2 Anaesthesia

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2. Anaesthesia

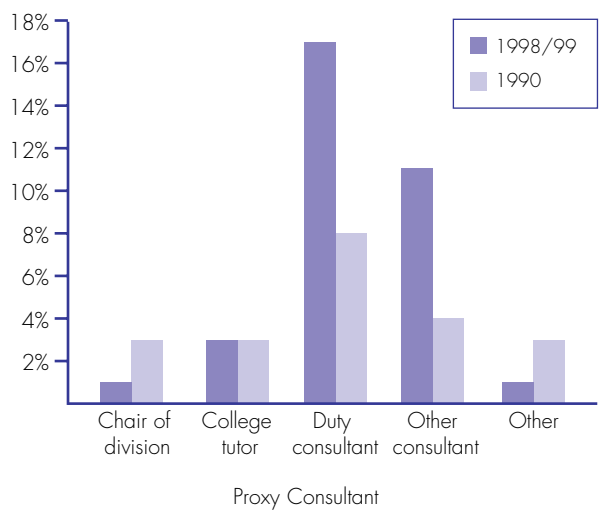
Introduction

Each year the National Confidential Enquiry into Perioperative Deaths (NCEPOD) has monitored the number of questionnaires completed by anaesthetists not directly involved with the anaesthetic, but who have responded on behalf of another. This is most often for cases performed by trainees but includes some for consultants no longer working at the hospital. NCEPOD recognises the extra work this entails and is grateful to those who undertake it.

In 1990, 20% of questionnaires were completed by those not directly involved with the case, in 1998/99 this had risen to 33%.

The return rate for anaesthetic questionnaires in 1990 was 73% and increased to 85% in 1998/99. The increase in questionnaires completed by those not directly involved with the case is probably due to the increased return rate. In most cases it is the duty consultant who undertakes the extra work (Figure 2.1).

Figure 2.1: Anaesthetists completing questionnaires but not directly involved with the case



Review of 1998/99 anaesthetic data and comparisons with 1990

Emergency operating theatres

Key Point

- *All hospitals admitting acute surgical cases should have sufficient daytime emergency operating lists that are appropriately funded and covered by senior anaesthetic and surgical staff.*

The NCEPOD report of 1990 recommended that essential services (including staffed emergency operating rooms, recovery rooms, high dependency units and intensive care units) must be provided on a single site wherever emergency/acute surgical care is delivered[4]. This recommendation was repeated in the NCEPOD reports of 1993/94[11] and 1995/96[13].

In the 1999 report, NCEPOD recommended that there should be sufficient, fully-staffed, daytime theatre and recovery facilities to ensure that no elderly patient requiring an urgent operation waits for more than 24 hours once fit for surgery. This includes weekends[2].

In 1990 there was no enquiry into the provision of daytime emergency operating rooms for urgent surgery. At that time a dedicated daytime emergency operating room was a recent concept and not generally available. In 1998/99 NCEPOD asked about the provision within the hospital of daytime 'emergency' lists for urgent general surgical and for urgent trauma or orthopaedic cases (Table 2.1).

We surmise that there has been a great increase in the availability of emergency daytime operating theatres since 1990. This response to the NCEPOD recommendation is encouraging since the opportunity for good quality care is greater during the day and the burden on junior hospital staff of out of hours operating is reduced.

In future reports questions on emergency operating lists will form part of core data collected by NCEPOD.

Table 2.1: Availability of scheduled daytime emergency lists for urgent cases				
Daytime emergency lists	General surgery		Trauma/orthopaedic	
Available	1005	75%	1152	86%
Not available	320	24%	168	13%
Not answered	12	1%	17	1%
Total	1337		1337	

Table 2.2: Grade of anaesthetist providing cover for emergency lists most of the time				
Grade	General surgery		Trauma/orthopaedic	
Consultant	482	48%	687	60%
Other grades	482	48%	423	37%
Consultant and other grades equally	16	2%	24	2%
Not answered	25	2%	18	1%
Total	1005		1152	

Patients undergoing urgent operations are more likely to be of poor physical status than those admitted for elective or scheduled operations. Recognising the increased operative risk of these patients, who may benefit from an experienced anaesthetist, all hospitals admitting acute surgical cases should have sufficient daytime emergency operating lists that are appropriately funded and covered by senior anaesthetic and surgical staff.

Patient profile

Key Point

- *The profile of patients who die within 30 days of an operation has changed since the report of 1990. Patients are more likely to be older, have undergone an urgent operation, be of poorer physical status and have a coexisting cardiovascular or neurological disorder.*

Age

Table 2.3: Age of patient at time of final operation				
Age in years	1998/99		1990	
0 - 10	15		excluded from sample	
11 - 19	4	5%		5%
20 - 29	15			
30 - 39	15			
40 - 49	31			
50 - 59	82	6%		7%
60 - 69	208	16%		23%
70 - 79	472	36%		33%
80 - 89	379	29%		26%
90 - 99	112	8%		6%
100+	4	<1%		<1%
Total	1337 (1322 excluding those 10 years or less)			

The sample in 1990 excluded children of ten years or less and so the percentages for 1998/99 shown in Table 2.3 have been calculated excluding those patients less than ten years of age.

Figure 2.2: Age of patient at time of final operation

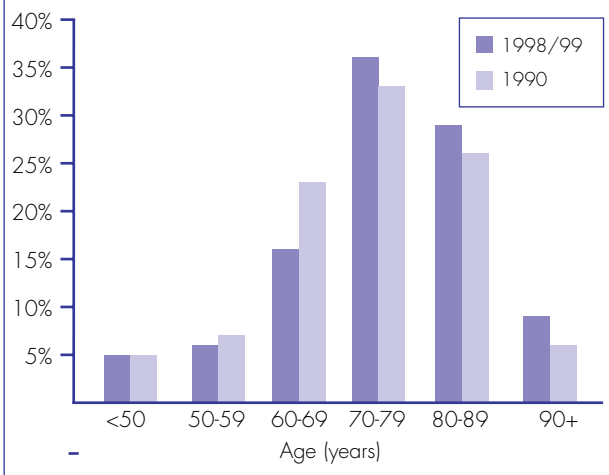
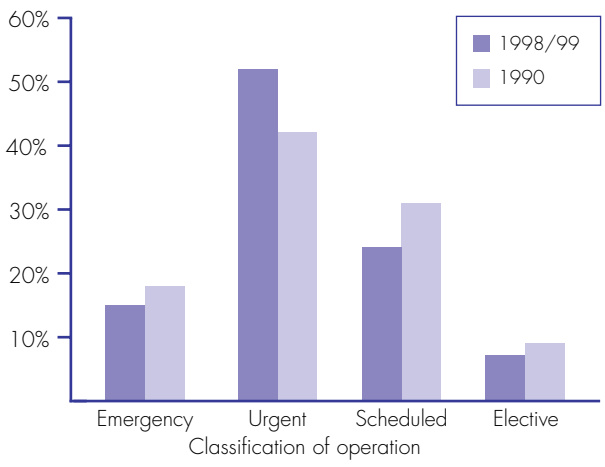


Figure 2.3: Classification of the urgency of the final operation



There appears to be a trend towards an increased patient age. In 1990, 65% of patients were 70 years or older and this increased to 73% in 1998/99. This possibly reflects an older surgical population.

Operations

The 1990 report did not analyse the type of operation and so direct comparisons cannot be made.

Table 2.4: Type of operation
(1518 surgical questionnaires in 1998/99)

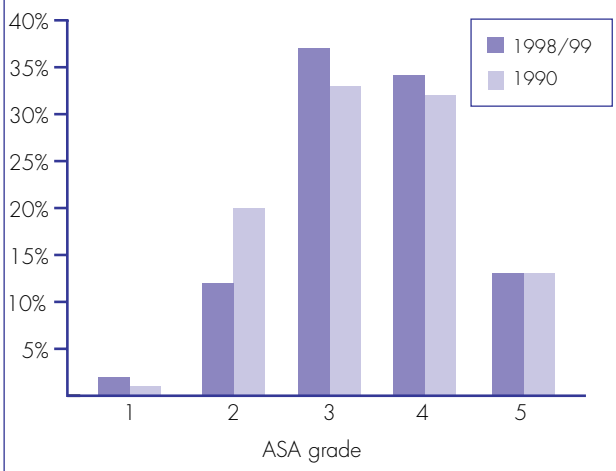
Type of operation	Number	
General surgery	639	42%
Orthopaedic	341	22%
Vascular	206	14%
Cardiothoracic	101	7%
Urology	73	5%
Neurosurgery	68	4%
Gynaecology	22	1%
Otorhinolaryngology	22	1%
Paediatric	18	1%
Plastic	15	1%
Ophthalmology	8	<1%
Oral/maxillofacial	5	<1%
Total	**1518**	

Sixty-nine percent of the general surgery, 81% of orthopaedic, 65% of vascular and 50% of cardiothoracic operations were classified as emergency or urgent.

In 1990, 60% of operations were classified as emergency or urgent; this increased to 67% in 1998/99. The increase was due to more patients having urgent operations (Figure 2.3).

ASA status

Figure 2.4: ASA status



In 1998/99, 84% of patients were ASA 3 or poorer compared with 78% in 1990. For a discussion of ASA classification see page 54.

Coexisting medical disorders

Table 2.5: Coexisting medical disorders at the time of the final operation
(1998/99: 1337 cases; answers may be multiple)

Coexisting disorder	1998/99		1990
None	77	6%	11%
Cardiac	888	66%	54%
Respiratory	496	37%	33%
Neurological	444	33%	18%
Alimentary	214	16%	19%
Renal	193	14%	10%
Endocrine	236	18%	13%
Sepsis	173	13%	*
Musculoskeletal	125	9%	12%
Haematological	139	10%	11%
Hepatic	70	5%	*
Other	184	14%	17%
Not answered	21	2%	2%

* *Not a separate category in 1990 question*

The percentage of patients with coexisting medical disorders increased from 89% in 1990 to 94% in 1998/99. There was an increase in the percentage of patients with cardiac disorders from 54% to 66% and an increase in the percentage of patients with neurological disorders from 18% to 33%.

In the 1998/99 sample cardiac disorders were mainly ischaemic heart disease. Seventeen percent of patients had angina, 27% had suffered a previous myocardial infarction and 18% had atrial fibrillation; overall 42% of patients had one or more of these three conditions. Twenty-eight percent of patients had hypertension and 7% had valvular heart disease.

Respiratory disorders included 18% of patients with chronic obstructive pulmonary disease and 11% had an active chest infection.

Neurological disorders included 11% of patients with a previous cerebrovascular accident and 10% had dementia.

Review of the questionnaires suggested that renal impairment and sepsis were under reported. It is of concern if these conditions are not recognised preoperatively as both are implicated in postoperative complications and death. (See also comment on preoperative creatinine on page 26).

Diabetes mellitus

In this sample a subsection on diabetes was included in the questionnaire. Eleven percent of patients had pre-existing diabetes mellitus.

Table 2.6: Type of diabetes mellitus

Type	Number
Diet controlled diabetes mellitus	34
Tablet dependent diabetes mellitus	68
Insulin dependent diabetes mellitus	44
Not answered	2
Total	**148**

Operative management

Seventy-seven diabetic patients had their blood sugar estimated at some time during the operation, 62 did not and in nine cases this question was either not answered or not known. Of the 62 diabetic patients who did not have their blood sugar estimated during the operation, 12 were insulin dependent diabetics. Often blood sugar was not estimated during the operation when patients had non-insulin dependent diabetes with normal preoperative blood sugar or insulin dependent diabetes with normal preoperative blood sugar undergoing a short procedure.

Table 2.7: Examples where blood sugar estimation was not performed during the operation					
Age (years)	Normal diabetic control	Coexisting disorders	Operation	Preoperative blood sugar	Peroperative insulin
53	Insulin	Alcoholic cirrhosis, pancreatic abscess	Partial pancreatectomy	10.9 mmol/l	GKI* infusion
73	Insulin	Diabetic retinopathy, ischaemic foot	Through knee amputation	12.7 mmol/l	None
61	Tablet	COPD, IHD, septic foot, PVD	Above knee amputation	5.3 mmol/l	Insulin infusion
78	Insulin	IHD, COPD, critically ischaemic leg	Gritti Stokes amputation	3.8 mmol/l	None
74	Tablet	Ruptured iliac artery	Laparotomy for iliofemoral graft	15.2 mmol/l	None
50	Tablet	Acute pancreatitis, shock, morbid obesity	Laparotomy	10.2 mmol/l	None
81	Insulin	IHD, septic foot	Below knee amputation	4.0 mmol/l	None
86	Diet	IHD, PVD	Laparotomy and resection of ischaemic bowel	17.8 mmol/l	None

* *GKI = glucose, potassium and insulin.*

In some of the cases in Table 2.7 blood sugar estimation during the operation could be considered unnecessary, in others it was clearly indicated.

Postoperative management

Of the patients with diabetes mellitus 102/148 (70%) had insulin prescribed postoperatively.

