No cause for macroglobulinaemia has been demonstrated. Although the patient has a marrow lymphocytosis and one enlarged axillary lymph node, the liver and spleen are not enlarged, and the findings differ from many of the cases of macroglobulinaemia so far described—for example, Mackay *et al.* (1956), who suffered from a disease resembling lymphosarcoma. However, it is possible that she may eventually develop this syndrome. It is purely speculative to suggest that lymphocytes might be the source of the abnormal protein.

The alteration in the serum electrophoretic pattern after prolonged prednisolone therapy is of great interest. It should be stressed that the values for γ-globulin shown in Fig. 3 represent both "normal" γ-globulin and macroglobulin. Therefore there are difficulties in interpreting fluctuations in their values, as a diminution in either would result in a decrease of total γ-globulin. However, the decrease in values between October, 1956, and June, 1957, was so marked that it is reasonable to conclude that it represents diminution in macroglobulin concentration. This is also confirmed by ultracentrifuge data, which estimated the macroglobulin to have diminished during this time. Furthermore, the discrete component on the paper electrophoretic strip which was presumably due to macroglobulin (Fig. 1, A) could not be seen on the later strip (Fig. 1, B).

The patient probably shows an increased susceptibility to infection, having suffered from recurrent furunculosis, orbital cellulitis, and a respiratory infection over a period of 18 months. It is possible that she suffers from hypogammaglobulinaemia, demonstration of which would be made difficult by the appearance of macroglobulin in the γ-globulin region on serum paper electrophoresis. Evidence to suggest hypogammaglobulinaemia is furnished by the electrophoretic strip performed in June, 1957 (Fig. 1, B). This shows an intensity of staining in the γ-globulin region within normal limits. As the serum still contained a considerable amount of macroglobulin demonstrable by ultracentrifuge analysis, the normal γ-globulin component was probably reduced.

Summary

The clinical findings are described in the case of an elderly woman who suffered from an unusual form of anaemia and macroglobulinaemia for at least three years. Treatment with prednisolone corrected the anaemia, and this was associated with a diminution in the amount of abnormal protein in the blood.

Dr. John O'Dea, Commonwealth Serum Laboratories, Victoria, carried out the ultracentrifuge analyses. One of us (J. A. O.) has received a grant from the National Health and Medical Research Council.

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DEATH CERTIFICATION OF CHILDREN

BY

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The certification of the cause of death is, to the lay person and the administrator, a simple statement of fact. To the pathologist, on the other hand, the "cause of death" is the summation of a number of factors each of which in isolation may be of little importance. At best one knows in part what a person dies with, but not necessarily what he dies from.

The practice of clinical medicine necessitates a concentration on the treatable aspects of disease and a simplification of pathology requisite for a practical approach to the patient. The present form of death certification is designed by necessity for use by clinicians. It has a twofold approach: first, steps in the progress of a major disease, and, secondly, associated disease. Its form is probably as good as can be devised.

The present small survey of 150 deaths was made to assess the efficiency of death certification as carried out in a children's teaching hospital. The resulting figures are statistically significant and show a degree of inaccuracy not generally appreciated.

Material and Method of Survey

Permission is requested to carry out a post-mortem examination on every child dying in the Sheffield Children's Hospital and is granted in over 90% of cases. At the same time the house officers are asked to indicate on the death certificate that additional information may be available later as a result of the necropsy. The cause of death is revised by the pathologist when the final necropsy diagnosis is made.

Other than this being a consecutive series, no particular selection of the 150 cases was made. The children's ages at death varied from several hours to 12½ years: 78 (52%) died at or before 3 months; 12 (8%) between 4 and 6 months; 24 (16%) between 7 months and 1 year; 23 (16%) between 2 and 3 years; and 13 (8%) between 4 and 12½ years. Thus 137 (92%) of the deaths occurred at or before 3 years of age. The cause of death entered on the death certificate was compared with the final pathological diagnosis made after consideration of the clinical findings, naked-eye pathology, and histology of the case. A record was also made of the duration the child had been in hospital, or, in cases where there had been more than one admission for the same condition, the duration under medical supervision was estimated. Each case was then placed in one of five groups, according to the following criteria.

