CLINICAL DATA

Recommendations

There are national agreed standards for anaesthetic monitoring. The absence of an essential anaesthetic monitor constitutes an unacceptable clinical risk that must be the subject of audit [13].

It is inappropriate for an SHO to anaesthetise an ASA 5 patient.

When operations are performed by the surgeon without the presence of an anaesthetist, the existing guidelines on patient monitoring, observation and record keeping should be followed.

Postoperative deaths should be the subject of anaesthetic and surgical review.

INTRODUCTION

This section of the report reviews selected data from the anaesthetic and combined surgical specialties. The full data from the anaesthetic and surgical questionnaires can be obtained from the NCEPOD website **www.ncepod.org.uk** or as a separate document on application to NCEPOD. The sample was from patients who died between 1 April 2000 and 31 March 2001 and comprised the first postoperative death reported for each consultant surgeon or gynaecologist, on the day of operation or within the next three calendar days. The report analysing the data of 1999/00 [2] sampled 10% of deaths within 30 days of an operation and the report for 1994/95 [3] reviewed deaths on or before the third postoperative day; comparisons will be made with those reports where appropriate.

COMPLETION OF QUESTIONNAIRES

A total of 2114 surgical questionnaires and 1911 anaesthetic questionnaires were analysed. NCEPOD is grateful to all clinicians that support this Enquiry. The consultant surgeon in charge of the case completed 1633/2114 (77%) of questionnaires and a member of the surgical team completed 400/2114 questionnaires, of which 344/2114 (16%) were reviewed by the consultant before their return to NCEPOD. Therefore, there was consultant surgical involvement with 94% of questionnaires.
An anaesthetist involved with the case completed the questionnaire in 1321/1911 (69%) of cases.
The proxy anaesthetists who completed the questionnaire, but were not directly involved with the case, are presented in Table 2.1. A duty consultant completed the majority of these, usually because he/she was the supervisor when a trainee was the senior anaesthetist present during the operation. Anaesthetists without any involvement in the case, and hence with no personal knowledge of it, completed a further 13%. NCEPOD is indebted to all proxy anaesthetists for their contribution. A consultant anaesthetist either completed or reviewed the questionnaire in 94% of cases.

Table 2.1	Anaesthetists who completed the questionnaire but were not directly involved with the case
Chairman of division	22
College tutor	73
Duty consultant	341
Other consultant	141
Trainee	10
NCCG	3
Total	**590**

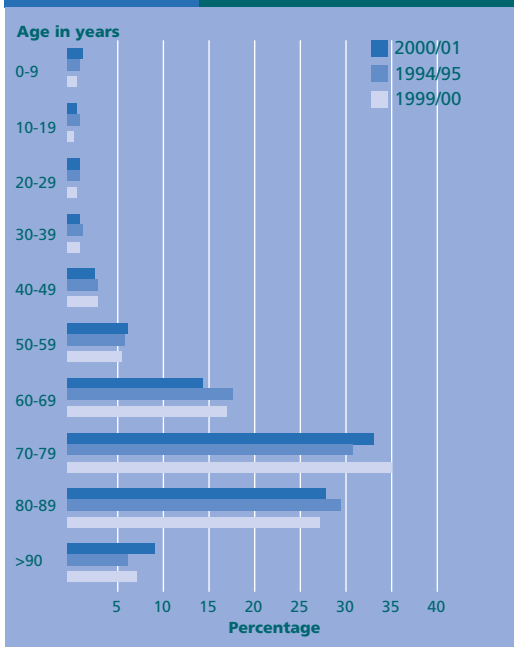
When non-consultant anaesthetists or surgeons complete a NCEPOD questionnaire, the supervising consultant should review the case notes and questionnaire.

PATIENT PROFILE

Age and sex

The age profile of patients in this sample is similar to that of the 1994/95 sample (3 day deaths) and 1999/00 sample (10% of 30 day deaths). Figure 2.1 shows the age profile of the patient at the time of the operation. 71% of the patients were 70 years of age or older. 51% of patients were male.

