification of Death by the Pathologist

Accurate data giving the incidence of disease of different types in a community are of extreme importance to the pathologist, particularly in my own field of developmental and children's diseases. My task is to draw attention to some of the problems that the pathologist has to face and to help in the assessment of data given by pathologists. The following case history indicates some of the problems involved.

A child of 2 years had appeared normal at birth, but failed to walk by 18 months and was referred to hospital because of his bow legs, flaccid limbs, late walking and apparently large head. If, on that day, this child had had a febrile convulsion or a sudden overwhelming infection, he would have died and the diagnosis of hydrocephalus, probably with neurological defect, would have been prominent on the death certification.

The child was, in fact, not a hydrocephalic. In the outpatient department of the hospital the mother was given assurance and prepared for the psychological trauma of bringing up an achondroplastic dwarf. Six months later, this boy developed a running nose and a temperature of 102° F. The family doctor found thick pus coming from the nostrils, an acute tonsillitis and pharyngitis, and no signs of meningitis. Penicillin was prescribed. The next morning the child vomited. Later in the day his general condition remained the same but, while he was in his mother's arms, he suddenly jerked and within a few minutes was dead.

At the request of the coroner, I did a necropsy on this child. I found pus in the nose, enlarged inflamed adenoids and tonsils with some ulceration and hæmorrhage in the nasopharynx. The lungs were heavier than normal and contained a few dark red firm areas. There was no meningitis and no evidence of any infection elsewhere in the body. Death was certified to and by the coroner as an acute respiratory infection and early pneumonia, with achondroplasia as an incidental occurrence.

It is our practice to take sections from all tissues of the body and later, when these were examined, the picture was changed. There was no pneumonia. There was some fluid and blood in the alveoli and, within some of the arteries in the lung, there were small twisted clots, which had obviously not arisen at those sites. The pituitary fossa included parts of the cavernous sinus, which was seen to be thrombosed. Thrombosed vessels were also seen in some of the peritonsillar tissues. At the same time we noted other abnormalities: the basement membrane of the epithelium of the trachea appeared unusually thick and there were abnormalities in the structure of the pancreas. The immediate cause of death was apparently œdema of the lung associated with pulmonary embolism, but the emboli were small and, if masses of that size had been put into any normal child, or even this child in other circumstances, it probably would not have died from embolism. A major factor of death, presumably, was the acute infection of the respiratory tract with infection of the nasal sinuses. But why did this child go this way whereas thousands of others do not? Also, was the thickening of the basement membrane and trachea an associated anomaly of the child's achondroplasia? If so, this association is, as far as I know, undescribed. Was there some abnormality at the base of the skull relating to

achondroplasia producing an unusual contact between nasopharynx and cavernous sinus?

The pathologist is basically concerned with diagnosing morbid anatomical lesions, something a little different from that of giving a cause of death. The relationship of the amount of disorganization of structure to cause of death varies considerably with the type of disease. Trauma and infection illustrate this well. With trauma, apart from very rare occurrences such as a light blow over the apex of the heart causing cardiac arrest, in general the greater the amount of trauma, the greater the amount of tissue destruction. From the point of view of infection, apart from infections that are almost symbioses, such as toxoplasmosis, conditions such as leprosy or tuberculosis, which produce large necrotic and scarred lesions, are infections with which the body has almost come to grips. It must be remembered that the clinical syndromes of 'diseases' such as measles are themselves a measure of the patient's response. The child who dies from measles virus infection does so, nowadays, usually before he has developed what we call the disease measles, in the invasive phase. Thus the severest and most lethal type of infection is the one that does not cause the typical disease complex.

The interpretation of findings at necropsy: Perhaps the disorders most easy to discuss are those of the coronary vessels and infarction and scarring of the heart muscle. How much scarred heart and how much coronary atherosclerosis are necessary to cause death? A study was recently carried out on the hearts of R.A.F. personnel who had died as a result of flying accidents. The men examined were not responsible for the accidents and all of them had been free of cardiac symptoms and completely fit. In these hearts large areas of scarring and degeneration were found, to such an extent that many of them would have been acceptable as causes of angina and even unexpected death.

