section. In support of this policy one can cite two cases in this series in which surgical induction of labour was carried out, onset of labour was delayed, and intrauterine death occurred within 24 hours of the membranes being ruptured.

Neonatal Period

Nine infants died in the neonatal period, six within the first 24 hours. This is a typical finding in babies of diabetic mothers. Their hold on life is slender during the first 72 hours, but if they survive this critical period, progress is usually satisfactory.

Post-mortem examination was performed in six of the nine infants, and it is interesting to note that hyaline membrane formation was found in three infants delivered by caesarean section and two delivered vaginally. This disease has been the most frequent finding in neonatal deaths in White's (1952) cases. Peel (1955b) found the condition in 85% of neonatal deaths in infants of diabetic mothers.

In the past, rearing of babies of diabetic mothers has presented a difficult problem. While all the difficulties have by no means been solved the outlook has improved. Formerly, foetal hypoglycaemia was blamed for many neonatal deaths. However, considerable doubt is now being cast on this view. Blood-sugar estimations taken during exchange transfusion for rhesus incompatibility have shown that very low levels are quite in keeping with survival (W. A. B. Campbell and O. D. Fisher, personal communication).

Many of the babies of diabetic mothers weigh much more for the period of gestation than those of non-diabetic mothers. Notwithstanding their increased weight they still behave as premature infants and must be treated as such. Most babies are oedematous and lose a considerable amount of fluid through diuresis in the first few days. In addition, pulmonary oedema is an ever-present risk leading to cyanotic attacks and pneumonia. In view of these considerations it is wise not to give fluids orally or subcutaneously for the first 48 hours of life.

Since about 1951 the care of these babies has been along the lines detailed below.

Immediately after delivery the air passages are adequately cleared. Once respiration is established satisfactorily, gastric aspiration is carried out. All babies are transferred to the premature nursery unit and, if necessary, placed in an oxygen tent. The baby is turned from side to side at regular intervals. Fluids are withheld for the first 48 hours unless this deprivation causes distress, in which case small amounts of glucose-water are given. In all other respects these infants are nursed in the same way as ordinary premature babies. Only one neonatal death has occurred in the last five years. This took place, following operation, in a baby with a meningocele. Great credit must be given to the paediatricians and nursing staff for such excellent results. Skilled nursing is the most important single factor in the survival of these infants.

When we are asked to undertake the care of a pregnant diabetic patient we should remember and take hope from the following saying of Seneca: "There is nothing which effort and unceasing and diligent care cannot overcome."

Summary

The 119 diabetic pregnancies treated in the Royal Maternity Hospital, Belfast, during the past 16 years are reviewed.

The results of foetal survival in this as in most series are unsatisfactory.

The figures for the present series are: total foetal loss, 30%; total foetal loss, excluding abortions, 25%; total foetal loss for past five years, 25%; and total foetal loss, excluding abortions for past five years, 19%.

Hormone therapy in its present form does not appear to be of any value.

There is at present no known method which will prevent intrauterine death and allow pregnancy to go to term.

Avoidable factors that have contributed to the high foetal mortality are discussed.

It is concluded that, if a substantial reduction in foetal loss is to be achieved, management of the pregnant diabetic patient should be along the following lines: (a) Team-work by obstetrician, physician, and paediatrician must be of the highest order. (b) Accurate control of maternal diabetes is essential. This implies very strict antenatal care from the beginning of pregnancy. (c) Admission to hospital at the 28th week, or earlier if stabilization is unsatisfactory. (d) Premature delivery at 35 weeks, or earlier if indicated. (e) Delivery by caesarean section in all primigravidae and all but a very few multigravidae. (f) Skilled nursing in a modern nursery unit.

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CLINICAL HISTORIES OF INFANTS REPORTED TO CORONER AS CASES OF SUDDEN UNEXPECTED DEATH

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Sudden and unexpected death forms an increasing proportion of deaths in the first few years of life, and in this country about 600 (446 to 911) infants are annually "found dead in bed" and registered as cases of accidental mechanical suffocation (Swinscow, 1951).

