

# Improving the quality of perinatal and infant necropsy examinations: a follow up study

G M Vujančić, P H T Cartlidge, J H Stewart

## Abstract

**Aim**—To compare the quality of perinatal and infant necropsy examinations in 1996 with those performed in 1993.

**Methods**—Cohort analysis, with data from the All Wales Perinatal Survey, of 1027 deaths (540 in 1993; 487 in 1996) of babies between 20 weeks' gestation and one year of age. The quality of the necropsy was assessed by scoring aspects identified as being part of the investigation.

**Results**—Necropsy was performed in 335 cases (62%) in 1993 and in 320 cases (66%) in 1996. The proportion done in a regional centre increased significantly from 39% (131/335) in 1993 to 76% (243/320) in 1996 ( $p < 0.0001$ ). The quality of necropsy was above the minimum standard in 54% of cases in 1993 (171/314) compared with 93% in 1996 (289/312) ( $p < 0.0001$ ). Improvement occurred in all categories. For stillbirths, 35% (46/133) were above the minimum standard in 1993 compared with 90% (104/116) in 1996 ( $p < 0.0001$ ); for cases not classified as sudden unexpected death in infancy (SUDI), the improvement was from 62% in 1993 (40/65) to 97% in 1996 (73/75) ( $p < 0.0001$ ); and for SUDI cases, the improvement was from 32% in 1993 (10/31) to 91% in 1996 (21/23) ( $p < 0.0001$ ). The quality of both non-regional and regional necropsies improved. For non-regional cases, the score was above the minimum standard in 28% (51/183) in 1993 compared with 69% (52/75) in 1996 ( $p < 0.0001$ ); for regional cases it improved from 92% (120/131) in 1993 to 100% (237/237) in 1996 ( $p < 0.0001$ ).

**Conclusions**—The quality of perinatal and infant necropsies improved considerably between 1993 and 1996, reflecting better awareness of the importance of good quality examination and an increase in referrals to paediatric centres.

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Keywords: audit; perinatal; infant; necropsy

A necropsy examination is important in identifying the cause of death and as a means of auditing clinical practice. Clinically significant information found at necropsy has been reported in 14-46% of perinatal and infant examinations, and in many cases it discloses the cause of death.<sup>1-5</sup> The quality of the necropsy examination is also important since clinically relevant information is more likely to emerge from a high quality investigation.<sup>1</sup> Yet

the quality of many perinatal and infant necropsies has been criticised. The Confidential Enquiry into Stillbirths and Deaths in Infancy (CESDI) found that 43% of necropsy reports were less than adequate.<sup>6</sup> The Clothier inquiry into the circumstances surrounding the Allitt murders also criticised the pathological investigations and made a recommendation that all necropsy examinations of children dying suddenly and unexpectedly should be done by a paediatric pathologist.<sup>7</sup> Systematic reviews of the quality of necropsy examinations have confirmed the problem. In Wales, we found that 46% of perinatal and infant necropsies done during 1993 were below the desired standard,<sup>8</sup> and similar findings have been reported from West Midlands, East Anglia, Northern England, and Northern Ireland.<sup>5 9-11</sup>

There have been several changes in recent years aimed at improving the situation. In 1993 the Royal College of Pathologists issued *Guidelines for Postmortem Reports* to update a working party report on fetal and perinatal pathology published in 1988.<sup>12 13</sup> The CESDI annual reports and other publications have highlighted the importance of a high quality necropsy and encouraged the use of a more centralised and specialist service.<sup>6 7</sup> In Wales, we also convened regional and local seminars to highlight the value of a high quality necropsy investigation and emphasised that it should either be done according to the College's Guidelines or referred to a regional paediatric pathology centre where all necessary facilities were available. In this paper we re-evaluate the quality of perinatal and infant necropsy examinations in the light of these initiatives, by comparing the quality of the examinations performed in a geographically defined population in 1996 with those done in 1993.<sup>8</sup>

## Methods

Subjects were identified using the All Wales Perinatal Survey, an ongoing population based surveillance of all deaths between 20 completed weeks of gestation and one year of age.<sup>14</sup> Wales has a population of nearly three million and about 36 000 births annually. In south Wales there are densely populated urban areas, in contrast to the large rural areas of Powys, Dyfed, and Gwynedd. Perinatal care is delivered by 16 consultant obstetric units and 11 general practitioner units within Wales, and several hospitals in neighbouring English health districts. Perinatal and infant pathology services are provided either by the local pathologist, or by a regional paediatric pathologist, and copies of necropsy reports are sent to the perinatal survey office.

