GENERAL INFORMATION ABOUT ANAESTHESIA & SURGERY

INTRODUCTION

Key points

- Eighty-three percent of surgical questionnaires and 64% of anaesthetic questionnaires were reviewed by a consultant involved with the case.
- One percent of patients who died were admitted for an elective day case operation. This small number compared to the total number of day case operations within the UK, suggests that overall there is appropriate patient selection and assessment for elective day case operations.
- A consultant or associate specialist surgeon was consulted before operation in 93% of cases. However, senior anaesthetic involvement was poor and a consultant or associate specialist anaesthetist was involved in some way in only 77% of cases.
- Some hospitals deny HDU facilities to selected patient groups.
- Six percent of patients had their operations delayed for non-medical reasons, mainly because of limited operating theatre availability or unavailability of an ICU or HDU bed.
- Where a pre-registration house officer obtained consent for the operation, 72% of the patients were ASA 3 or poorer.
- CVP monitoring was used in 44% of the patients. Peer review suggested that a further 13% might have benefited from invasive monitoring before, during or after the operation.
- Up to 16% of this sample had an indication for ICU or HDU care but did not receive it.
- The value of postmortem examinations for education and audit is poorly recognised.
- Anaesthetic departments did not review 70% of deaths. It would appear that many anaesthetic departments do not understand that a review of deaths can detect both organisational and clinical problems locally.
- That gynaecologists did not discuss 79% of their deaths is particularly poor.

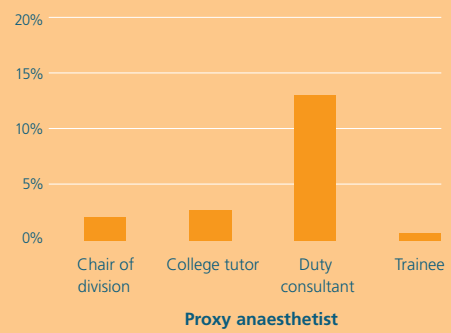
The process for the collection of data is described in Appendix E. This section of the report reviews some of the anaesthetic and combined surgical specialties data for 10% of the deaths reported to NCEPOD from 1st April 1999 until 31st March 2000. Where appropriate the data will be compared to those from the 1990 NCEPOD Report[36] or the 'Then and Now' NCEPOD Report of 1998/99[13]. The full data from the anaesthetic and surgical questionnaires can be obtained, as a separate document, on direct application to NCEPOD or on the NCEPOD web-site (www.ncepod.org.uk).

COMPLETION OF QUESTIONNAIRES

All surgical questionnaires were completed either by the consultant surgeon or by a NCCG surgeon or surgical trainee. The consultant surgeon with responsibility for the care of the patient during their final operation subsequently reviewed most of the questionnaires. A consultant surgeon did not review 70 (4%) questionnaires. In 211 (13%) cases it is not known whether the consultant surgeon reviewed the questionnaire. Potentially, the consultant in charge of the case did not review 281 (17%) of the questionnaires.

An anaesthetist involved with the case completed the questionnaire in 64% of cases. A proxy anaesthetist, usually on behalf of a trainee anaesthetist, completed 35% questionnaires, but interestingly a trainee who was not involved in any way completed 14 questionnaires (Figure 6.1). NCEPOD is grateful to the proxy anaesthetists for the support that they give to this enquiry. It is surprising that a proxy completed 94 questionnaires for cases when the most senior anaesthetist at the start of the operation was a consultant and only three of these consultants were likely to have retired. The reason why consultants did not complete the questionnaire for a case in which they were involved is not known. Nevertheless, it does mean that an opportunity to reflect on their personal practice was lost on this occasion, as is additional information from personal recall of the circumstances surrounding the case.

Fig 6.1 Anaesthetists who completed the questionnaire but were not directly involved with the case



HOSPITAL AND FACILITIES

Table 6.1 Type of hospital in which the final operation took place

	1999/00		1998/99
District general	1169	73%	69%
University teaching	373	23%	26%
Limited surgical specialties	39	2%	2%
Independent	16	1%	1%
Others/not answered	9	<1%	2%
Total	**1606**		

Table 6.1 presents the types of hospitals in which the final operation took place and compares the percentage of the sample in each type of hospital with the data from the 1998/99 NCEPOD report. The distinction between district general and university teaching hospitals is not clear-cut. There are a large number of regional training programmes during which postgraduate trainees rotate through university teaching and district general hospitals, and consultants at both these types of hospitals are involved in their training. Moreover, the training status of a hospital does not indicate a level of facilities; for example, a response from a university teaching hospital reported that the hospital had no daytime emergency lists for general surgical patients, and no acute pain service. For acute hospitals, definitions based on the numbers of surgical beds might be more appropriate.

Critical care facilities

Table 6.2 compares the percentage of patients that had critical care facilities available in the hospital of their final operation with those in 1998/99.

Table 6.2 Special care areas in the hospital where the final operation took place* *(answers may be multiple n=1606)*

	1999/00	1998/99
Recovery area or room	97%	97%
24-hour recovery area	81%	76%
High dependency unit	69%	61%
Intensive care unit	97%	96%
Coronary care unit	82%	N/A

Recovery area or room

Forty-two (3%) respondents to the surgical questionnaire did not indicate the presence of a recovery area in the appropriate tick box. Thirty-five of these were from district general or university

teaching hospitals so presumably this was an error of omission. Clearly a recovery area is now almost universally available. Twenty-one percent of anaesthetic questionnaires and 15% of surgical questionnaires indicated that there was in their hospital a recovery area that was not staffed 24 hours a day and seven days a week. The difference in reporting is probably one of perception of the local organisation of recovery services for out-of-hours patients. For those hospitals without a full-time recovery it would be timely to review their procedures for postoperative recovery of patients out-of-hours with reference to guidance published by the Royal College of Anaesthetists[38]. Immediately after their operation all patients not returning to a special care area (e.g. an ICU or HDU) need to be nursed until they are in a stable physiological state by nursing staff who are trained and practised in postoperative recovery care. If there are separate arrangements for staffing the operating theatres out-of-hours, these must include the provision of specialised recovery staff.

Case Study 9

An 85-year-old, ASA 2 patient with a pelvic abscess and peritonitis underwent a laparotomy and Hartmann's procedure out-of-hours in a hospital with a part-time recovery area. The anaesthetist was a SHO 2. The operation finished at 22.30 and the patient was recovered by this anaesthetist for 15 minutes, and then returned to the ward at 22.45. The patient died on postoperative day seven.

These sorts of local arrangements are clearly not acceptable.

Intensive care and high dependency facilities

An ICU is now almost standard in hospitals in which acute surgery is undertaken. This is not so for an

Fig 6.2 Percentage of patients with an HDU in the hospital of their final operation

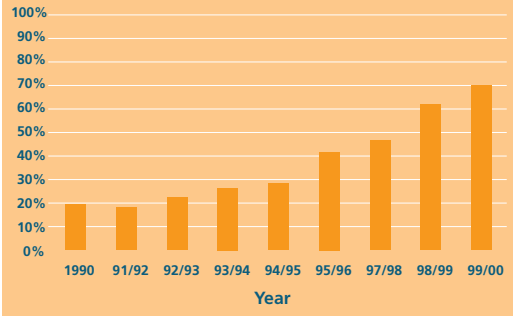


Figure 6.2 shows the NCEPOD data on the percentage of patients that had an HDU in the hospital of their final operation, by year since 1990. Since 1994/95 there has been a commendable steady increase in HDU facilities. Of those patients whose operation was in a hospital without an HDU, 77% were in a district general hospital and 18% were in a university teaching hospital. The lack of an HDU facility for 31% of patients remains a cause for concern to NCEPOD[13, 25, 36, 39], surgeons and anaesthetists[40]. All hospitals, where major acute surgery is undertaken, should have a critical care facility that is appropriate for level 2 patients. A level 2 patient is defined as one requiring more detailed observation or intervention including support for a single failing organ system or postoperative care, and those 'stepping down' from higher levels of care[37]. Patients should be made aware when this facility is not available.

The following deaths were in hospitals where HDU care was not available.

Case Study 10

A 68-year-old, ASA 3 patient was scheduled for a Whipple's procedure. General anaesthesia was supplemented with thoracic epidural analgesia. During the operation there was persistent hypotension with a systolic arterial pressure of 80 mmHg or less, despite doses of ephedrine. After the operation the patient returned to the general ward. By postoperative day one a positive fluid balance of 12 litres was recorded and the patient was then admitted to the ICU where he died six days later.

Case Study 11

A 77-year-old, ASA 3 patient was admitted for a laparotomy and drainage of a pelvic abscess. Coexisting medical disorders included hypertension, abdominal sepsis and anaemia with a haemoglobin of 9.1 gm/dl. After the operation the patient returned to the ward. The responding anaesthetist thought that the patient would have benefited from HDU care but this is not available in their hospital. Death was on the first postoperative day.

It is difficult to understand why some hospitals deny HDU facilities to selected patient groups.

Case Study 12

A 55-year-old had an operation for a second primary carcinoma of the colon some 16 years after two previous abdominal operations. During the operation technical difficulties were encountered. Thirty hours postoperatively, peritonitis was evident. The hospital has an HDU for medical patients only; it is the surgeon's opinion that an HDU facility could have resulted in the earlier recognition of this postoperative complication.

Case Study 13

A 92-year-old, ASA 3 patient had an operation for insertion of an Austin Moore prosthesis. Both the surgeon and anaesthetist commented that the hospital has an HDU, but orthopaedic patients are not allowed access to it.

Emergency operating theatres

Table 6.3 Availability of daytime emergency lists for urgent cases

	General surgery		Trauma /orthopaedic	
	1999/00	1998/99	1999/00	1998/99
Available	1143 78%	75%	1280 87%	86%
Not available	317 21%	24%	173 12%	13%
Not answered	7 <1%	1%	14 1%	1%
Total	**1467**		**1467**	

NCEPOD has collected this data on daytime emergency lists for 1998/99 and 1999/00 only (Table 6.3). It is perhaps too soon to see a pattern of change but there is the suggestion that the number of cases in hospitals with general surgery emergency lists is increasing. This data is from the anaesthetic questionnaire, which also asked about anaesthetic staffing. Figure 6.3 shows the grade of anaesthetist providing cover for the emergency lists most of the time and Table 6.4 allows comparison of anaesthetic staffing for this sample with 1998/99 data.

Fig 6.3 Grade of anaesthetist providing cover for emergency general surgery and trauma/orthopaedic lists most of the time

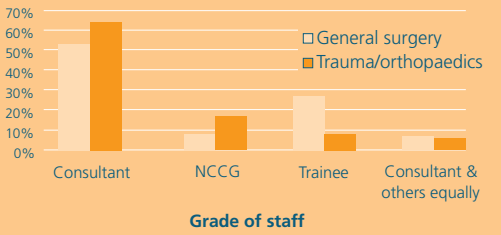


Table 6.4 Grade of anaesthetist providing cover for the emergency lists most of the time, comparison with 1998/99

	General surgery		Trauma /orthopaedics	
	1999/00	1998/99	1999/00	1998/99
Consultant	605 53%	48%	819 64%	60%
Other grades	431 38%	48%	337 26%	37%
Consultant and other grades equally	93 8%	2%	112 9%	2%
Not answered	14 1%	2%	12 1%	1%
Total	**1143**		**1280**	

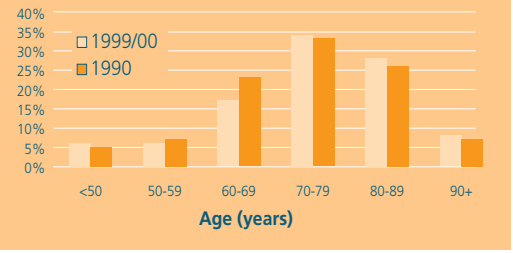
From Table 6.4 it would appear that consultant anaesthetic involvement with these lists, in which high-risk patients undergo operations, is increasing. This change is to be encouraged. Whilst comparable surgical data is not yet available, it is to be hoped that consultant surgical involvement is following a similar trend. NCEPOD is currently acquiring core data on the number and staffing of emergency operating lists.