Fig 2.1 The age of the patient at the time of the operation

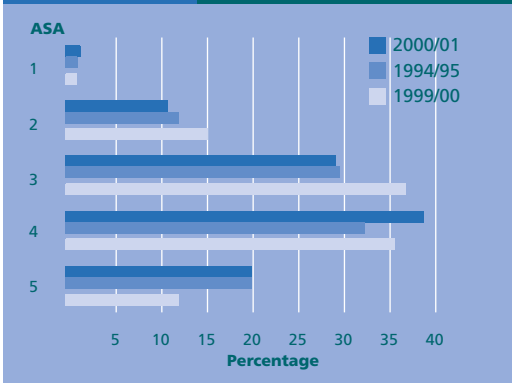


Preoperative status

Disorders of the cardiovascular system were the most common comorbidities in the sample.

The physical status of patients, as reported in the anaesthetic questionnaire, is presented in Figure 2.2. Compared with the sample of 1999/00 (10% of 30 day deaths) there is a trend for patients who die on or before postoperative day 3 (samples of 2000/01 and 1994/95) to be of a poorer physical status. There was a smaller percentage of ASA 2 and 3 (40% vs. 51%), and a larger percentage of ASA 5 (20% vs. 12%) patients.

Fig 2.2 The ASA of patients



From the anaesthetic questionnaires, 96% of patients had one or more co-existing medical problems at the time of their operation. The systems involved are presented in Table 2.2.

Table 2.2	Co-existing medical problems at the time of the final operation *(answers may be multiple n=1911)*
None	3%
Cardiovascular	76%
Respiratory	56%
Neurological	37%
Alimentary	25%
Renal	21%
Sepsis	20%
Endocrine	17%
Musculoskeletal	13%
Haematological	11%
Hepatic	6%
Other	11%
Not answered	1%

The reporting of renal disorders, which NCEPOD had thought previously to be under recognised [2], has increased; 21% compared with 16% in 1999/00.

A table of common diseases is presented in Table 2.3.

Table 2.3	Common co-existing diseases *(answers may be multiple n=1911)*
Ischaemic heart disease	37%
Hypertension	31%
Chronic cardiac failure	20%
Atrial fibrillation	18%
COPD	15%
CVA or TIAs	13%
Diabetes mellitus	12%
Peripheral vascular disease	12%
Active chest infection	10%

There was a lower incidence of myocardial ischaemia in this sample of deaths on or before postoperative day 3, compared to deaths within 30 days of operation.

In this sample (3 day deaths) 37% of patients had ischaemic heart disease at the time of their operation, compared with 60% in 1999/00 (10% of 30 day deaths). One reason for the lower incidence of myocardial ischaemia may be the different sampling technique. It may be that this sample contained a greater number of patients whose death was related primarily to their surgical condition or some unanticipated cause (e.g. ruptured abdominal aortic aneurysm, acute abdominal catastrophe or PE). However, in a sample of deaths within 30 days of an operation, later postoperative deaths are more likely to be associated with the patient's underlying medical condition, and that includes myocardial ischaemia.

There was a high incidence of atrial fibrillation when compared to that expected in the general population.

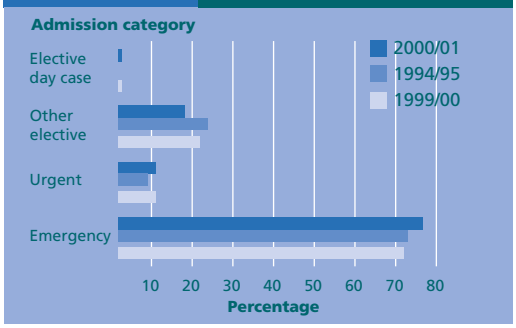
There is a 10% incidence of atrial fibrillation in the non-surgical population over the age of 70 [14]. However, the incidence of atrial fibrillation and of other types of arrhythmia in this sample was higher. Often the arrhythmia was of recent onset and precipitated by an acute medical disorder such as myocardial ischaemia, chest infection or sepsis. In these conditions arrhythmia may be a marker of the severity of the systemic illness.