Table 2.8: Route(s) for insulin given in the first 48 hours *(102 cases; answers may be multiple)*	
Route	Number
Intravenous sliding scale	73
Glucose, potassium and insulin infusion	19
Subcutaneous sliding scale	6
Subcutaneous fixed dose	4
Other	2

Table 2.9: Specialty of the clinician supervising postoperative diabetic management		
Specialty	Number	
Surgeon	75	51%
Anaesthetist	39	26%
Physician	16	11%
Other	12	8%
Not answered/not known	6	4%
Total	**148**	

Table 2.10: Grade of the supervising clinician		
Grade	Number	
Trainee	80	54%
Consultant	53	36%
Other grade	5	3%
Not answered/not known	10	7%
Total	**148**	

It is primarily surgical trainees who supervise the diabetic management of patients after operation. The high incidence of insulin used postoperatively, and the fact that it is usually given by intravenous sliding scale, suggests that most patients with diabetes are being monitored and managed actively in the immediate postoperative period.

Preoperative preparation

Key Points

- *Patients of poor physical status may require an emergency medical opinion in the perioperative period. There should be the organisational structure within all acute surgical hospitals for prompt medical referral and treatment.*
- *One hundred and sixty-three operations were delayed for non-clinical reasons, 45 (28%) of which were due to insufficient emergency theatre time. Local audit/clinical governance leads need to be involved in monitoring non-medical reasons for delays in the timing of operations in order to assess the requirements for critical care facilities.*

Weight

The percentage of patients who had their weight recorded was unchanged at 37% in 1998/99 compared with 40% in 1990.

Preoperative intravenous fluid

The percentage of patients who received intravenous fluid therapy in the 12 hours before induction increased from 56% of patients in 1990 to 69% in 1998/99. Over this time there was an increase of seven percent (60% to 67%) in the number of patients undergoing urgent or emergency surgery (Figure 2.3) and of 6% (78% to 84%) in the patients of ASA 3 or poorer (Figure 2.4). Nevertheless, these changes indicating a sicker population are unlikely to account totally for the increase in preoperative use of intravenous fluids. The increase in preoperative intravenous fluids is more likely to reflect an increasing recognition of the high incidence of preoperative dehydration in urgent and emergency cases and their need for active resuscitation.

Delays before operation

Medical reasons

Three hundred and four (23%) patients had their operation delayed in order to improve their medical status.

Table 2.11: System(s) needing attention before operation
(304 cases; answers may be multiple)

System	Number	
Cardiac	176	58%
Metabolic	110	36%
Respiratory	94	31%
Haematological	78	26%
Not answered	23	

Case 1 • *An 81-year-old ASA 3 patient was admitted as an emergency with a prolapsed ileostomy that required revision. She also had severe ischaemic and valvular heart disease and was in heart failure. Postoperatively she returned to the ward where she developed cardiac arrhythmia, severe pulmonary oedema and pneumonia and died on day four.*

Case 2 • *A 76-year-old ASA 3 patient with a rectosigmoid carcinoma was admitted for a scheduled anterior resection. He had known ischaemic heart disease and untreated hypertension. His preoperative arterial pressure was 230/85 mmHg. On the first postoperative day he developed left shoulder tip pain in conjunction with ST segment changes on his ECG, and was referred to a cardiologist. The cardiologist had not reviewed him when he was found dead in bed 24 hours later.*

Neither of these patients received a medical opinion.

Patients of poor physical status may require an emergency medical opinion in the perioperative period. There should be the organisational structure within all acute surgical hospitals for prompt medical referral and treatment.

Non-medical reasons

One hundred and sixty-three (12%) operations were delayed for other reasons.

Forty-five patients had their operation delayed because there was insufficient emergency theatre time. NCEPOD has identified that most patients are admitted into hospitals with daytime emergency operating lists (Table 2.1). Are there sufficient sessions available within all hospitals? Other organisational delays included full ICU beds (11) and because a suitably experienced surgeon was not immediately available (6).

Locally, non-medical reasons for delay in the timing of operations need to be monitored in order to assess the demands on the service provision.

If deficits are detected, more consultant-staffed emergency lists or critical care beds may be deemed to be required. Local audit/clinical governance leads need to be involved in this monitoring process.

Premedication

There has been a change in the practice of prescribing premedicant drugs. In 1990, 39% of patients received a premedication compared with 15% in 1998/99. In 1990, 21% of the sample received a benzodiazepine premedication, the remaining 18% being mostly intramuscular. NCEPOD now monitors only the route of administration and in 1998/99, 11% of the sample received an oral premedication and 2% intramuscular.

Table 2.12: Route of administration of premedicant drugs
(207 cases; answers may be multiple)

Route	Number
Oral	153
IM	25
PR	2
Other	42
Not answered	4

Preoperative investigations

Table 2.13: Preoperative investigations (including tests carried out in a referral hospital and available before the operation)
(1998/99: 1337 cases; answers may be multiple)

Investigation		1998/99		1990
None		12	1%	1%
Haemoglobin		1301	97%	97%
Packed cell volume		935	70%	80%
White cell count		1265	95%	93%
Platelets		1237	93%	*
Sickle cell test		22	2%	2%
Blood group +/- cross match		1027	77%	*
Coagulation screen		654	49%	*
Plasma electrolytes	Na	1276	95%	95%
	K	1272	95%	92%
	Cl	337	25%	55%
	HCO_3	494	37%	61%
Blood urea		1222	91%	92%
Creatinine		1237	93%	73%
Serum albumin		765	57%	47%
Bilirubin (total)		702	53%	43%
Glucose		747	56%	52%
Amylase		200	15%	*
Urinalysis (ward or lab)		298	22%	50%
Blood gas analysis	Inspired oxygen	288	22%	18%
	pH	319	24%	
	pCO_2	318	24%	
	pO_2	317	24%	
Chest X-ray		917	69%	80%
Electrocardiography		1126	84%	82%
Respiratory function tests		86	6%	6%
Special cardiac investigations (e.g. echocardiography)		174	13%	**
CT scan/ultrasound/MRI/NMR		232	17%	*
Special neurological investigations (e.g. imaging)		30	2%	3%
Special vascular investigations (e.g. angiography)		88	7%	*
Others relevant to anaesthesia		48	4%	17%
Not answered		8	<1%	<1%

* *Not a separate category in 1990 question.*

** *In 1990 there were two questions: preoperative echocardiography was performed in 4% and special cardiac investigation in 5%. As patients may have had one or both investigations the total percentage for comparison with 1998/99 is not known.*

There has been no change in preoperative haemoglobin measurement. In 1998/99 haemoglobin results were reported in 1265 cases. Haemoglobin was <10 gm/dl in 19% of patients, 10 – 14.9 gm/dl in 73% and 15 gm/dl or more in 8%; a high percentage of abnormal results.

There has been an increase in preoperative serum creatinine measurement, presumably recognising the importance of perioperative renal dysfunction. Preoperative creatinine values in 1998/99 were reported in 1196 cases. Creatinine was <140 micromol/l in 74% of patients, 140 – 199 micromol/l in 14% and 200 micromol/l or more in 12%. A total of 26% therefore had preoperative creatinine of 140 micromol/l or more.

There has been an apparent decrease in preoperative urinalysis. However, this may be due to results being disregarded as they are often recorded in the nursing notes and are seldom of interest to anaesthetists[14].

There appears to have been a true increase in special cardiac investigations. This is most likely to be due to developments in echocardiography services. Cardiac disease is a major contributor to postoperative death. This non-invasive assessment, which can give a more comprehensive assessment of cardiovascular reserve preoperatively, should be available and used more widely.

There has been a decrease in preoperative chest radiography. This is perhaps secondary to the statement by the Royal College of Radiologists in 1982 that routine preoperative chest X-ray was no longer justified[15] and the requirement for a preoperative chest X-ray is now more often determined on an individual case basis. It cannot be estimated whether 69% is an appropriate rate for preoperative chest X-ray investigation for this sample. However, the population suggests that preoperative chest X-rays may often have been indicated; many patients were emergency admissions with coexisting disorders, and the abnormality yield and influence on patient management increases with age and poorer ASA status[14].

The anaesthetists

Key Points

- *There has been a 7% increase (52% to 59%) in anaesthetics given by consultants and a similar reduction in those given by registrars.*
- *The number of anaesthetics given by those without an anaesthetic qualification was 6% in 1990 and 7% in 1998/99.*
- *When anaesthetics were given by those below consultant grade, in 65% of cases more senior advice was not sought.*

There has been a small increase in the communication between surgeons and anaesthetists. The anaesthetist was consulted, as distinct from informed, before the operation for 56% of patients in 1998/99 compared with 51% in 1990.

The practice of preoperative anaesthetic assessment is unchanged. In this sample an anaesthetist visited 96% of patients before their final operation, compared with 92% in 1990, and this was mostly on the ward. The anaesthetist who made the preoperative assessment was also present at the operation for 92% of patients, compared with 94% in 1990.

Table 2.14: Site of preoperative assessment

Site	Number	
Ward	1037	81%
ICU/HDU	171	13%
Accident & Emergency department	44	3%
Outpatient department	4	<1%
Other	17	1%
Not answered/not known	11	1%
Total	1284	

Table 2.15: Grade of the most senior anaesthetist present at the start of the operation			
Grade	1998/99		1990
Consultant	788	59%	52%
Associate specialist	41	3%	2%
Staff grade	77	6%	<1%
SpR - Accred/CCST, 3 or 4	174	13%	Senior registrar 10%
SpR 1 or 2	77	6%	Registrar 16%
SHO	151	11%	15%
Other (trainee)	8	<1%	-
Other (non-trainee)	17	1%	4%
Not answered/not known	4	<1%	<1%
Total	1337		

The increase in the percentage of consultant anaesthetists present at the start of the anaesthetic is primarily due to an increase in consultant numbers. It may also reflect consultant participation in the staffing of emergency general surgical and trauma operating lists that tend to have more patients of poorer physical status and higher operative mortality than elective surgical operating lists.

Over the past ten years there has been an increase in the percentage of non-consultant career grade anaesthetists as the most senior anaesthetist present for the operation, and a 5% increase in staff grade anaesthetists that almost exactly matches the decrease in SHO anaesthetists. The increase in non-consultant career grade anaesthetists is a result of changes in anaesthetic staffing. There has been a removal of the ceiling on staff grade appointments since 1997, reduced length of training for trainees within the Calman training scheme since 1996 and reductions in junior doctors' hours of work. Non-consultant career grades, particularly staff grade anaesthetists, now more often take part in the 'on call' rota at nights and weekends. For further discussion of non-consultant career grade anaesthetists see page 51.

Figure 2.5: Grade of the most senior anaesthetist present at the start of the operation

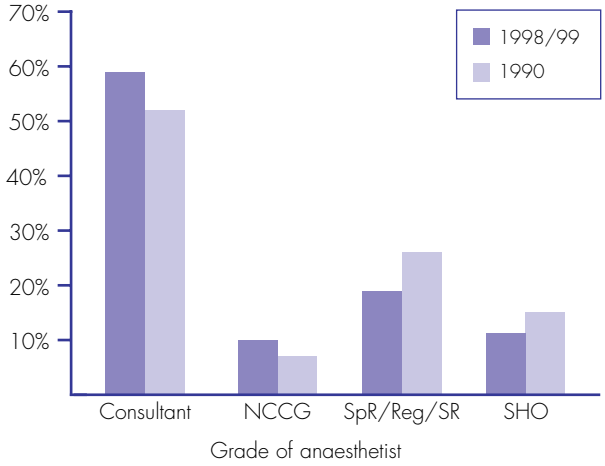


Table 2.16: Anaesthetic qualifications held at the time of the operation *(1337 cases; answers may be multiple)*			
Qualification	1998/99		1990
None	89	7%	6%
Fellowship (Royal College, College or Faculty)	1026	77%	66%
DA (or 'old' Part 1 FRCA)	267		
'Old' Part 2 FRCA (physiology/pharmacology)	129		
'New' Part 1 FRCA	61		
Other	83		
Not answered/not known	32		

Table 2.17: Availability of consultant help for non-consultant anaesthetists	
Availability of consultant	Number
A consultant came to theatre before the end of the anaesthetic	40
A consultant was available in the operating suite but not directly involved	182
A consultant was available in the hospital but not present in the operating suite	77
A consultant was available by telephone	219
Other	5
Not answered/not known	26
Total	**549**

There has been a 4% reduction (15% to 11%) in the number of cases where an SHO is the most senior anaesthetist (Table 2.15). However, Table 2.16 shows that there has been no reduction in the percentage of anaesthetists without an anaesthetic qualification (6% in 1990 and 7% in 1998/99). This is disappointing and implies little improvement in supervision of the most junior anaesthetists. The training and supervision of SHO anaesthetists is discussed on page 46.

