MODERN TRENDS

IN

FORENSIC MEDICINE

Edited by

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PREFACE

THE FIRM IMPARTIALITY and traditional fairness of the Law demands high standards of integrity among those who operate its machinery, and, more, a restrained authority in its scientific aides. A skilled witness cannot afford to be ignorant either when he assists in the preparation of a case or when he faces counsel, who may have taken the trouble to become well informed on the matter in hand.

This " Modern Trends " is designed to review—for the pathologist who is entrusted with medico-legal autopsies, for the forensic science worker and for the barrister—the last 10 years' experience in the subject, research designed to illuminate forensic problems and modern trends in the evaluation of such evidence. Attention has been restricted to fields in which change or reassessment has been notable, or in which a ponderous or equivocal literature has accumulated.

I particularly wish to indicate in my fellow contributors a choice of author not merely experienced in his own field but also practised in its application to the needs of the Law—and, I think it will be found, interested in the art of writing English. It is not enough merely to be well informed, but vital also to know in what respects that knowledge is applicable to the needs of the Law, and, especially in courts, to be able to state the case with a clarity which will appeal to those who are trying to find out the facts.

Parts of the final text were submitted to academic opinion for comment at a stage when it was impossible to interfere with the original flavour of the writing but still possible to benefit by advice, and I am particularly grateful in this respect to Dr. H. S. Holden, Advisor in Forensic Science to the Home Office, Dr. T. A. H. Munro, Director of the York Clinic, Guy's Hospital, and the following Professors in the University of London: Martin Rushton (Dental Medicine), G. Stead (Physics), R. H. S. Thompson (Chemical Pathology), J. Whillis (Anatomy) and Payling Wright (Pathology). The searchings into the literature, which a book of this kind demands, and detailed correction of the entire bibliography were undertaken by Mr. W. Hill, Assistant to the Wills Librarian at Guy's Hospital.

My secretary during this period, Miss J. Scott-Dunn, has shown a calm efficiency and an optimism in the project which has done much to smooth the task of both writing and of welding the contributors' material into a whole.

It is my earnest hope that this new book will serve the best interests of forensic medicine and reward the probings of both expert witnesses and of counsel whose real desire is to attain the facts—or as reasonable an approach to them as seems proper at the present time.

Guy's Hospital, London KEITH SIMPSON

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CHAPTER 1

FORENSIC ASPECTS OF STILLBIRTH AND NEONATAL DEATH

KEITH SIMPSON

SECTION I

NATURAL HAZARDS

THE social and obstetric interests of stillbirth, of neonatal, and infant mortality have received much attention in the last ten years (Ministry of Health Special Report, 1949; Morison, 1952). The natural hazards of prematurity, of labour, and of the first month of life alone accounted in 1948 for a loss of some 30,000 infant lives, still-born or dying within a month, the majority in poor social circumstances, often without skilled midwifery, into illegitimate, hostile or indifferent parenthood. Nearly a half of the live-born neonatal deaths take place in the first week, about a quarter of them on the first day.

This is largely true, too, of criminal infant deaths, stillborn or neonatal—though the difficulty of achieving access to the real facts prevents the exact figures being attained. The annual stillbirth and neonatal death rates recorded in the Registrar General's statistics raise forensic problems of great practical interest, quickened by the acknowledged difficulty of reaching a satisfactory conclusion, even after autopsy, on the causes of many stillbirths and infant deaths in which the clinical features of childbirth are uncertain or unknown because birth was unattended.

The strongest suspicion of deliberate interference often arises and it requires the most painstaking autopsy to identify the charges of some "wilful act or omission" which the Infanticide Act requires the Crown to prove, and to exclude the possibility of natural obstetric hazards. It is plainly of the first importance that the faintest clue to criminal interference shall be detected and that no doubt shall exist when the pathologist has good forensic proof of crime, or, on the contrary, is faced with an equivocal finding which is capable of obstetric explanation.

Clear evidence exists to show that social and economic conditions, age, parity and prematurity can all affect both stillbirth and neonatal mortality even in legitimate parenthood and where, as in a large maternity hospital, skilled attention is available; illegitimacy adds grave disadvantages. These factors operate irrespective of the obstetric risks of delivery or of infant infections and disease.

Social conditions

The analysis made by the Registrar General to show the stillbirth and neonatal mortality rates in the various social grades arbitrarily classed from I (members of professions, commissioned officers and well-to-do people in commerce) to V (unskilled workers) reflects the increasing menace to infant life from both the prospect of stillbirth and of neonatal risks.