ADMISSION AND OPERATION

Admission

The admission categories of the patients are presented in Figure 2.3. The pattern of admissions is similar for patients who died on or before postoperative day 3 (sample 2000/01 and 1994/95) and the sample of 10% of deaths (1999/00).

Fig 2.3 Admission category*



*In 1994/95 the elective category comprised both elective day case and inpatients.

In this sample, 36% of patients were admitted via an A&E department, 26% were referred by their general medical or dental practitioner, 14% were transferred as an inpatient from another hospital and 13% were admitted following a previous outpatient consultation.

For the patients transferred as inpatients from other hospitals, the types of referring hospitals are presented in Table 2.4.

Table 2.4	Patients transferred from another hospital
District general hospital	200
University teaching hospital	35
Limited surgical specialties	14
Community	32
Independent	5
Psychiatric	2
Overseas	4
Not answered	3
Total	**295**

Most patients in this sample were admitted directly to the surgical specialty that undertook the operation but 31% were referred from another specialty. The source of intra-hospital referral to the final surgical team is presented in Table 2.5.

Table 2.5	The source of intra-hospital referral to the surgical team
Medical specialty	402
Same surgical specialty	123
Another surgical specialty	118
ICU	10
Not answered	6
Psychiatry	1
Total	**660**

Of note, almost one-fifth of all patients (19%) were admitted to a medical specialty within the admitting hospital before referral to a surgeon.

Operation

The surgical specialties of the operation are presented in Table 2.6.

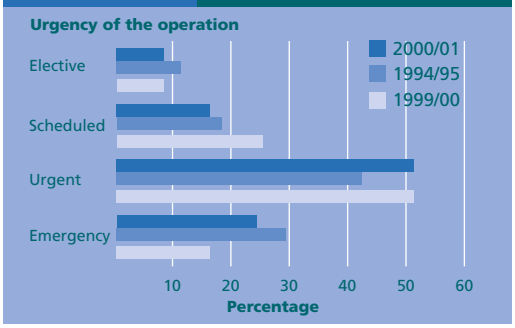
Table 2.6	Surgical specialty of the operation	
	2000/01	1994/95
General surgery	808 (38%)	35%
Orthopaedic	562 (27%)	23%
Vascular	236 (11%)	17%
Cardiothoracic	123 (6%)	6%
Urology	12 (6%)	6%
Neurosurgery	83 (4%)	4%
Paediatric*	48 (2%)	
Gynaecology	45 (2%)	5%
Otorhinolaryngology	44 (2%)	1%
Plastic surgery	19 (<1%)	1%
Ophthalmology	16 (<1%)	1%
Oral/maxillofacial	9 (<1%)	<1%
Total	**2144**	

*Paediatric surgery was not analysed as a separate specialty in 1994/95, 1.7% of patients in 1994/95 were aged 0 to 10 years and 1% were aged 11 to 20 years.

As this sample is made up of the first death on or before postoperative day 3 reported by each surgeon or gynaecologist, the proportion of deaths in each specialty will to some extent reflect the number of consultants in that specialty. The distribution of cases between the specialties in the two samples 1994/95 and 2000/01 is the same.

The urgency of the final operation according to the surgical questionnaires is presented in Figure 2.4 and the anticipated risk in relation to the operation is presented in Table 2.7.

Fig 2.4 Urgency of the final operation



A greater percentage of patients who died on or before postoperative day 3 (2000/01 and 1994/95) underwent an emergency operation compared with 10% of 30 day deaths (1999/00) (26.5% vs. 16%). In contrast, fewer underwent a scheduled operation in 2000/01 and 1994/95 compared with the sample of 1999/00 (17% vs. 25%). In this sample, when compared with 1994/95, the percentage where death was expected was greater (15% vs. 9%) (Table 2.7).