It is of concern that trainee and NCCG anaesthetists provide cover most of the time for 38% of the emergency general surgical and 26% of emergency trauma/orthopaedic lists in the hospitals of these patients. It is recognised that training and experience in emergency anaesthesia are valuable, but senior anaesthetists are better able to deal with the organisational problems associated with running emergency operating lists, as well as providing greater clinical experience. It is the responsibility of each anaesthetic department to ensure that the anaesthetists running emergency lists are of sufficient experience, and to provide appropriate consultant supervision.

PATIENT PROFILE

Age and sex

Fig 6.4 Age of the patient at the time of their final operation



The age profile (Figure 6.4) repeats the trend seen in the 'Then and Now' NCEPOD Report[13] that patients who die after their operation are older compared to those in 1990[36]. Seventy percent of patients in this sample were aged 70 years or older compared with 65% in 1990. Fifty-two percent of patients were male.

Preoperative status

Fig 6.5 ASA status of patients

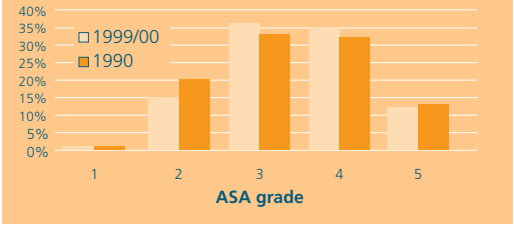


Figure 6.5 repeats the trend seen last year, that patients who die after their operation are of poorer physical status compared to those in 1990. Eighty-three percent of the sample was ASA 3 or poorer compared to 78% in 1990.

From the anaesthetic questionnaires, 95% of patients had coexisting medical problems at the time of the operation.

The data in the first column of Table 6.5 is from the anaesthetic questionnaires. Compared with the 1998/99 data there is, apparently, an increase of cardiac, respiratory, neurological, alimentary and septic disorders. This may not be a true increase; rather the result of an increased recognition of the presence of these disorders. Under reporting of disorders has been suspected previously, for example the opinion of the 'Then and Now' NCEPOD Report[13] was that sepsis was under reported. An increased recognition of coexisting disorders is to be commended; it is likely to result in improved patient management.

Table 6.5 Coexisting medical problems at time of the final operation *(answers may be multiple)*

	Anaesthetic questionnaire *(n=1467)*		Surgical questionnaire *(n=1606)*
	1999/00	1998/99	1999/00
Cardiac	72%	66%	46%
Respiratory	55%	37%	30%
Neurological	39%	33%	-
Alimentary	23%	16%	13%
Endocrine	19%	18%	14%
Sepsis	18%	13%	11%
Renal	16%	14%	16%
Haematological	10%	10%	9%
Musculoskeletal	10%	9%	8%
Hepatic	5%	5%	-
Other	15%	14%	-
None	-	6%	-
Not answered	-	2%	-

The data in the last column is from the surgical questionnaires. Some of the responses by the anaesthetists and surgeons are markedly different, for example the cardiac and respiratory problems. This may be because the wording of the enquiry into coexisting disorders in the anaesthetic questionnaire differs from that in the surgical questionnaire. In the anaesthetic questionnaire "*coexisting medical symptoms, signs or diagnoses at the time of the final operation*" was requested. However, in the surgical questionnaire "*coexisting problems other than the main diagnosis at the time of operation*" was requested. It might be, for example, that controlled or previous cardiac or respiratory disorders were not viewed by the responding surgeon as a problem, and hence not reported. Not all the 'disorder' categories are directly comparable; for example the surgical questionnaire asks for neurological and psychiatric disorders separately. The wording of this and some other questions within the questionnaires makes comparisons between the surgical and anaesthetic data difficult. It is a weakness that NCEPOD recognises and will address.

The most common coexisting cardiac disorders and respiratory disorders as cited in the anaesthetic questionnaires are presented in tables 6.6 and 6.7 respectively.

Table 6.6 Coexisting cardiac disorders *(n = 1467, answers may be multiple)*

Previous MI/ischaemic heart disease	60%
Hypertension	29%
Chronic cardiac failure	19%
Angina	18%
Atrial fibrillation	17%
Peripheral vascular disease	15%

Table 6.7 Coexisting respiratory disorders *(n = 1467, answers may be multiple)*

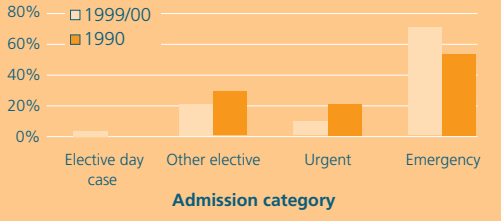
COPD	19%
Chest infection	12%
Asthma	7%

NCEPOD has not previously been able to separately identify patients with either a previous myocardial infarction or ischaemic heart disease; in 1998/99 it could only estimate that 42% of patients had one or more cardiac conditions that indicated myocardial ischaemia[13]. This year NCEPOD has identified that 60% of the patients had known ischaemic heart disease at the time of their final operation; an incidence higher than has previously been identified. National Statistics [41] identified that for the year 2000, 20% of all deaths had ischaemic heart disease reported as the main cause of death. However, National Statistics under represent ischaemic heart disease, as importantly, they do not include co-morbidity, i.e. section II of the Medical Certificate of Death.

ADMISSION AND OPERATION

Admission category

Fig 6.6 Admission category



The type of operation and, admission data is from the surgical questionnaires. Figure 6.6 repeats the trend seen in the 'Then and Now' NCEPOD Report[13], that patients who die are more likely to be admitted as an emergency.

For the first time, this year's elective admissions were subdivided into those planned as day case admissions and other elective admissions. Twenty-three (1%) patients were elective day case admissions. The ASA of elective day case patients is presented in Table 6.8.

Table 6.8 ASA status of elective day case operations *(n = 1606)*

ASA 1	6
ASA 2	5
ASA 3	8
ASA 4	3
Not specified	1
Total	**23**

The 'Who Operates When' NCEPOD Report[42] identified that in 1995/96, 36% of all cases were elective day case operations; this figure now has probably increased. This figure of deaths (Table 6.8) after elective day case operations may slightly underestimate the true number of deaths; as patients who die at home do not always get reported to NCEPOD. Nevertheless, they suggest that very few of the patients that are admitted for elective day case operations die and that overall there is appropriate patient selection and assessment. The three ASA 4 patients were reviewed. One underwent dilatation and laser treatment of an oesophageal carcinoma, which was performed regularly at four-weekly intervals. Two underwent cataract surgery. One was an 80-year-old

with cardiac and respiratory problems but no information was given as to whether these were longstanding problems, or of their severity. The other was a 74-year-old with non-Hodgkins lymphoma who had the operation at a specialist eye hospital. He had been unwell for six days before the operation and four days afterwards his medical team admitted him to hospital because of abdominal masses, splenomegaly, lymphadenopathy and jaundice; clearly these medical complications were missed at his preoperative assessment. This last case was the only one considered inappropriate.

Admission route

The main routes of admission were as follows: 31% of patients were referred from their general medical practitioner, 30% directly from A&E and 15% were admitted following an outpatient appointment. Thirteen percent were transferred from another hospital and this compares with 12% in 1990. In total 213 were transferred from another hospital to that of their final operation and details of these other hospitals are presented in Table 6.9. Of these, 25 were transferred from a hospital outside the region.

Table 6.9 Patients transferred from another hospital

	1999/00	1990
District general hospital	132	189
University teaching hospital	31	33
Community hospital	13	36
Nursing home	12	
Independent hospital	11	6
Limited surgical specialty	7	19
Defence secondary care unit	1	3
Other		14
Not answered	6	13
Total	**213**	**313**

In 18/213 (8%) cases the patient's condition deteriorated during the transfer. Regional specialisation of services has concentrated surgical expertise in centres of excellence for specialist procedures. However, this does require some patients to be transferred between hospitals in order that they receive the best care for their condition. It is inevitable that some patients will be in an unstable condition and may deteriorate on transfer, for example patients with a leaking aortic aneurysm travelling to a vascular unit (six patients) or those with a severe head injury travelling to a neurosurgical centre (four patients). Nine of these 18 patients were already critically ill with an ASA 5. Some cases may be affected by insufficient availability of ICU beds. The availability of ICU beds is something that requires local audit and remedy when indicated.

Case Study 14

A 62-year-old, ASA 5 patient with a leaking abdominal aortic aneurysm was admitted to a hospital without a vascular service. The patient waited "several hours" in the admitting hospital, whilst several hospitals tried to find an ICU bed. Although haemodynamically stable in the initial hospital, the patient arrived badly shocked at the hospital of referral and the situation was by then probably irretrievable. There was still no ICU bed available after the operation so the patient's lungs were ventilated in recovery until one became available. The surgeon commented that "lack of ICU beds nationally costs lives on a regular basis - this is one of them".

Operation

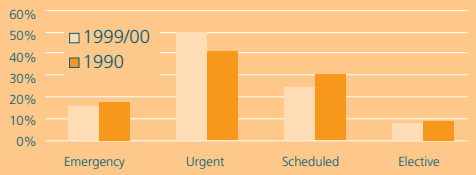
The surgical specialties for the operations are presented in Table 6.10 and the percentages of each specialty as a percentage of the whole sample are similar to those in 1998/99.

Table 6.10 Surgical specialty of the operation

General surgery	703	44%
Orthopaedic	358	22%
Vascular	222	14%
Urology	81	5%
Cardiothoracic	75	5%
Neurosurgery	74	5%
Gynaecology	25	2%
Paediatric	23	1%
Otorhinolaryngology	21	1%
Plastic surgery	10	<1%
Ophthalmology	7	<1%
Oral/maxillofacial	7	<1%
Total	**1606**	

The classification of the urgency of the final operation is presented in Figure 6.7.

Fig 6.7 Classification of the urgency of the final operation



Sixty-seven percent of operations were classified as emergency or urgent compared with 60% in 1990 (Figure 6.7). This repeats the trend seen in the last NCEPOD report that patients who die after an operation are more likely to have undergone emergency or urgent surgery. Fifty-one percent had urgent surgery; this compares with 42% in 1990.

The anticipated operative risk is presented in Table 6.11 and follows the pattern of classification of the urgency of the final operation. This has not changed over the past 10 years.

Table 6.11 The anticipated risk of death related to the proposed final operation

	1999/00 (*n*=1606)	1990
Not expected	15%	14%
Small but significant risk	22%	24%
Definite risk	54%	50%
Expected	8%	3%

Delays to operation

From the anaesthetic questionnaire, 329/1467 (22%) patients had their operation delayed in order to improve their medical condition. The systems that required attention are presented in Table 6.12.