In 1990, 21% of anaesthetists sought advice at some time from another anaesthetist who was not present during the anaesthetic. This had decreased to 15% (200 cases) in 1998/99. In 1998/99 there were fewer responses of 'not answered' or 'not known', 4% compared with 11% in 1990, and perhaps this indicates that trainees now document more clearly when advice is sought.

Forty-three (22%) of those who sought advice were established consultant anaesthetists and they generally consulted with intensive care doctors about admission into critical care units. Despite this, 545 patients (41% of the sample) were anaesthetised by those below consultant grade and for 353 of these (65%) more senior advice was not sought. In 1990, 59% of cases performed by those below consultant grade were undertaken without advice from a more senior anaesthetist.

The numbers shown in Table 2.18 are examined in greater detail on page 48.

Table 2.18: Timing of requests for advice by non-consultant anaesthetists			
Grade	Before operation	During operation	After operation
NCCG	27	2	1
SpR	55	10	7
SHO	44	3	6
Total	**126**	**15**	**14**

Table 2.19: Grade of anaesthetist from whom advice was sought *(1990: 467 cases; answers may be multiple)*			
Grade	1998/99		1990
Consultant	128	64%	64%
SpR - Accred/CCST, 3 or 4	8	4%	Senior registrar 18%
SpR 2/year not stated	10	5%	Registrar 22%
Other	3	2%	6%
Not answered	51	26%*	<1%
Total	**200**		

* *The 26% of cases where this question was not answered make comparison with 1990 difficult.*

The anaesthetic

Anaesthetic records

Key Points

- *In 3% of cases there was no anaesthetic record in the notes.*
- *Improvements in information technology can make retrieval of patient information more, rather than less, difficult.*

Three percent of questionnaires reported that there was no preoperative assessment and anaesthetic record in the patient's notes. It is very disappointing that there has been no improvement at all since1990 when 3% of cases also had no anaesthetic record in the notes.

In some such cases the anaesthetic chart may never have been completed, indicating poor medical record keeping. In others the anaesthetic chart may have been wrongly filed or lost after the operation. Proper preoperative assessment and record keeping is essential to good anaesthetic practice[16]. Comment has been made in the general data section (page 14) about problems with lost notes. There was a particular problem during cardiac anaesthesia when often there was no recording of events, physiological variables or drugs given during the period of cardiopulmonary bypass.

There were further problems caused by the introduction of information technology. Many anaesthetic machines and monitors now provide automated charting or paper printouts, which are very helpful at the time of the anaesthetic. On occasions, anaesthetists who used such equipment reported that when they came to review the patient's records to complete the NCEPOD questionnaire, no printout could be found in the notes, and it was either very difficult or impossible to retrieve the missing electronic data. It is highly unsatisfactory that information about the management of an anaesthetic can be lost in this way despite a supposed improvement in anaesthetic technology. Trusts and hospitals must ensure that it is always possible to provide a paper copy of the anaesthetic record at any time.

Retention of the anaesthetic record is vital; it should be available for reference should the patient require another anaesthetic, or if the anaesthetist has to defend his/her actions against complaints or litigation.

Intravenous fluids

Key Point

- *Improvement in the management of major blood loss is required.*

Table 2.20: Crystalloids administered during operation
(1998/99: 1273 cases; answers may be multiple)

Crystalloid	1998/99		1990
Dextrose 5%	33	3%	7%
Dextrose 4% saline 0.18%	88	7%	14%
Dextrose 10%	12	1%	2%
Saline 0.9%	437	34%	28%
Hartmann's (compound sodium lactate)	803	63%	62%
$NaHCO_3$	24	2%	*
Other	13	1%	6%

* *Not a separate category in 1990 question*

Figure 2.6: Use of crystalloids during operation

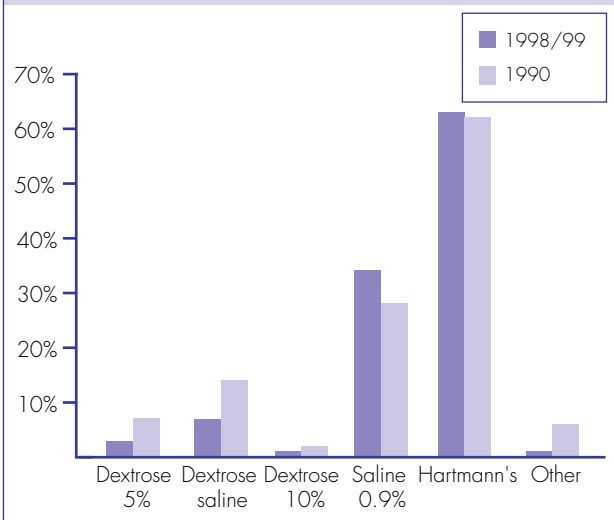


Figure 2.7: Use of colloids during operation

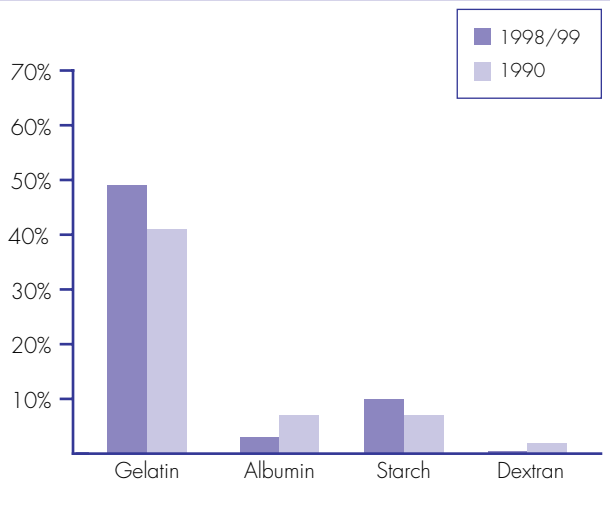


Table 2.21: Colloids administered during operation
(1998/99: 1273 cases; answers may be multiple)

Colloid	1998/99		1990
Modified gelatin	623	49%	41%
Human albumin solution	42	3%	7%
Starch (HES)	123	10%	7%
Dextran	4	<1%	2

Ninety-five percent of patients received intravenous fluids during their operation. This is little changed from the 1990 figure of 92%, but there have been changes in the type of fluids administered.

There has been a decrease in the use of solutions containing dextrose and an increase in the use of saline and Hartmann's solutions as shown in Figure 2.6.

The use of gelatins and starch has increased whilst that of albumin and dextran has decreased as shown in Figure 2.7.

Blood products

Blood transfusion practice is difficult to compare with 1990 because of differences in the wording of questions and changes in blood components.

Table 2.22: Use of blood products during operation
(1273 cases; answers may be multiple)

Blood product	Number	
Red cells	377	30%
Platelets	74	6%
Fresh frozen plasma	148	12%
Other components	33	3%

In the 1998/99 sample, 62 (5%) patients lost 3000 ml or more of blood at operation, either measured or estimated. Only 21 received a platelet transfusion, and 20 received neither platelets nor fresh frozen plasma. One patient was a Jehovah's witness.

The NCEPOD report of 1993/94[11] recommended local protocols for the management of major perioperative blood loss, but improvement is still required.

CASE 3 • *An 87-year-old patient presented with a leaking abdominal aortic aneurysm. He was anaesthetised by an SHO with more than two years' experience who did not seek advice. The patient lost 8700 mls of blood in theatre but was not given any platelets or clotting factors. On arrival in the intensive care unit his platelet count was 43x10⁹.litre and his partial thromboplastin time was greater than 250 seconds. He died two days later.*

Induction and monitoring

Key Points

- *The overall standard of monitoring was good.*
- *Some anaesthetists were unable to monitor expired carbon dioxide in all locations because of a lack of equipment.*

The questionnaires show that the anaesthetic room was not used in 29% of cases, presumably because the patient was in poor condition or about to undergo major surgery, or both. It was noted in the 1990 report that the anaesthetic room was not used in 17% of cases. This may be because the patients in this sample were more sick than those in 1990.

Table 2.23 and Figure 2.8 show that there has been an increase in monitoring of all types since 1990. This is especially noticeable for oxygen and expired carbon dioxide analysers, presumably because the introduction by the Association of Anaesthetists of Great Britain and Ireland (AAGBI) of minimum monitoring standards[17] influenced trusts to invest in monitors. The use of invasive cardiovascular monitoring has also increased. This change in practice is welcome and has been advocated by NCEPOD in the past[11,18]. Monitoring of neuromuscular blockade continues to be uncommon.

Problems with monitoring

Ninety-one questionnaires reported that there were problems with monitoring. In 17 the problem was the unavailability of capnography, especially in the anaesthetic room. This issue was highlighted by the Royal College of Anaesthetists, which stated that *"if tracheal intubation is performed in the anaesthetic room then capnography must be used immediately the tracheal tube is inserted"*[19].

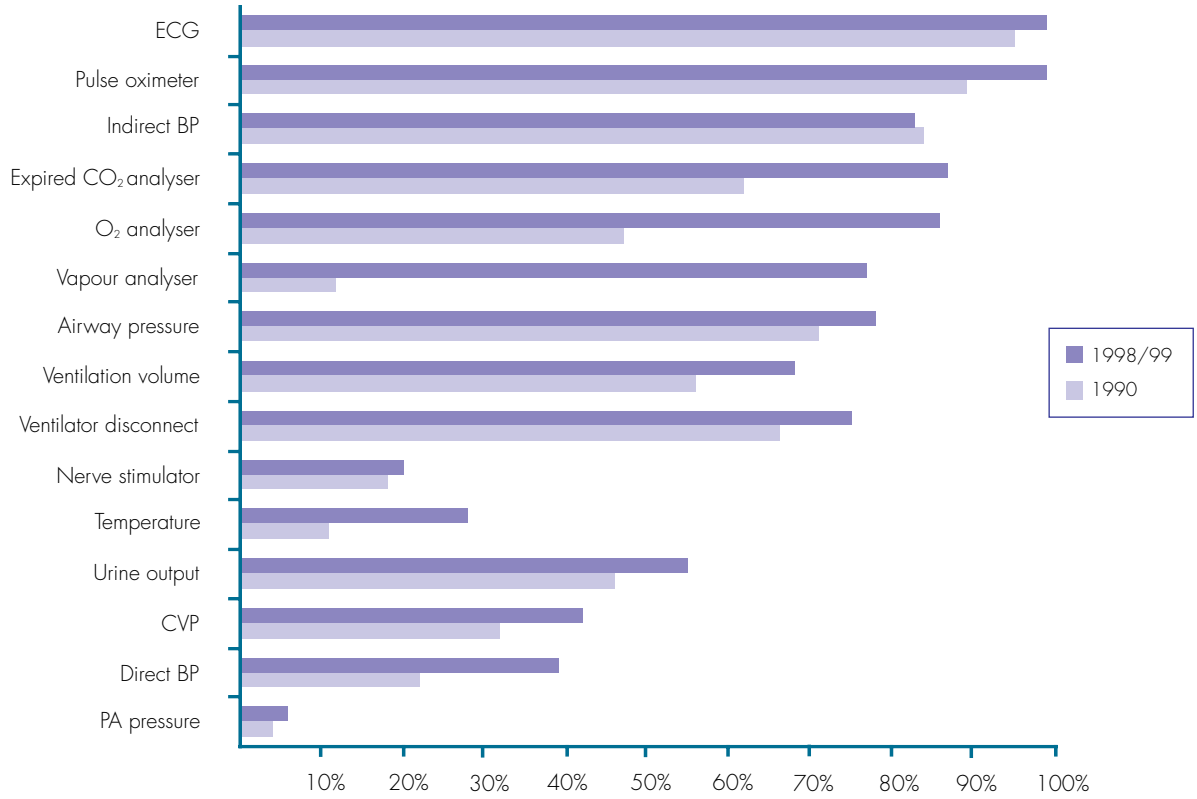
Other concerns were problems due to poor peripheral perfusion, and technical difficulties siting arterial and central lines.