Table 2.7 The anticipated risk of death related to the proposed operation

	2000/01	1994/95	1999/00
Not expected	12%	13%	15%
Small but significant risk	17%	18%	22%
Definite risk	53%	60%	54%
Expected	15%	9%	8%

Delays to operation

8% of operations were delayed for non-clinical reasons.

From the anaesthetic questionnaires, 28% (527/1911) of patients had their operation delayed in order to improve their physical state, compared with 22% of the sample of 1999/00 (10% of 30 day deaths). The systems that needed attention are presented in Table 2.8.

Table 2.8 System(s) needing attention before operation as a percentage of those delayed for medical reasons *(answers may be multiple n=1911)*

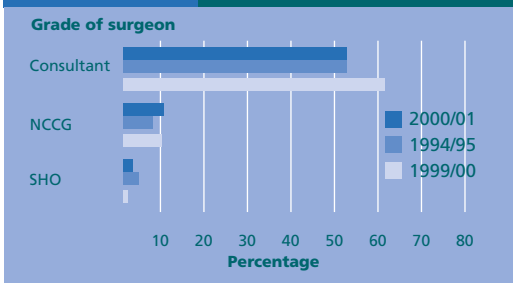
Cardiac	56%
Metabolic	41%
Respiratory	31%
Haematological	26%
Other	4%

From the surgical questionnaire, 8% of patients had their operation delayed for reasons other than clinical, mostly due to limited operating theatre availability.

STAFFING

The grade of the most senior operating surgeon is presented in Figure 2.5 and the grade of the most senior anaesthetist is presented in Figure 2.6.

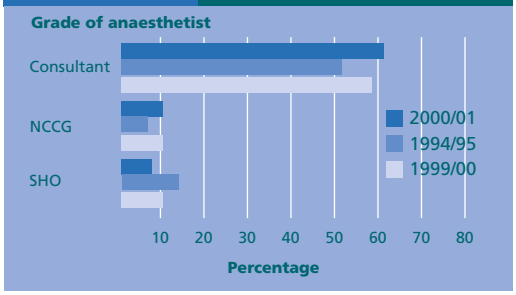
Fig 2.5 **Grade of most senior operating surgeon***



* Analysis in 1994/95 excluded 27/1366 operations that were undertaken in independent hospitals. Comparisons of the registrar grades cannot be made with the sample of 1994/95 because of the changes following the introduction of Calman training. In this sample a SpR was the most senior operating surgeon in 27% of cases.

Despite the patients who died on or before postoperative day 3 being of poor physical status, the most senior operating surgeon was a consultant in only 54% of cases and has not changed since 1994/95. The percentage where the most senior operating surgeon was an SHO was 2% in 2000/01 and 4% in 1994/95. A consultant surgeon was involved in the decision to operate in 87% of cases.

Fig 2.6 **Grade of most senior anaesthetist***



* Comparisons of the registrar grades cannot be made with the sample of 1994/95 because of the changes following the introduction of Calman training. In this sample a SpR was the most senior anaesthetist in 20% of cases.

In this sample the most senior anaesthetist was a consultant for 61% of cases, compared with 52% in 1994/95 (3 day deaths), and the most senior anaesthetist was an SHO for 7% compared with 13% in 1994/95.

The halving of the proportion of cases in which the senior operating surgeon was an SHO, and in which the anaesthetist was a SHO, between 1994/95 and 2000/01, indicates that now, care of the sickest patients is more likely to be by more experienced medical personnel.

The qualifications of the most senior operating surgeon and anaesthetist were analysed. 1% (25/2114) of operating surgeons held no higher diploma in surgery and 6% (110/1911) of anaesthetists held no higher diploma in anaesthesia. The fellowship of their college was held by 76% (1597/2114) of operating surgeons and 78% (1488/1911) of anaesthetists.

14% (301/2114) of patients were graded ASA 5 on the surgical questionnaire and 20% (383/1911) of patients were graded ASA 5 on the anaesthetic questionnaire. The grade of the senior operating surgeon and anaesthetist in theatre for these patients is presented in Table 2.9; mainly they were of appropriate experience.