Table 6.12 System(s) needing attention before operation
(n = 329, answers may be multiple)

Cardiac	51%
Metabolic	38%
Respiratory	27%
Haematological	25%
Other	8%

From the surgical questionnaire, 100/1606 (6%) patients had their operation delayed due to factors other than clinical. The numbers of cases delayed for each specialty, and these expressed as a percentage of the total number of cases in that specialty, are presented in Table 6.13. From this it would seem that orthopaedic patients are more likely to suffer delays for non-medical reasons than patients in other specialties are. Information provided by surgeons and anaesthetists allowed NCEPOD to identify 69/1606 (4%) patients whose operation was delayed due to limited operating theatre availability and 13/1606 (1%) whose operation was delayed due to unavailability of an ICU or HDU bed. Delays to operation due to the availability of emergency operating time or critical care facilities requires close monitoring locally. An inadequacy of critical care facilities is detrimental to patient care.

Table 6.13 Delays for non-clinical reasons and presented as a percentage of deaths for that specialty

Orthopaedic	43	12%
Cardiothoracic	6	8%
Vascular	15	7%
General surgery	30	4%
Others	6	
Total	**100**	

Consent for the operation

The grade of the most senior surgeon taking consent from the patient is presented in Table 6.14.

Table 6.14 The grade of the most senior surgeon taking consent from the patient

Consultant	571	36%
Associate specialist	21	1%
Staff grade	48	3%
SpR	417	26%
SHO	350	22%
Pre-registration house officer	108	7%
No consent taken	43	3%
Other	6	<1%
Not known	11	<1%
Not answered	31	2%
Total	**1606**	

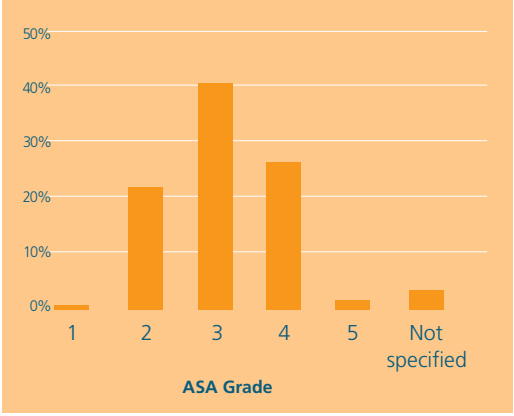
Obtaining informed consent appropriately is one of the fundamental aspects of good surgical practice [43, 44, 45]. In 28% of cases the person who obtained consent was not present during the operation. The General Medical Council has published guidance for those delegating the seeking of consent for operations and other invasive procedures[46] and the specific issue of consent was discussed in the 'Then and Now' NCEPOD Report [13]. The taking of a patient's consent for treatment should only be

delegated in exceptional circumstances. If consent is delegated to one *not* undertaking the procedure it is the responsibility of the operating surgeon to ensure that:

- the person to whom this responsibility is delegated is suitably trained;
- they have sufficient knowledge of the proposed investigation or treatment;
- they understand the risks involved and possess the appropriate communication skills;
- they act in accordance with the GMC guidance.

Consent was not obtained in 3% of cases and these were when the patient was physically or mentally unable to provide it. On 108 (7%) occasions the person who obtained consent was a pre-registration house officer. The specialties where consent was by a pre-registration house officer were general surgery 65/703(9%) (53 patients undergoing a laparotomy); vascular 29/222 (13%); urology 7/81 (9%) and orthopaedic 7/358 (2%). The physical status of the patients where consent was by a pre-registration house officer is presented in Figure 6.8.

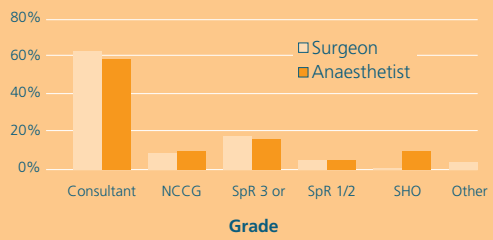
Fig 6.8 **ASA grades of the patients where a pre-registration house officer obtained consent for the operation**



On 78/108 (72%) occasions when a pre-registration house officer obtained consent, the physical status of the patient was ASA 3 or poorer. It is hoped that all junior doctors that obtain consent have knowledge of, or have discussed with the senior surgeon, the specific complications of the procedure and communicate these to the patient. However, it must be questioned as to whether the most junior member of the team is the appropriate person to obtain consent in patients of poor physiological status and when there is an anticipated risk of death.

STAFFING

Fig 6.9 **Grade of the most senior operating surgeon and anaesthetist**



Surgeons

A consultant was the most senior operating surgeon present in the operating room for 63% of cases and either a consultant or associate specialist was consulted before operation in 93% of cases. This is a commendably high senior surgical involvement in the decision to operate. The 'other' surgeons shown in Figure 6.9 were mostly locum appointments for service or training, or visiting SpRs of unknown grade.

In this sample there were 36 cases where the most senior surgeon was stated not to have a higher surgical diploma (36/1606, 2%). This is the same percentage as in the 1998/99 NCEPOD report (30/1518, 2%) in which we questioned its accuracy[13]. However, the consistency of the percentage suggests that the figure may be true. The grade and specialty of these surgeons are presented in Table 6.15. It seems unlikely that the surgeons in some of these grades would not have a higher surgical diploma. However, if the statements are true, then there appears to a problem, particularly in orthopaedic and general surgery. In these specialties individuals without a higher diploma are apparently holding senior surgical posts, including posts that usually have responsibilities for training.

Table 6.15 Grade and specialty of most senior operating surgeon for whom no higher surgical diploma was indicated

Most senior operating surgeon	Specialty of surgeon in charge	1999/00	1998/99
Consultant	Orthopaedic	0	1
	General surgery	1	1
	Vascular	0	1
	Neurosurgery	0	1
	Cardiothoracic	2	0
Associate specialist	Orthopaedic	4	2
	General surgery	1	0
Staff grade	Orthopaedic	8	8
	General surgery	1	3
SpR 4+	Orthopaedic	1	0
	General surgery	1	1
	Neurosurgery	1	0
SpR 3	Orthopaedic	1	1
	General surgery	0	1
	Neurosurgery	1	0

Anaesthetists

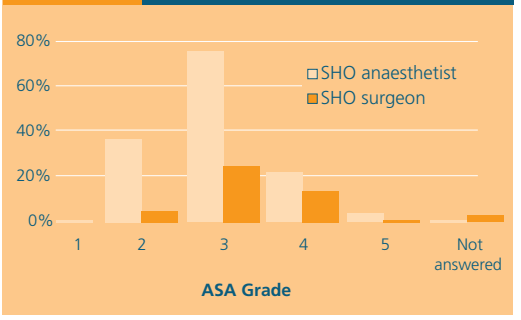
A consultant was the most senior anaesthetist for 59% (860/1467) of cases. However, senior anaesthetic involvement was less apparent than was senior surgical involvement; a consultant or associate specialist anaesthetist was involved in some way in 77% of cases. Of the 569/1467 cases where the senior anaesthetist was not a consultant or associate specialist grade, advice was sought on only 212/569 (37%) occasions. When advice was sought, for 77% of these cases it was sought from a consultant, compared to 64% in 1998/99. This level of consultant input into the anaesthetic care of these patients, who were generally of poor physical status and at risk of death, is far too low. The supervision of anaesthetic trainees was fully discussed in the 'Then and Now' NCEPOD Report[13] and has been a recurring concern of all the NCEPOD and CEPOD reports.

The qualifications of the most senior anaesthetists were: 75% had the anaesthetic fellowship and 6% had no higher diploma in anaesthesia. In 1990 these figures were 66% and 6% respectively.

Operations by a SHO surgeon or anaesthetist

There were 48 patients who were operated on by an SHO and 141 patients who were anaesthetised by an SHO. The ASA grade of these patients is presented in Figure 6.10.

Fig 6.10 ASA grade where the surgeon or anaesthetist was an SHO



SHO surgeons

The surgical specialties of the 48 patients operated on by an SHO were orthopaedics 17; general surgery 17; vascular 5; urology 2; maxillofacial 2; neurosurgery 3 and otorhinolaryngology 2. Of the 12 general surgical cases, 11 were ASA 3 or poorer.

The 1999 'Extremes of Age' NCEPOD Report[1] recommended that the experience of the anaesthetist and surgeon should be matched to the physical status of the elderly patient, as well as to the technical demands of the procedure. The technical abilities of these trainees to perform the operation are not being questioned. However, a senior surgeon is more likely to have a shorter operating time and is able to take responsibility for difficult decision-making if, or when, untoward events occur.

The following cases were discussed with a consultant surgeon before the operation. It must be questioned whether these consultants were aware of the poor physical status of the patients.

Case Study 15

A 59-year-old, ASA 3 patient with ischaemic heart disease, diabetes mellitus and thyroid disease was operated on at 21.40 for a perineal abscess. His preoperative haemoglobin was 10.1 gm/dl and serum creatinine 186 micromol/l. The surgeon was an SHO with seven months' experience and no higher diploma in surgery. The anaesthetist was a second year SHO. The patient received a general anaesthetic and the lungs were ventilated using a laryngeal mask airway. One hour into the procedure the patient suffered a cardiac arrest. He was initially resuscitated but died the following day.

Case Study 16

A 76-year-old, ASA 4 patient with CCF, shortness of breath, pleural effusion, dementia and a previous CVA underwent a simple closure of a dehisced colostomy stoma at 17.00. The surgeon was an SHO with more than two years' experience and had part 2 of the surgical Fellowship. The anaesthetist was a consultant. The patient suffered a fatal cardiac arrest 1 h 50 min into the operation, from what was presumed to be either acute left ventricular failure or a pulmonary embolus.

In the following case the consultant surgeon was clearly aware of the patient's poor physical status.

Case Study 17

An 80-year-old, ASA 5 patient developed peritonitis and hypoxaemia five days after a hemiarthroplasty for a fractured neck of femur. Preoperative haemoglobin was 9.1 gm/dl, serum urea 17.2 mmol/l and creatinine 169 micromol/l. Laparotomy revealed ischaemic colitis, and a partial left colectomy and transverse colostomy were performed. The surgeon had been an SHO for 36 months and had the surgical Fellowship. The anaesthetist was an associate specialist with the DA. No HDU existed in the hospital and the patient died in the recovery area one hour after the operation. The consultant who completed the surgical questionnaire commented that there was only a remote chance of survival.

In some cases, as illustrated in cases 18 and 19, SHO surgeons were both experienced and well qualified. It must be questioned as to whether it was appropriate for them to be occupying an SHO training post.

Case Study 18

A 74-year-old patient developed peritonitis 11 days after a right hemicolectomy for colonic carcinoma. The consultant was on leave but commented that the trainees were slow to react to the peritonitis. The case was discussed with a consultant who was providing cover. It was suspected that there was ileal ischaemia. The SHO who was deputed to operate had passed the FRCS three years previously. There was an associate specialist in the hospital to provide support. The patient suffered a cardiac arrest in the anaesthetic room, was resuscitated and the laparotomy went ahead. A further ileal resection and primary anastomosis was done. The patient did not survive 24 hours.

Case Study 19

A 79-year-old patient had a laparotomy to oversew a perforated duodenal ulcer. The surgeon was an SHO with the FRCS who had previously worked as an SpR. The consultant was at home. The patient died from cardiac complications three weeks after surgery.

SHO anaesthetists

The responsibilities of trainees in anaesthesia were discussed in detail in the 'Then and Now' NCEPOD Report[13] and so the following comments will be brief.