ANALYSIS BY REGISTRAR GENERAL OF VARIOUS SOCIAL GROUPS FOR 1939

England & Wales	Class					All
	I	II	III	IV	V	
Stillbirth – – –	24·4	33·4	35·6	37·6	39·7	36·2
Neonatal mortality –	18·9	23·4	25·4	27·7	30·1	27·1

It is clear that, irrespective of the variable desire for the child, the resources and comforts available for the better classes play an important part in the prospects of survival. Baird (1947) made an analysis of class privileges in relation to stillbirth and neonatal mortality in Aberdeen which emphasizes the same point from a somewhat different angle.

ANALYSIS BY BAIRD OF CLASS PRIVILEGES

Registrar General's Social Class	Place of Delivery	Maturity	Stillbirth rate	Neonatal mortality
I or II – – –	Nursing home –	Full-term 1,348 Premature 71	25·4	13·6
III, IV or V – –	Booked hospital –	Full-term 8,070 Premature 738	30·4	34·1
Private cases – –	Specialist – –	Full-term 481 Premature 20	10·0	7·9

A social survey in the United States (Douglas, 1951) showed how the risk to infant life from infection was governed by the income grade, deaths from pneumonia decreasing as the family income rose.

CASES OF PNEUMONIA PER 1,000 CHILDREN AGED LESS THAN A YEAR

Family income per annum	Pneumonia-rate per 1,000 children aged less than a year	Number observed
Relief – – – –	49·2	6,871
$1000 or less – –	28·4	6,660
$1000–1500 – – –	21·0	7,580
$1500–2000 – – –	19·0	4,648
$2000–3000 – – –	12·2	2,709
Over $3000 – – –	16·1	1,151

(*After* Douglas, 1951)

The elimination of premature infants (under 5½ lb. at birth) levels the mortality rate among the social grades during the first month (Fig. 1(*a*)) and the elimination of deaths from pneumonia and enteritis does the same for the rates among the social grades during the first year (Fig. 1(*b*)).

It remains that the prospect of survival, even when a live-birth has been achieved, lies much at the mercy of social conditions and the comforts and protection which can be afforded. These figures achieve even more significance when it is realized that the gross production rate (1·3) of class V in the Registrar General's analysis is so much higher than that of class I (0·7). The totals tend to grow with descent