Table 2.23: Monitoring devices used during management of the anaesthetic
(1998/99: 1337 cases; answers may be multiple)

Monitoring	1998/99		1990
ECG	1319	99%	95%
Pulse oximeter	1324	99%	89%
Indirect BP	1114	83%	84%
Expired CO_2 analyser	1163	87%	62%
O_2 analyser	1153	86%	47%
Inspired anaesthetic vapour analyser	1029	77%	12%
Airway pressure gauge	1048	78%	71%
Ventilation volume	914	68%	56%
Ventilator disconnect device	1005	75%	66%
Peripheral nerve stimulator	273	20%	18%
Temperature	376	28%	11%
Urine output	740	55%	46%
CVP	567	42%	32%
Direct arterial pressure (invasive)	518	39%	22%
Pulmonary artery pressure	76	6%	4%
Intracranial pressure	10	1%	*
Cardiac output	43	3%	*

* *Not a separate category in 1990 question*

Figure 2.8: Comparison of the use of monitoring devices



DVT prophylaxis

Table 2.24: Measures taken (before, during or after operation) to prevent venous thrombosis
(1998/99: 1337 cases; answers may be multiple)

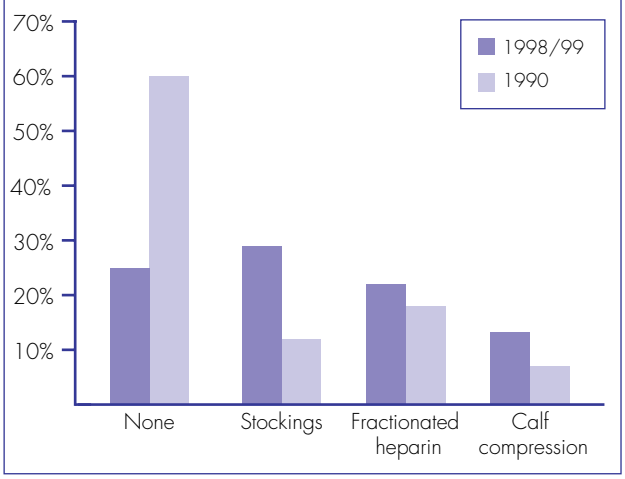
DVT prophylaxis	1998/99		1990
None	343	26%	59%
Stockings	393	29%	12%
Fractionated heparin	299	22%	18%
Low molecular weight heparin	308	23%	*
Warfarin	27	2%	*
Calf compression	172	13%	7%
Dextran	1	<1%	2%
Calf stimulation	14	1%	*
Other	85	6%	2%

* *Not a separate category in 1990 question*

Analysis of the postmortem reports returned to NCEPOD indicated that 6% of patients died from a pulmonary embolus (page 122). It is gratifying that the percentage of cases receiving no prophylaxis has fallen from 59% to 26%. Amongst those receiving no prophylaxis 93 (27%) were classified as emergencies, that is, they needed to go to the operating theatre immediately. Two hundred and fifteen (86%) of the 250 patients who did not require immediate surgery were ASA 3 or worse. These figures imply a failure of good practice rather than a conscious decision not to take such measures; for example, there were 37 scheduled or urgent intra-abdominal operations without any measures taken against deep vein thrombosis.

There is controversy in anaesthetic circles as to where the responsibility lies for ensuring that the patient is receiving prophylaxis against venous thrombosis. Many measures need to be instituted before surgery; surgeons may not wish others to be used for patients undergoing particular operations. Anaesthetists may request that heparin therapy is delayed until central neural blocks have been performed. This is an area for the development of protocols so that whatever the local arrangements may be, every patient receives the correct prophylaxis (see also page 66 and page 94).

Figure 2.9: Venous thrombosis prophylaxis



Maintenance of body temperature

Table 2.25: Measures taken to maintain body temperature
(1337 cases; answers may be multiple)

Measures taken	Number	
None	292	22%
IV fluid warmer	603	45%
Heated mattress	587	44%
Warm air system	385	29%
Other	145	11%

Type of anaesthesia

Key Points

- *There has been a marked increase in the use of regional anaesthesia.*
- *Regional techniques should only be used where appropriate and require careful management.*

Table 2.26: Type of anaesthesia

Technique	1998/99		1990
General alone	834	62%	83%
Local infiltration alone	6	<1%	<1%
Regional alone	69	5%	3%
General and regional	272	20%	7%
General and local infiltration	58	4%	2%
Sedation alone	5	<1%	<1%
Sedation and local infiltration	9	1%	1%
Sedation and regional	81	6%	4%
Not answered	3	<1%	-
Total	1337		

Figure 2.10: Type of anaesthesia

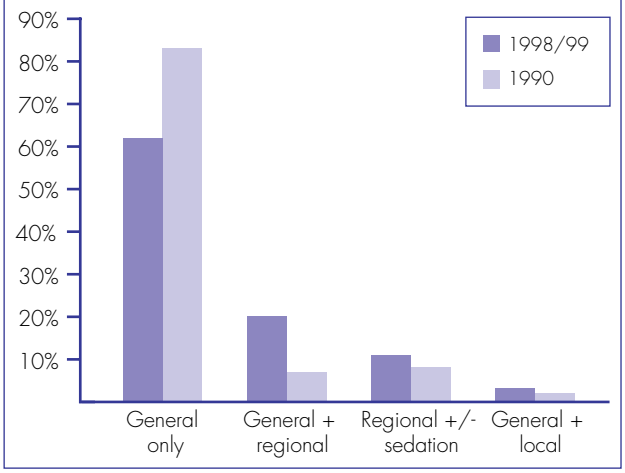


Table 2.26 and Figure 2.10 show that there has been a major increase in the use of regional techniques, mainly accompanying general anaesthesia, but also combined with sedation or the use of regional anaesthesia on its own.

Table 2.27: Airway management during general anaesthesia
(1990: 2018 cases; answers may be multiple)

Airway management	1998/99		1990
Face mask	15	1%	9%
Laryngeal mask airway (LMA)	146	13%	4%
Tracheal intubation	870	75%	87%
Double lumen tube	31	3%	*
Tracheostomy	18	2%	2%
Patient already intubated prior to theatre	75	6%	*
Other	8	1%	2%
Not answered	1	<1%	1%
Total	**1164**		

* *Not a separate category in 1990 question*

The total use of either face mask or LMA is the same for the two periods, with a significant shift away from the use of the face mask towards use of the LMA in 1998/99. Differences in the questions asked in the two reports make it difficult to compare other returns.

The 1998/99 figures highlight how very sick many of these patients were when they came to theatre; 6% were already intubated on arrival in theatre and 13 of the patients with a tracheostomy presumably came from the ICU, since that is where they were seen by the anaesthetist preoperatively.

The figures in Table 2.28 seem to suggest that the use of suxamethonium before maintenance with non-depolarising agents has decreased. However, this question was answered badly. Operations apparently performed using suxamethonium alone included pneumonectomy, anterior resection and aortic valve replacement.

Whilst the figures in Table 2.29 appear to show a considerable decrease in the use of nitrous oxide since 1990 in patients receiving a general anaesthetic, review of anaesthetic records accompanying questionnaires showed this could, in part, be due to poor answering of the question.

Table 2.28: Muscle relaxants used during the anaesthetic
(1998/99: 1164 cases; answers may be multiple)

Muscle relaxant	1998/99		1990
None	158	14%	10%
Depolarising	415	36%	45%
Non-depolarising	928	80%	84%

Thirteen patients received no agents regarded as having anaesthetic properties. In some cases the anaesthetist apparently decided that the patient's condition was so poor that no anaesthetic agent was needed and used opiates alone. In others, the anaesthetist seemed to consider that the use of midazolam would be sufficient to prevent awareness in a patient who received neither nitrous oxide, nor a volatile agent, nor an intravenous anaesthetic agent.

Table 2.29: Maintenance of general anaesthesia
(1998/99: 1164 cases; answers may be multiple)

Anaesthetic agent	1998/99		1990
Nitrous oxide	839	72%	93%
Volatile agent	1043	90%	88%
Propofol infusion	121	10%	9%
Other	134	12%	73%*

* *includes replies stating that narcotic agents were used to maintain anaesthesia*

Table 2.30: Regional anaesthetic techniques
(1998/99: 422 cases; answers may be multiple)

Technique	1998/99		1990
Epidural - caudal	6	1%	4%
- lumbar	86	20%	18%
- thoracic	109	26%	13%
Cranial or peripheral blocks	30	7%	12%
Plexus block	48	11%	4%
Subarachnoid (spinal)	158	37%	51%

Thirty-three percent (141/422) of patients having a regional anaesthetic received a narcotic drug as part of the technique; in 1990 the figure was 16%.

In 1990, 14% (304/2191) of patients had some form of regional anaesthesia, compared to 32% (422/1337) in the 1998/99 sample. There has, therefore, clearly been a significant increase in the number of regional anaesthetic blocks used, of all sorts. There is evidence that the use of regional anaesthesia can improve outcome, but the 1999 NCEPOD report 'Extremes of Age'[2] highlighted the problems that can be seen with these techniques, especially the prevalence of hypotension associated with general and epidural anaesthesia in septic patients. Many of the questionnaires returned in 1998/99 raised the same concerns. Regional techniques were chosen inappropriately given the patient's preoperative condition, and problems that occurred during the anaesthetic were not managed properly. Sometimes, though not always, this was related to the inexperience of the anaesthetist.

CASE 4 • *A 45-year-old patient required laparotomy for intra-abdominal sepsis. His blood pressure was 100/60 mmHg preoperatively, with a tachycardia of 130. He was anaesthetised by a consultant who used a general anaesthetic with placement of an epidural catheter at L1/2, with a total of 16 ml of 0.5% bupivacaine. He received repeated doses of ephedrine and finally an infusion of adrenaline, but continued to be tachycardic and hypotensive with a lowest systolic pressure of 60 mmHg.*

CASE 5 • *A 76-year-old patient with non-insulin dependent diabetes required an urgent distal gastrectomy for bleeding. He was anaesthetised by an SHO 2 who did not seek advice. The preoperative blood pressure was 160/70 mmHg. After induction of general anaesthesia, an epidural catheter was sited at T10/11 and bupivacaine given. The systolic pressure fell to 100 mmHg, when further bupivacaine was given. Despite requiring repeated boluses of methoxamine to maintain the systolic pressure at 80 mmHg the anaesthetist continued to give further bolus injections down the epidural catheter. Postoperatively the patient went to the HDU where inotropic support was started immediately. After five days he returned to the general ward, and died on the eleventh postoperative day.*

CASE 6 • *An 80-year-old patient was anaesthetised by an accredited SpR for a sigmoid colectomy. After induction of general anaesthesia, the anaesthetist attempted to place an epidural catheter. After making a dural tap at T12/L1 and at L1/2, a third attempt was made at L3/4 with the same result. The anaesthetist administered 2 ml 0.5% bupivacaine and 2 mg diamorphine intrathecally. The blood pressure, which had been 110/70 mmHg preoperatively, remained at 90/45 mmHg throughout the operation.*

Sedation

Seven percent (95/1337) of cases in 1998/99 were performed under sedation, compared to 5% (110/2191) in 1990.

Table 2.31: Sedative drugs given (excluding premedication)
(1998/99: 95 cases; answers may be multiple)

Sedative	Number	
Inhalant	4	4%
Narcotic analgesic	11	12%
Benzodiazepine	74	78%
Sub-anaesthetic doses of IV anaesthetic agents	30	32%
Other	8	8%

POSTOPERATIVE CARE

Table 2.32: Destination of patient immediately on leaving the operating room

Destination	1998/99		1990
Recovery area	801	60%	66%
High dependency unit	40	3%	1%
Intensive care unit	395	30%	25%
Specialised nursing area	4	<1%	*
Ward	16	1%	2%
Other	1	<1%	1%
Died in theatre	63	5%	5%
Not answered	17	1%	<1%
Total	1337		

* *Not a separate category in 1990 question*

Early postoperative care is discussed in detail on page 40.

Recovery room

Table 2.33 shows good practice; of the five patients reported as receiving no monitoring, three were dying in the recovery area and receiving palliative care, and one was undergoing insertion of a CVP line.

There have been marked changes in monitoring practice in recovery areas (Table 2.34). Practically all patients now have their oxygen saturation measured, compared with only 52% in 1990. There have also been increases in the proportions who have their temperature monitored and blood pressure measured directly. It is surprising that the ECG was monitored in only 58% of cases in the recovery area when it was monitored in 99% of cases intraoperatively.

Postoperative ventilation

Thirty-one percent (421/1337) of patients received intermittent positive pressure ventilation (IPPV) to their lungs postoperatively, for the reasons shown in Table 2.35.

Six patients were ventilated for a period in the recovery area, then extubated and sent to the ward.

CASE 7 • *A 72-year-old patient was admitted with diverticulitis, and a laparotomy performed. The preoperative blood pressure was 130/80 mmHg. During the operation the systolic blood pressure was 80 mmHg. There was no invasive monitoring. Postoperatively she required ventilation in recovery and was not extubated until two hours after the end of the operation. Despite her poor condition she was returned to the ward where she died two days later from congestive cardiac failure.*

Table 2.33: Use of monitoring devices in the recovery room

Monitoring in recovery room	Number	
Monitors used	746	93%
Monitors not used	5	1%
Not answered	49	6%
Not known	1	<1%
Total	801	

Table 2.34: Recovery room monitoring
(1998/99: 746 cases; answers may be multiple)

Monitoring	1998/99		1990
ECG	436	58%	45%
Pulse oximeter	741	99%	52%
Indirect BP	705	95%	95%
Expired CO_2 analyser	24	3%	1%
O_2 analyser	35	5%	1%
Airway pressure gauge	19	3%	2%
Ventilation volume	15	2%	2%
Ventilator disconnect device	15	2%	1%
Peripheral nerve stimulator	4	1%	1%
Temperature	219	29%	12%
Urine output	220	29%	27%
CVP	86	12%	10%
Direct arterial BP (invasive)	65	9%	3%
Blood gas analysis	29	4%	*
Pulmonary arterial pressure	1	<1%	<1%
Other	17	2%	4%

* *Not a separate category in 1990 question*

Table 2.35: Reasons for postoperative IPPV
(421 cases; answers may be multiple)

Reason	Number	
Routine management	101	24%
Respiratory inadequacy	150	36%
Cardiac inadequacy	109	26%
Control of intracranial pressure or other neurosurgical indications	39	9%
Part of the management of pain	21	5%
Poor general condition of patient	247	59%
To allow recovery of body temperature	57	14%
Other reasons	23	5%

Critical events and complications

Critical events during anaesthesia or recovery

In 1998/99, critical events requiring specific treatment occurred during anaesthesia or the immediate recovery period in 32% (431/1337) of cases, compared to 22% (481/2191) in 1990. These are summarised in Table 2.36.