The fashions in pathological diagnosis of the cause of death in these infants reflect our basic lack of knowledge. Until relatively recently almost all were ascribed to an inherent inborn weakness, characterized by "status thymaticus." Many unexpected deaths were thought to be due to overlying—a diagnosis recorded in the Old Testament (1 Kings iii, 19) but, with changes in sleeping habits and the greater numbers of cots, it would seem that deaths which would previously have occurred in bed now occur with the child alone in a cot. Davison (1945) thought that most of these deaths were due to

natural causes, and that with skilled necropsy the cause of death would be found. Unfortunately this is not wholly true.

The pathologist is faced with an almost impossible task in attempting to explain these apparently extremely sudden deaths in infants. What were once regarded as signs of asphyxia are no longer of value. The same histological changes found in the lung can be interpreted as being those of a non-specific mononuclear pneumonia (Gruenwald and Jacobi, 1951), inhalation of milk or other foreign material (Moran, 1953), acute infection (Werne, 1942), violence (Garrow and Werne, 1953), accidental smothering (Barrett, 1954), or influenza (Bowden and French, 1951). The problem facing the pathologist has been well reviewed by Barrett (1954).

In a study of children dying suddenly in Sheffield, it soon became obvious that the histories obtained did not always fit the necropsy findings. An attempt was made to obtain more correct histories, and a report of 50 infants studied this way is given below.

History-taking

The co-operation of the coroner's officer was first sought, and his interest and that of his staff was stimulated in the details to be asked for in each case—for example, feeding history, illness in contacts, etc.—with the result that the case histories available from the coroner's officer were in most instances more complete than the majority of admission histories in the local teaching hospital. The coroner's history was the only information available at the time of necropsy.

Further information often became available during the inquest, when the coroner asked the parents, while under oath, further questions that have arisen from his own questioning or directly out of the necropsy findings.

A third history was available immediately after the inquest.

Since finding that mothers with children attended the out-patient department of the Sheffield Children's Hospital with what were virtually "anxiety states" arising from a previous child's having died for no known cause, our policy has been to give some definite cause of death at inquests. We also talk to the parents after an inquest; first, to explain to them the stated cause of death (it is often found that although the coroner explained this to them with great clarity a few minutes before they did not "take it in" at all, and one is often greeted with, "What did baby die from, doctor?"); secondly, to tell them that it is futile blaming themselves for the death of the child; and, thirdly, to advise them about other children, and to point out the extreme unlikelihood of a similar happening in any future child they may have. If the parents are anxious about any of their other children, arrangements are made either to communicate with the family doctor or for the siblings to be examined at the Children's Hospital. During this interview it is often possible to sense the relief felt by the parents. At the termination of this interview it is explained that we are endeavouring to find out more about these sudden deaths in infants with the aim of preventing them, and that, with their permission, a colleague from the hospital will visit them in a few days' time. Whether or not direct questions are asked at this interview depends largely upon the emotional state of the parents, but occasionally there is spontaneous volunteering of "things we forgot to tell before."

All the home visits were made by one of us (E. M. C.) a few days after the infant had been buried. The visits were not made by appointment, but were casual calls. The necropsy findings and the coroner's history were not known to E. M. C. at the time of the visit, and a complete social and individual history of the child was taken independently

of that given to the coroner. The mother or grandmother was told that the information they gave was only for the doctor at the hospital. These interviews were informal; information was given willingly, sometimes by the mother alone, and sometimes with the help of other members of the family.

Material

The cases in this series occurred during a period of two and a half years, 1954-6. Cases that were reported to the coroner from a hospital, after operative treatment, or were under treatment in the out-patient department, or were known to have any long-standing disease—for example, mongolism or heart deformity—were not followed up. All cases were referred freshly by the coroner's department. Infants under 14 days old were excluded from this series. The cases did not represent a consecutive series referred to the coroner, as infants dying through road accidents, drowning, etc., would be referred by him to the forensic pathologist. The Sheffield coroner's usual practice is to refer other cases of unexpected deaths of infants to a paediatrician pathologist, and this has enabled the present investigation to be made.

Of the 50 infants, 12 had died while in bed with an adult; 35 had been found dead in their cot, in a pram, or in a bed by themselves; and 3 had died while being nursed in an adult's arms. Of the 35 cot deaths, only 4 babies (aged 9, 16, 18, and 25 weeks) were found face down in a pillow as if self-smothered.