The surgical specialties of the 141 patients' anaesthetised by an SHO were: orthopaedics, 60; general surgery, 60; vascular, 14; urology, 4, plastic surgery, 2 and otorhinolaryngology, 1. Of the orthopaedic cases 57 had a fractured hip or femur and 41/57 (72%) were ASA 3 or 4. Of the general surgery cases 51 involved a laparotomy and 36/51 (71%) were ASA 3, 4 or 5. This picture of the physical status of patients who are being anaesthetised by SHOs is not reassuring. All anaesthetic departments need to review whether their most junior trainees are assuming responsibilities appropriately.

OPERATIVE MONITORING

Table 6.16 presents the patient monitoring that was used during the operation.

Table 6.16 Monitoring devices were used during the management of this anaesthetic
(n = 1467, answers may be multiple)

Pulse oximetry	1457	99%
Indirect arterial pressure	1176	80%
ECG	1442	98%
Capnography	1314	90%
Vapour analyser	1191	81%
Urine output	781	53%
Temperature	445	30%
CVP	642	44%
Direct arterial pressure	618	42%
Pulmonary artery pressure	66	4%

The first five monitors in this list are essential to the safe conduct of anaesthesia[47]. Only one patient had no operative monitoring.

Case Study 20

An 86-year-old, ASA 5 patient was undergoing femoral embolectomy under local anaesthesia that was provided by the operating surgeon. When the patient became agitated an SHO anaesthetist, who had not previously assessed the patient, was called upon to provide sedation. There was no monitoring during the procedure and no anaesthetic chart was completed.

In almost all cases pulse oximetry and ECG were monitored. If those patients having either direct or indirect arterial pressure monitoring are analysed, blood pressure was also monitored in almost all cases. The percentage of cases in which capnography was monitored was lower, but 81/1467 (8%) had local anaesthesia alone and some patients had intravenous sedation and face mask oxygen, making the monitoring of expired CO_2 difficult. Only 13/1467 (<1%) questionnaires complained of a lack of monitoring equipment. NCEPOD recognises the commendable efforts by anaesthetists and managers to achieve this. However, non-invasive blood pressure was not present in the anaesthetic room for one case, capnography was not present in the anaesthetic room for one case and in the operating room for two cases, and a vapour analyser was not

present in the operating room for five cases. Of concern was case 21:

Case Study 21

A 55-year-old, ASA 5 patient with a chest infection, shortness of breath and CCF had a flexible bronchoscopy performed. An experienced SpR anaesthetist with the CCST provided the general anaesthesia in an environment that had no facility for ECG monitoring. The patient died three days later.

The environment for this general anaesthetic must be questioned.

The 'Recommendations for Standards of Monitoring During Anaesthesia and Recovery'[47] state explicitly that a pulse oximeter, non-invasive blood pressure monitor, electrocardiograph and capnograph in the anaesthetic room, and these four plus vapour analyser in the operating room, are essential for the safe conduct of anaesthesia. If it is necessary to continue anaesthesia without a particular device then the anaesthetist must clearly record the reasons for this in the anaesthetic record.

CVP monitoring was used in 44% of patients who died. Peer review suggested that a further 13% might have benefited from invasive monitoring, mostly CVP monitoring, before, during or after the operation. The following cases are examples.

Case Study 22

A 78-year-old, 51 kg, ASA 4 patient with faecal peritonitis, tachycardia and tachypnoea was admitted to a hospital without an HDU. Coexisting disorders included ischaemic heart disease with angina. There was ECG evidence of bundle branch block. The operation was a laparotomy, washout of the abdomen, drainage of an abscess and loop ileostomy. A staff grade anaesthetist with part 1 of the anaesthetic Fellowship and working with an SHO 2 provided general anaesthesia for the operation that lasted 1 h 45 min. No temperature or CVP monitoring was used and 3500 ml of fluid were infused. The anaesthetist declared that no critical incidents occurred during the anaesthesia. But immediately postoperatively the patient was transferred to the ICU where he was in a poor general condition and required ventilation to the lungs. He was hypotensive, oliguric, had metabolic acidosis, needed inotropic support, developed pulmonary oedema and died on postoperative day two.

Case Study 23

A 75-year-old, ASA 2 patient weighing approximately 60 kg was admitted with a bowel obstruction. The patient had COPD and was 'frail' but otherwise had been fit. The patient received fluid resuscitation overnight that was not guided by CVP monitoring, and the next morning her operation was delayed for more than five further hours because the emergency theatre was busy with other cases. An SHO 2 anaesthetist with part 1 of the anaesthetic Fellowship provided general anaesthesia for the operation, a subtotal colectomy and ileosigmoid anastomosis, that lasted 3 h 45 min. Operative monitoring did not include urine output or CVP. The patient had a persistent tachycardia of greater than 100 per minute during the operation, despite receiving 3100 ml of intravenous fluid. Before the end of the operation this case was discussed with a consultant anaesthetist. After 30 minutes in a recovery area the patient was transferred to an HDU where she developed septicaemic shock accompanied by acute renal failure and metabolic acidosis. Death was in the ICU on postoperative day six.

It would appear that these patients were severely unwell with sepsis before their operation, and one also had severe coexisting cardiovascular disease. It was predictable that a CVP might be useful to guide fluid replacement during the operation. It was also likely to help guide fluid and drug treatment afterwards. Why then was it not inserted at the start of the anaesthetic? Does the absence of an HDU and/or the ability of the ward to manage or monitor a CVP line affect the decision to use, what would appear to be, appropriate invasive monitoring? If so, is it acceptable to have these sorts of restrictions placed on the way such patients are managed? Further discussion on this issue can be found in the section on perioperative care and the involvement of critical care teams.

POSTOPERATIVE CARE

ICU and HDU care

Admission

Four percent (63/1606) of this sample died in the operating theatre and 1% (24/1606) died in the recovery room. Immediately postoperatively 32% (521/1606) went to an ICU, 8% (130/1606) went to an HDU and one patient went to a coronary care unit. From the anaesthetic questionnaire, 6% (89/1467) of respondents were unable to transfer a patient to an ICU or HDU when they thought that this was indicated, mainly because these units were full. Peer review of cases suggests that for a further 10% of this sample there was an indication for ICU or HDU care.

From the surgical questionnaires NCEPOD knows of 21 (1%) patients who underwent an inter-hospital transfer preoperatively specifically for ICU care, either because there was no staffed and available ICU bed or no ICU facility in the referring hospital. NCEPOD does not know how many patients were transferred postoperatively because critical care facilities were not available.

Case Study 24

A 74-year-old, ASA 4 had an operation for perforated peptic ulcer. Postoperatively she required an ICU bed, but no bed was available and she was transferred to another hospital. She required a second operation for gastric outlet obstruction.

Case Study 25

A 68-year-old patient, ASA 4 had an operation for a perforated duodenal ulcer. No ICU bed was available after the operation so he was transferred to another hospital. He was transferred back to the original hospital's ICU and required re-operation for an abdominal washout three days before he died.

It is evidently unsatisfactory to transfer patients to another hospital for ICU care immediately postoperatively when they are likely to be in an unstable physiological status. The unenviable task of determining priorities, such as which patient is to be transferred because of insufficient ICU beds, falls to the intensive care physician and NCEPOD respects their decision; it should not need to be made.

Forty-one patients were admitted to an ICU/HDU after they had initially been admitted to a ward.

Case Study 26

A 74-year-old, ASA 2 patient underwent a laparoscopy and subsequent open cholecystectomy for an inflamed gall bladder. Following surgical difficulties an HDU bed was requested. Another patient also needed the one remaining HDU bed and, after consultation with the HDU consultant and another anaesthetic consultant, this postoperative patient was deemed a lower priority and returned to the ward. Ward care in that hospital precluded epidural analgesia. Sputum retention, hypoxaemia and sepsis were established by the following morning when the patient was admitted to ICU. The patient died from multiple organ dysfunction on day eight.

Evidence from this sample is that clinicians can experience difficulty in securing admission for patients to ICU/HDU facilities. Failure to secure a critical care bed postoperatively often results in a delayed admission with a subsequent protracted ICU stay. The under-provision of critical care beds, and its impact on mortality, morbidity and length of hospital stay, seems to make very little sense in either clinical or economic terms.

Discharge

The reason for discharge of patients from ICU or HDU is presented in Table 6.17.

Table 6.17 Reason for discharge of patients from ICU and HDU

Death	395	(57%)
Elective transfer to the ward	182	(26%)
Pressure on beds	13	(2%)
Not answered/not known	102	
Total	**692**	

NCEPOD knows of 13 patients that were discharged from ICU or HDU because of the pressure on beds. However, often the reason for discharge from a critical care facility is not documented in the clinical notes and the number is probably higher. Patients who die within 30 days of an operation represent a high-risk group that should be well provided for with

critical care facilities and the data presented here reaffirms the persisting national shortfall in that provision.

The Audit Commission report, 'Critical to Success'[48] and the Department of Health's review, 'Comprehensive Critical Care'[37], reviewed critical care services nationally and made recommendations. At a local level hospitals undertaking acute surgery should collect the type of data that is presented in this section in order to identify and quantify inadequacies in their critical care facilities. The solutions to this inadequacy are not simply increased beds, manpower and funding. There is interdependency between the use of critical care and ward based care. Once areas of inadequacy in the critical care service have been identified discussions between intensive care consultants, surgeons, physicians, senior nursing staff and senior hospital management can agree organisational changes across the hospital that may improve its use (see section 6 on perioperative care).

POSTOPERATIVE COMPLICATIONS

The complications after operation reported in the anaesthetic questionnaires are presented in Table 6.18.

From the surgical questionnaire 502/1606 (31%) cases had shared care with another medical specialty; of these for 93/1606 (6%) patients it was with another surgical specialty and for 371/1606 (23%) patients it was with a medical specialty. The postoperative ward care of patients is discussed more fully in section 6 on the organisation of perioperative care.

Table 6.18 Complications after operation *(n = 1476, answers may be multiple)*

Cardiac	44%
Ventilatory	42%
Renal failure	28%
Septicaemia	23%
Progress of surgical condition	17%
Haematological including blood loss	14%
Central nervous system failure	14%
Hepatic failure	4%
None	5%
Not answered	11%

POSTMORTEM

Sixty-two percent (993/1606) of deaths were reported to the coroner and a coroner's postmortem was performed on 425/993 (43%) of the deaths reported to them. Of the remaining cases, a hospital postmortem was undertaken on 79/1181 (79%). (Table 6.19)

Table 6.19 Postmortem examinations *(n = 1606)*

Coroner's postmortem	425	(26%)
Hospital postmortem	79	(5%)
No postmortem	930	(58%)
Not answered or not known	173	(11%)

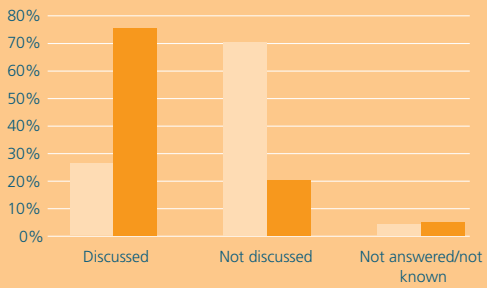
Thus, in total for 31% of cases there was a postmortem examination and this compared with 41% in 1990.