Table 2.9 **The grade of the most senior operating surgeon and anaesthetist for ASA 5 patients**

	Surgeon	Anaesthetist
Consultant	230 (76%)	272 (71%)
NCCG	9	10
SpR>year3	50	81
SpR1/2	6	11
SHO	0	7
LAT/LAS	3	0
Not answered	3	2
Total	**301**	**383**

The operations of the seven ASA 5 patients that were managed by an SHO anaesthetist were: laparotomy (4), insertion of a Sengstaken tube for bleeding oesophageal varicies (1), salvage thoracotomy following trauma (a consultant then joined the anaesthetist in theatre) (1) and a femoral embolectomy (1). Except in exceptional circumstances, it is inappropriate for a SHO to anaesthetise an ASA 5 patient.

ANAESTHESIA AND OPERATIVE MONITORING

Anaesthesia

There was a trend towards increasing use of regional techniques, and towards use of higher epidural analgesia.

The type of anaesthesia used is presented in Table 2.10 and compared with those in 1994/95 (deaths on or before postoperative day 3). There appears a trend for an increase in anaesthetics where a regional technique is used.

Table 2.10	The type of anaesthesia used	
	2000/01	1994/95
General alone	1260 (66%)	77%
General and regional	351 (18%)	11%
Regional alone	89 (5%)	5%
Regional and sedation	120 (6%)	4%
General and local infiltration	56 (3%)	3%
Sedation and local infiltration	13 (1%)	<1%
Sedation alone	7 (<1%)	<1%
Local infiltration alone	8 (<1%)	0%
Not answered/not known	7 (<1%)	<1%
Total	**1911**	

The types of regional techniques used are presented in Table 2.11 and are compared with those in 1994/95.

Table 2.11	If anaesthesia included a regional technique, which method was used *(answers may be multiple n=560)*	
	2000/01	1994/95
Epidural - thoracic	130 (23%)	14%
- lumbar	67 (12%)	22%
- caudal	3 (<1%)	2%
Spinal (subarachnoid)	213 (38%)	42%
Combined spinal/ epidural	11 (2%)	0%
Plexus block (e.g. 3 in 1 block)	108 (19%)	12%
Cranial or peripheral nerve block	34 (6%)	7%
Intravenous regional	2 (<1%)	0%
Surface (e.g. for bronchoscopy)	1 (<1%)	0%

There is a trend towards an increase in the use of thoracic epidural analgesia, and a corresponding decrease in the use of lumbar epidural analgesia. For 2000/01, 126 of the thoracic epidurals were performed for abdominal operations and four for thoracic operations. Of the lumbar epidural procedures, 41 were for abdominal operations and 26 for lower limb operations. Similar data for 1994/95 is not available. NCEPOD again cautions that heavy-handed use of epidural local anaesthetic, particularly for patients with sepsis, can cause operative hypotension [2]. It is likely that the trend towards using a higher spinal block will predispose also to greater sympathetic block and haemodynamic compromise.

Operative monitoring

The patient's temperature was not always monitored when active warming devices were being used.

The monitoring devices used during the management of the anaesthetic are presented in Table 2.12 and the measures taken to maintain body temperature are presented in Table 2.13.

Table 2.12	Monitoring devices used during the management of the anaesthetic
ECG	1894 (99%)
Pulse oximeter	1897 (99%)
Indirect BP	1468 (77%)
Direct BP	929 (49%)
Expired CO_2 analyser	1702 (89%)
O_2 analyser	1714 (90%)
Peripheral nerve stimulator	324 (17%)
Temperature	653 (34%)
Urine output	1135 (59%)
CVP	922 (48%)
Pulmonary artery pressure	97 (5%)
Cardiac output	56 (3%)

Many of these patients were very sick and this is shown by the high usage of invasive monitoring. Should the pulmonary artery pressure and cardiac output have been measured more often?