Group 1.—Cause of death recorded on the death certificate accurate and complete as compared with the pathological findings.

Group 2.—Cause of death accurate in major respects but incomplete in minor points, which did not alter the final diagnosis.

Group 3.—Cause of death inaccurate as compared with the major pathological findings, but minor points accurate.

Group 4.—Pathological findings necessitated a complete revision of the cause of death.

Group 5.—Cause of death as recorded not substantiated by post-mortem examination and no adequate pathological cause of death found.

The following are examples of cases placed in the above groups.

Certified Cause of Death	*Pathological Findings*
Group 1: Girl aged 10 months	
(*a*) Acute adrenal insufficiency. (*b*) Meningococcal meningitis. (*c*) Meningococcal septicaemia.	Congestion of the adrenal glands and histochemically greatly reduced lipoid content. Meningococcal meningitis and septicaemia.
Group 2: Boy aged 4 months	
Tuberculous meningitis.	Tuberculous meningitis. Miliary tuberculosis involving lungs, spleen, liver, kidneys, and meninges. Primary tuberculous complex in right lower lobe of lung and caseating hilar glands.
Group 3: Girl aged 11 days	
(*a*) Bronchopneumonia. (*b*) Congenital meningomyelocele.	Purulent meningitis associated with hydrocephalus due to congenital obstruction between lateral and third ventricles and lumbar meningomyelocele. Oedema of lung (no pneumonia).
Group 4: Girl aged 1 day	
(*a*) Asphyxia neonatorum. (*b*) Breech delivery.	Cerebral haemorrhage due to tears in the falx cerebri and tentorium. Bilateral atelectasis and left-sided pneumothorax. Bilateral adrenal infarction and renal vein thrombosis. Breech delivery.
Group 5: Boy aged 3 weeks	
(*a*) Gastro-enteritis. (*b*) Prematurity.	Post-mortem findings showed wasted mature child, but no adequate cause of death.

Group 1 comprises 23 (15%) cases; group 2, 59 (40%); group 3, 33 (22%); group 4, 28 (18%); and group 5, 7 (5%). If one omits group 5 and combines groups 1 and 2, as those cases where there was no significant change in the certification, and combines groups 3 and 4, where the pathological findings differed considerably from the clinical assessment, the distribution becomes: groups 1 and 2, 82 (55%); groups 3 and 4, 61 (40%). These figures may be regarded as having a statistical trustworthiness—that is, as indications of a firm underlying rate—of about ±15 (±10%) in both cases.

In seven of the 150 cases no pathological diagnosis was eventually made. These deaths all occurred at or before 3 months and represented almost 10% of deaths occurring under 3 months or 5% of all deaths.

Effect of Age.—The ratio of groups 1 and 2 to groups 3 and 4 at different ages is shown in the Table. The figures give no statistically significant—that is, by tests using the 5% level of significance—or even strongly suggestive evidence that the age of death played any part in determining the accuracy of the cause of death given.

Group:	1	2	3	4	5	Total
No. in group	23 (15%)	59 (40%)	33 (22%)	28 (18%)	7 (5%)	150
	82 (55%)		61 (40%)			
Age at death:						
0–3 days ..	7		13		3	23
4 days–3 months	32		19		4	55
4 months–1 year ..	22		14		—	36
1 year–3 years ..	12		11		—	23
4–10 years	9		4		—	13
Duration under medical care:						
24 hours or less ..	26		17		4	47
2–5 days ..	9		18		1	28
6 days–6 months	36		21		2	59
7 months+	11		5		—	16

Duration under Medical Supervision.—In assessing the consistency of diagnosis related to the duration of the children's medical care, of 47 children who died after medical care for 24 hours or less, 26 (55%) had an accurate diagnosis. Among the 28 dying after medical care of two to five days' duration, 9 (32%) diagnoses were accurate. Of 59 under care for six days to six months, 36 (61%) diagnoses appeared accurate, and among the 16 cases with medical care of over six months, 11 (69%) were apparently accurate. These figures show no significant difference, and suggest that the duration under treatment is not a major factor in the accuracy of diagnosis.