The classification of adverse events was not the same for the two samples. However, the incidence of many complications seems similar. Reporting of hypoxaemia has increased; this may be due to the greater use of pulse oximeters. Reporting of hypotension and tachycardia, which was not requested in 1990, is common; it was, however, noted in the 1990 report that the majority of events in the grouping 'other' were related to hypotension.

Equipment failure

In 1998/99 there were only six reports of mechanical failure of equipment during anaesthesia or recovery. This is a similar number to that reported in 1990 when eight cases were identified.

Modern anaesthetic equipment, properly checked, seems to be very reliable.

Postoperative complications and events

Of 1274 patients (excluding those who died in the operating theatre) in 1998/99, 401 (31%) received inotropes in the first 48 hours after operation.

The responses summarised in Table 2.37 further reinforce how poor was the physical status of these patients and how great the demands made on acute surgical services.

Table 2.37: Complications or events after the operation
(1998/99: 1274 cases, excluding those who died in the operating theatre; answers may be multiple)

Complication	1998/99		1990
Ventilatory problems	492	39%	34%
Cardiac problems	480	38%	40%
Renal failure	294	23%	18%
Septicaemia	219	17%	12%
Progression of surgical condition	193	15%	*
Haematological disorder	166	13%	*
Central nervous system	152	12%	6%
Electrolyte imbalance	108	8%	*
Hepatic failure	43	3%	3%
Other	79	6%	20%

* *Not a separate category in 1990 question*

Table 2.36: Critical events during anaesthesia or the immediate recovery period
(1998/99: 431 cases; answers may be multiple)

Critical event	1998/99		1990
Airway obstruction	7	2%	2%
Anaphylaxis	1	<1%	<1%
Arrhythmia	71	16%	25%
Bradycardia (to or less than 50% of resting)	36	8%	*
Bronchospasm	5	1%	4%
Cardiac arrest (unintended)	65	15%	21%
Convulsions	1	<1%	<1%
Hyperpyrexia (greater than 40°C or very rapid increase in temperature)	2	<1%	<1%
Hypertension (increase of more than 50% resting systolic)	19	4%	*
Hypotension (decrease of more than 50% resting systolic)	248	58%	*
Hypoxaemia less than 90%	72	17%	6%
Misplaced tracheal tube	2	<1%	1%
Pneumothorax	3	1%	1%
Pulmonary aspiration	9	2%	1%
Pulmonary oedema	26	6%	4%
Respiratory arrest (unintended)	8	2%	4%
Tachycardia (increase of 50% or more)	59	14%	*
Unintentional delayed recovery of consciousness	20	5%	*
Ventilatory inadequacy	40	9%	*
Excessive spread of regional anaesthesia	5	1%	*
Wrong dose or overdose of drug	1	<1%	<1%
Other	34	8%	52%

* *Not a separate category in 1990 question*

Pain relief

There were no questions on acute pain services in the 1990 report so there are no data for comparison.

Eighty-two percent (1092/1337) of cases were performed in hospitals which had an acute pain service.

Table 2.38: Membership of the pain team
(1092 cases; answers may be multiple)

Team members	Number	
Anaesthetic consultant(s)	942	86%
Anaesthetic trainee(s)	448	41%
Specialised pain nurse(s)	953	87%
Pharmacist(s)	165	15%
Other	48	4%

Table 2.39: Availability of the pain service

Availability	Number	
24 hours a day, seven days a week	397	36%
Weekdays, 9 am to 5 pm	566	52%
Limited times	79	7%
Not answered	50	5%
Total	**1092**	

Table 2.40: Ward nursing staff specially trained in epidural and/or PCA analgesia

Nurses trained	Number	
None	78	6%
Some	1024	77%
All	155	12%
Not answered	70	5%
Not known	10	1%
Total	**1337**	

Table 2.41: Analgesia in the first 48 postoperative hours
(1103 cases; answers may be multiple)

Type of analgesic	Number	
Opiate/opioid	995	90%
Local analgesic	177	16%
Non-steroidal analgesic	101	9%
Paracetamol	181	16%
Other	61	6%

Sixty-three percent (841/1337) of patients did not have a pain assessment chart.

Eleven hundred and three patients (87%) received drugs for pain in the first 48 hours after operation. The types of analgesic used are shown in Table 2.41.

Table 2.42: Method or route for postoperative analgesia
(1103 cases; answers may be multiple)

Method/route	Number	
Intramuscular injection	297	27%
Oral	289	26%
Rectal	37	3%
Continuous intravenous infusion	328	30%
Patient-controlled analgesia	158	14%
Continuous epidural infusion	155	14%
Patient-controlled epidural analgesia	20	2%
IV bolus	101	9%
Other	44	4%

There appear to have been a high number of continuous intravenous infusions but nearly all were administered in specialised areas; only twelve were administered on the general ward.

Question 2.1: Did complications occur as a result of these analgesic methods?

		1998/99	1990
Yes	45	4%	3%
No	1049	95%	95%
Not answered	7	1%	2%
Not known	2	<1%	-
Total	1103		

Table 2.43: Other sedatives or hypnotics
(432 cases; answers may be multiple)

Drug	Number
Propofol	216
Midazolam	153
Other benzodiazepine	46
Major tranquillisers (e.g. phenothiazine, butyrophenones)	47
Other	12

Four hundred and thirty-two patients (32%) received other sedatives or hypnotics. The drugs used are shown in Table 2.43.

The number of patients receiving sedatives is not surprising when so many patients were admitted to intensive care or high dependency units.

Key Points

- *Despite the recommendations of the Royal College of Anaesthetists and Association of Anaesthetists, morbidity and mortality meetings are not held in all departments.*
- *Only 28% of cases were discussed at a departmental audit meeting.*

Question 2.2: Do you have morbidity/mortality review meetings in your department?

		1998/99	1990
Yes	1246	93%	93%
No	79	6%	6%
Not answered	12	1%	1%
Total	1337		

If yes, has this case been discussed, or will it be discussed, at your departmental meeting?

		1998/99	1990
Yes	352	28%	31%
No	876	70%	68%
Not answered	14	1%	2%
Not known	4	<1%	-
Total	1246		

Question 2.3: Has a consultant anaesthetist seen and agreed this questionnaire?

		1998/99
Yes	590	44%
No	25	2%
Not applicable*	675	50%
Not answered	47	4%
Total	1337	

* *completed by consultant*

The last decade has seen great emphasis on audit, continuing professional development and clinical governance, from within the profession and without. The Royal College of Anaesthetists and the Association of Anaesthetists have issued guidance[16, 19, 20, 21]. Previous reports by NCEPOD have recommended that anaesthetists discuss all deaths at departmental meetings[2, 18].

At an individual level consultants do seem committed to the process of learning from deaths. As shown in Question 2.3 consultants saw at least 94% of questionnaires before they were returned, either completing the questionnaire themselves, or reviewing the questionnaire when it had been completed by a trainee or non-consultant career grade doctor. This review is a valuable method of appraising the work of non-consultant anaesthetists.

At a departmental level there has been no development or improvement since 1990. It is extraordinary that 6% of departments still do not have morbidity and mortality meetings, exactly the same figure as in 1990. The number of deaths discussed at morbidity and mortality meetings has even decreased slightly, from 31% to 28%.

Successive NCEPOD reports have shown that most deaths occurred in patients who were severely ill and who received care of high quality; however, in some the care given could have been better. NCEPOD can only look at a sample of the perioperative deaths that occur. The report in 1990[4] proposed that *"anaesthetists could perhaps encourage their colleagues (surgeon and pathologist) so that no death is unreported and that for all such deaths questionnaires are completed and considered at local audit meetings"*. This is not happening. Unless every death is reviewed locally, the potential for learning lessons to improve care will not be realised.

CASE 8 • *A 78-year-old patient with previous hypertension and angina was admitted for scheduled repair of a popliteal aneurysm. The preoperative haemoglobin was 15.5 gm/dl. Following blood gas analysis in the recovery ward at 15.00 it was decided he required a blood transfusion. No blood was available and cross-matching was delayed because he had abnormal antibodies. Later that evening the haemoglobin was 7.0 gm/dl, but blood transfusion had still not been started when he suffered a cardiac arrest at 22.00. Resuscitation was unsuccessful. The case was not discussed at an anaesthetic departmental meeting.*

Hospitals must have systems in place to ensure that all perioperative deaths are recorded and that this information is available to anaesthetic (and surgical) departments. In turn, anaesthetic departments must have systems to review all perioperative deaths and the results must be reported to morbidity and mortality meetings. All anaesthetists should attend these departmental meetings, and there should be the opportunity to discuss every case as fully as the circumstances require. Perioperative deaths should be discussed at multidisciplinary meetings whenever possible.

Specific issues

Early postoperative care

Key Points

- *The 40% of hospitals where surgery is taking place, that at present do not have a high dependency unit (HDU), and in which patients are dying within 30 days of operation, should take urgent action to create this facility.*
- *The current debate on the more flexible and effective use of critical care facilities is of value. It should not be allowed to disguise the fundamental lack of HDU beds in many hospitals.*
- *Critical care facilities demand high levels of resources together with medical and nursing staff. There is no value in creating facilities without addressing these needs. A closed ICU or HDU bed is of no benefit to patients.*
- *A method of defining an individual patient's need for postoperative critical care in an ICU or HDU, based on simple, nationally agreed criteria such as their age, preoperative condition and the complexity of the surgery they are to undergo, is urgently required.*

Previous NCEPOD reports have, on many occasions, raised concerns in relation to the early postoperative care of patients. Deficiencies in the management of intravenous fluids, particularly in the elderly, and the variability in the provision of appropriate arrangements for acute postoperative pain relief, have been highlighted as examples of poor practice[2]. However, in seeking ways to improve care, particularly when, as can be seen in this report, the surgical population that is dying is both older and sicker than that in 1990, this issue needs to be considered from a broader perspective. The facilities available, in terms of adequate numbers of ICU and HDU beds and the availability of resources and sufficient highly skilled staff to run these beds effectively, are paramount in the care of those patients whose postoperative survival is dependent on high quality critical care. Merely to have the appropriate facilities in a hospital is not sufficient. They need also to be available to all those who require them.

Case 9 • *A 78-year-old patient had an anterior resection of the rectum. He had a history of hypertension and ischaemic heart disease and was taking nifedipine, atenolol and GTN. He was assessed as being ASA 3. Although a bed was requested on the HDU, none was available. Therefore, following an uneventful operation, the patient went to the ward after one hour in recovery. Two hours later he was seen by the consultant anaesthetist who had given the anaesthetic and noted to be cold and clammy but alert when roused. At this time the systolic blood pressure was 68 mmHg and the saturation 68% even though the patient was receiving oxygen at 5 l/min via a Hudson mask. A litre of colloid was given but an hour later the patient was continuing to deteriorate. As attempts were made to arrange an ICU bed a bradycardia developed and then cardiac arrest. Resuscitation was unsuccessful.*

The necessity for all patients to go to an appropriately staffed and equipped recovery room during their recovery from anaesthesia is now universally accepted. Should there not be a similar requirement for the availability of high dependency and intensive care based solely on the patient's age, preoperative condition and the complexity of the surgery they are to undergo?

The provision for recovery, high dependency and intensive care

A number of questions relating to this provision were asked in the anaesthetic questionnaire and comparisons with 1990 can be made.

The apparent absence of a recovery area in the hospitals where 45 of the deaths occurred does at first appear alarming (Table 2.44). However, further analysis reveals that 13 of these cases were cardiothoracic. Here the explanation may be that there are no recovery facilities in some specialist units where the practice is to return postoperative patients directly to an ICU or HDU. This view is further supported by no hospital reporting that it had no critical care areas. The remaining 32 questionnaires in which the box was not ticked to record there being a recovery area, may well be examples of inattentive completion. This suggestion is reinforced when these answers are linked with those of a later question asking where the patient went on leaving the operating room. Thirteen patients, who are recorded as having been operated on in a hospital with no recovery area, are recorded in this question as having gone to this non-existent area at the conclusion of their operation.