The surgical team was apprised of the date of the postmortem for 141/503 (27%) cases when a postmortem was being performed. On 62/141 (44%) occasions no one from the surgical team attended, and a consultant attended only 23/141 (16%), despite being informed that the examination was taking place. The hospital postmortem rate and the interest of clinicians in their findings appear low. The value of postmortem examinations for education and audit is poorly recognised. One surgeon commented that no postmortem was requested because there was "*no surgical problem*". Is there then little interest in postoperative medical complications? The postmortem did not confirm the clinical impression in 43 cases, and in a further 61 there were additional unexpected findings; thus there was something to be learned from 104/503 (21%) of postmortem examinations. Five hundred and sixty-four patients died in an ICU or HDU and only 217/564 (38%) of them had a postmortem. One hundred and ninety-three of these 217 (89%) had a coroner's postmortem and 25/217 (11%) had a hospital postmortem. It is hoped that intensive care physicians are being involved in the decision to request postmortems of patients treated in their units, and are taking an interest in the findings (see Section 9).

AUDIT

Seventy-seven (5%) deaths were in hospitals in which the anaesthetic department still has no morbidity/mortality review meetings. That there are anaesthetic departments without morbidity/mortality review meetings is unacceptable in the current climate of clinical governance and risk management. Whether such departmental meetings exist was not asked in the surgical questionnaire. The percentage of cases discussed at anaesthetic and surgical departmental audit meetings is presented in Figure 6.11.

Fig 6.11 **Cases discussed at an anaesthetic and surgical departmental audit meeting**



That anaesthetic departments did not review 70% of patients who died is deplorable. The advice in 'Good Practice: a Guide for Departments of Anaesthesia'[49] is explicit; there should be a monthly review of deaths, complications, unexpected outcomes and critical incidents. This NCEPOD report contains a plethora of examples in which organisational problems affected outcome. It would appear that many anaesthetic departments do not understand that a review of deaths can detect both organisational and clinical problems locally.

Table 6.20 **Cases that were not discussed at a surgical audit meeting by specialty and the percentage of deaths for that specialty not discussed**

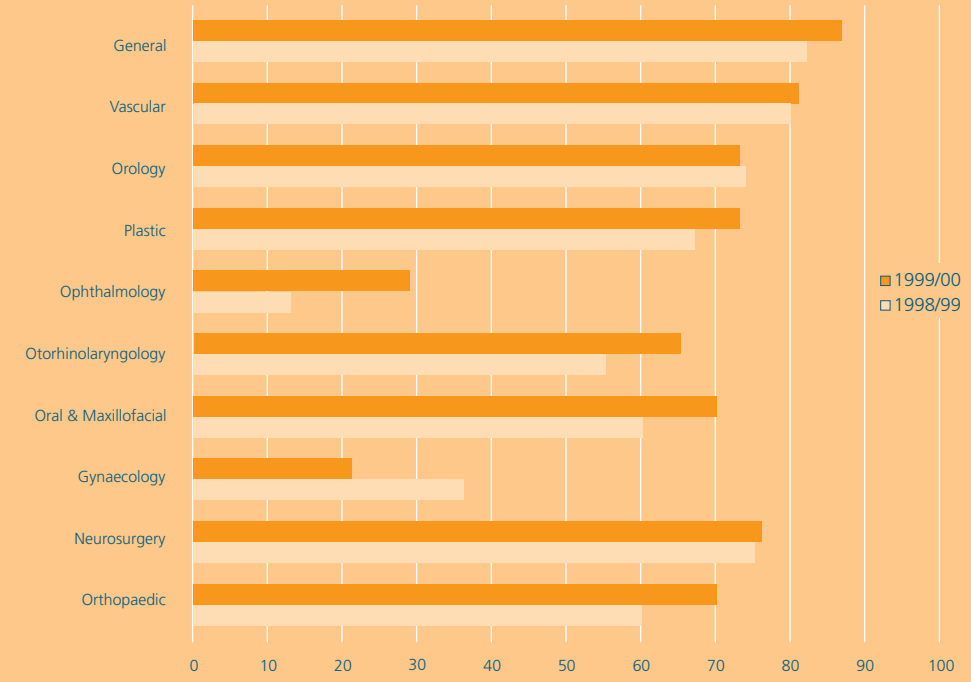
	Not discussed	% of deaths
Orthopaedic	107	30%
General surgery	102	14%
Vascular	28	13%
Urology	22	27%
Neurosurgery	18	24%
Gynaecology	15	60%
Cardiothoracic	8	11%
Otorhinolaryngology	7	33%
Ophthalmology	5	24%
Others	9	
Total	**321**	

There are clear recommendations that surgeons must take part in surgical audit[43]. Despite this, surgical departments did not discuss 20% of deaths. The comments concerning the value of audit in anaesthesia must also apply to surgery. The breakdown of the numbers for each surgical specialty is presented in Table 6.20

The percentage of patients discussed at audit in the last two reports has remained unchanged at 75% compared with 64% in 1990. However, the use of audit varies between the specialties (Figure 6.12).

There has been maintenance of standards in many specialties and a marked improvement in some. The audit of deaths in the specialty of gynaecology is particularly poor and this anomaly needs to be addressed in the light of clinical governance.

Fig 6.12 The percentages of deaths considered at audit meetings in 1998/99 and 1999/00 by speciality



Recommendations

- Immediately after their operation all patients not returning to a special care area (e.g. an ICU or HDU) need to be nursed by those who are trained and practised in postoperative recovery care. If there are separate arrangements for staffing the operating theatres out-of-hours, these must include the provision of specialised recovery staff.
- All hospitals where major acute surgery is undertaken should have a critical care facility that is appropriate for level 2[37] patients. Patients should be made aware when this facility is not available.
- It is the responsibility of each anaesthetic department to ensure that the anaesthetists running emergency lists are of sufficient experience, and to provide appropriate consultant supervision.
- Delays to operation due to the availability of emergency operating time or critical care facilities require close monitoring locally.
- Where there is a definite risk of death and patients are in a poor physiological condition, junior doctors in training (SHO or pre-registration house officers) should not obtain consent for surgery.
- Medical Directors should review the responsibilities of those consultant and NCCG surgeons who do not hold a higher surgical diploma.
- There needs to be a much higher level of involvement of anaesthetic consultants in the care of those patients who are in a poor physical state and at risk of death.
- Hospitals should identify and quantify inadequacies in their critical care facilities. If inadequacy exists discussions between intensive care consultants, surgeons, physicians, senior nursing staff and senior hospital management can agree organisational changes across the hospital that may improve its use.
- Medical Directors should ensure that morbidity/mortality meetings are held in all specialities.

GENERAL ANAESTHESIA WITH REGIONAL ANALGESIA

Key points

- A regional anaesthetic technique can provide good analgesia, both during the operation when combined with general anaesthesia, and postoperatively. NCEPOD supports both techniques.
- Regional analgesia combined with general anaesthesia may precipitate hypotension, especially in those who are septic or dehydrated.

For some years NCEPOD has been concerned about operative hypotension and the measures and/or timeliness of its treatment. This section reviews the relationship between regional analgesia with general anaesthesia and hypotension in specific patient groups.

Type of anaesthesia

Table 6.21 presents the type of anaesthesia used for the patients in this report and compares this with that used in 1990.

Table 6.21 Types of anaesthesia

	1999/00		1990
General alone	914	62%	83%
Local infiltration	7	<1%	<1%
Regional alone	74	5%	3%
General and regional	301	21%	7%
General and local infiltration	75	5%	2%
Sedation alone	4	<1%	<1%
Sedation and local infiltration	5	<1%	<1%
Sedation and regional	81	6%	4%
Not known/Not answered	6	<1%	-
Total	**1467**		

Compared with 1990, there has been a move away from general anaesthesia alone, towards general and regional techniques. The use of these techniques, both during the operation and for pain relief after the operation was applauded in the 1990 NCEPOD Report[36] and is so now. Of the 301 patients who had general anaesthesia combined with regional analgesia, 195 patients had general anaesthesia combined with epidural analgesia and 21 patients had general anaesthesia combined with spinal analgesia. Epidural analgesia is particularly valuable postoperatively for patients who have undergone major vascular, abdominal or thoracic operations and, in conjunction with the achievements of local acute pain services, provides safe and effective analgesia on the general ward. Good postoperative pain control may improve patient outcome [50, 51]. However, the incautious use of regional techniques in association with general anaesthesia during an operation can lead to excessive vasodilatation and hypotension. Each year NCEPOD reviews cases where the use of general anaesthesia with regional analgesia was associated with persistent hypotension during the operation. Some of these cases are presented here.

General and regional anaesthesia in association with dehydration or sepsis

Case Study 27

An 82-year-old, 76 kg, ASA 4 patient with no coexisting medical disorders underwent a laparotomy for peritonitis. On arrival in the anaesthetic room the patient was dehydrated, hypotensive with a blood pressure of 76/50 mmHg and hypoxic with a SpO_2 of 86%. The SHO anaesthetist with more than two years' experience did not discuss the case with someone of greater experience before the operation. Invasive monitoring, CVP and arterial lines, and an epidural at the L1/L2 level were established with the patient awake. A test dose of 3 ml of 0.5% bupivacaine was followed by 20 ml of 0.125% bupivacaine into the epidural space. The subsequent hypotension (systolic arterial pressure of between 70-100 mmHg) persisted for 1 h 20 min before and during the operation despite bolus doses of ephedrine. However, almost total small bowel infarction was found and, after consultation with a consultant anaesthetist and surgeon, the operation was abandoned and a diamorphine infusion was started.

Case Study 28

A 70-year-old, male, ASA 3 patient weighing 45 kg required oversewing of his perforated duodenal ulcer. He had alcohol-related cachexia, was 'dry', had a possible right hilar lung mass and a preoperative haemoglobin 9.1 gm/dl. A consultant provided the anaesthesia for the operation that lasted for 1 hr 45 min. Following induction of anaesthesia a CVP and a thoracic epidural were sited. The first recorded blood pressure was 110/60 mmHg. After 5 ml of 0.125% bupivacaine with morphine was given into the epidural space the blood pressure decreased to 80/45 mmHg. A further 10 ml of epidural 0.125% bupivacaine with morphine and 1000 ml of fluid were given over the next 30 minutes. The blood pressure had by then decreased to 45/30 mmHg. Fifteen minutes later, when the blood pressure was 50/30 mmHg, a final 5 ml of epidural 0.125% bupivacaine with morphine was given. The blood pressure remained at 60/25 mmHg for the following 40 minutes during which time a further 1500 ml of intravenous fluid and, when the haemoglobin was 4.8 gm/dl, two units of blood were given as well as 6 mg ephedrine. The CVP, which was 6 mmHg at the start of the operation, had increased to 20 mmHg by the end of the operation. Towards the end of the operation the patient had increasing arterial desaturation and a postoperative chest X-ray showed a "collapsed left lung" After the operation the patient was nursed on a general ward. He developed a supra-ventricular tachycardia and ST segment changes on his ECG monitor and died on postoperative day five. No postmortem was requested but the surgeon recorded that he died of a myocardial infarction.

Case Study 29

A 62-year-old patient with a carcinoma of the lung and ischaemic heart disease required a laparotomy for closure of a perforated duodenal ulcer. A junior SpR anaesthetist with the Fellowship, and working with an SHO, provided the anaesthesia. The case was discussed with a consultant who was available by telephone. The patient was resuscitated in the anaesthetic room between 21.00 and 22.45. His baseline blood pressure was 120/60 mmHg. Two thousand ml of intravenous fluid was given and then a thoracic epidural was established at the level of T10. Following a test dose of 3 ml of 0.5% bupivacaine into the epidural space, the blood pressure decreased to 80/40 mmHg. After 15 minutes a further 5 ml of 0.25% bupivacaine was given into the epidural space. During the next hour the blood pressure remained between 80/40 mmHg and 90/50 mmHg despite another 500 ml of intravenous fluid, 18 mg ephedrine and 6 mg methoxamine. Following this, the first CVP reading of minus 2 mmHg was recorded. Anaesthesia was induced at 22.45 and the hypotension persisted throughout the 45 minute operation, during which time a further 1000 ml of intravenous fluid was given. After the operation the part-time recovery ward was closed and so the patient was returned directly to the general ward at 23.45. The epidural was not used for postoperative analgesia; instead the patient received intermittent subcutaneous morphine. The patient remained haemodynamically unstable overnight and died 14 h 30 min after the operation.

