Value and quality of perinatal and infant postmortem examinations: cohort analysis of 400 consecutive deaths

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Abstract

Objectives—To evaluate the contribution that perinatal and infant necropsy makes to clinical practice and to see how this might be influenced by the quality of the investigation.

Design—Cohort analysis, with data from the all Wales perinatal survey, of perinatal and infant deaths during 1993 of babies born to mothers usually resident in Wales. The clinicopathological classification of death based on clinical details was compared with the classification after necropsy. Similarly, cases in which necropsy yielded new information were identified. The quality of the necropsy was assessed by scoring six aspects of the examination.

Subjects—400 consecutive deaths at 20 weeks of gestation to 1 year of age.

Main outcome measures—Necropsy rate, effect of necropsy on clinicopathological classification, new information disclosed by necropsy, quality of necropsies, and the link between new information and quality of the necropsy.

Results—Necropsy was performed in 232 cases (58%). The clinicopathological classification was altered by necropsy in 29 cases (13%). New information was obtained in 60 cases (26%), and in 42 (18%) it disclosed the cause of death. The quality of necropsy was substantially higher when the main cause of death was detected than when nothing new was found.

Conclusion—Necropsy is underused. Clinicians should be more positive about necropsies and realise how much clinically relevant information can be obtained from a good quality examination.

Introduction

The aim of a postmortem examination in late fetal, neonatal, or infant death is primarily to investigate the cause of death for accurate parental counselling.¹ A precise diagnosis is particularly important after the death of a baby or fetus because it may have implications for future pregnancies. The information is also likely to be useful for auditing the effectiveness of new diagnostic and management techniques.²

In 1988, a joint working party of the Royal College of Obstetricians and Gynaecologists and Royal College of Pathologists recommended that a perinatal necropsy rate of less than 75% was unacceptable and that the ideal was 100%.³ It also recommended that material from all midtrimester abortions, spontaneous and therapeutic, should be examined. The report included a basic protocol for investigating a perinatal death, which should be followed even with an obvious cause of death. Despite these recommendations, however, the perinatal necropsy rate in most of the United Kingdom has failed to reach even the minimum target of 75%. Several regions have a rate below 50% (R Stanwell-Smith, personal communication). These low rates result chiefly from failure to request a post-mortem examination, sometimes because of unwillingness of the parents.

The national confidential enquiry into perioperative deaths disclosed that new and relevant information was

found in at least 49% of necropsies after perioperative deaths, but that the necropsy rate was only 45% (mostly coroner's cases).⁴ Many surgeons were sceptical of the value of the examination. The low perinatal necropsy rate suggests that obstetricians and paediatricians are also ambivalent about the value of necropsy. This may be because new diagnostic techniques are assumed to allow a better understanding of the cause of death, so reducing the need for necropsy. Alternatively, the yield from perinatal postmortem examinations may be so low that clinicians consider them unnecessary. These problems may be further compounded by the poor quality of many necropsies as perceived by some obstetricians, paediatricians, pathologists, parental pressure groups and parliamentarians.⁵ That necropsies may be of poor quality was supported by a review in the west midlands, which found that 44% of necropsies were below standard.⁶ If there is a link between the quality of the postmortem examination and the yield, then probably it is not surprising that many clinicians are disillusioned by the investigation.

We have re-evaluated the contribution that perinatal and infant postmortem examinations make to clinical practice. In particular, we aimed at identifying clinical settings in which the examination is likely to yield new important information and at seeing how this might be influenced by the quality of necropsy.

Methods

Subjects were identified from the all Wales perinatal survey, a population based surveillance of all deaths at 20 weeks of gestation to 1 year of age among fetuses and babies whose mothers are usually resident in Wales. Wales has a population of nearly 3 million and about 37 000 births annually. It has large rural areas such as Powys, Gwynedd, and Dyfed, in addition to the densely populated urban areas of South Wales. It is divided into nine district health authorities, with 16 consultant obstetric units and 11 general practitioner units. Many babies are also looked after in neighbouring English health authority areas. Pathology services are mainly provided locally, though most fetuses aborted therapeutically because of anomalies are examined by the regional paediatric pathologist. Information about each case is collected on the survey form which is normally completed by the team in whose unit the baby died. This includes detailed information about the mother's medical and obstetric history, current pregnancy, labour, and delivery. Data on the baby include sex, birth weight, gestation, details of resuscitation, and a narrative about neonatal management. When a postmortem examination has been performed a copy of the report is included in the return. If there was no necropsy the form establishes whether one was not requested or whether one was requested but was refused by the parents.