Discussion

In this series of 150 certifications the correct cause of death, as assessed by the pathologist, was not given in more than 55% of the cases. The accuracy or inaccuracy of the primary entry was influenced very little by the age of the child at the time of death or by the length of time the child was under medical care.

The cause of death entered on the certificate is not necessarily the complete clinical diagnosis made in hospital. That 40% of the total number of cases fell into group 2 (accurate but incomplete) and 40% into groups 3 and 4 suggests that the information submitted on the death certificate was not adequate.

It would seem possible that doctors may have been to some extent influenced by the knowledge that they were initialling the reverse side of the death certificate, but this would affect only the accuracy of certifications as between our groups 1 and 2, but not between groups 2 and 3. The same applies to the use of different terms to describe similar conditions.

The accuracy of the cause of death statistics according to death certification appears to have been of more concern to American workers than to workers in this country (Lane and Holla, 1954; West, 1955), and varying degrees of accuracy of certification have been given as a result of several surveys. We have been unable to find any published figures of this kind for this country.

The Registrar-General is well aware of the problems of accuracy of death certification, and has discussed these in his reports for 1940 and 1950, stressing improvement in certification which follows necropsy.

The extent of the problem is shown in his report for the year 1953 (Registrar General, 1956), where he analyses the certification of causes of 114,642 deaths for the June quarter of 1953, grouping the certifications according to whether the certificate was filled in by the coroner or by the general practitioner, and whether death occurred inside or outside hospital. Great variation in the causes of death in these different groups was found, ranging from 1% disagreement for senility to 70% for pneumonia in the newborn and 75% for meningococcal infections. These certifications obviously involve different groups of cases, and the Registrar-General, by the very nature of the information available to him, is able to compare only the causes of death certified by different groups of people on different cases, but he is not directly able to compare the differing diagnoses in the same cases, the essential for a fair comparison.

Swartout and Webster (1940) report an accuracy of 79% in a study of 8,000 deaths in Los Angeles. They compared the necropsy diagnosis with what they considered would have been the clinical diagnosis, but without reference to the original death certificates. Evans (1949) found an accuracy of only 43% in a study of 3,900 death certificates, basing the findings on his own judgment and without the aid of necropsy findings. Korns and Lintz (1949) found disagreement between the clinical cause of death statement

and pathological findings in 11–20% of 500 hospital cases; and James, Patton, and Heslin (1955) found 71% of original certificates agreeing with necropsy reports in a survey of 1,889 necropsies, but with wide variation within the groups of different diseases, ranging from 21% agreement in the group of arteriosclerotic heart disease to 93% agreement in the group covering tuberculosis. Pohlen and Emerson (1942, 1943) found consistency in diagnosis in 96% of tumours of the heart, compared with 26% in liver tumours, 99% in measles, and 52% in heart disease.

In the above articles, all of which come from public health departments, there is a tendency to state that errors in registration occur between the few larger groups of causes of death, and that the errors in one direction tend to cancel the others out, making the overall statistics relatively accurate. This seems to be an unfortunate argument, as it would appear to give the published figures false accuracy—the type of accuracy obtained by drawing random diagnoses out of a hat—and minimize the danger of arguing from any of the registrar's statistics.

In assessing the accuracy of certification, any comparison made must be between the cause of death as originally certified and the cause of death after survey of all information obtained by clinical and necropsy examination. Inaccuracies in certification arise in two ways: first, a failure to record accurately the knowledge available at the time of death—that is, negligent certification; and, secondly, the inadequacy of the knowledge available at the time of certification.