Case Study 30

A 72-year-old, ASA 3 patient with bowel obstruction and weighing 37 kg required a laparotomy for a sigmoid colectomy, left oophorectomy and salpingectomy. She had COPD. The anaesthetist, a first year SHO with no anaesthetic qualification did not discuss the case with someone of greater experience before the operation. The patient's preoperative blood pressure was 107/49 mmHg. The operation started at 19.00. Following induction of anaesthesia an attempted epidural at the L2/3 level resulted in a dural tap. An epidural was subsequently established at the L3/4 level. Ten ml of 0.5% bupivacaine was given into the epidural space and an epidural infusion of 0.125% bupivacaine was run at 20 ml/hr throughout the operation. During the operation that lasted for 2 h 45 min, the blood pressure remained at 80/40 mmHg and the heart rate was between 105-110 per minute. Three thousand ml of intravenous fluid was infused but no vasoconstrictors were used. Following tracheal extubation the patient went into pulmonary oedema and respiratory failure, the trachea was re-intubated and the patient was then nursed in the ICU where she died three days later.

Hypotension resulting from the vasodilator effects of local anaesthetic in the epidural space could have been expected in these patients who were dehydrated and, in some instances, possibly septic. It cannot be proved that the operative hypotension these patients suffered was a direct cause of their deaths. Nevertheless, most anaesthetists would consider this degree of hypotension unacceptable. The above cases highlight that the use of epidural analgesia during general anaesthesia for urgent operations requires caution in the dose of local anaesthetic that is used. Trainee anaesthetists managed some of these patients and this highlights the need to ensure that they are trained in the prompt and appropriate management of operative hypotension.

General and regional anaesthesia in association with other medical disorders

Case Study 31

A 69-year-old male, ASA 2 patient weighing 61.5 kg required an abdominoperineal resection. He had angina that had been recently stabilised. A consultant anaesthetist, working with an associate specialist, provided the anaesthesia. A CVP and thoracic epidural at the level of T10/11 were established with the patient awake. The preoperative blood pressure was 140/70 mmHg. After induction of anaesthesia and an epidural test dose of 3 ml of 1% lignocaine, the arterial pressure decreased to about 70/35 mmHg for one hour, during which time 24 mg of intravenous ephedrine was given. After one hour the blood pressure increased to 100/70 mmHg. At this time a further 12 ml of bupivacaine 0.5% was given into the epidural space, followed shortly afterwards by ST segment changes and hypotension unresponsive to epinephrine. The patient suffered a fatal cardiac arrest during the procedure one hour later.

Case Study 32

A 76-year-old, ASA 3 male patient required a sliding hip screw for a fractured left hip. His medical history included ischaemic heart disease, angina, three previous CVAs, confusion, dementia and several TIAs. A second year SHO with part 1 of the Fellowship provided the anaesthesia. The patient's blood pressure preoperatively was 180/100 mmHg at which time 1.6 ml of heavy 0.5% bupivacaine and 20 micrograms of fentanyl were injected into the subarachnoid space at the level of L3/4. During the anaesthetic the patient breathed spontaneously through a laryngeal mask airway. At the start of the anaesthetic the blood pressure decreased to 50/20 mmHg. After 20 minutes it spontaneously increased and it remained between 90/40 mmHg and 110/50 mmHg for the next 1 h 15 min. During the operation 2000 ml of crystalloid was infused. The patient suffered a CVA six hours after the operation.

Case Study 33

An 86-year-old, ASA 3 female patient underwent an operation for insertion of a Thompson's prosthesis following a fractured neck of femur. Her weight was not recorded. She had severe angina, confusion and a previous CVA. An associate specialist with the DA provided anaesthesia. The preoperative blood pressure was 148/91 mmHg. After induction of anaesthesia a femoral and lateral cutaneous nerve block was established using 40 ml of 0.5% bupivacaine (200 mg). During the operation the patient breathed spontaneously through a laryngeal mask airway. During the one-hour operation the blood pressure remained between 50/20 mmHg and 70/30 mmHg, no vasoconstrictors were given and 1000 ml of crystalloid fluid was infused. Postoperatively on the ward the blood pressure stayed between 90/60 mmHg and 100/65 mmHg, and the patient received 4300 ml of intravenous fluid, but did not pass urine before she died 16 hours after the operation. Although the weight of the patient is not known, this dose of bupivacaine seems large.

In these cases, the choice of anaesthetic, a combination of regional analgesia with general anaesthesia, was not criticised by NCEPOD. However, the management of the resulting hypotension in these patients, all three of whom had known coronary arteriopathy and two had cerebrovascular disease, could be questioned. It is a matter of opinion, but it is difficult to avoid the conclusion that the management of the regional technique was 'heavy handed'. When using combined general anaesthesia with regional analgesia the incidence of complications is probably the sum of each technique, and hypotension is more likely when the general anaesthetic has a tendency to vasodilatation. Could better or more prompt treatment of the subsequent hypotension then, have avoided these adverse events?

Recommendations

- Anaesthetists should be cautious about the dose of local anaesthetic used for a regional technique in those patients who are predisposed to hypotension.
- Operative hypotension demands an appropriate and timely response, especially for those patients who have a coexisting disease such that hypotension is potentially harmful.

AORTIC STENOSIS

Key points

- An asymptomatic cardiac murmur may indicate significant cardiac disease.
- Patients with a large aortic valve gradient or small aortic valve area, particularly in association with a reduced ejection fraction, have an indication for invasive monitoring, ICU/HDU care and excellent postoperative pain control.

As people are living longer so disorders associated with age become more common. Aortic stenosis is mostly secondary to degenerative valve disease and is becoming increasingly prevalent. Approximately thirty percent of those aged 80 years or older who have a postmortem examination have evidence of degenerative changes in their aortic valve, inevitably some of these will be clinically important aortic stenosis. This section of the report discusses their operative management

Aortic stenosis and operative risk

In 1977 Goldman and co-workers[52] identified critical aortic stenosis as an operative risk factor. Recent studies by Lee and co-workers of postoperative cardiac complications in patients undergoing major non-emergency surgery have failed to confirm this correlation, and so aortic stenosis has been removed from the Revised Cardiac Risk Index[35]. However, in their study, aortic stenosis was present in only 5/2893 (0.2%) patients and with such small numbers, finding a correlation with adverse outcome was unlikely. This does not mean that aortic stenosis is no longer a worrying prognostic factor, indeed it is likely to be important for the sorts of patients within this Enquiry who often are undergoing emergency surgery and/or have other coexisting medical problems. The risk factors that were identified within the Revised Cardiac Risk Index were high risk surgery (intraperitoneal, intrathoracic or supra-inguinal vascular operations), a history of ischaemic heart disease, a history of congestive heart failure, cerebrovascular disease, preoperative treatment with insulin and a serum creatinine >177 micromol/l.

The 1994/95 NCEPOD Report[39] expressed concerns about the assessment and management of patients with aortic stenosis. Aortic stenosis in the Western World is now less often secondary to rheumatic fever and more commonly bicuspid, calcific, or what is termed 'senile degenerative' disease in the valve. Although rheumatic aortic stenosis may progress slowly, the progression of calcific aortic stenosis can be rapid. Symptoms of aortic stenosis can present late in the disease process, and patients often remain asymptomatic despite having moderate to severe aortic stenosis. Aortic stenosis occurs most often in elderly patients, who are also more likely to have coexistent cardiac and/or other systemic diseases. It is therefore evident that patients with aortic stenosis should be carefully assessed preoperatively. Those with coexisting risk factors should be considered for invasive monitoring during and after their operation. In this sample NCEPOD identified 22 patients who had aortic stenosis and died after non-cardiac surgery. This is a sample of 10% of deaths. Extrapolating from this there will be approximately 220 patients with aortic stenosis that die postoperatively each year; this equates to one patient within each Trust per year. Of the 22 patients, two were not diagnosed until a post mortem examination.

Case Study 34

A 74-year-old, ASA 2 patient underwent a right shoulder replacement. An asymptomatic murmur was detected preoperatively that was thought to arise from the mitral valve. No echocardiography was performed. The patient had a cardiac death six days after operation. Postmortem examination revealed severe aortic stenosis.

Case study 35

A 73-year-old, ASA 2 patient with COPD and shortness of breath underwent a sigmoid colectomy. General anaesthesia was supplemented with lumbar epidural analgesia. No invasive monitoring was used. One hour after the start of the operation, when the blood loss was 200 ml and 2500 ml of fluid had been infused, the patient suffered a fatal cardiac arrest. Postmortem examination revealed left ventricular hypertrophy and senile calcific aortic stenosis.

An asymptomatic cardiac murmur may indicate significant cardiac disease and should be investigated preoperatively by echocardiography.

Preoperative assessment

The 1994/95 NCEPOD[39] Report recommended that *"A patient with an ejection systolic murmur in association with evidence of left ventricular hypertrophy or myocardial ischaemia requires referral to a cardiologist preoperatively for assessment of the aortic valve."* The questionnaires for this sample do not allow us to identify clearly how many of the 20 patients with known aortic stenosis had a preoperative medical review. We can identify three that did and they are presented below.

Case Study 36

An 83-year-old, ASA 5 patient with known ischaemic heart disease and aortic stenosis, but no other medical problems, was anaesthetised by a consultant for a left cemented Thompson prosthesis. The operation was delayed for a preoperative medical review of the aortic stenosis that included echocardiography. The severity of the aortic stenosis was not reported to NCEPOD. The patient received a general anaesthetic, but no invasive monitoring was used during the operation that lasted for two hours. The patient entered the recovery area and was then returned to the ward almost straight away. Cardiogenic shock ensued and the patient died on postoperative day two.

Case Study 37

An 86-year-old, ASA 4 patient with ischaemic heart disease, angina, known moderate to severe aortic stenosis, confusion and deafness required a hemiarthroplasty. The operation was delayed for a medical opinion, but no echocardiography was performed. Anaesthesia was provided by an SHO of more than two years' experience with the DA who had asked advice from a consultant. The patient received a spinal anaesthetic, but no invasive monitoring was used. The patient returned to the ward and died three days after the operation. The cause of death was recorded as cardio-respiratory failure secondary to cardiac failure, pulmonary oedema, aortic stenosis and mitral regurgitation.

The support and advice this trainee received would appear to be inappropriate.

Case Study 38

An 88-year-old, ASA 3 patient with known aortic stenosis and bundle branch block on the ECG, dementia and confusion, required internal fixation of a displaced fracture of the proximal femur. The operation was delayed for a medical opinion but no echocardiography was performed. An associate specialist with the DA provided the general anaesthetic. No invasive monitoring was used during the operation that lasted for 2 h 5 min. The patient died on postoperative day 27.