The first 400 cases reported during 1993 were included in the study. Each case was assessed by a panel consisting of a neonatal paediatrician, an obstetrician with a special interest in fetal medicine, a paediatric pathologist, and a midwife. Initially the panel viewed each case without knowledge of the necropsy report and made two decisions. Firstly, the

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clinicopathological (Wigglesworth) classification of the cause of death was allocated on the clinical information available. The classification used the amendments to Wigglesworth's original definitions designed to clarify certain ambiguities and expanded to take account of postneonatal deaths (table 1).⁷⁻⁹ Secondly, a consensus decision was reached on how good was the understanding of the cause of death; cases were categorised as either well understood or poorly or not understood. In most cases a consensus decision was achieved quickly, but if there was a difference of opinion resulting in a 2:2 split then the opinion of the appropriate clinician—for example, the obstetrician in the case of stillbirths—prevailed.

The panel then reassessed each case using the findings in the necropsy report to see how often the clinicopathological classification was altered by necropsy. The panel also assessed how informative the necropsy had been by using the following system: (1) "diagnostic" referred to new information which disclosed the primary cause of death or which had

important implications for future pregnancies; (2) "additional" referred to new information not included in (1); (3) "audit" referred to information useful for clinical audit (this category was used when the clinical diagnosis or management relied on new techniques still under evaluation; a necropsy disclosing features typical of a chromosomal anomaly in which the antenatal diagnosis was based on chromosomal analysis was classified in (4)); (4) "none" referred to no new information and not in (3).

The quality of postmortem examinations was assessed by the system described by Rushton, which objectively scores factors identified by the Royal College of Pathologists as being part of a necropsy.⁶ The six factors used were: (a) body measurements—length from crown to rump or heel, head circumference, foot length, and body weight score (score=100); (b) organ weights—lung, heart, liver, and brain (score=40), others in addition (score=40), quoting normal values (score=20); (c) histological report on main organs (score=50), others in addition (score=50); (d) radiology report (score=100); (e) microbiology report (score=100); (f) other relevant investigations—for example, cytogenetics (score=100). The maximum score for each factor was 100 and therefore the maximum total score was 600. The minimum acceptable score was based on college guidelines and set at 250.¹⁰ The scores in our study were lower than those used by Rushton as we omitted the descriptive content of necropsy reports as too subjective.

Results

Two hundred and thirty two postmortem examinations were carried out, an overall rate of 58% varying by district health authority from 20% (2/10) to 73% (41/56). In 101 cases (25%) necropsy was refused by the parents and in 67 (17%) it was not requested. The necropsy rate was 79% (27/34) after a therapeutic abortion compared with 42% (40/95; $\chi^2=13.95$, df=1, $P<0.001$) after a neonatal death and 43% (33/76, $\chi^2=12.27$, df=1, $P<0.001$) after a fresh stillbirth (table II). The rate of 63% (24/38) after postneonatal death was intermediate, though in many of these cases the necropsy was ordered by the coroner.

The clinicopathological classification of the death was altered in 12.5% (29/232) of cases (tables III and IV). The most common reason for change was infection (11 cases) followed by specific conditions (eight) and congenital anomalies (five). Changes were particularly frequent after spontaneous abortion (35%, 13/37), because of the high incidence of chorioamnionitis with pneumonia and the twin-twin transfusion syndrome. In stillbirths the classification changed in 12% (12/104), mainly because of the discovery of infection or specific conditions.