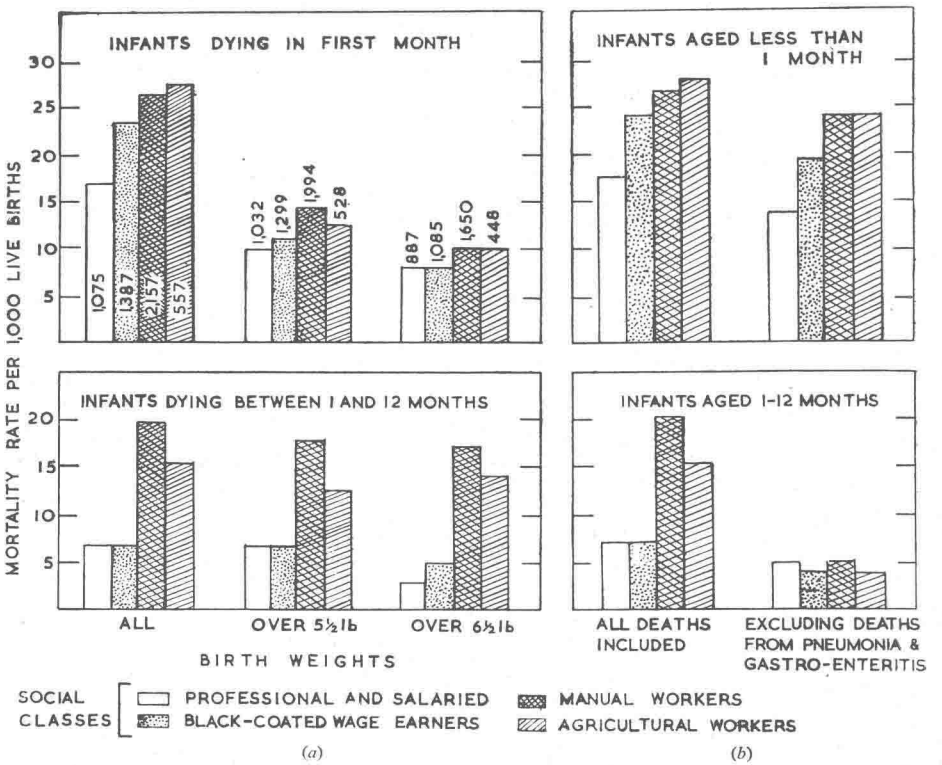

FIG. 1.—(*a*) Effect on mortality rates among infants by social class and age, excluding prematurely born infants—numerals on columns indicate numbers of live births on which mortality rates are based: (*b*) effect on mortality rates among infants by social class and age, excluding deaths from pneumonia and from gastro-enteritis (*after* Douglas, 1951).

down the social grade. Roughly speaking, class V held a stillbirth rate 30 per cent higher and neonatal death 50 per cent higher than in class I.

Ryle's survey (Fig. 2) provided a very graphic illustration in respect of stillbirth in relation to social conditions on a wider scale. The poor social conditions prevalent in the vast mining population of Wales in the thirties compare most unfavourably, when reflected in the stillbirth rate, with the better facilities and higher social grading of the inhabitants in the Metropolis of London—or, of course, with the remarkable achievements of Denmark.

Maternal age and parity

Maternal age and parity also play important parts. Baird's analysis of 8,808 stillborn children born in hospital in Aberdeen (1945) is given in Table 1.

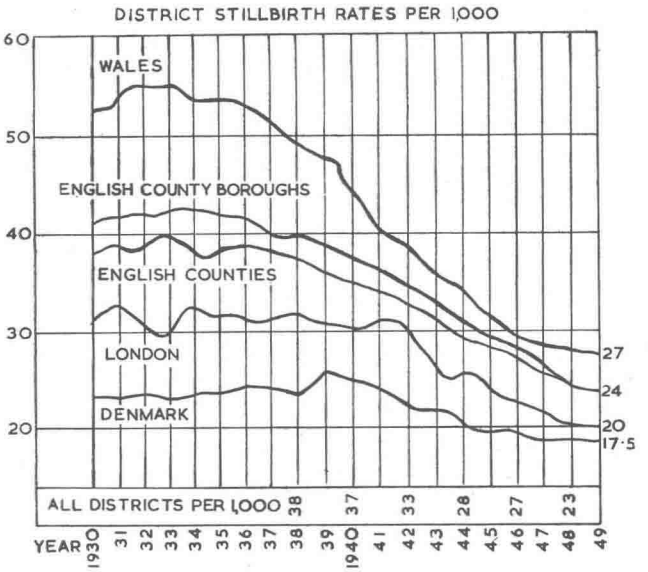

FIG. 2.—Social aspects of stillbirth. The relative rates in various districts of England and Wales; and in Denmark (*after* Ryle).

TABLE I

Parity	Maternal age			
	Under 25 years	25–34 years	Over 35 years	All ages
1st pregnancy	20·2	53·4	83·3	33·6
2nd pregnancy	12·8	20·3	59·2	20·0
3rd, 4th, 5th pregnancy	13·7	32·1	33·2	29·1
6th, 7th, 8th pregnancy	0·0	30·4	49·8	38·5
9th pregnancy	—	105·3	67·6	73·5
All parities	17·7	35·8	53·5	30·4

The degree of suspicion attaching to unattended stillbirth is naturally, therefore, reduced as the age of the mother increases, and in first, even more late first, pregnancies in which the prospects of an easy, uncomplicated delivery are the smaller. This is a matter of plain common sense.

Immaturity

The endeavour, mainly among obstetricians, to define "prematurity" more exactly in its medical sense of timing—short of the full period of gestation—by limiting the qualification to infants of under 2,500 grammes (5½ lb.) has some practical obstetric value if of no significance in law. The law is concerned strictly with only one period of immaturity, the 28th week at which, though still weighing only some 1,200 grammes (about 2½ lb.), the foetus becomes "viable" in law and might be expected to have a reasonable chance of survival upon delivery. It is true, of course, that the stage of "full maturity" has also some significance in law as implying the ability, in the absence of defects or disease, to achieve a vigorous separate existence: this is, however, a more general observation.