It would appear that these patients who received a medical referral were recognised as having serious medical problems. For two out of three of these patients, although their medical treatment was reviewed, the severity of their aortic stenosis was not assessed by echocardiography. From a medical point of view perhaps it was judged that this was not indicated, although its findings might have influenced the anaesthetic management. There is no reason why a physician should understand the risks of aortic stenosis in relation to anaesthesia, or that an accurate assessment of its severity can influence the operative and postoperative anaesthetic management. Patients with a large aortic valve gradient (>50 mmHg) or small aortic valve area (<1.0 cm^2) particularly in association with a reduced ejection fraction have an indication for invasive monitoring, ICU/HDU care and excellent postoperative pain control. These cases illustrate the paramount importance of clear communication between the anaesthetist, surgeon and physician on the aims and benefits of all medical referrals. In many hospitals it is a technician who performs the echocardiography and anaesthetists have direct access to that service. Whenever possible, the anaesthetist of a patient with aortic stenosis should obtain a preoperative echocardiographic assessment of the aortic valve.

Six out of the 20 (30%) patients with known aortic stenosis before their operation had a preoperative echocardiogram. Nine percent of all the patients in this report (excluding those patients that underwent a heart operation) had a preoperative echocardiogram. This is a very low percentage in this sample where 72% of patients who died after their operation had a cardiac disorder. NCEPOD recognises that many echocardiography services are under pressure from a spiralling increase in workload. However, the clear relationship between

preoperative cardiac disorders and postoperative death demands that the echocardiography service is accorded an appropriate priority in the funding and development of plans by Trusts/hospitals. Anaesthetists should help to promote this.

Operative and postoperative care

Patients with aortic stenosis require close control of their heart rate, arterial and venous filling pressures, both during and after their operation. Invasive monitoring is so readily available to the technically competent, modern anaesthetist that its appropriateness should be considered for each individual with this disorder. Some of the cases in this section of the report can be criticised on the lack of invasive monitoring, despite the presence of known aortic stenosis in association with serious cardiac or systemic disorders. Eleven out of the 20 patients with known aortic stenosis did not have any invasive monitoring during their operation.

Case Study 39

An 81-year-old, ASA 4 patient with aortic stenosis, uncontrolled AF, CCF and renal impairment (serum creatinine 179 micromol/l) was scheduled for a sigmoid colectomy. Preoperative echocardiography confirmed aortic stenosis and revealed an ejection fraction of 49%. The AF was controlled preoperatively with a loading dose of amiodarone and maintenance continued with oral amiodarone 200 mg daily. A consultant provided the general anaesthesia but did not use invasive monitoring. During the operation, which lasted for 1 h 25 min, the heart rate was 110 per min and systolic arterial pressure was 90 mmHg. After the operation the patient spent 20 minutes in recovery before returning to the general ward. Overnight the heart rate remained elevated at 120 per minute and the patient was in a 2000 ml positive fluid balance 18 hours after the operation when he suffered a fatal cardio-respiratory arrest.

Case Study 40

An 80-year-old, ASA 3 patient with a history of four previous myocardial infarctions, aortic stenosis and a serum creatinine of 181 micromol/l was anaesthetised by a consultant for a scheduled right hemicolectomy. There was no preoperative echocardiographic assessment. The patient received a general anaesthetic without invasive monitoring. Postoperatively he was nursed in the ICU and died of a perioperative myocardial infarction ten days later.

It is recognised that for patients with known aortic stenosis who are admitted for emergency operations, preoperative echocardiography may be impractical. For these patients, their anaesthetic management, including their monitoring and perioperative care, should be based on the assumption that the lesion is moderate or severe.

Case Study 41

An 84-year-old, ASA 3 patient with known aortic stenosis, a cardiac pacemaker and serum creatinine of 225 micromol/l required repair of a strangulated inguinal hernia. No preoperative anaesthetic assessment was made but a preoperative haemoglobin of 16.6 gm/dl suggested probable dehydration. A SpR with the CCST provided general anaesthesia at 21.15. No invasive monitoring was used during the operation that lasted for 1 h 25 min. The patient was returned to the general ward, without going to a recovery area, at 23.40 where he remained anuric and hypoxaemic. He developed acute LVF and died 18 hours after the operation. Despite the obvious organisational problems, this case was not discussed at an anaesthetic audit meeting.

For patients with aortic stenosis, the appropriate level of postoperative care needs to be considered preoperatively. The patients cited above with known aortic stenosis were all aged 80 years or older. Irrespective of their age, for many of the cases cited above, intensive monitoring and HDU or ICU care would have been appropriate. Nine out of the 20 patients with known aortic stenosis were admitted to an HDU or ICU after their operation.

Case Study 42

An 82-year-old, ASA 4 patient with IHD and aortic stenosis was admitted for a scheduled anterior resection of rectum and end colostomy. Preoperative assessment included echocardiography. A consultant provided general

anaesthesia for the four-hour operation. Anaesthetic management included CVP, direct arterial and pulmonary artery pressure monitoring. Postoperatively the patient was nursed in the ICU. Unfortunately the patient suffered a perioperative myocardial infarction and died on postoperative day three.

Case Study 43

An 85-year-old, ASA 3 patient with aortic stenosis and AF required a subtotal colectomy and ileostomy. No preoperative echocardiographic assessment was made. A staff grade with the Fellowship, who had discussed this case with a consultant preoperatively, provided the general anaesthesia for the operation that lasted 3h 15min. The anaesthetic management included CVP and direct arterial pressure monitoring. After the operation the patient went to an HDU. The patient suffered a perioperative myocardial infarction and died on postoperative day three.

The two cases above are examples of indisputably excellent care. That they died despite this standard of care reflects serious anaesthetic risk for patients with aortic stenosis and coexisting ischaemic heart disease. This standard of operative care must minimise that risk.

Recommendation

- Whenever possible the anaesthetist of a patient with aortic stenosis should obtain a preoperative echocardiogram of the aortic valve.
- The availability of the echocardiography service for patients preoperatively should be accorded an appropriate priority in the funding and development plans of hospitals.

THE ORGANISATION OF PERIOPERATIVE CARE AND THE INVOLVEMENT OF CRITICAL CARE TEAMS

Key points

- Preoperative resuscitation of some patients was inadequate and/or poorly coordinated.
- Timing of operations was often inappropriate to the patient's physical state.
- Resuscitation plans were not always adhered to.
- Doctors in training can be slow to seek advice.
- CVP lines were poorly managed on the wards thus providing misleading information.

Patients step-up to or step-down from units with different nursing care levels, e.g. ICU to HDU, HDU to the general ward. However, irrespective of where they are nursed, patients require a continuum of levels of medical and nursing expertise. This section considers the interface between care on the general ward and care in a critical care facility. It explores ways of providing that continuum of medical and nursing expertise that is tailored to the patient's requirements. Included in this section are discussions on the use of critical care teams and ward based management by doctors in training.

Preoperative care

The perioperative status of patients is a continuous spectrum from the very well to the critically ill. It is obvious then that medical requirements of patients are also a continuum, both for levels of facilities and levels of medical expertise.

Within hospitals the facilities, specialised and general care units, are physically separate so a continuum of care levels is not easy to provide. A patient will step-up to or step-down from a care level. In addition, the presence of an ICU or HDU facility in a hospital does not mean that there is a bed within such a facility available for all patients when it is required. NCEPOD[13] and clinicians recognise that there is a chronic shortage of critical care beds, critical care clinicians and nursing staff. There is a need to make the best use of the existing facilities. This report includes the period of the ICU bed crisis in the winter of 1999/2000 and it is recognised that the cases reviewed may reflect the crisis as well as the ongoing national ICU/HDU bed shortage.

The issue of providing a continuum of medical and nursing expertise can be addressed. 'Critical to Success', a report by the Audit Commission[48] was published in 1999 and Comprehensive 'Critical Care'[37], was published by the Department of Health in May 2000. Both reports contain many recommendations on how the care of seriously ill patients might be improved, and the Department of Health has provided additional funding for critical care services. Many hospitals are using that funding to implement organisational changes, including critical care outreach teams. These changes should enable critical care expertise to be deployed outside the confines of the ICU or HDU facility.

This section of the report aims to promote change by illustrating and commenting on some aspects of perioperative care where NCEPOD sees deficits.

Preoperative assessment

The anaesthetic questionnaire enquired where the anaesthetist assessed the patient before the operation (Table 6.22). This gives some indication of where patients were managed and resuscitated preoperatively.

Table 6.22	Location of anaesthetic assessment*	
Ward	1132	80%
ICU/HDU	204	14%
A&E	62	4%
Outpatients	6	
Not known/not answered	5	
Total	**1409**	

** Fifty-eight patients (4%) were not assessed preoperatively.*

Eighty percent of patients were assessed on the general ward. Fourteen percent of patients were assessed on the ICU/HDU, few had been admitted specifically for preoperative resuscitation or optimisation and most of these patients had undergone a previous operation and/or were receiving ongoing treatment within the unit. Six percent of patients were assessed in the A &E department and then progressed rapidly to the operating theatre. Most of these were true emergencies for example, leaking abdominal aneurysms or acute intracranial pathology. But for some, the rapid progression to the operating theatre was inexplicable.

Case Study 44

An 87-year-old, ASA 5 patient with peritonitis was assessed in the A&E Department by an SpR 1/2 anaesthetist. Coexisting medical problems included a previous MI, angina, atrial fibrillation, a previous CVA and hypothyroidism. The patient was breathless due to LVF, and confused. Preoperative investigations revealed ECG evidence of bundle branch block and serum potassium of 2.6 mmol/l. The operation, a laparotomy for repair of a perforated transverse colon and tube caecostomy, was started at 02.30 by the same anaesthetist who did not seek more senior advice and a visiting SpR surgeon who discussed the case with their consultant. No invasive monitoring was used during the operation and after 40 minutes in recovery the patient was returned to the general ward at 04.45.

In this case there are questions to be asked about the timing of the operation and the grades of the operating surgeon and anaesthetist. The case was discussed at a surgical audit but not at an anaesthetic one.

Preoperative ward based resuscitation

The surgical team mainly undertakes the initial assessment of patients. They determine the investigation, resuscitation and referral needs of a patient before their operation. For urgent or emergency operations, referral to an anaesthetist should precede a joint decision on when the condition of the patient is optimal, within the constraints of the operative urgency. Following a consensus opinion, subsequent undue delay should not occur.

Case Study 45

An 87-year-old, ASA 3 patient was admitted for amputation of two infected and gangrenous toes. Coexisting medical problems included poorly controlled diabetes mellitus and atrial fibrillation. For four days the diabetes mellitus was managed using an intravenous potassium, insulin and dextrose/saline infusion. Preoperative investigations on the day of operation revealed serum sodium 129 mmol/l, serum potassium 3.7 mmol/l and blood glucose 2.0 mmol/l.

Case Study 46

A 90-year-old, ASA 3 patient with COPD, IHD, AF and confusion was admitted at 21.00 with a fractured hip. Preoperative investigations revealed a haemoglobin of 17.1 gm/dl. Over the next 12 hours the patient received 1000 ml of 0.9% saline. A consultant anaesthetist assessed that the patient was still dehydrated at 09.00 and recommended that the intravenous fluids be increased. By 16.00, the time of starting the operation, the patient had received only a further 200ml of dextrose/saline.

Case Study 2

An 86-year-old, ASA 5 patient with no coexisting medical disorders was admitted for a laparotomy and exploration of left femoral hernia. On the day of admission an ICU SpR reviewed the patient on the ward, advised on appropriate intravenous fluids and recommended that hourly urine output and CVP be measured. The patient was anuric for five hours overnight but none of the medical staff was informed. The next day the patient was admitted to ICU for preoperative resuscitation including intravenous fluids and inotropic therapy.