Insufficient data precluded assessment of new information and necropsy report quality in four cases, so these assessments were done in 228 cases. Necropsy provided new information in 26% (60/228) of cases (fig 1). In 42 cases (18%) it disclosed the main cause of death and in 10 (4%) the findings had implications for future pregnancies. Naked eye examination alone was diagnostic in 25 cases (11%) but in the other 17 (7%) histological examination was essential. As before, the highest yield was in spontaneous abortions (38%, 14/37) and between 12% and 19% was in stillbirths and infant deaths. After therapeutic abortion the main diagnosis was made at necropsy in one case (a fetus with an encephalocele in which necropsy disclosed the Meckel-Gruber syndrome, an autosomal recessive condition), but necropsy proved more useful as an audit of the accuracy of antenatal diagnosis. When the cause of death seemed understood clinically but necropsy was nevertheless performed, the main diag-

TABLE I—Clinicopathological (modified Wigglesworth) classification of death

	Classification
Congenital anomaly	1
Unexplained death before onset of labour	2
Placental abruption before onset of labour	2A
Intrapartum events	3
Conditions consequent on preterm birth	4
Infection	5
Specific condition	6
Accidental death	7
Sudden infant death	8
Unclassifiable	9

TABLE II—Postmortem rates according to timing of death

Outcome	Total	No (%) in which necropsy was done	No (%) in which necropsy was not requested	No (%) in which necropsy was refused
All deaths	400	232 (58)	67 (17)	101 (25)
Therapeutic abortion	34	27 (79)	3 (9)	4 (12)
Spontaneous abortion	54	37 (69)	9 (17)	8 (15)
Macerated stillbirth	103	71 (69)	8 (8)	24 (23)
Fresh stillbirth	76	33 (43)	13 (17)	30 (39)
Neonatal death	95	40 (42)	28 (29)	27 (28)
Postneonatal death	38	24 (63)	6 (16)	8 (21)

TABLE III—Changes in clinicopathological classification after post-mortem examination

Outcome	No of postmortem examinations done	No (%) in which clinicopathological classification was changed
All deaths	232	29 (13)
Therapeutic abortion	27	0
Spontaneous abortion	37	13 (35)
Macerated stillbirth	71	8 (11)
Fresh stillbirth	33	4 (12)
Neonatal death	40	3 (8)
Postneonatal death	24	1 (4)

TABLE IV—Changes in clinicopathological classification after necropsy (29 cases)

Case No	Timing of death	Classification		Comments
		Clinical only	Clinical plus necropsy	
1	Spontaneous abortion	1	6	Twin-twin transfusion syndrome
2	Spontaneous abortion	1	6	Twin-twin transfusion syndrome
3	Spontaneous abortion	2	1	Congenital heart disease
4	Spontaneous abortion	2	1	Chromosomal anomaly
5	Spontaneous abortion	2	2A	Large retroplacental clot
6	Spontaneous abortion	2	5	Chorioamnionitis and pneumonia
7	Spontaneous abortion	2	5	Chorioamnionitis and pneumonia
8	Spontaneous abortion	2	5	Chorioamnionitis and pneumonia
9	Spontaneous abortion	2	5	Chorioamnionitis and pneumonia
10	Spontaneous abortion	2	6	Twin-twin transfusion syndrome
11	Spontaneous abortion	2	6	Twin-twin transfusion syndrome
12	Spontaneous abortion	2	6	Twin-twin transfusion syndrome
13	Spontaneous abortion	2A	5	Chorioamnionitis and pneumonia
14	Macerated stillbirth	2	1	Congenital heart disease
15	Macerated stillbirth	2	2A	Large retroplacental clot
16	Macerated stillbirth	2	5	Pneumonia
17	Macerated stillbirth	2	5	β Haemolytic streptococcal infection
18	Macerated stillbirth	2	5	Non-specific pneumonia
19	Macerated stillbirth	2	6	Intracranial haemorrhage
20	Macerated stillbirth	2	2A	Large retroplacental clot
21	Macerated stillbirth	2	5	Chorioamnionitis
22	Fresh stillbirth	2	6	Congenital myeloid leukaemia
23	Fresh stillbirth	2A	5	Congenital cytomegalovirus infection
24	Fresh stillbirth	5	2	Parvovirus infection suspected clinically
25	Fresh stillbirth	3	6	Massive pulmonary haemorrhage
26	Neonatal death	1	4	No congenital heart disease
27	Neonatal death	5	1	DiGeorge syndrome
28	Neonatal death	8*	1	Congenital heart disease
29	Postneonatal death	8*	5	Pneumonia

*Sudden, unexpected death.

nosis was altered in 9% of cases (9/97) and other new information found in a further 12% (12/97) (table V). By comparison, when the cause of death seemed poorly understood the main cause of death was found in 24% (33/135) and other new information in 4% of cases (6/135).