Table 2.44 shows that in 1998/99 there were HDU facilities in 61% of the hospitals from which questionnaires were returned. This is based on the current 10% sample of all deaths occurring within 30 days of a surgical operation. Can we take this to be an accurate reflection of the provision for high dependency care in acute hospitals, or does the misreporting highlighted above with regard to recovery areas suggest caution? The identity of hospitals returning information is not known to the clinical staff at NCEPOD, and the Chief Executive was therefore asked to analyse the returns against individual hospitals.

Table 2.44: Special care areas in the hospital in which the operation took place
(1998/99: 1337 cases and 1990: 2191 cases; answers may be multiple)
(Percentages are derived solely from those answering this question)

Special care area	1998/99		1990	
Recovery area	1277	97%	1991	95%
High dependency unit	801	61%	407	19%
Intensive care unit	1264	96%	1686	80%
Other	72	5%	35	2%
Not answered	15		88	

The number of hospitals represented by the 1337 anaesthetic questionnaires was 242:

Question 2.4: Do you have an HDU?

Yes	119
No	85
Responses mixed	38
Total	242

In compiling these figures, if all or almost all said 'yes' or 'no' this was deemed to be correct. However, for 38 hospitals the 'yes' and 'no' answers were evenly divided. Therefore, if these are excluded, 204 hospitals remain of which 119 (58%) indicated they have an HDU and 85 (42%) do not.

It can probably be concluded therefore that about 60% of acute hospitals do now have an HDU and that this has grown from about 20% in 1990. This increase can also be demonstrated by charting the response to the question asking if there was an HDU available in the hospital over successive NCEPOD data collection periods, as shown in Figure 2.11.

Figure 2.11: Percentage of patients having an HDU available to them in the hospital in which surgery was performed

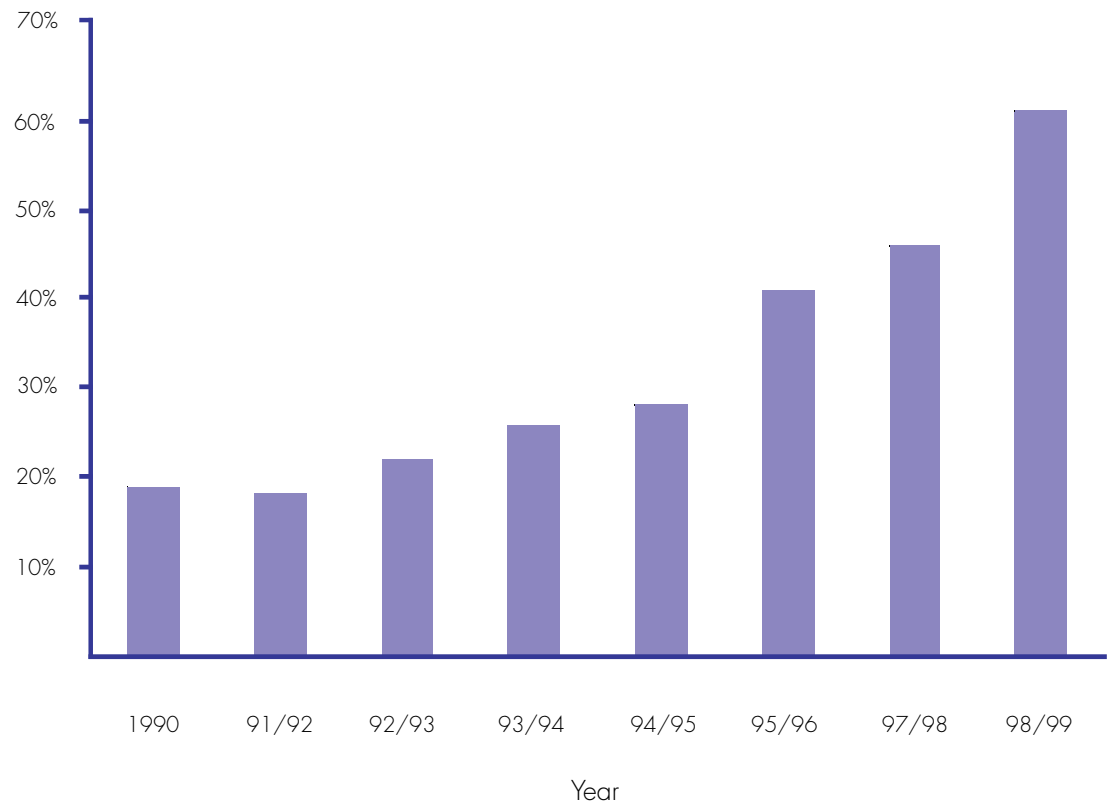


Table 2.45: Destination of the patient on leaving the operating room	
Destination	**Number**
Recovery area or room equipped and staffed for this purpose	801
High dependency unit	40
Intensive care unit	395
Specialised nursing area	4
Ward	16
Other	1
Died in theatre	63
Not answered	17
Total	**1337**

Intensive care facilities are recorded as being present in 96% of the hospitals from which questionnaires were returned. This probably equates to a near universal availability of intensive care facilities in acute hospitals once allowance is made for errors in reporting and the fact that there remain a few small units dealing with limited surgical specialties which only have an HDU.

Further evidence with regard to the adequacy of provision for HDU and ICU beds is given in Table 2.45 and Question 2.5.

In Question 2.5 it can be seen that there were 61 patients, 5% of those who died, who could not be given appropriate postoperative care, for although the facility existed there was no bed available.

Question 2.5: Were you unable at any time to transfer the patient into an ICU, HDU etc?

Yes	61
No	1157
Not answered	110
Not known	9
Total	1337

CASE 10 • *A locum consultant surgeon operated on a 70-year-old ASA 2 patient with a history of diverticular disease and recurrent diverticulitis. The operation, an elective Hartmann's procedure, was difficult as the adhesions were extensive, and took almost four hours. In view of the unanticipated difficulties encountered, the ICU was asked to take the patient, but the unit was full and no bed was available. The patient was noted to be deteriorating on the first postoperative day and this downward course continued. Finally, on the fourth postoperative day, an ICU bed was found and the patient transferred. Despite active treatment the patient died two days later as a result of septicaemia.*

The pressure on the ICU beds was clearly detrimental to the quality of the postoperative care that this patient received. Who should decide when the lack of essential services such as acute care beds makes it inappropriate to undertake an operation?

The comparison with 1990 shown in Table 2.46 is instructive; the proportion of deaths occurring in theatre and recovery remains almost the same, although slightly more are dying in recovery. The proportion dying in ICU has increased, but only slightly. However, looking at the three specialist critical care areas, a change has taken place. The increase in HDU beds has inevitably resulted in more deaths occurring there.

Table 2.46: Place of death				
Place of death	1998/99		1990	
Theatre	64 *	5%	115	5%
Recovery area	26	2%	30	1%
Intensive care unit	393	29%	559	26%
High dependency unit	55	6%	33	2%
Coronary care unit	10			
Specialised nursing area	9			
Ward	721	54%	1369	62%
Home	10		15	
Another hospital	23		41	
Other	12		21	
Not answered	9		8	
Not known	5		-	
Total	1337		2191	

* *There is a difference of one between this figure and that shown in Table 2.32 as one patient went from theatre to recovery to the ward before returning to theatre, where death occurred.*

High dependency units

A high dependency unit (HDU) is an area for patients who require more intensive observation, treatment and nursing care than can be provided on a general ward. It would not normally accept patients requiring mechanical ventilation but could manage those receiving invasive monitoring.

Should we be concerned that in two out of five hospitals where surgery is carried out, and patients die postoperatively, there is no HDU? In its 1997 annual report[22], our sister organisation the Scottish Audit of Surgical Mortality (SASM) recommended that:

"It seems reasonable to say that all hospitals which are big enough to justify having ICU facilities should have designated HDU beds and that hospitals which are not big enough to have ICU beds but which perform emergency or major elective surgery should also have some designated HDU provision. This study shows that this is still not yet happening in a significant number of Scottish hospitals."

The same it seems could be said for the rest of the United Kingdom. NCEPOD has repeatedly made recommendations concerning the need for high dependency beds:

- *"Essential services (including staffed emergency operating rooms, recovery rooms, high dependency units and intensive care units) must be provided on a single site wherever emergency/acute surgical care is delivered."*[4]
- *"Surgeons, gynaecologists and anaesthetists must have immediate access to essential services (recovery rooms, high dependency and intensive care units) if their patients are to survive."*[9]
- *"NCEPOD has again identified the substantial shortfall in critical care services. Any hospital admitting emergency patients, and hospitals admitting complex elective patients, must have adequate facilities for intensive and/or high dependency care at all times."*[10]
- *"Essential services (high dependency and intensive care beds) are still inadequate and resources need to be increased to correct deficiencies."*[12]
- *"All hospitals admitting emergency surgical patients must be of sufficient size to provide 24-hour operating rooms and other critical care services. There should also be sufficient medical staff to perform these functions. These provisions should be continuous throughout the year: trauma and acute surgical emergencies do not recognise weekends or public holidays."*[13]

The continued absence of high dependency beds in 40% of hospitals where surgery is performed and patients die in the postoperative period requires urgent action.

CASE 11 • *An 82-year-old patient fell and sustained a subcapital fracture of his left neck of femur. There were no other injuries. His preoperative assessment notes that he was on atenolol and grades him as ASA 2. The anaesthetist, an SHO apparently in his/her first year and without the Primary FRCA, gave a light general anaesthetic, the patient breathing spontaneously through an LMA. This was supplemented by 'triple block' with 20 ml of 0.5% bupivacaine. Approximately 45 minutes into the anaesthetic it was noted that suction down the LMA revealed 'yellow liquid ?aspiration'. At the same time the saturation was noted to have dropped from 95 to 91%. At the end of the operation at 14.00, and half-an-hour after the apparent aspiration, the anaesthetist notes that the saturation was 100% on 100% oxygen but that it fell to 90% with the patient receiving oxygen via a facemask in recovery. A chest X-ray showed an opaque right side, but there is no record of blood gas measurements being carried out. It was recognised that these findings suggested that aspiration had occurred. The patient was written up for antibiotics and to receive 40% oxygen for 48 hours. Shortly afterwards the patient was seen by another anaesthetist and discussion took place with a consultant microbiologist. The patient was awake, comfortable and pain-free; the saturation was 91%, but shortly after 14.45 saturations of 86% and 83% were recorded. At 15.15 the patient was returned to the ward and at 16.30 was declared dead following unsuccessful attempts at resuscitation.*

Despite the patient's early postoperative death and its association with the aspiration, at postmortem the cause of death was given as ischaemic and valvular heart disease. Although both lungs, and particularly the right, were severely oedematous and congested, it was also recorded that all three coronary vessels were severely atheromatous with almost total occlusion locally.

With the benefit of hindsight it is easy to be critical of this patient's medical care and the apparent misplaced optimism of those making decisions. However, this hospital did not have an HDU. Would the lack of this key facility not have made the decision making very much more difficult?

This heavy demand on critical care beds leads to surgeons and anaesthetists being forced into unsatisfactory compromise.

CASE 12 • *An 83-year-old arteriopath was admitted to a DGH as an emergency and referred to a general surgeon with an interest in vascular surgery. As the patient had severe ischaemic pain in both legs it was decided to carry out an axillobifemoral bypass. The patient was taking frusemide, nifedipine and digoxin, and as a consequence of the cardiac and respiratory problems, was assessed as being ASA 4. The operation, which lasted over five hours, was carried out by the consultant surgeon with an SpR. The anaesthetic was given by a second year SpR who had the FRCA and was on his/her own. The operation was reported to have been uneventful and from recovery the patient returned to the ward. Eight hours later the patient developed severe left ventricular failure and recurrent ischaemia of the right leg. In conjunction with intensive care doctors it was decided not to transfer the patient to the ICU but to adopt a policy of 'aggressive medical management'. This proved unsuccessful and the patient died on the second day following the operation. The SpR who gave the anaesthetic observed that an HDU would have been helpful in managing this case before and after the onset of LVF in view of the decision not to admit to ICU.*

If this hospital is to accept patients for complex vascular surgery, and in particular those in such a poor state of health, does it not have a duty to the population it serves to ensure that the appropriate postoperative facilities are available?

The way forward

Concerns about the organisation, provision and utilisation of critical care services have been reviewed in recent years by a number of groups. In 1999 the Audit Commission[23] completed an extensive study; they recognised the value of HDUs but pointed out the way such beds can be misused if appropriate criteria for admission and discharge are not set. More recently the Department of Health has convened an expert group to review adult critical care services; their report has been recently released[24]. Whilst recognising that the development of additional beds and services was essential, they suggested that the current divisions into high dependency and intensive care beds be replaced by a more flexible classification. They also proposed the linking of critical expertise, both outside individual hospitals on the basis of regional networks, and inside with an involvement from intensive care into the management of the sick patient on the ward. Valuable as these documents are, they cannot be allowed to deflect attention from the current inadequacies. Whether the intermediate level of care between full intensive care and ward care is called 'high dependency' or known by some other name, there can be no question that it is needed.