The ages of the children varied from 4 to 68 weeks, the majority being between 10 and 30 weeks.

Findings

An analysis of the duration of symptoms is given in the Table. Since it is uncertain when many of these infants died—most of them having been put to bed about midnight and having been found dead some six to eight hours later—the duration of symptoms is taken from the time the parent last saw the child alive.

Duration of Symptoms Preceding Time Parents Last Saw Child Alive. From 50 Unexpected Deaths

Duration of Symptoms	Onset of Initial Symptoms	Respiratory	Alimentary	Others
None	1	—	—	—
Less than 2 hours	0	0	0	0
2 to 6 hours	4	1	4	3
6 " 12 "	3	3	1	1
12 " 24 "	6	1	3	5
24 " 48 "	8	4	8	4
3 " 7 days	10	6	1	6
7 " 14 "	9	5	2	2
14 days or more	9	5	8	1
Total	50	26	27	22

Only 14 of the 50 infants had symptoms of less than 24 hours' duration. Four had symptoms for only three to five hours. In only one case was no history of symptoms preceding death available. This child was found dead on a Tuesday morning in April, face down in its cot. The coroner's officer obtained a history of the child being completely normal, and with no recent "cold." The follow-up visit produced no further history of definite symptoms other than that the mother had been giving the child some medicine for the past two weeks for "night cough." Thus even that history was not completely negative. It is possible that the child had a sensitivity to some dust related to its cot.

Many of the infants exhibited symptoms in more than one system of the body, but, contrary to expectation, alimentary symptoms, diarrhoea, vomiting, or grossly abnormal constipation were as prominent as respiratory symptoms, each affecting approximately half of the cases. In addition there were often convulsions or rashes, or the mother made vague but highly significant remarks, such as, "He was very pale, didn't cry, and slept almost all day."

In 33 cases the later histories revealed information directly related to the child's death that was contrary to the history given to the coroner's officer. In a further nine cases the later histories gave additional information bearing on the disease, but not enough to affect the diagnosis. In only five cases did the almoner's history and the inquest history agree on all essential points. In the remaining three cases the additional information obtained concerned the presence of disease in the child's immediate environment, and did not concern the history of the child itself.

The impression gained was that often the parents did not fully understand what they said to the coroner's officer. For example, a mother of an 8-weeks-old baby found dead in bed in the crook of her arm told the officer that the baby had been quite well, and that she had given it an evening feed and one in bed. Later she stated that the child had refused both of these feeds.

The following cases illustrate the way in which the complete history of a child is gradually built up.

Case 1

The history given to the coroner's officer was that the child had been seen by the doctor on account of a cold six days before it had died. It was seen again the next day, when the doctor had thought that the cold was better. On the day before death the child took its feed normally and fell asleep in its cot after taking some emulsion at 2.45 a.m. At 5.30 a.m. it was found dead, lying on its left side, with the face clear of the pillow.

During the inquest it was discovered that the child had not been taken to the doctor's surgery, but that the mother had gone down to the surgery and told the doctor that the child was unwell and constipated. The doctor had not seen the child for five days.

In the interview with the parents after the inquest it was ascertained that the child had been grossly off its food ever since its cold, and for the week preceding death had been taking less than 10 oz. (280 ml.) of fluid a day—the normal for a child of its age should be in the region of 30 oz. (850 ml.). Also the child had appeared extremely "vacant" and listless on the day before death.

The later home visit disclosed that the child had not had its bowels opened for three days before death. The parents had simply thought that the child was severely constipated, and had given it three doses of "emulsion" for opening the bowels during its last day.

At necropsy the child appeared to have been very well looked after. It was dehydrated, and there was ante-mortem thrombosis of the basilar artery.

The sequence of events appears to have been that the child had gone off its food during a relatively mild cold and had been permitted gradually to reach a stage of severe dehydration owing to an inadequate fluid intake during the week before death.

The parents of this child were intelligent and of "grammar school" type, the father being manager of a city store. The health visitor informed us that the home was a good one and that she had not thought a monthly visit necessary. In actuality this mother was at a considerable disadvantage. She had had no experience of ill children, and, as a new-comer to the district, lived a rather isolated life. She had no friends locally. It was basically due to this and her own ignorance of what an ill infant is like that the baby died.