University of Wales  
College of Medicine,  
Cardiff, UK:  
Department of  
Pathology  
G M Vujančić

Department of Child  
Health  
P H T Cartlidge  
J H Stewart

Correspondence to:  
Dr Gordan M Vujančić,  
Department of Pathology,  
University of Wales College  
of Medicine, Heath Park,  
Cardiff CF4 4XN, UK.

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Table 1 Scoring system for the quality of perinatal and infant necropsy examination

Category	Score
Body weight	20
Crown-rump/heel length	20
Head circumference	20
Foot length	20
Gestational age assessment	20
Organ weights (main)*	40
Organ weights (other)	40
Normal values	20
Histology (main organs)*	50
Histology (other organs)	50
Placenta, macroscopic examination	50
Placenta, histology	50
Radiology	100
Microbiology	100
Other relevant investigations (eg, cytogenetics, biochemistry)	100

\*Brain, liver, lungs, heart.

The cases were divided into four groups: fetal deaths at 20 to 23 weeks of gestation, stillbirths, sudden unexpected deaths in infancy (SUDI), and other infant deaths (non-SUDI). As in our previous study, the quality of each necropsy report was assessed using a modification of the system described by Rushton, which objectively scores aspects identified by the Royal College of Pathologists as being part of a necropsy (table 1).<sup>9-12</sup> Six aspects of the infant necropsy (body measurements, organ weights, histology, radiology, microbiology, other relevant investigations) were assessed, giving a maximum score of 600. The necropsy after a fetal death should also include an examination of the placenta, so the maximum score was 700. The minimum acceptable score was also based on the Royal College of Pathologists guidelines, and for the fetal necropsy it was set at 350 (body measurements, organs weights, main organ histology, and examination of the placenta). The infant necropsy does not include the placental examination and so the minimum acceptable score for non-SUDI cases was 250. The necropsy for SUDI cases needs to be more detailed and so the minimum acceptable score was set at 350.

Statistical analysis used 95% confidence intervals for the means, and the  $\chi^2$  test to compare two proportions.

## Results

A necropsy examination was performed on 62% of cases in 1993 (335/540) compared with

66% (320/487) in 1996. The proportion done in a regional paediatric pathology centre increased significantly from 39% (131/335) in 1993, to 76% (243/320) in 1996 ( $p < 0.0001$ ). In 20–23 weeks' gestation fetal deaths it increased from 84% (71/85) to 92% (90/98), in stillbirths from 23% (31/135) to 69% (81/118), in non-SUDI cases from 29% (22/75) to 70% (57/81), and in SUDI cases from 18% (7/40) to 65% (15/23).

Twenty two necropsy reports were unavailable for assessment, and in seven cases only a limited necropsy examination was performed, so 626 cases (314 in 1993, and 312 in 1996) were included in the analysis. Overall the scores for the quality of the necropsy report increased significantly from a mean (95% confidence interval) of 306 (289 to 322) in 1993 to 454 (444 to 464) in 1996, with significantly higher scores in each subgroup of cases (table 2).

Scores for the quality of the necropsy report were above the minimum acceptable score in 54% of cases in 1993 (171/314) compared with 93% (289/312) in 1996, a highly significant increase ( $p < 0.0001$ ). The proportion with a quality score above the minimum acceptable level improved in stillbirths from 35% (46/133) in 1993 to 90% (104/116) in 1996 ( $p < 0.0001$ ); in non-SUDI cases from 62% (40/65) to 97% (73/75) ( $p < 0.0001$ ); and in SUDI cases from 32% (10/31) to 91% (21/23) ( $p < 0.0001$ ). The proportion of 20–23 week fetal deaths with a score above the minimum acceptable level was similar in 1993 (88%) and 1996 (93%).

The quality score for necropsy reports from both non-regional pathology and regional paediatric pathology services improved between 1993 and 1996. The score for the non-regional necropsy reports increased significantly from 228 (210 to 246) in 1993 to 349 (327 to 371) in 1996, and the proportion of scores above the minimum acceptable level improved from 28% (51/183) to 69% (52/75) ( $p < 0.0001$ ). Similarly, for regional cases the score increased from 414 (399 to 430) in 1993 to 487 (481 to 494) in 1996, with the proportion above the minimum acceptable score improving from 92% (120/131) to 100% (237/237) ( $p < 0.0001$ ).

