Value of the necropsy in perioperative deaths

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Abstract

A series of 213 perioperative deaths was studied out of a total of 1451 consecutive necropsies carried out over three years. Discrepancies between the clinical and the necropsy diagnosis were assessed under four classes of discrepant diagnosis: class I, patient survival affected, treatable; class II, patient survival affected but not treatable; class III, correlated to cause of death but treatable; and class IV, incidental diagnosis which could not have been made before death. Major discrepancies of classes I and II were found in 44 (21%) and 62 (29%) cases, respectively. Minor discrepancies of classes III and IV were found in 63 (30%) and 101 (47%) cases, respectively. No discrepancies were found in 50 (23.5%) cases. These results confirm the continuing value of the necropsy in the assessment of perioperative deaths.

A specialised form of clinical audit is currently being introduced in the United Kingdom in the form of a national Confidential Enquiry into Perioperative Deaths. This enquiry, coordinated jointly by the Royal Colleges of Surgeons and of Anaesthetists, will consider aspects of deaths occurring within the 30 days following any surgical operation in an attempt to identify and eliminate avoidable factors. The pilot study, known generally as the CEPOD,¹ placed little emphasis on the necropsy. This reflects a worldwide decline in the hospital post-mortem examination, despite its acknowledged importance.

Although general studies of hospital necropsies have repeatedly shown important rates of discrepancy between clinical diagnosis and necropsy findings, we are not aware of any studies which have looked specifically at the contribution of the necropsy in cases of perioperative death, as defined by the CEPOD. This study examines a series of such cases, with particular reference to the discrepancies between clinical and necropsy diagnoses.

It might reasonably be argued that in this group there would be a lower than average rate

of diagnostic discrepancies, in view of the more detailed clinical information available from the preoperative work-up and from the direct inspection of tissues provided by the surgical procedure itself. This, however, was not the case.

Methods

The records of all necropsies performed during 1986-88 by the pathology staff of the Royal Victoria Hospital in Belfast were examined retrospectively. Patients who had died in hospital during surgery or within 30 days following a surgical operation and who subsequently came to necropsy were included in the study. The age and sex distribution of these patients was determined and the types of surgery categorised. The clinical records of each case were examined and a comparison was made between the final clinical diagnosis (the diagnosis made by the clinicians involved in the case) and the necropsy findings. A distinction was made between a diagnosis made in life but not confirmed at necropsy (false positive clinical diagnosis) and a diagnosis not considered clinically but made at necropsy (false negative clinical diagnosis). Discrepancies were classified as major or minor, depending on their perceived importance. Major discrepancies were subdivided further into classes I and II, and minor discrepancies into classes III and IV, using the criteria of Hill and Anderson (table 1).²

Results

From a total of 5983 hospital deaths, 1451 necropsies were carried out at the mortuaries of the Royal Victoria Hospital, the Mater Infirmorum Hospital, and the Ulster Hospital. This figure includes hospital necropsies, hospital coroners' cases, and forensic necropsies carried out by the Northern Ireland State Pathologist's Service. All non-forensic cases were undertaken by staff of the Department of Pathology based at the Royal Victoria Hospital, Belfast. Forensic cases carried out at these mortuaries in the period of study totalled 240 (16.5% of cases necropsied).

Table 1 Criteria for inclusion of discrepancies between diagnoses before and after death in classes I-IV

Major discrepancies	Class I	Discrepant diagnosis which affected patient survival and which could have been treated
	Class II	Discrepant diagnosis which affected patient survival but which could not have been treated
Minor discrepancies	Class III	Discrepant diagnosis which was not related to the cause of death but which could have been treated
	Class IV	Incidental diagnosis which could not have been made before death

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Table 2 Age and sex distribution of necropsied perioperative deaths

Age (years)	No of cases	Male: Female
0-9	31*	20:11
10-19	21	18:3
20-29	20	16:4
30-39	15	11:4
40-49	19	12:7
50-59	27	14:13
60-69	43	23:20
70-79	27	12:15
80-89	10	3:7

*(19 cases were less than 1 year old).

Out of the total of 1451 necropsies, 213 (14.7%) were cases of perioperative death as defined by the CEPOD. Table 2 shows the age and sex distribution of necropsied cases of perioperative death. Table 3 shows the types of surgical procedure carried out in these cases. Cases in which more than one procedure was carried out are included in the figures. This table also includes a breakdown of cases into emergency and elective surgical procedures. For the purposes of this study an emergency surgical procedure was defined as one which could not be delayed by more than 24 hours because of the urgency of the clinical situation, or one which was carried out within 24 hours of admission on a patient admitted as an emergency case.

The numbers of cases which had one or more diagnostic discrepancies are shown in table 4. Many patients had discrepancies of more than one class, the classes not being mutually exclusive. This table also shows these figures as a percentage of the total number of necropsied perioperative deaths. The ratio of false positive to false negative diagnostic discrepancies was 1:3.7 overall.

Examples of class I discrepancies included an unsuspected deep vein thrombosis with fatal pulmonary emboli; unsuspected anastomotic breakdown following hemicolectomy for an obstructing carcinoma at the hepatic flexure; and an unsuspected empyema of the gall bladder which was not found at laparotomy for intestinal obstruction.

Class II discrepancies included unsuspected pancreatitis in a patient with a severe head injury and an unsuspected ruptured aortic aneurysm in an elderly man with terminal bronchopneumonia following internal fixation of a fractured neck of femur.