Table 2.13	The measures taken to maintain body temperature
None	331 (17%)
IV fluid warmer	1022 (53%)
Warm air system	930 (49%)
Heated blanket under the patient	582 (30%)
Blankets/foil wraps	313 (16%)

It is evident that the patient's temperature was not monitored in all cases where active warming systems were used. It cannot be assumed that the use of active warming devices will fully compensate for temperature loss (hypothermia) during an operation, and their use does not obviate the need for temperature monitoring. Conversely, temperature monitoring is necessary to detect hyperthermia.

There was a lack of monitoring equipment in 18 cases and these included: anaesthetic agent monitor (9), inspired oxygen analyser (3), end tidal CO_2 monitor (2), ventilation volume and ventilation disconnect device (1) and an appropriate transport monitor for transfer between theatre and ICU (only NIBP and pulse oximetry available) (1). That these devices were not available contravenes the Association of Anaesthetists of Great Britain and Ireland recommendations for monitoring during anaesthesia [13]. They advise that *"If a monitoring device deemed essential is not available and anaesthesia continues without it, the anaesthetist must clearly state in the notes the reasons for proceeding without the device."* The absence of any essential monitor should be brought to the attention of the clinical director of anaesthesia and recorded via the clinical risk management system.

Operations under local anaesthesia or sedation provided by the surgeon

There were cases where operations were performed without the presence of an anaesthetist and monitoring devices were not used when indicated.

6% (123/2114) of operations were performed under local anaesthesia and/or sedation administered by the surgeon without an anaesthetist being present. The surgical specialty of the surgeon for these operations is presented in Table 2.14 and the monitoring devices used during these procedures is presented in Table 2.15.

Table 2.14	Surgical specialty for cases under local anaesthesia and/or sedation without an anaesthetist present
General	49
Urology	20
Vascular	13
Ophthalmology	9
Orthopaedic	9
Neurosurgery	5
Otorhinolaryngology	5
Gynaecology	4
Cardiothoracic	3
Plastic	3
Oral/maxillofacial	2
A&E	1
Total	**123**

Table 2.15	Monitoring devices used during operations solely under local anaesthesia or sedation administered by the surgeon *(answers may be multiple n=123)*
Pulse oximeter	77 (63%)
Blood pressure	60 (49%)
Pulse	73 (59%)
ECG	49 (40%)
None	26 (21%)

The use of sedation during an operation mandates an appropriate level of monitoring and in 2001 the Academy of Medical Royal Colleges reviewed the evidence on safe provision of sedation services [15]. They recommended *"Clinical and instrumental monitoring, to a degree relevant to the patient's medical status and the sedation method, should be used. In addition, one member of the care team must have a defined responsibility for patient observation and record keeping."* Existing guidelines have identified that pulse oximetry is a minimum monitoring requirement when a patient receives sedation, and that blood pressure and ECG may be essential in older patients, especially if there are any cardiovascular problems. There is a paucity of guidelines for monitoring patients whose operation is under local anaesthetic without sedation, but the patient's physical status is a consideration. There are guidelines for eye surgery that stipulate *"All patients having cataract surgery under local anaesthesia should be monitored with ECG and pulse oximetry by a member of the theatre staff dedicated to this task, who should be in constant contact with the patient throughout the procedure."*[16] and *"From prior to the administration of the LA to the end of the operation, continuous monitoring of ventilation and circulation by clinical observation and pulse oximetry is essential."*[17].

21% (26/123) of cases that had local anaesthesia and/or sedation administered by the operating surgeon had no monitoring devices attached. Unfortunately, NCEPOD cannot identify how many of these cases involved sedation, so should at least have had pulse oximetry, and how many were performed under local anaesthesia alone. The operations are presented in Table 2.16.

17 patients were ASA 4, so for those some form of monitoring device, pulse oximetry or ECG, was likely to have been indicated.

Three questionnaires stated that no resuscitation facilities, including airway management, were immediately available. These cases were: a Denham pin for an ASA 5 patient in ICU (resuscitation facilities were likely to have been available) and pleural aspiration for two ASA 4 patients. A patient may experience an adverse reaction or require sedation during any surgical procedure under local anaesthesia, and resuscitation equipment should always be immediately available, no matter where the procedure is undertaken.