FIG 1—Information provided by necropsy in 228 cases

TABLE V—Value of necropsy according to clinical understanding of cause of death

	No (%) of deaths understood clinically (n=208)	No (%) of deaths poorly understood clinically (n=192)
Necropsy	97 (47)	135 (70)
Information from necropsy:		
Diagnostic	9 (9)	33 (24)
Additional information	12 (12)	6 (4)
Clinical audit	25 (26)	3 (2)
No new information	49 (51)	91 (67)
Insufficient data	2 (2)	2 (1)
Necropsy not requested	48 (23)	17 (9)
Necropsy refused	63 (30)	38 (20)
Altered clinicopathological classification	4 (4)	25 (19)

Scores for the quality of the necropsy report ranged from 0 to 600. The mean score was 249, and in 43% (98/228) of cases the report failed to attain the minimum score of 250. In cases in which the clinicopathological classification was altered by the post-mortem examination, the mean score (95% confidence interval) was 314 (277 to 352) compared with 240 (222 to 257) when no change resulted (95% confidence interval for difference between scores 27 to 121). Similarly, the mean score was 288 (252 to 324) in cases in which the necropsy yielded diagnostic information compared with 227 (206 to 249) when no new information was found (95% confidence interval for difference between scores 10 to 96 (fig 2).

Discussion

The necropsy rate in Wales is considerably below the minimum recommended level of 75% but similar to that in other areas in the United Kingdom. This is in stark contrast with the situation in Sweden 20 years ago, when the rates were above 90% because necropsies were performed after all hospital deaths unless relatives objected.¹¹ Parental refusal to allow the investigation was the main reason for the low rate, but the

FIG 2—Relation between quality of necropsy and information disclosed. Plots are 95% confidence intervals. Bars are means

failure of clinicians to request necropsy was also common.

The ambivalence of some clinicians towards the value of postmortem examination is inappropriate and confirms previous findings. Possibly it points to a poor understanding of the contribution necropsy can make when all the problems in the care of the baby are thought to have been known by medical staff. But as we have shown, this ambivalence is unwarranted. Clinically relevant information was obtained at autopsy in 18% of cases, giving parents and clinicians a better understanding of the cause of death and in 4% of cases a precise assessment of the implications for future pregnancies. In settings in which the cause of death did not seem clinically obvious, necropsy was even more valuable, providing the diagnosis in 24% of cases. Necropsy was more likely not to contribute further information when the clinical diagnosis seemed secure, but even then the cause of death was proved incorrect in 9% of cases. Indeed, negative findings are important in reassuring parents and clinicians that important disease has not been missed.

Necropsy in late spontaneous abortion seems particularly useful if our finding of a high incidence of infection, the twin-twin transfusion syndrome, and congenital anomaly is typical. In macerated stillbirths, we confirmed the findings of Porter and Keeling that necropsy is often useful despite the technical difficulties presented by autolysis.¹² After therapeutic abortion new and genetically important information was found in only one case (4%). By comparison, Clayton-Smith *et al* found genetically important lesions in 23% of cases, though cases in their study were diagnosed between 1982 and 1987 when antenatal diagnosis was less precise.¹³ Despite this, necropsy remains a useful investigation after a therapeutic abortion as the final audit of new diagnostic techniques.

Previous reports have described clinically important findings at necropsy in 14-46% of cases.^{2,12,14} In the most recent from Oxford, clinically important information was found in 40% of necropsies.¹¹ This may in part be due to differences in definition, but more importantly it probably reflects differences in the cases studied. Thus in the Oxford study necropsies were done in a regional centre with many complicated cases. By comparison, our study was based on an unselected sample of a geographical population and should be more representative.