Table 3 Distribution of necropsied perioperative deaths according to type of surgery performed and whether an elective or an emergency procedure

Type of surgery	Number of cases	Elective: Emergency
Neurosurgery	65	11:54
Exploratory laparotomy	51	6:45
Cardiac surgery	34	25:9
Fracture surgery	21	8:13
Thoracic surgery	16	8:8
Vascular surgery	9	1:8
Colorectal surgery	5	5:0
Plastic and burns surgery	6	6:0
Gynaecological surgery	2	2:0
Caesarean section	2	1:1
Below knee amputation	1	1:0
Lumbar sympathectomy	1	1:0
Open prostatectomy	1	1:0
Removal of cataract	1	1:0
Stripping of varicose veins	1	1:0
Dental	1	1:0

Table 4 Number and percentage of cases with discrepancies of each class between diagnoses before and after death in 213 perioperative deaths

	Class	No (%)
Major discrepancies	Class I	44 (20.6)
	Class II	62 (29.1)
Minor discrepancies	Class III	63 (29.6)
	Class IV	101 (47.4)
No discrepancies		50 (23.5)

Numerous examples were found of additional disease which would have ultimately affected survival (class III). These included unsuspected bronchogenic and rectal tumours, along with less common conditions such as neuroendocrine tumours with metastases and a parathyroid carcinoma. Class IV findings were also common and included many unsuspected benign lesions which would have produced no clinical symptoms.

Discussion

In a recent study of deaths occurring in a major Belfast teaching hospital,³ one of the three hospitals under scrutiny in the present investigation, a post mortem examination was performed in only 35% of cases of perioperative death, as defined in the CEPOD report. The necropsy rate in perioperative cases was greater than that for non-perioperative surgical patients and for medical patients, due to an excess of coroners' cases in the perioperative group. The coroner's necropsy is commonly called for in Northern Ireland in cases when death occurs within 24 hours of a surgical operation. These figures suggested that no particular emphasis was being placed on the hospital necropsy in such cases. This was also evident from the CEPOD pilot study, which made only a passing reference to necropsies in surgical audit and which did not attempt to evaluate the contribution of those necropsies which were undertaken in the course of the study.

A large number of general studies of the hospital necropsy have shown a substantial incidence of diagnostic discrepancies. In a retrospective study of 2145 consecutive necropsies Stevanovic *et al* found that the overall rate of major discrepancies between clinical and necropsy diagnosis was 29%.⁴ They concluded that this figure was sufficiently large to warrant continued emphasis on the necropsy. Cameron *et al* found that 15% of main diagnoses and 42% of causes of death suspected clinically were not confirmed at necropsy.⁵ Of main diagnoses felt to be "definite" clinically, 10% were not confirmed. Hill and Anderson recently reviewed a series of studies looking at the accuracy of diagnosis before death and found that the percentages of cases with discrepancies which might have had a major impact on patient survival ranged from 4% to 18.7%.² Battle *et al* found that 13% of cases had discrepancies.⁶ Within this group 20.6% showed major diagnoses which had been missed with a possible adverse impact on survival.

None of these previous investigations looked specifically at perioperative deaths. For this reason, our present study was designed to determine the current role of the necropsy in perioperative cases dying in a major teaching hospital. It might reasonably be argued that this group would show a lower than average rate of diagnostic discrepancies in view of the more detailed clinical information available from the preoperative work-up and from the direct inspection of tissues provided by the surgical procedure itself. This, however, was not the case.

The present study shows that in 20.6% of perioperative deaths there was a major discrepancy of diagnosis with a potential impact on patient survival. Twenty nine percent of cases had an unsuspected or incorrect diagnosis, which, although not treatable, contributed to death. A similar percentage had one or more unsuspected or unconfirmed secondary diagnoses. Finally, 47% of cases had incidental findings not clinically suspected. In 23.5% of perioperative cases there were no discrepancies found between diagnoses before and after death.

These figures of diagnostic accuracy correspond broadly to those determined by other studies and show that it cannot be assumed that in cases of perioperative death access to preoperative investigations and direct organ inspection at surgery obviates the need for necropsy. On a similar theme it is interesting that Goldman *et al* studied the necropsy in three medical eras and showed that the advent of modern imaging techniques had not reduced the incidence of unexpected necropsy findings.⁷

With regard to the types of surgery undertaken in this series, a large proportion of our cases were neurosurgical procedures and exploratory laparotomies, with a preponderance of emergency operations. These were mostly young people involved in road traffic accidents who sustained severe head and abdominal injuries. This is reflected in the high proportion of perioperative deaths in young men. Our figures may differ in terms of patient mix and types of procedures undertaken from the pattern of a district general hospital, as the regional centres for neurosurgery and cardiac surgery are based at one of the hospitals

included in this study. A large proportion of the cardiac surgery cases fall into the elective surgery category by our definition, because they involve infants with severe congenital heart defects referred to the regional centre. This accounts for many of the 19 cases who were less than 1 year old.

In this study 51% of necropsied perioperative deaths occurred within the first three days after operation. Since we previously showed an overall necropsy rate of only 35% in perioperative cases,³ this distribution may not be representative of perioperative deaths as a whole. There will undoubtedly be a group discharged from hospital after operation and dying at home, who do not fall within the CEPOD definition of perioperative death and who will not be necropsied. Moreover, it may well be that cases dying in hospital later in the perioperative period have necropsies performed less frequently than those dying within three days of operation, when the coroner is more likely to become involved. Further study is necessary to determine possible variations in the necropsy rate throughout the 30 day perioperative period, although the cumulative percentage of cases against time of death in the present series did not seem to differ considerably from the experience of CEPOD.¹

In summary, this investigation has confirmed the frequent occurrence of discrepancies between clinical and necropsy diagnosis in cases of perioperative death. This reaffirms the value of the necropsy in the audit of current perioperative patient care.

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