In a teaching hospital, where every child, particularly an ill child, is under constant discussion, it is unlikely that faulty certification is due to the absence of available knowledge of diseases; on the other hand, certificates are often filled in by junior housemen who have not acquired the art of avoiding terminology that may lead to inquiries by the coroner. The tendency in both of these instances would be towards a more accurate registration if not conventional. We would thus expect the registration in the present survey to be at least as accurate as is likely to occur in the general field of child deaths.

Summary

A survey of the accuracy of the causes of death given to the registrar at a children's hospital showed that almost one-half of the certifications were not correct as judged by the final pathological diagnosis.

We are grateful to Dr. G. H. Jowett, head of the Department of Statistics of the University of Sheffield, for his advice and comments, and to our clinical colleagues for permitting these diagnostic ablutions.

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In an address on "The Art and Science of Research," before a sectional meeting of the Manchester Medical Society last month, Dr. J. H. SCOTT, lecturer in anatomy at Queen's University, Belfast, defined research as the intellectual fashion of our time. He compared "useless" and "useful" research as illustrated by the discovery of Nasmyth's membrane in 1839 and of penicillin in 1929, and the part played by chance in certain cases. Discussing Humphry's work on jaw growth in pigs, he pointed out how the results of research were not always applied successfully to the solution of the problems they were supposed to solve. Research, he said, did not primarily depend on money, or on complicated apparatus, but on a peculiar attitude of mind in which curiosity, persistence, and clarity were essential features.

INFLUENCE OF MATERNAL MALARIA ON NEWBORN INFANTS

BY

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It is well known that schizonts of *Plasmodium falciparum* tend to concentrate in the maternal tissue of placentae in the latter half of pregnancy in women infected with that parasite (Blacklock and Gordon, 1925; Garnham, 1938; Bruce-Chwatt, 1952). There has, however, been considerable controversy about what effect this concentration has on the infant born of such placentae to women who are natives of territories where malaria is so prevalent that adult immunity to it is substantial. On the one hand is the Sierra Leone series of Blacklock and Gordon containing "proof of a very complete association between maternal infection of the placenta and death of the child *in utero* or within a seven-day observation period after birth." On the other hand is Garnham's (1949) diametrically opposite assertion from observations in Kenya that "malarial infection in the mother seldom resulted in stillbirths or in death of the infant in the first week," and that "Luo children are unlikely to suffer ill effects from infection in the mother."

Observations in Lagos (Bruce-Chwatt, 1952) have shown that, although there is no apparent correlation there between neonatal mortality and malarial infection of the placenta, yet there are grounds for believing that such infection is a cause of prematurity and, more generally, of the birth of underweight babies. A further report from Southern Nigeria (Archibald, 1956) confirmed these ill effects.

The present paper presents evidence from Northern Nigeria that this infection commonly prevents African infants born there to malarious mothers from reaching their proper weight at birth.

Present Investigation

The evidence was collected from a number of centres in Northern Nigeria where the birth weight of infants was noted, a number of particulars were obtained from the mother, and blood smears were collected from the maternal surface of the placenta and from the mother's finger at the delivery. The blood smears were examined by the regional malaria unit. The group investigated was mainly drawn from deliveries which took place in medical institutions, and was obviously a selected sample of the population. This was underlined by the finding of malaria parasites in only 15% of the smears examined, a rate much lower than the adult parasite rate generally found in the Northern Region of Nigeria.

The present series consisted of 484 women, 73 of whom were infected at delivery with *P. falciparum* (a few were also infected with *P. malariae*). In most of the mothers, parasites could be detected in the smear both from the finger and from the placenta, but in eight cases they were found only in the placenta and in seven only in the finger. Of the 484 pregnancies, 18 were multiple, two of triplets; and of the 504 infants born, 30 (5.9%) were stillborn, 4 (0.8%) were born alive before term, and 470 born alive after pregnancies which had gone to full term. Of these full-term babies, 440 were single deliveries, and it is with these that the further analysis deals.

Table I shows the distribution of birth weights of these babies. Of the 62 infants born from malarious placentae, 13 (20.6%) were premature—that is, weighing 5½ lb. (2,495 g.) or under (W.H.O., 1950)—as contrasted with 31 (8.2%)