There has to be an HDU, with resources plus appropriate medical and nursing staff, in all acute hospitals where surgery is carried out. These beds supplement those in the ICU in larger hospitals and provide the sole critical care facility in smaller units. But, rather than considering ICU and HDU provision in isolation, these beds need to be regarded as the basis of a critical care facility that extends from the ward, to the HDU, to the ICU. This is then supported by critical care staff, both medical and nursing, who bring their expertise to all of these areas. This is not a new concept. In January 1996 the Royal College of Anaesthetists and The Royal College of Surgeons of England published a 'Report of the Joint Working Party on Graduated Patient Care'[25].

The recommendations made were summarised as follows:

"Graduated Patient Care is a concept that allows stratification of patients according to clinical dependency into those who:

- *should be admitted to an intensive care unit (ICU) for the management of single or multiple organ failure.*
- *should best be treated in a high dependency unit (HDU).*
- *can be adequately treated on a general surgical ward.*
- *are clinically stable and self-caring and can be managed on a convalescent or hotel unit.*
- *have a long-term disability and require care in a long stay unit.*

Good clinical practice requires that special skills and expensive equipment are concentrated where they are most needed, and where the available skills and technology can be used to the best advantage."

These proposals need to be re-examined in the light of more recent developments so as to ensure the appropriate provision of integrated, cost effective-critical care services.

Training and supervision in the anaesthetic department

Key Points

- *Anaesthetic departments should formulate guidelines relating to appropriate responsibilities for their trainees, particularly senior house officers (SHOs).*
- *Consultants, and trainees who have attained their fellowship examination, should have a clear understanding of their training responsibilities.*

Introduction

In 1990 NCEPOD observed that trainee anaesthetists, particularly senior house officers (SHOs), were anaesthetising patients who required the presence of a more senior anaesthetist[4]. This concern has been reiterated in subsequent reports. In 1998 the Audit Commission[26] highlighted that anaesthetic staff are not always matched to the individual patient's needs.

Since 1990 the percentage of cases where the most senior anaesthetist present was an SHO has decreased from 15% to 11% and the percentage anaesthetised by a non-consultant career grade (NCCG) has increased from 7% to 10%. Amongst NCCG anaesthetists the percentage anaesthetised by a staff grade increased from less than 1% to 6%.

Trainees

In 1994 the Royal College of Anaesthetists set out clear guidance on the levels of supervision appropriate to the experience of trainees in anaesthesia[27]. In 1995 these were followed up in a specific training guide for SHO anaesthetists[28].

The levels of supervision for anaesthetic trainees are defined as:

1. Trainer in the operating theatre or intensive care unit directly supervising or demonstrating techniques.

2. Trainer present in operating theatre suite or intensive care unit, able to assist or to advise.

3. Trainer available within the hospital.

4. Trainer available from outside the hospital as for emergency on-call service.

Trainers

Trainers are generally consultants. Anaesthetic trainees who have obtained the FRCA, who are present in theatre, the intensive care unit or labour wards, may supervise more junior trainees. Non-consultant career grade anaesthetists should not normally be involved in training unless they are in possession of the FRCA. They must be approved for training by the relevant School of Anaesthesia and would not normally be involved in training those who have already attained their FRCA[29, 30].

Guidance

The Royal College of Anaesthetists recommends that during the first year of SHO training a consultant should be available in the operating room during anaesthesia for all patients graded ASA 3 or poorer. An SpR 1 anaesthetist requires supervision at level 1 for cardiac and neurosurgical operations[27].

SHO anaesthetists in their first year of training

Table 2.47: Cases anaesthetised by unsupervised SHO 1 anaesthetists

Age in years	Operation	ASA	From whom advice sought	Before or after operation
69	Above knee amputation	3	Locum registrar	Before
91	Sliding hip screw	3	Consultant	Before
87	Austin Moore	3	SpR 3	Before
91	Sliding hip screw	3	Advice not sought	
88	Laparotomy, colostomy	3	Advice not sought	
67	Repair of perforated DU	3	SpR 2	Before
83	Sliding hip screw	2	Advice not sought	
67	Laparotomy	1	Registrar	Before
74	Femoral embolectomy	3	Consultant	Before
78	Laparotomy	1	Advice not sought	
86	Austin Moore	3	Advice not sought	
76	Laparotomy, colostomy	3	Consultant	Before & after
60	Hartmann's procedure	2	Advice not sought	
57	Hickman line	3	Advice not sought	
63	Laparotomy	3	Consultant	Before
91	Sliding hip screw	3	Advice not sought	
85	Sliding hip screw	3	Advice not sought	
92	Sliding hip screw	3	Consultant	Before
63	Laparotomy, small bowel obstruction	1	Not stated	After
88	Hemiarthroplasty	4	Advice not sought	
86	Sliding hip screw	3	Advice not sought	
88	Laparotomy, small bowel abscess	3	Advice not sought	
77	Sliding hip screw	3	Consultant	Before
79	Exploration brachial artery	2	Advice not sought	
86	Sliding hip screw	2	Advice not sought	
85	Hemiarthroplasty	3	Advice not sought	

There were 26 cases for which a first year SHO was the most senior anaesthetist in the operating theatre (Table 2.47).

It is evident that some of our most junior trainees are anaesthetising patients whose physical status demands a more experienced anaesthetist to be present in the operating theatre.

Eleven (42%) SHO 1 anaesthetists sought advice on the case before the operation and nine of these cases were ASA 3 or poorer; nevertheless, the anaesthetist was alone in the operating theatre. The Royal College of Anaesthetists' guidelines state that a first year SHO should not anaesthetise patients graded ASA 3 or poorer and these trainees, despite seeking advice, were not given appropriate supervision.

In total, 19/26 (73%) patients were graded as ASA 3 or poorer and on ten occasions the trainer was not asked for advice at any time. Thus SHO 1 anaesthetists undertook these ten cases without supervision. Supervision is impossible if the trainer does not know that the trainee is undertaking the case.

Anaesthetists graded three patients who underwent a laparotomy for malignancy and/or bowel obstruction incorrectly as ASA 1. At the start of his/her training an anaesthetist should be taught to assess the patient's physical status and anaesthetic/operative risk.

SHO anaesthetists and hip fracture

The update on the Audit Commission report on the management of hip fracture[31] commented that the number of operations where the anaesthetic was administered by an unsupervised SHO had decreased. Nevertheless, in about a half of the Trusts surveyed unsupervised SHOs were still administering anaesthetics. In total 11% of all patients with a hip fracture received an anaesthetic administered by an unsupervised SHO. In the report, what constituted supervision was not defined.

In this sample we identified 50 patients undergoing an operation for a fractured hip where the most senior anaesthetist was an SHO (Table 2.48).

On at least 66% of occasions when a patient was anaesthetised for an operation on a fractured hip by an SHO, that anaesthetist was unsupervised, as no advice was sought. It seems likely that the trainer was not aware the case was being undertaken. However, when advice was sought the case should be considered as supervised at level 2 or more distant.

Table 2.48: Grade of SHO anaesthetising for fractured hip and advice sought before operation

Grade	Number	Advice sought	Not known/ not answered
SHO 1	13	4	0
SHO 2	16	3	5
SHO >2	21	3	2
Total	**50**	**10**	**7**

Other trainees

For more senior trainees the appropriate level of supervision depends on the trainer having knowledge of the skills of the trainee and evaluating the extent to which this matches the complexity of the individual case.

The trainee must also recognise his/her own experience and limitations.

For 63% of cases the trainee did not ask advice at any time (Table 2.49). It is the responsibility of the trainee to know when to seek advice. It is impossible for appropriate supervision to take place if the consultant or trainer has no knowledge of the case that a trainee is undertaking. Equally important is that appropriate advice is sought pre-emptively, before problems supervene during or after the operation. Good supervision depends on both trainers and trainees maintaining high levels of communication. When advice has been sought then both should agree the appropriate level of supervision.

In some cases the advice sought by trainees was timely, for example cases that were appropriate to the trainee's ability until unforeseeable events supervened. In others, problems could have been anticipated and trainees sought advice too late (Table 2.50).

Table 2.49: Trainees seeking advice

Grade	None sought		Before operation	During operation	After operation	Not answered/ not known	Total
SpR	167	66%	55	10	7	14	253
SHO	87	58%	44	3	6	11	151
Total	**254**	**63%**	**99**	**13**	**13**	**25**	**404**

Table 2.50: Examples where advice was first sought after the start of the operation

Grade of anaesthetist and qualifications	Operation	Physical status	Clinical events
SpR 4	Re-operation coronary artery bypass grafts	66 years, ASA 3 with unstable angina, shortness of breath at rest and diabetes mellitus	Consultant was called when the patient failed to separate from cardiopulmonary bypass
SHO >2 with parts 1&2 FRCA, patient assessed preoperatively by a different SHO 2	Laparotomy, loop colostomy	73 years, ASA 3 with IHD, CCF and hypertension	Given 11 500 ml fluid in theatre and developed acute LVF before a consultant was called
SpR 4	Sliding hip screw	77 years, ASA 3 with chest infection, dementia and alcoholism, had been in hospital for 1 month	Massive PE on the table, consultant informed postoperatively.
SHO 2 with no anaesthetic qualifications	Partial gastrectomy	76 years, ASA 2 with diabetes and a previous CVA	Out-of-hours operation for a GI bleed. GA with epidural, persistent operative hypotension. Discussed with SpR postoperatively
Accredited SpR	Sigmoid colectomy	63 years, ASA 4 with a perforated viscus	Discussed further management with a consultant during the operation
SpR 2 with parts 1&2 FRCA	Sliding hip screw	85 years, ASA 3 with active chest infection, IHD and serum Na^+ 128 mmol/l	Respiratory failure in recovery. Then the case was discussed with a consultant
SHO >2 with part1 FRCA	Femoral hernia repair	89 years, ASA 4 with large bowel obstruction and dehydration	Little information, the patient died in recovery after discussion with another anaesthetist
SHO 2 with no anaesthetic qualifications	Laparotomy, choledochoduodenostomy	81 years, ASA 3 with pneumoconiosis, previous MI, angina, renal impairment and CVA	Discussed the case with a consultant postoperatively, before the patient went to HDU
SpR 4	Incarcerated hernia involving necrotic bowel and bladder	82 years, ASA 4 with COPD, IHD, serum creatinine 856 micromol/l	Changed from a spinal anaesthetic to GA and discussed with a consultant during the operation
Locum SHO with DA	Sliding hip screw	88 years, ASA 3, operation previously delayed for treatment of heart failure and rapid AF. Known IHD, AF, CCF, pulmonary oedema and confusion	Pyrexia and rigors in recovery before advice sought from a consultant.
SpR 2 with FRCA	Laparotomy for incarcerated inguinal hernia repair	84 years, ASA 4 with obstructed inguinal hernia, preoperative Hb 16.1 g/dl, urea 20 mmol/l, creatinine 93 micromol/l and $PaCO_2$ 9.8 kPa	Attempted tracheal extubation, respiratory failure. Reventilation in recovery and consultant informed
SHO >2 with no anaesthetic qualifications	Laparotomy, hemicolectomy and colostomy for perforated diverticulum	80 years, ASA 2 with IHD, ECG ischaemia, anaemia, renal impairment, abdominal sepsis and bowel obstruction	Tracheal extubation and aspiration in theatre, respiratory failure in recovery then advice sought, advisor not specified
Post FRCA research fellow	Revision hip replacement	82 years, ASA 3 with confusion, carcinoma of the breast and bony metastases	Massive bleeding and hypotension. Discussed with a consultant postoperatively. No HDU beds so went to the ward and died after a few hours

Table 2.51: Examples where trainees sought advice preoperatively

Grade of anaesthetist and qualifications	Patient	Operation
SHO >2 with FRCA, discussed with a consultant, continued alone	76 years, ASA 4 with ST segment changes during the first (same day) 5.5 h operation and unstable diabetes	Out-of-hours evening 3 h re-exploration of femoropopliteal and poplitopedal grafts
SHO >2 with no anaesthetic qualifications, discussed with an SpR, continued alone	84 years, ASA 4, IHD, CCF, orthopnoea, electrolyte imbalance and acute renal failure	In-hours, weekday, transurethral resection of a bladder tumour
SHO 2 with part 1 FRCA, discussed with an accredited SpR, continued alone	68 years, ASA 3 with diabetes and pancreatic carcinoma	Out-of-hours night time 3.75 h laparotomy for revision of cholecystenterostomy
SpR 1 with part 1 FRCA, discussed with an ICU consultant who joined later in the case	38 years, ASA 5 with a perforated viscus, septicaemia, acute renal failure and epilepsy	In-hours laparotomy and peritoneal washout
SHO >2 with no qualifications, discussed with a consultant, continued alone	85 years, ASA 4 with bronchopneumonia, hypertension and perforated colonic carcinoma	Out-of-hours evening 3.45 h laparotomy, anterior resection and peritoneal washout
SpR 1 with part 1 FRCA, discussed with a consultant, continued alone	91 years, ASA 3 with a recent (1 week) MI, LVF, arterial desaturation and thyroid disease	In-hours, weekday, hemiarthroplasty for a fractured hip
SHO >2 with part 1 FRCA working with an SHO 1, discussed with a consultant before operation	80 years, ASA 4 with hypertension, renal impairment (creatinine 225 micromol/l,urea 32 mmol/l) hypovolaemia, tachycardia, incarcerated incisional hernia and peritonitis	Out-of-hours 5 h laparotomy, necrotic small bowel resection and incisional hernia repair

Trainees sought advice before the operation in 24% of the cases that they undertook. When advice was sought the patients were often of poor physical status. In some of the examples in Table 2.51 when trainees sought advice the supervision they received was inadequate.