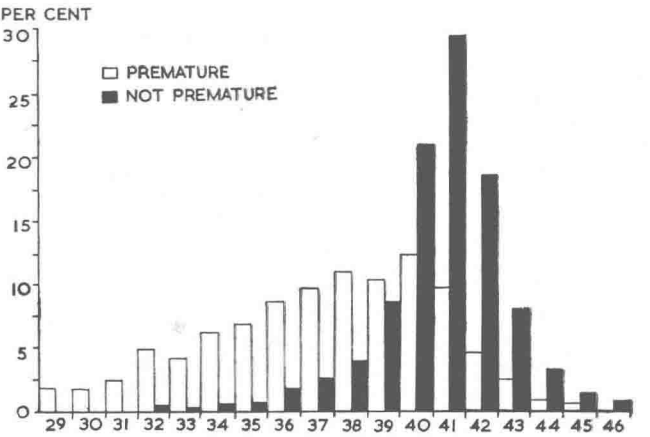

FIG. 3. — Distribution of "premature" and "not premature" births (judged by a weight limit of 2,500 grammes at periods around "full term"). (*By courtesy of Brit. med. J. and T. McKeown and J. R. Gibson.*)

The weight alone is not an entirely reliable basis for the estimation of the period of gestation, or the prospect of survival: twins are not comparable (Duffield and his colleagues, 1940), and it has long been recognized that the mean weight of a female is some 100 grammes under that of the male at the same period (Morison, 1952). McKeown and Gibson (1951) have shown (Fig. 3) that some 14 per cent of 38th week deliveries are obstetrically "premature" if judged by the weight alone.

The question of maturity is an important one both obstetrically and forensically, and it is as well that there should be no confusion in the mind of the law as to what either definition really means. The word "immature" (defining a state) is

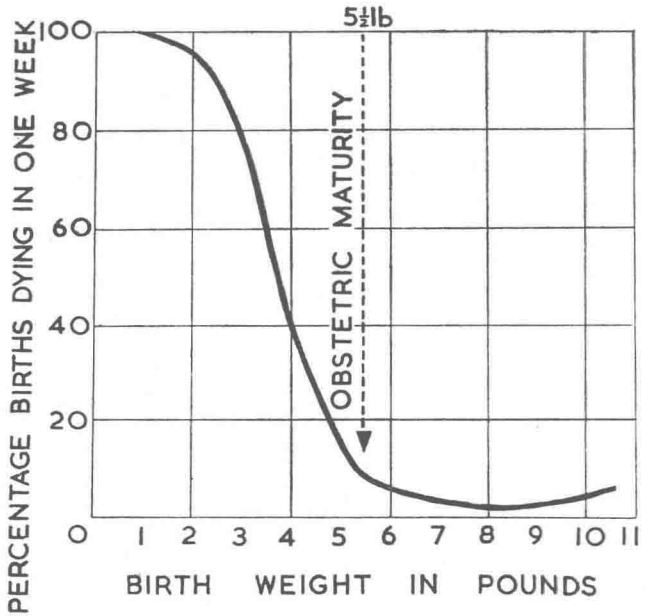

FIG. 4.—Graph showing survival rate in relation to birth-weight (*after* Bowes 1952).

more acceptable than "premature" (defining a period of time) as a description of a condition which, *whatever the date of delivery*, produces a child not yet mature enough to meet and survive the normal risks of delivery and neonatal existence.

This definition could achieve its practical use in both medicine and law without interfering with statutory regulations. The *Registration of Stillbirths* is not related to maturity but to viability, for the law only requires that a foetus shall have reached, or passed, the 28th week of gestation for it to be registrable upon stillbirth. As regards *Infanticide*, the charge rests upon the Crown giving proof of a separate existence; it is of no matter whether the child was viable at law or