Case 2

This 4-weeks-old child had simply been found dead in its cot, and the history given to the coroner was that the child had been taking its feeds normally and regularly, and had not been in contact with any acute infection. It was apparently completely normal the night before going to bed.

During the inquest, in response to direct questions, it was discovered that the child had been crying considerably

during the night before it died, and had been given frequent small feeds. The mother remarked that the child had always brought food back after a feed, and also "it gets rid of excess." Further questions were asked after the inquest, and the amount of food brought back appeared to be much more than the usual posset. At the later interview it was found that the child normally took more than an hour to feed, and often refused its feeds. The parents had been advised by the district nurse to take the infant to the children's hospital for medical attention, as she thought its feeding was quite abnormal.

At necropsy there was evidence of terminal inhalation, and also an abnormally wide conical lower end of the oesophagus, with an extremely large lax cardia, a finding which suggested the presence of a "hiatus hernia."

Case 3

A baby girl aged 8 weeks was found dead in her cot, and the case was referred to the coroner. The history obtained by the coroner was that the child had been breast-fed until three weeks before death, when it was weaned on a proprietary milk food. It was quite fit and took all its feeds during the day, and on the evening before death was put to bed at 10 o'clock on a flock pillow. It was found dead at 7.15 the next morning.

Subsequent history revealed that the child had lost 2½ lb. (1,130 g.) in weight in the three weeks preceding death, and that on the day preceding death it had had severe diarrhoea. A severe "cold" was going through the home at the time of death. Necropsy revealed a pyelonephritis.

This child had probably developed a renal infection about three weeks before death, and the general upset associated with this had caused it to be weaned inadequately. The terminal disturbance may have been associated with a secondary infection or metabolic changes.

Case 4

This illustrates a different type of case. A 26-weeks-old child had been found dead in its cot with no reported abnormal symptoms. At necropsy the only abnormality found, other than the common lung changes, was that the fingers were covered with small fragments of dead skin. The later follow-up history revealed that the child had been fretful and off its food, and had lost weight. Three weeks before death its hands had become red and swollen, and later the hands had scaled. The child apparently died while affected with acrodynia (Southby, 1950).

Discussion

Disease in infancy is much more closely related to functional alterations than to the naked-eye or histological structural changes seen in adult life; therefore the clinical history of a case is frequently crucial in making a correct diagnosis. Often one cannot be certain of the cause of death in infants who have been under close observation in hospital, and diagnosis involves much greater difficulties in infants "found dead." In such cases a complete correct history is a prime essential.

In only five of the 50 infants studied was the complete correct history available at the time of necropsy. In 33 the history obtained was wrong enough to affect the diagnosis. It would thus seem that the clinical history available to the pathologist was not only inadequate but misleading.

These discrepancies may in theory be due to the poor quality of the coroner's histories or to the follow-up histories being incorrect, or to both of these factors. However, most of the histories given to the coroner were taken by two very able full-time coroner's officers, and the histories obtained by them were, in our experience, much more complete than is usual. The follow-up histories were taken quite

independently and with no knowledge of the detailed necropsy findings, and these histories fitted the cases as one would expect histories to fit cases within hospital.

Was the information given by the mother to the police or to us deliberately incomplete or false? We are quite certain that there is no intention to mislead, but the whole mental disturbance produced by the infant's death and the police investigation that follows is enough to affect the sanest mother.

First the mother remembers that the child had not been completely well, but was not thought to be in great danger. Then it dies unexpectedly. A doctor is frantically called, confirms that the child is dead, and says that the death must be reported to the coroner. The coroner is associated immediately with ideas of homicide. Within a few hours the local police are in the house, seeing the child, examining the cot, taking away samples of anything suspicious that the child may have eaten. This is shortly followed by the police van to take the child to the mortuary. The child's death becomes "the talk of the road." The mother is requested to attend the coroner's office the next morning. After a night's "rest" the mother makes a statement to a police sergeant, often for the first time in her life, and the statement is typed out as it is taken and then signed. This is followed by a couple of completely blank days when the parents are awaiting a call to the inquest.