Changes also occurred in the provision of necropsy services in individual hospitals. In

Table 2 Quality of perinatal and infant necropsy examinations in 1993 and 1996

Category	1993			1996		
	n	Mean score (95% CI)	No of necropsies above MAS	n	Mean score (95% CI)	No of necropsies above MAS
Overall	314	306 (289 to 322)	171 (54%)	312	454 (444 to 464)	289 (93%)
20–23 week fetal deaths	85	419 (397 to 440)	75 (88%)	98	485 (473 to 498)	91 (93%)
Stillbirths	133	263 (237 to 288)	46 (35%)	116	454 (437 to 474)	104 (90%)
Non-SUDI	65	264 (240 to 289)	40 (62%)	75	413 (392 to 433)	73 (97%)
SUDI	31	265 (213 to 315)	10 (32%)	23	460 (421 to 499)	21 (91%)
Regional necropsy	131	414 (399 to 430)	120 (92%)	237	487 (481 to 494)	237 (100%)
Non-regional necropsy	183	228 (210 to 246)	51 (28%)	75	349 (327 to 371)	52 (69%)

CI, confidence interval; MAS, minimum acceptable score; SUDI, sudden unexpected death in infancy.

Table 3 Quality of perinatal and infant necropsy examinations in 1993 and 1996 according to the hospital of death

Hospital of death	1993		1996		Differences in score	
	Regionally performed necropsy (%)	Mean score	Regionally performed necropsy (%)	Mean score	Mean	95% CI
A	21	184	92	507	323	275 to 371
B	42	203	100	507	304	280 to 328
C	22	211	100	505	294	253 to 335
D	100	344	100	500	156	134 to 178
E	56	370	100	500	130	106 to 154
F	27	292	100	492	200	182 to 218
G	40	202	100	478	276	220 to 332
H	97	323	100	463	140	122 to 158
I	13	170	89	453	283	228 to 338
J	44	270	75	447	177	151 to 203
K	38	265	37	424	159	123 to 195
L	33	259	60	419	160	111 to 209
M	0	237	17	418	181	128 to 234
N	0	228	40	406	178	77 to 279
O	0	230	33	393	163	-86 to 412
P	0	165	13	344	179	153 to 205

CI, confidence interval.

1993, only three of 16 hospitals were using the regional paediatric pathology services for 50% or more necropsy examinations compared with 11/16 in 1996 (table 3). This change was reflected in an improvement in the quality score in all hospitals dealing with fetal and infant deaths.

### Discussion

The quality of perinatal and infant necropsy examinations in Wales has improved significantly in recent years. In 1993 the standard of necropsies in stillbirths and infant deaths was poor, although the quality of examinations in late fetal losses (20–23 weeks' gestation), most of which were done in a regional paediatric pathology centre, was satisfactory.<sup>8</sup> By contrast, good quality necropsies were performed on 90% or more stillbirths and infant deaths in 1996, and the standard of the examination on late fetal losses was also better. Improvement was most pronounced for necropsies in SUDI, a particularly important change since a thorough and detailed necropsy examination is, by definition, mandatory for the diagnosis of sudden infant death syndrome. This coincided with an increased use of the regional paediatric pathology services from 18% to 65%, although the recommendation in the Clothier report—that a paediatric pathologist should be involved in the investigation of all such deaths—was not achieved.<sup>7</sup> Further, although these results are very encouraging, they should not be regarded as fully satisfactory, as SUDI necropsy examinations should be very detailed and always include body measurements, external and internal examinations, weight of all major organs, histology of all organs, bacteriology, and x ray skeletal survey. Using these more stringent criteria, 30% of cases (including 7% of cases done in a regional centre and 75% in non-regional centres) would have been unacceptable.

The previous poor quality of necropsy examinations and falling necropsy rates were perceived to reflect the low priority given to the investigation.<sup>1 8 15</sup> This was shown to be inappropriate by the demonstration that clinically important information is more likely to emerge from a good quality necropsy.<sup>1 8</sup> At the same

time, guidelines for reporting necropsy findings were published, and the use of specialist perinatal pathology services encouraged, particularly for complex cases.<sup>6–8 12</sup> Dissemination of these findings resulted in a sharp increase in the use of centralised services in Wales, from 39% of necropsies in 1993 to 76% in 1996. It may also have halted or maybe reversed the declining necropsy rate.

The higher standard of necropsy examinations in Wales was not only due to a centralisation of paediatric pathology services; the quality of investigations improved regardless of where they were performed. In non-regional centres, 69% of necropsies were of a good standard in 1996, compared with only 28% in 1993, and a smaller but significant improvement was also evident in regional centres, from 92% being of good quality in 1993 to 100% in 1996. We speculate that this was the result of an increased use of the Royal College of Pathologists guidelines, and a higher priority being given to perinatal and infant necropsies.

### CONCLUSION

Significant improvements in the quality of perinatal and infant necropsy examinations correlate with an increased use of specialist paediatric pathology services. Moreover, the standard of necropsies in general is improved by highlighting the importance of the investigation. Nevertheless, we have used minimum standard to assess the quality of perinatal and infant necropsies, and the data are reported anonymously. Further improvement requires the identification of individual poor performers to allow remedial action to be taken.

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