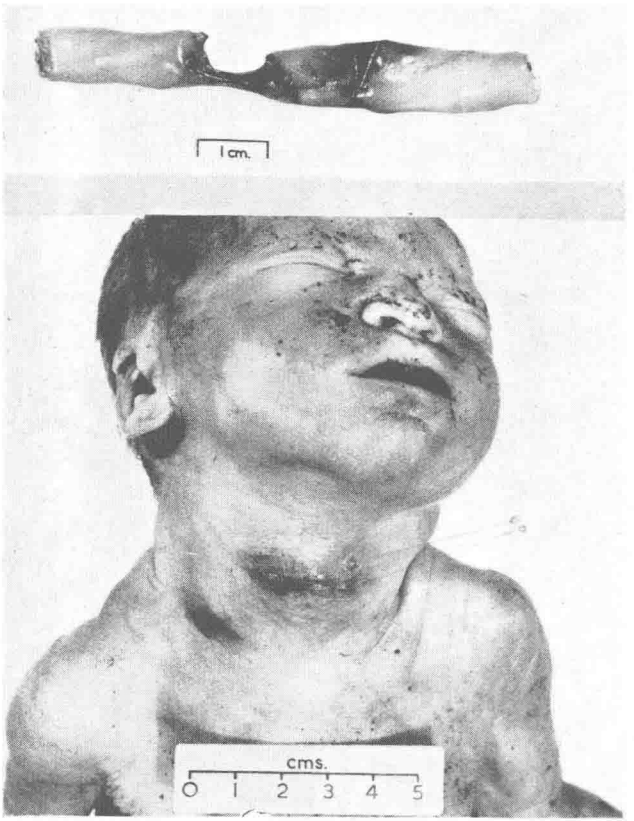

FIG. 5.—Marks said by mother to be due to cord encircling neck. Cord cut, not stretched, and marks too localized and well defined for encirclement by soft cord. Strangling by linen sheet pinned taut across front of neck. The child, though breathing, was still not completely born, and death followed whilst a foot lay in the vagina—a technical bar to a charge of infanticide.

immature, though the likelihood of a charge being pressed in respect of an infant of less than 28 weeks must be remote.

Under the Infant Life Preservation Act of 1929 the rare charge of *Child Destruction* may be made in respect of the death of a child by any wilful act, committed before delivery with intent to destroy life, where that child was capable of being born alive, that is, had reached 28 weeks gestation. No question of immaturity arises, the law being concerned only with its own definition of "viability"—the ability to achieve a separate existence at, or after, the 28th week.

Immaturity carries its own particular natural hazards—respiratory (Wilson and his colleagues, 1942), circulatory (Barcroft, 1946) and thermal instability leading

to bouts of cyanosis, atelectasis, circulatory collapse, asphyxia; imperfect digestion (Werner, 1948) and immature defence mechanisms (Wood and his colleagues, 1946), undeveloped renal function (Windle, 1940), lack of stored iron and a host of trivialities may menace a continued separate existence. Holt and Mackintosh (1940) showed the prospects of survival in relation to weight to be as follows:

Weight—lb.		Percentage survival	
2			5
2–3	circa 28 weeks		33 Viable in law
3–4			75
$4\frac{1}{2}$–$5\frac{1}{2}$			90

and in a series recorded from the City of Birmingham in 1945 by Crosse (1946 some 50 per cent of stillbirths and neonatal deaths were found to be associated with "prematurity": the neonatal mortality rate was 278 per 1,000 as compared with 11 per 1,000 in mature infants. In the 1938 Registrar General's returns some 21,000 deaths, or 33 per 1,000 of the total births, were thought to be due to "prematurity".

Immaturity also carries another risk of considerable forensic importance—a reduced resistance to trauma. Interference with infant life usually involves violence; suffocation, strangling, drowning and blunt injury are the common forms of infanticide, and in law it is of no matter what degree of injury it involves provided that it is in some respect contributory to death. The difficulty of distinguishing between natural complications of delivery and wilful interference with life is discussed later (page 10).

Illegitimacy

Illegitimacy, a social rather than a forensic problem, often provides grounds for the strongest suspicion that many deaths regarded—certified for lack of evidence to the contrary—as stillbirths or natural infant deaths are, in fact, unnatural deaths from neglect, often deliberate, or from wilful interference with breathing. If a hand is placed over the mouth and nose as the child is born, the face is buried in bedding, or, as in one case admitted, in the placenta, breathing will either not commence or be quickly terminated and the condition will be indistinguishable from stillbirth or ordinary neonatal asphyxia and must be recorded as such for lack of evidence to the contrary.

In England in 1940 the rates were:

		Stillbirths	Neonatal deaths
Legitimate delivery – –	581,156	21,427 (35·5)	16,375 (28·2)
Illegitimate delivery – –	25,873	1,304 (48·0)	1,128 (43·6)

It is true, of course, that in illegitimacy, poverty, lack of preparation and of skilled professional care at delivery must provide serious obstacles to a continued separate existence; but in illegitimacy there are also the less ponderable

factors of disinterest, carelessness, neglect, even deliberate interference, short of violence and injury, which may prevent a separate existence being established, or terminate it when it has been achieved. These things are most difficult to assess: suspicion is far short of proof, but the high rates of stillbirth and neonatal death in illegitimacy must raise strong doubts of the natural qualities of the changes found at autopsy.