Table 2.16	Cases where no anaesthetist was involved and no monitoring used	
Specialty (total no.)	**No.**	**Operation**
General (6)	4	Paracentesis
	1	Dilatation of PEG track, insertion of tube
	1	Percutaneous drainage of abdominal abscess
Maxillofacial (2)	1	Excision and graft of cheek lesion
	1	Suture of forehead laceration
Ophthalmology (2)	1	Laser photocoagulation of the retina
	1	Weiss procedure of the lower eyelid
Orthopaedic (3)	1	Debridement of wounds and closure
	1	Excision of a sebaceous cyst
	1	Denham pin
Otorhinolaryngology(2)	1	Nasal packing
	1	Tracheostomy
Thoracic (3)	3	Pleural aspiration
Urology (8)	4	Flexible cystoscopy
	2	Suprapubic catheter
	1	Nephrostomy
	1	Prostate biopsy
Total	**26**	

POSTOPERATIVE CARE AND CAUSE OF DEATH

6% of cases could not be transferred to a critical care facility when clinically indicated.

The destination of the patient after the operation, as recorded in the anaesthetic questionnaires, is presented in Table 2.17, and compared with the sample of 1994/95.

Table 2.17	The destination of the patient after the operation	
	2000/01	1994/95
ICU	679 (36%)	33%
HDU	131 (7%)	3%
Ward	795 (42%)	46%
Died in theatre	208 (11%)	12%
Died in recovery	74 (4%)	4%
CCU*	5 (<1%)	
Another hospital	2 (<1%)	1%
Other/not answered	17 (1%)	1%
Total	**1911**	

*Not recorded in 1994/95 .

This sample shows a trend towards increasing use of critical care facilities compared with 1994/95, nevertheless 42% of patients who died within three days of their operation returned directly to the general ward. 6% of cases could not be transferred to an ICU, HDU or other specialised nursing area when clinically indicated, mainly because there were no beds available. The systems implicated in the cause of death are presented in Table 2.18 and illustrate a prevalence of cardiac, respiratory, renal and septic disorders.

Table 2.18	Systems implicated in the cause of death *(answers may be multiple n=1911)*	
Cardiac	1133	(59%)
Respiratory	664	(35%)
Renal	418	(22%)
Septicaemia	403	(21%)
Haematological (including coagulopathy/ blood loss)	226	(12%)
Gastrointestinal tract	212	(11%)
Metabolic	189	(10%)
Progress of surgical condition	173	(9%)
Central nervous system	158	(8%)
Hepatic	63	(6%)

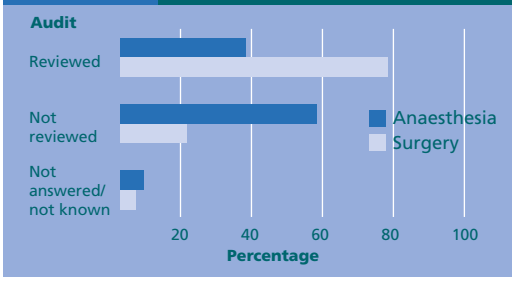
AUDIT

57% of deaths were not reviewed by anaesthetists and 19% not reviewed by surgeons.

6% of patients died in hospitals where no anaesthetic morbidity/mortality review meetings take place and 2% died in hospitals without surgical audit meetings. Morbidity/mortality review meetings should be conducted in all hospitals and by both surgeons and anaesthetists. There should be multidisciplinary review meetings whenever appropriate.

The percentage of all cases that were discussed in surgical and anaesthetic morbidity/mortality review meetings is presented in Figure 2.7.

Fig 2.7 **Percentage of cases that were discussed at morbidity/ mortality meetings**



It is unacceptable that anaesthetists did not review 57% of deaths and the surgeons did not review 19% of deaths. Problems in the delivery of patient care locally are difficult to detect without formal review of the care of critically ill patients.