The quality of necropsies in our study was very similar to that found by Rushton, with 43% failing to achieve the minimum score.⁶ Clinically important information and changes in the clinicopathological classification were significantly more likely to emanate from a good quality necropsy, so probably the value of the examination would increase if the quality was improved. The Royal College of Pathologists recently published guidelines for investigating late fetal, perinatal, and infant deaths which it is hoped will improve the quality of the examinations and with it the necropsy rate.⁹

The main epidemiological requirements of a classification of death system are accuracy and consistency. The clinicopathological system has evolved over many years, and the aim of a recent revision was to allow use in most cases even when there is no postmortem examination.¹⁵ Nevertheless, overall the classification of death on clinical data alone was incorrect in 13% of deaths and in 19% when the cause of death was clinically in doubt. This compares with a 9% change found by Keeling *et al*,⁷ a difference largely accounted for by the inclusion of late abortions and postneonatal deaths in our study. Changes in classification were mainly due to the discovery of infection and specific fetal conditions. Congenital anomalies were found in several fetuses and babies but refuted in others, so the

Key messages

- The perinatal necropsy rate in most of the United Kingdom fails to reach the minimum target of 75%
- The quality of many perinatal postmortem examinations is considered poor
- Present findings show that necropsy discloses the main cause of death in 18% of perinatal and infants deaths and other new information in a further 8% of deaths
- Clinically important information is more likely to emanate from a good quality necropsy
- Clinicians should take a more positive attitude towards postmortem examinations

net increase in the number classified as dying of a congenital anomaly was only 4% as compared with 10% reported by Duley.¹⁶ The classification was most frequently changed in spontaneous abortions and stillbirths, and so for epidemiological surveys it is particularly important to obtain a necropsy in these settings.

This study has shown that necropsy is an invaluable investigation which is currently underused. The rate is likely to increase only if clinicians take a more positive attitude and realise how much clinically relevant information can be obtained from a good quality examination.

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Sexual health education interventions for young people: a methodological review

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Abstract

Objectives—To locate reports of sexual health education interventions for young people, assess the methodological quality of evaluations, identify the subgroup with a methodologically sound design, and assess the evidence with respect to the effectiveness of different approaches to promoting young people's sexual health.

Design—Survey of reports in English by means of electronic databases and hand searches for relevant studies conducted in the developed world since 1982. Papers were reviewed for eight methodological qualities. The evidence on effectiveness generated by studies meeting four core criteria was assessed. Judgments on effectiveness by reviewers and authors were compared.

Papers—270 papers reporting sexual health interventions.

Main outcome measure—The methodological quality of evaluations.

Results—73 reports of evaluations of sexual health interventions examining the effectiveness of these interventions in changing knowledge, attitudes, or behavioural outcomes were identified, of which 65 were separate outcome evaluations. Of these studies, 45 (69%) lacked random control groups, 44 (68%) failed to present preintervention and 38 (59%) post-intervention data, and 26 (40%) omitted to discuss the relevance of loss of data caused by drop outs. Only 12 (18%) of the 65 outcome evaluations were

judged to be methodologically sound. Academic reviewers were more likely than authors to judge studies as unclear because of design faults. Only two of the sound evaluations recorded interventions which were effective in showing an impact on young people's sexual behaviour.

Conclusions—The design of evaluations in sexual health intervention needs to be improved so that reliable evidence of the effectiveness of different approaches to promoting young people's sexual health may be generated.

Introduction

Reducing the risks some young people take with their health is an aim incorporated into current "health of the nation" targets in the United Kingdom. These include reducing by at least half the rate of conceptions among under 16s by the year 2000 and reducing by at least one fifth by this year (1995) the rate of gonorrhoea among men and women aged over 15.¹ Health education interventions are widely seen as the most appropriate strategy for promoting young people's sexual health, particularly in view of the fact that many studies show low levels of information among young people about sexuality, reproduction, contraception, and sexually transmitted diseases²⁻⁵ and in view of the evidence that age at first intercourse is showing a steady decline with cohort age.⁶

School based health education has been poorly

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