The problem of atheroma is even more obvious. All medical students have seen the patient with apparently normal mental function whose arteries appear to be almost completely calcified, and also the patient with progressive mental degeneration and apparent phases of thrombosis with quite small lesions. Knowing these things the pathologist is likely to fight shy of committing himself as to the cause of death and he is likely to be swayed considerably by the patient's symptomatology and the views of the clinician as to what is the lethal lesion. Herein lie some of the snags that are liable to arise from surveys such as those that are being carried out comparing certification before and after routine necropsy. The pathologist is a fool indeed who does a routine necropsy without knowing the clinical history

of the patient. A consistency in certification recording between the clinician and pathologist is only in a relatively minor degree a test of accuracy of diagnosis. It is biased in favour of a persistent diagnosis.

In considering pathologists' reports following necropsies it must be appreciated that there are different types of post-mortem examination: (1) Necropsies carried out for the coroner, the purpose of which is basically to exclude any unnatural cause of death. Provided the pathologist doing the necropsy is sure that the cause of death is of natural origin, unless the case falls into the category of occupational or industrial hazard, the detailed assessment of cause of death is of no great concern. (2) Routine necropsy carried out on patients who die in hospital and in whom the surgeons and physicians are anxious to find out whether or not their diagnoses were accurate and complete and, in surgical cases particularly, any reason why an operation was not successful. With such necropsies, examination of sections is usually carried out only on tissues that appear abnormal to the naked eye. The routine necropsies comprise the largest proportion of all post-mortem examinations. They are usually carried out by busy pathologists, whose aim is to help the clinician as quickly as he can, and the pathologist may have half a dozen such dissections to do in an hour. (3) Complete necropsy, an extended form of the routine necropsy but involving the systematic examination and the taking of samples of all organs for microscopy, irrespective of whether they show any naked eye lesion or not. The time and energy required to do a complete necropsy are such that it is very rarely carried out except in some university centres and teaching hospitals. The average hospital pathologist has not the time or the technical facilities for doing other than simple routine necropsies except on the particular or rare interesting case. If accurate assessments of morbidity and causes of death are to be made, the type of necropsy will greatly affect the issue and result obtained. The complete necropsy nearly always reveals some abnormality unsuspected by the naked eye. It was only when sections were examined routinely that fibrocystic disease of the pancreas was discovered.

Another function is the personal one. What is found at a necropsy is determined by who does it. The general practitioner doing a necropsy in a cottage hospital is not likely to find all that would be seen by the professor of pathology. The experienced pathologist in a provincial non-teaching hospital is also likely to find more than the young registrar or junior lecturer in the teaching hospital and the neuropathologist is not likely to cut a section of the pancreas of the child whose head may come his way.

Finally, in what proportion of cases do we really know the cause of death? In a very large proportion of necropsies some anatomical lesion is found, but assessing its importance is more a matter of philosophy than fact. For example, the finding of a few minute areas of bronchopneumonia in a child's lung may give a satisfactory cause of death to the coroner until one wonders why such minute lesions are associated with death in one child while another child will have gross areas of consolidation and still survive. One suspects that, to be completely honest, the basic cause of death as distinct from the finding of some anatomical deformity, can only be found with certainty in perhaps 20% of neonates, perhaps 60% of children and probably 80–90% of adults.

No one, however, certifies cause of death 'unknown'. The most reliable morbidity statistic is to be obtained on a multifactorial rather than a primary, secondary and final cause of death basis. If possible, the factors should have some quantitative basis also. For example, if atheroma of the aorta is considered, the proportion of the aorta affected could be indicated; or in cases of cardiopulmonary syndromes, the weights of the cardiac ventricles. Such types of record are not practicable on a nation-wide basis, and the results of blitzkrieg nation-wide surveys, such as the recent perinatal mortality survey, can be very misleading.

The only solution would appear to be for certain areas of the country to be selected where complete and quantitatively tabulated necropsies can be carried out on as high a percentage of the total local population as possible and over a considerable period of time. It would not be necessary to do the whole population in the same area; for example, adults could well be done at Bristol and children at Sheffield. This would give – as far as they are obtainable – factual morbidity data that would have the respect of both pathologists and others.

Meeting March 16 1962

Papers on the **Ætiological Factors in Cerebral Palsy** were read by members of the Pædiatric Research Unit, Guy's Hospital Medical School, London, as follows: **Cerebral Palsy and Kernicterus** by Professor P E Polani; **Birth Factors in Cerebral Palsy** by Dr E D Alberman; **Cerebral Palsy and Prematurity** by Dr A D McDonald.

Meeting June 21 1962

The meeting was held at The Duchess of Kent Maternity Wing, Hillingdon Hospital, Uxbridge, Middlesex. Mr John Frankenberg (*Hillingdon Hospital*) read a paper on **Maternity Hospital Design**.