Anaesthetic departments should formulate guidelines relating to appropriate responsibilities for their trainees, particularly SHOs. These should be readily available for reference, circulated to trainees during their induction course and to locum trainees new to the hospital. Consultants and trainees who have attained their fellowship examination should have a clear understanding of their training responsibilities.

Non-consultant career grade anaesthetists

Key Points

- *In 10% of cases a non-consultant career grade (NCCG) was the most senior anaesthetist. The continuing professional development of NCCG anaesthetists needs to be based on nationally prescribed standards and supported locally.*
- *A named consultant and the duty consultant have responsibilities for monitoring and supervising staff grade anaesthetists within their department.*

There has been an expansion of non-consultant career grade (NCCG) anaesthetists and the Royal College of Anaesthetists estimates that there are up to 1500 NCCG anaesthetists currently working within the UK[32].

Definitions[29, 30]

Associate specialist in anaesthesia is a senior hospital post, but the ultimate responsibility for the patients treated by the practitioner rests with the relevant consultant. The post is usually appointed by personal recommendation, without advertisement. Eligibility includes ten years of medical work since attaining a primary medical qualification acceptable to the General Medical Council (GMC), and four years as either a registrar/SpR or staff grade doctor, of which two should have been in anaesthesia. All appointees would normally be expected to possess a higher qualification, e.g. FRCA.

Staff grade in anaesthesia is a permanent career grade post of limited responsibility. The staff grade is accountable to a named consultant, but on a day-to-day basis to the duty consultant. Eligibility includes full registration with the GMC and three years of full time training and service in hospitals recognised by the Royal College of Anaesthetists for training, in SHO grade or higher, or the ability to demonstrate equivalent overseas training. The College recommends that applicants should hold the FRCA or equivalent. Although discretionary, all appointees would normally be expected to possess a postgraduate qualification.

Clinical assistant is a part-time appointment and, since 1989, should not comprise more than 5 NHDs a week. There are no agreed minimum qualifications but with regard to their work, often in isolated units, a minimum of two years of whole time training, the FRCA and updated resuscitation skills are advised.

Non-consultant career grade anaesthetists

In 1990 an NCCG was the most senior anaesthetist in 7% of cases; by 1998/99 this had increased to 10%.

It is obvious from Table 2.52 that non-consultant career grade anaesthetists vary widely in their qualifications. The 'other' qualifications included European and other overseas postgraduate anaesthetic qualifications.

Table 2.52: Highest qualification of NCCG anaesthetists

Grade	None	FRCA	DA/part FRCA	Other/not specified	Total
Associate specialist	2	23	16	0	41
Staff grade	7	25	39	6	77
Clinical assistant	3	1	7	4	15
Trust grade	0	2	0	0	2
Total	12 9%	51 38%	62 46%	10	135

Table 2.53 shows that the majority of the operations managed by NCCG anaesthetists were classified as emergency or urgent.

Table 2.53: Classification of operation where the most senior anaesthetist was an NCCG

Classification	Number	
Emergency	15	11%
Urgent	80	59%
Scheduled	27	20%
Elective	10	7%
Not answered	3	
Total	135	

Staff grade anaesthetists

The most rapidly expanding group of non-consultant career grade anaesthetists is that of staff grade. The 1993/94 NCEPOD report[11] advised that the roles and responsibilities suitable for staff grade anaesthetists needed to be defined and implemented. The Royal College of Anaesthetists considers it essential that those appointed to staff grade posts, where they might be working largely on their own and at times in isolated locations, should at least possess the FRCA or equivalent. Although they may be appointed without possessing the fellowship, in such circumstances they should work as an SHO equivalent and be *closely* supervised by senior staff.

In this sample 6% of anaesthetics were provided by a staff grade, 32% of whom had the fellowship. In 1990, 14 cases (<1%) were anaesthetised by a staff grade, three of whom had the fellowship. Staff grade anaesthetists not in possession of the FRCA are encouraged by the College to be as well-qualified as possible and to work towards attaining postgraduate qualifications. However, to date there have been few courses designed nationally or regionally that provide for this aspect of their professional development.

Staff grade appointments are long-term and the responsibilities appropriate to individual staff grade anaesthetists will change with their professional development and over time. Their appropriate responsibilities should form part of a yearly assessment and be understood by all working within the anaesthetic department.

Table 2.54 details the seven operations where the anaesthetic was provided by a staff grade without anaesthetic qualifications. Six anaesthetists did not seek advice and for the seventh there was no response to this question.

Table 2.54: Cases anaesthetised by staff grade anaesthetists without anaesthetic qualifications

Patient	Operation
72 years, ASA 4 with NIDDM and bowel obstruction	Laparotomy, gastrojejunostomy, ileotransverse bypass
81 years, ASA 4 with IDDM, IHD, PVD, sepsis and intermittent confusion	Right above knee amputation
58 years, ASA 3 with carcinoma of the lung	Laparotomy, division of adhesions, repair of perforation in small bowel
77 years, ASA 2 with AF, hiatus hernia, respiratory arrest following morphine in A&E and WCC 28x10^9/l	Sliding hip screw
63 years, ASA 3 with IHD, occluded aorto bi-iliac graft and ischaemic legs	Laparotomy, division of adhesions, repair of perforation in small bowel
74 years, ASA not specified with liver cirrhosis	Sliding hip screw
79 years, ASA 3 with COPD, CCF and dementia	Revision of a sliding hip screw

Table 2.55: ASA grade of the patients anaesthetised by staff grade anaesthetists without the FRCA						
Advice	ASA 1	ASA 2	ASA 3	ASA 4	ASA 5	ASA not specified
Advice *not* sought	1	6	18	11	2	1
Advice sought	0	0	4	1	0	1
Advice not specified	0	1	2	1	0	1
Total	1	7	24	13	2	3

Fifty patients were anaesthetised by staff grade anaesthetists who did not have the anaesthetic fellowship. The physical status of these patients is presented in Table 2.55.

Staff grade anaesthetists without the FRCA anaesthetised 39 patients of ASA 3 or poorer. For 79% (31/39) of these cases a more senior anaesthetist was not consulted.

Table 2.56 shows that three-quarters of the cases managed by staff grade anaesthetists were classified as emergency or urgent.

Table 2.56: Classification of operation where the most senior anaesthetist was a staff grade		
Classification	Number	
Emergency	8	10%
Urgent	49	64%
Scheduled	12	16%
Elective	5	6%
Not answered	3	4%
Total	77	

CASE 13 • *A staff grade anaesthetist, with the DA in 1990, working out-of-hours with a first year SHO anaesthetised an 83-year-old ASA 2 patient with bowel obstruction. No invasive monitoring was used and the patient returned to the general ward at 02.00. The patient was in a 10 litre positive fluid balance when he died on the following day.*

It was inappropriate for this staff grade anaesthetist to be training.

CASE 14 • *Following discussion with a consultant, a staff grade anaesthetist, with the DA and working alone, anaesthetised a 73-year-old patient, ASA not specified, for a laparotomy for small bowel obstruction due to adhesions. The patient had pneumonia, myocardial ischaemia, gross abdominal distension, severe hypotension and confusion. Investigations revealed Hb 18 g/dl, Na^+ 125 mmol/l, urea 42 mmol/l and creatinine 357 micromol/l.*

Was sufficient consultant support given?

It must be questioned whether the work of staff grade anaesthetists is being appropriately monitored and supervised.

Continuing education and professional development

In 1995 the Royal College of Anaesthetists implemented proposals for continuing medical education of all career anaesthetists[33]. At that time the College accepted that the system would need modification. In 2000 the proposals were revised but still grouped all career anaesthetists, consultant and non-consultant, together[34]. We have identified that non-consultant career grade anaesthetists are a rapidly expanding and important group with heterogeneous qualifications and, presumably, responsibilities and experience.

In 10% of cases a non-consultant career grade was the most senior anaesthetist. Nationally they are important to the provision of the anaesthetic service. Their continuing education and professional development requirements may differ from those of consultants and should be subjected to a separate review. It is important to develop national standards for continuing professional development of non-consultant career grade anaesthetists and ensure that these receive support locally.

Towards better use of the ASA classification

Key Point

- *The American Society of Anesthesiologists' (ASA) classification of physical status needs to be applied appropriately. Greater consistency might be achieved by more careful teaching of the classification.*

The American Society of Anesthesiologists' (ASA) scoring system is used for the preoperative assessment of patients' physical status. The wording of the classification was approved by the American Society of Anesthesiologists in 1962[35] and is widely used by both surgeons and anaesthetists. It is a simple five point score:

ASA classification*

1. A normal healthy patient.
2. A patient with mild systemic disease.
3. A patient with severe systemic disease that limits activity, but is not incapacitating.
4. A patient with incapacitating systemic disease that is a constant threat to life.
5. A moribund patient not expected to survive 24 hours with or without an operation.

* *The definitions cited here were those in use during the data collection period. The wording of ASA grades 3-5 was modified, and a sixth grade added, in 1999*[36].

Most anaesthetic records have a place to record the ASA class, and the majority of anaesthetists record the ASA grade as part of their routine preoperative patient assessment. It can be used to communicate the patient's physical status, both within and between specialties, to match the grade of operating surgeon or anaesthetist to the patient's condition and in clinical audit to define the physical status of the patient population. ASA describes the physical status of the patient at the time of anaesthesia; it is not a chronic health score. It is not designed to give an indication of operative risk, nor can it, since it takes no account of the operative procedure. Operative risk is more appropriately assessed by specific scoring systems, such as the Modified Multifactorial Cardiac Risk Index (heart disease and major surgery)[37] or the Uniform Stratification of Risk (adult acquired heart disease and heart surgery)[38].

NCEPOD has routinely collected information on the ASA classification of patients in both the surgical and anaesthetic questionnaires. From the reports it can be seen that most of the patients who die have ASA scores of three or poorer. It has been shown that the ASA classification usefully profiles the overall physical status of a population[39]; however, for an individual patient there is often wide variation in the ASA classification when assessed by different clinicians[4,40].

The ASA definitions do not exclude either medical or surgical conditions, but often the disorder precipitating surgery appears not to be perceived as a systemic disease and is disregarded. The ASA score indicates the patient's physical status at the time of anaesthesia and it is inappropriate to apply it to the patient as they were before a traumatic event that preceded surgery.

When the ASA classification was first used[39] the surgical disorders and trauma were scored and there were no deaths in 16 000 patients who were classified as ASA 1.

In the 1998/99 NCEPOD sample the following cases were all classified as ASA 1:

- A 42-year-old with multiple fractures and a head injury who underwent a craniotomy for evacuation of extradural haematoma.
- A 24-year-old with head and facial injuries (GCS 3), fractured femur and tibia who underwent internal fixation of the long bone fractures.
- A 30-year-old with severe head injury who had an ICP monitor inserted.
- A 75-year-old with a bladder tumour who underwent a radical cystectomy.
- A 69-year-old who had unsuccessful surgery for a ruptured abdominal aortic aneurysm.
- A 63-year-old with a preoperative diagnosis of gastrointestinal or gynaecological malignancy who underwent a laparotomy, hysterectomy, bilateral salpingo-oophorectomy, ileal bypass and omentectomy.
- A 70-year-old with colonic carcinoma who had an AP resection.
- A 63-year-old who underwent a laparotomy and division of adhesions that were causing small bowel obstruction.
- A 74-year-old with NIDDM who had a TURP.
- A 67-year-old with asthma and carcinoma of the lower oesophagus and stomach who underwent a thoracoabdominal oesophagectomy.
- A 91-year-old with a previous myocardial infarction, angina, atrial fibrillation and an irreducible inguinal hernia who had an inguinal hernia repair.
- A 72-year-old with hypertension, depression and NIDDM who had a surgical repair of a fractured patella.

Notably, in these examples, recent trauma and malignancy were not perceived as systemic disorders. If these cases were presented to a group of clinicians it is doubtful that a consensus as to the appropriate ASA grade would be achieved, but clearly none of these patients was ASA 1.

The ASA scoring system has now been in use for many years. It is a simple classification that is widely known by surgeons and anaesthetists, and that is its major strength. In order to use it as a physical status score for individuals and groups it needs to be applied appropriately. Greater consistency might be achieved by more careful teaching of the classification and by discussion of cases within departments aimed at achieving consensus opinion.