Immaturity may itself be sufficient to disarm suspicion, but with increasing maturity, and in the post-natal period, it is wise to exercise a suspicious mind whenever there is no satisfactory explanation of stillbirth or early neonatal death.

Natural risks of delivery and neonatal life

In the process of birth and the immediate post-natal period a large number of hazards menace survival, and it is important that the forensic pathologist shall

TABLE 2

CAUSES OF STILLBIRTH

Incidence per 100 cases

Cause	Antepartum		Intrapartum	
	Belfast	Chicago	Belfast	Chicago
Congenital anomalies	6	7	10	16
Trauma	—	—	11	11
Infection (non-specific)	1	1	15	3
Syphilis	4	1	1	—
Rh factor incompatibility	6	5	4	1
Diabetic or pre-diab. mother	3	—	1	—
Miscellaneous	—	1	—	1
Extrinsic anoxia :—				
accidents to cord	1	8	10	15
haemorrhage plac. praevia	1	3	1	7
haemorrhage cause uncertain	23 } 26	— } 32	8 } 34	— } 48
premature plac. detachment	—	15	—	15
complicated mechanics of labour	—	—	13	—
miscellaneous	1	6	2	11
Not ascertained :—				
evidence of extrinsic anoxia	— } 54	— } 53	21 } 25	— } 20
no evidence available	54	53	4	20

(*After* Morison, 1952)

both detect and evaluate them with accuracy if his assessment of criminal interference is to be sound.

The causes of stillbirth—of antepartum and intrapartum death—are tabulated by Morison (1952) using the figures of Potter and Adair (1943) and Potter and Dieckmann (1948) in Chicago as shown in Table 2.

Even after careful consideration of the clinical and autopsy findings the exact cause of stillbirth often remains obscure, and to hope that autopsy alone will clarify the issue is a correspondingly slighter possibility. The higher incidence of "stillbirth" in illegitimacy (where, as a rule, autopsy offers the only evidence available) is likely to conceal a number of criminal infant deaths, but the real facts are often beyond reach. Where no known complication of either pregnancy or labour exists post-maturity may provide a hazard (McKiddie, 1949). Careful examination of the placental tissues which alone explains many clinically observed stillbirths is seldom possible in forensic practice.

Causes of neonatal mortality

The post-natal periods at which the natural risks of birth and neonatal life carry a high mortality are shown in the 1948 Registrar General's statistics of neonatal mortality:

England & Wales, 1948	Infant mortality							Rate per 1,000	Legitimate per 1,000	Illegitimate per 1,000
Total	Under 1 day	1–7 days	1–4 wks.	1–3 mths.	3–6 mths.	6–9 mths.	9–12 mths.			
26,766	6,029	6,118	3,179	4,287	3,803	2,109	1,241	34	33	45

During the first month of life the more common risks to life, revealed by an analysis of the first three columns of the 1948 figures, are:

Neonatal Mortality 1948

All causes (during 1st month)	15,326
Prematurity	6,282
Asphyxia and atelectasis	2,121
Injury at birth (cranial 1,445)	1,975
Congenital malformations	1,127
Pneumonia (all forms)	733
Rh incompatibility	524
Enteritis and diarrhoea	220
Melaena	193
Congenital debility	174
Maternal toxaemia	156
Convulsions	69
Bronchitis	65
Meningitis	29

The separation of prematurity, asphyxia and atelectasis is not an easy matter even for an obstetrician who has had the advantage of attending to the delivery, and for the forensic pathologist who may see the child dead only—often several days old—the task may be an impossible one. The duration of labour alone may be sufficient to account for failure to survive—with signs of anoxia and atelectasis—and precisely the same findings may be true of a labour of moderate duration and little obstetric difficulty conducted *in toto* beneath bedclothes, as many unwanted or unanticipated deliveries are.

Anoxia can quickly cause passive congestion and cyanosis with petechiae in the loose tissues: it may serve as a stimulus to foetal respiration and result in aspiration of copious vernix—amnion, blood, meconium—and anoxia may (when not explained by some intrinsic defect of the foetus) have a large number of extrinsic explanations—cord obstructions from ties or prolapse, antepartum or intrapartum haemorrhage, prolonged or impacted labour, retraction of the uterus causing the placental bed to shrink. No pathological examination can assess these factors from mere examination of the foetus.