The inquest itself is usually preceded by an identification of the body of the child in the mortuary or chapel. At the inquest the parents are confronted by the almost mythical figure of the coroner, the pathologist, and, often more fearful than these, the local press. After repeating the oath—made familiar through murder stories—the mother listens to her own statement being read by the coroner. Her eyes can often be seen to wander from the face of the coroner to the reporter's pencil. Except when the parents feel that the doctor had delayed in visiting the child or gave the wrong treatment, one is conscious that they, particularly the mother, are in a slightly dazed state.

The above ritual is described in some detail as we feel that in the process of excluding a homicidal death information leading to the natural cause of death is submerged. This would not be of importance were it not that these "unexpected deaths" are becoming an increasingly important proportion of infant deaths, and also that in many of these cases the infants had symptoms and could have been diagnosed and treated.

Davison (1945), the coroner for Birmingham, showed the great advance in the diagnosis of the causes of unsuspected infant deaths that was made by employing pathologists. On the other hand, regarding the histories of such cases, he says, "There was a complete absence of prodromal symptoms or any departure from the normal sufficient to justify the parent in seeking advice—in other words, death was entirely unexpected, even in those cases in which the cause of death was found to be respiratory or due to otitis media. It would appear that an infant could develop bronchopneumonia and die suddenly without warning." We feel that such statements are based on the type of evidence likely to be offered to a coroner's officer, and are far from the truth.

A problem concerning the obtaining of the correct history in these cases is that the inquest has to be closed, a diagnosis made, and the infant buried before the mother regains her rational poise. Previous to this study, when an inquest was delayed for the purpose of obtaining microscopical sections a home visit was made before the final inquest. These visits were found to be quite unsatisfactory, and, as many mothers were extremely worried, these visits were abandoned.

How much of this mental disturbance is due to the unexpected death and the feeling that the death may have been prevented, and how much to the added psychic trauma of the coroner's routine, it is difficult to say, but the impression is gained that there is nothing like the same difficulty with the history when infants die from illness of only a few hours' duration after admission to hospital.

It has often been suspected that the histories in cases of sudden death in infancy were not accurate (Farber, 1934). Werne and Garrow (1953), forensic pathologists in New York, remark: "The suddenness of death so stirs the family that attempts to obtain a reliable history on the first visit to the scene are frequently unsuccessful."

Bowden (1950), in one of the most careful studies of sudden death in infancy that have been carried out, remarks: "On looking back on the evidence given in our previous cases of accidental suffocation in Melbourne, one is impressed by the frequency with which the deceased children did have some symptoms prior to death, suggesting that they were suffering from some natural disease." Bowden and French (1951) state: "It was often difficult to obtain an accurate account of the child's condition in the period immediately preceding his unexpected death." They were able to obtain evidence of several days or weeks of minor ill-health in 29 of 43 children that had died unexpectedly.

The coroner has a statutory duty to investigate all cases in which a person "has died a sudden death of which the cause is unknown" (Thomas, 1927). The method of investigation would seem to be almost entirely in the hands of the individual coroner.

In these cases of unexpected death the general practitioner is always placed in a difficult position. The most efficient procedure would seem to us to be for the practitioner to obtain consent for a necropsy, and for the child to be taken to the local children's hospital for the examination. The practitioner would also notify the coroner. It would seem likely that a careful history taken from the mother by a paediatrician or paediatrician-pathologist at the hospital would be the most likely way of obtaining the correct history before a diagnosis has to be made. The coroner has authority to permit this, and the Sheffield coroner occasionally does this, leaving the pathologist to notify him if anything but a natural form of death was revealed. It would be helpful to know the views of coroners on this subject.

Summary

In a series of 50 infants in which "sudden unexpected death" occurred, in only five instances was the history obtained by the coroner substantially consistent with the history obtained after the child's burial. Follow-up histories showed that all of the infants had shown some abnormality before death, and that the majority had had symptoms of over two days' duration.

It is suggested that these inadequate histories are due to the psychic trauma of the unexpected death, together with the fear produced by the police and the coroner's investigation. The procedures connected with these infant deaths seem to need revision.

This investigation would not have been possible but for the progressive outlook of Mr. A. P. Lockwood, H.M. Coroner for the City of Sheffield. As well as thanking him we thank our colleague Dr. J. Edwards for his wise criticism.

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