Clearly the resuscitation of these patients and others within this enquiry was inadequate and/or poorly coordinated between specialties, and the timing of the operations was inappropriate to the patient's physical state. For some reason the resuscitation plans were not adhered to. Preoperative resuscitation involves the skills of surgical, anaesthetic and nursing staff and its successful coordination, or otherwise, should be a subject of multidisciplinary case review.

The preoperative involvement of critical care teams

Resuscitation

Critical care teams by their outreach activities are increasingly being involved in the preoperative resuscitation of patients. The responsibility for referral of patients to critical care staff rests with ward based doctors. It is they who must identify which patients might benefit from the critical care team's early involvement. The process for appropriate referral of patients to critical care clinicians can be, and in some centres is, facilitated by guidelines or early warning systems[48]. The skills of ward based nursing and medical staff vary between hospitals, and even between wards within hospitals. It is therefore, important that guidelines to determine which patients should be referred to the critical care team should be developed locally and subsequently validated.

Specialised critical care teams are best equipped to identify which of the referred patients will benefit from ward based resuscitation, which require a period of intensive resuscitation on the ICU or HDU and when the patient has attained the best 'window of opportunity' for an operation to take place.

Case Study 47

An 87-year-old, ASA 2 patient was admitted with a strangulated femoral hernia accompanied by faeculent vomiting and confusion, but without any other coexisting medical problems. Preoperative investigations revealed a haemoglobin of 16.2 gm/dl and serum urea 26.3 mmol/l with a normal serum creatinine. The patient went to the operating theatre at 00.55, a few hours after admission. The SpR anaesthetist commented that the patient had not received fluid resuscitation, but nevertheless continued with the anaesthetic. The patient received 500 ml of crystalloid fluid during the operation, returned to the general ward after the operation and died from congestive heart failure on postoperative day six.

Case Study 48

A 54-year-old without any coexisting medical disorders was admitted with a perforated peptic ulcer. The operation was delayed for three days for fluid resuscitation but this appeared inadequate and was not guided by invasive monitoring. By the time of the operation the patient's physical status was graded as ASA 5. After 2 h 20 min in recovery the patient was returned to the general ward and died of peritonitis on postoperative day 12.

These are the sort of cases that might benefit from the advice of a critical care clinician. This does not mean that the critical care team should take over ward based management. If the decision is to manage the patient on the ward then, for reasons of locality, the primary responsibility for the ongoing supervision of the resuscitation or postoperative care will most likely still remain with the ward based clinicians and nursing staff, albeit supported by the critical care team.

The anaesthetic and surgical questionnaires were not specific as to where patients were resuscitated, but NCEPOD could identify only 11 patients who were admitted to the ICU or HDU specifically for resuscitation before their operation.

Case Study 49

A 42-year-old, ASA 4 paraplegic patient was admitted for treatment of a gluteal ulcer and necrotising fasciitis. Preoperative resuscitation included invasive monitoring and inotropic treatment on the ICU before the operation for debridement of the ulcer that started at 23.00. The anaesthetist was a SpR 1/2 working with a second year SHO. There was no involvement by an intensive care or anaesthetic consultant preoperatively. The patient suffered a respiratory arrest before the operation and died in the ICU on postoperative day one.

Case Study 50

An 85-year-old, ASA 3 patient with IHD, COPD, NIDDM was admitted with a bowel obstruction. A medical SHO and a staff grade anaesthetist resuscitated the patient on the HDU overnight before a laparotomy and division of adhesions. A consultant anaesthetist was involved in the decision-making before the operation at 11.00 the following morning, but a SpR 1/2 anaesthetist who had not seen the patient preoperatively, provided the anaesthesia.

The management of these patients by the doctors in training is not criticised. However, adequate medical standards cannot be ensured when there is such a large reliance placed on junior medical staff in the management of critically ill patients. These situations are a result of the shortfall of suitably experienced critical care clinicians and that needs remedy[48].

Combined specialty decision-making

It must be recognised that some patients are so seriously ill that an operation, even with postoperative intensive care, is likely to be futile.

Case Study 51

A 60-year-old who was bed bound with TB suffered a severe gastrointestinal haemorrhage. Preoperatively his physical status was ASA 5. The surgeon thought that the patient had little chance of surviving the surgery, but his family insisted that he should receive an operation.

Case Study 52

An 87-year-old patient with severe cardiac disease had suffered six gastrointestinal bleeds that had been managed by medical treatment during the previous six months. Preoperatively his physical status was ASA 5 and, in the opinion of his physician, he was not fit for surgery. The surgeon agreed with this, but stated in the questionnaire that he had been persuaded to operate.

These cases illustrate difficult decisions that needed to be made before the operation and at the highest level. Consultation between the consultant surgeon and a consultant anaesthetist can best decide when a patient has little chance of surviving and therefore, is unlikely to benefit from an operation or ICU treatment. In such cases where both consultants agree, an explanation to the patient and their relatives may result in a decision made jointly by all parties.

The time to plan the ongoing intensive or high dependency care in critically ill patients is before the operation and with the full involvement and support of the critical care team.

Case Study 53

A 75-year-old, ASA 5 patient underwent a laparotomy for treatment of a perforated diverticular abscess. He had severe ischaemic heart disease, pulmonary oedema and hypoxaemia (PaO_2 6 kPa on a FiO_2 0.5). He went to theatre in the afternoon on the day following his admission, but without any obvious preoperative resuscitation. Postoperatively his trachea was extubated, his SpO_2 was 65% and he died in recovery.

A predictably difficult case with, apparently, no planning of how the patient's ongoing care would be organised.

The development of critical care outreach teams needs to be supported by developments in the skills of ward based staff. This was recognised in the Department of Health's review, 'Comprehensive Critical Care'[37] which recommended that 50% of ward based nursing staff should have received competence based high dependency training by March 2002 and 100% by March 2004. Similar arrangements for the training of ward based junior medical staff in high dependency medicine are also appropriate. If this is achieved then improvements in ward based care will result, and this should help to ease the pressures on critical care resources.

Postoperative ward based care

The responsibilities of ward based doctors in training

NCEPOD was critical when doctors in training were either inappropriately slow to seek advice or did not. This was not confined to any specialty; it applied to surgical, anaesthetic and medical clinicians.

Case Study 54

A 79-year-old, ASA 2 patient underwent sub-total colectomy. Seven days postoperatively he became acutely unwell coinciding with the onset of atrial fibrillation. A surgical HO and a medical SHO assessed the patient and diagnosed that he had suffered from a pulmonary embolus, even though the clinical picture suggested pneumonia. Without seeking more senior advice, they decided not to instigate any further treatment. The patient died later that day. Postmortem examination showed bilateral lower lobe consolidation with no evidence of pulmonary embolism.

Case Study 55

An 83-year-old, ASA 3 patient underwent a femoro-distal arterial bypass. He was known to be a high risk patient who had suffered a previous myocardial infarct accompanied by a cardiac arrest. The patient was treated on the HDU for the first day postoperatively. The next day he was transferred to the ward where two surgical SHOs supervised the management, with advice from a medical registrar. Over the first 24 hours on the ward the patient received five litres of fluid, despite a blood loss of only 300 ml, and developed oliguria that progressed to established renal failure. The consultant surgeon was not informed of the situation and was critical of the trainees. The patient died on the third postoperative day.

For doctors in training to see and assess a sick patient in the first instance, and to form an opinion is entirely appropriate; it is a good way to learn. However, recognising the limits of one's knowledge and experience and assuming a readiness to seek advice is a prime responsibility of all doctors. Serious questions arise when doctors in training inappropriately do not seek advice. Do they have unrealistic belief in their education and experience and so fail to recognise their limitations? If so, how much is this due to their own, perhaps over confident personality and how much a failure of their training? Do they have, or perceive that they have a lack of senior support, and so are reluctant to seek advice? How much is this a failure of supervision of the doctors in training by the consultant responsible for the care of the patient? Ultimately, it is the consultant's responsibility to ensure that the lines of communication are open between them and the doctors that are under their supervision, and that those doctors are acting appropriately.

Ward based central venous pressure monitoring

The maintenance of appropriate fluid balance in the perioperative patient, the prevention of severe dehydration or fluid overload, is of paramount importance. This was discussed in detail in the NCEPOD Report, 'Extremes of Age'[1]. A useful aid to guide fluid therapy is central venous pressure (CVP) monitoring. In the sample for this report, 642/1467 (44%) patients had CVP monitoring during and after their operation. However, peer review advised that there was a monitoring deficiency, mainly of CVP monitoring, in a further 13% of cases.

Case Study 56

An 81-year-old, ASA 4 patient was scheduled for abdominoperineal resection. Past medical history included four previous myocardial infarctions, and coexisting disorders included angina and hypertension. The operation was in a hospital with no HDU and the ICU was full. Knowing this, the consultant anaesthetist proceeded without invasive monitoring. After 56 minutes in recovery the patient returned to the ward where she suffered a further myocardial infarction and died on postoperative day two.

Case Study 40

An 80-year-old ASA 3 patient with a history of four myocardial infarctions, hypertension, aortic stenosis and serum creatinine 181 micromol/l was anaesthetised by a consultant for a right hemicolectomy. This consultant anaesthetist wrote on his assessment form "I have warned him of the consequences to have (sic) this operation prior to CABG". The patient received a general anaesthetic, but no invasive monitoring was used. The patient was nursed on the ICU for two days before discharge to the general ward where he died of a perioperative myocardial infarction ten days later.

NCEPOD considers it likely that, with increased involvement of critical care teams on the wards and an increase in patient optimisation, the use of CVP

monitoring will increase. The reasons for an under use of CVP monitoring may include a lack of training in CVP line management amongst the ward based staff. The surgical advisors in particular emphasised that CVP lines were poorly managed by the nursing staff on their wards, and the information from them was often misinterpreted by their trainees. They were of the opinion that all patients who would benefit from CVP monitoring should be admitted to a critical care unit. However, there is a national shortage of HDU beds. An alternative approach is to develop training programmes to increase the skills of the nurses and doctors on the wards in CVP management and interpretation. This concept of monitored beds on the general ward is not entirely new, and some hospitals are already successfully practising ward based CVP monitoring. On these wards, CVP monitoring is viewed as merely an extension of already established ward monitoring practices.

A programme for the development and maintenance of ward based CVP monitoring skills within a hospital should include:

- the development of formal training schemes to ensure that sufficient ward based nurses receive training, and training update in the correct management of CVP lines;
- sufficient ward monitoring equipment with transducer pressure monitoring facility for accurate and continuous CVP monitoring;
- training for ward based surgical trainees in the insertion of CVP lines;
- special attention to all aspects of CVP interpretation within the basic surgical training programme. The understanding of fluid balance and the correction of problems in the perioperative patient already form part of the core basic surgical training requirements[53];
- the involvement of anaesthetists and critical care teams (both clinicians and nurses) in the training and support of ward based medical and nursing staff who are supervising the CVP monitoring.

More widespread use of ward based CVP monitoring should result in fewer patients competing for scarce critical care beds.

Recommendations

- Preoperative resuscitation of patients and the success of its coordination should form part of multidisciplinary case review involving surgical, anaesthetic and nursing staff.
- Guidelines to determine which patients should be referred to a critical care team should be developed locally and subsequently validated.
- It is the consultant's responsibility to ensure that there are open lines of communication between them and the doctors that are under their supervision, and to ensure that those doctors are acting appropriately.
- There should be more training programmes to increase the skills of nurses and doctors on the wards in CVP management and interpretation.