2 CHILDREN

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RECOMMENDATIONS

- The concentration of children's surgical services (whether at a local or regional level) would increase expertise and further reduce occasional practice.
- A review of manpower planning is required to enable anaesthetists and surgeons in various specialties to train in the management of small children.
- There is a need for a system to assess the severity of surgical illness in children in order to gather meaningful information about outcomes. The ASA grading system is widely used by anaesthetists but, as a comparatively simple system, does have limitations for use in children.
- Anaesthetic and surgical trainees need to know the circumstances in which they should inform their consultants before undertaking an operation on a child. To encourage uniformity during rotational training programmes, national guidelines are required.
- In the management of acute children's surgical cases a regional organisational perspective is required. This particularly applies to the organisation of patient transfer between units. Paediatric units have a responsibility to lead this process.
- All Trusts should address the requirements of the framework document on paediatric intensive care[22]. Most children's hospitals have a good provision but many district general hospitals are deficient.
- The death of any child, occurring within 30 days of an anaesthetic or surgical procedure, should be subject to peer review, irrespective of the place of death.
- The events surrounding the perioperative death of any child should be reviewed in the context of multidisciplinary clinical audit.
- There is a need for central guidance to ensure the uniformity of data collection on surgery in children.

2. Children

Introduction

Most deaths after anaesthesia and surgery in children are associated with congenital anomalies, necrotising enterocolitis (NEC), tumours or trauma (particularly of the central nervous system). These are all conditions with potentially serious implications for the outcome of surgery and the prospects for the child's satisfactory future development. Even from the perspective of an enquiry based on the management of those who died within 30 days of surgery it is clear that anaesthetists and surgeons, despite the problems presented by patients in such parlous medical states, are doing most things well. For example, there were no deaths after the common childhood operations of appendicectomy and tonsillectomy. Many of the children in this study had diseases from which, without surgery, they would certainly have died and even if surgery had been successful many would have been left with permanent disability. Thus, for example, in otorhinolaryngology and head and neck surgery, the operations were an episode in the general deterioration of each of these children who had very serious and ultimately fatal congenital abnormalities or systemic disease.

By comparison with the data from the 1989 NCEPOD report on deaths in children, published in 1990[10], the process and structure of services for the provision of anaesthesia and surgery for children have changed for the better. It is, however, deplorable that there are still little or no data, e.g. numbers of patients who have operations, to enable rates of death to be calculated. A general conclusion of the previous report on children was that the data systems in the NHS in 1989 were inadequate and did not allow the calculation of rates of operations and deaths. Comparisons between centres, which might have influenced clinical practice, could not be made in a timely manner. This situation remains unchanged, despite several voluntary comparative audit projects conducted by the Royal College of Surgeons of England and the British Association of Paediatric Surgeons (BAPS). These studies initially recruited 25% of BAPS members (26/102) in 1993/4[11] and 31% of members (34/109) in 1994/5[12]. In 1997/8 data concerning 50% of neonatal surgical admissions were recorded, which allowed calculation of mortality rates for procedures[13]. However, this does not represent comprehensive national data.

The 1989 NCEPOD report referred to above recommended that 'surgeons and anaesthetists should not undertake occasional paediatric practice'. The information presented here shows that this message has been acted upon; the proportion of anaesthetists not undertaking the care of infants of less than six months has increased from 16% to 58% since the earlier report. Whilst applauding this concentration of practice and the potential benefit to be gained from having fewer but more experienced anaesthetists undertaking the care of infants, it has to be recognised that there is a limit to how far this trend can go unless further changes take place in the staffing and organisation of acute hospital services for the very young.

The sample reviewed in this report includes deaths in children aged from birth to 15 years (i.e. until the day preceding the 16th birthday). All surgical specialties except cardiac surgery are included. A decision was made to exclude cardiac surgery for several reasons. Firstly, an audit of these deaths is already in place and we did not wish to place an additional burden on these clinicians. Secondly, the individual nature of many of the cardiac anomalies makes broad conclusions difficult. Lastly, we wished to revisit the provision of surgery for children and review changes in the ten years since the last report on paediatric anaesthesia and surgery; it was felt that this would be more meaningful within non-cardiac surgical specialties.

General issues

Who anaesthetises and who operates on children?

Key Points

- *There is a lack of uniformity of data collected within the NHS.*
- *The proportion of anaesthetists who do not anaesthetise infants of less than six months old has increased from 16% to 58% when compared with data from ten years ago.*
- *A significant number of anaesthetic consultants giving anaesthesia to children still do a small number of cases each year.*
- *There has been a considerable shift in practice (with more specialisation in children's surgery) within some specialties, for example orthopaedic surgery, whereas in other areas there has been little change, when compared with data from ten years ago.*
- *Very occasional practice in emergency situations persists within surgery on children.*

At the beginning of 1999 a short questionnaire was sent to all consultant anaesthetists and surgeons on the NCEPOD database requesting information on consultants' paediatric practice. Consultants were asked 'Do you ever anaesthetise children aged 15 or under?' or 'Do you, or your junior staff, ever operate on children aged 15 or under?' If an affirmative answer was given to this question, figures were requested on the number of children anaesthetised or operated on each year, in three age groups: birth to less than six months, six months to less than two years and two to 15 years.

The replies indicate that the majority of anaesthetists (66%, 2126/3247) and surgeons (55%, 3580/6513) in all regions treat some children (Tables 2.2 and 2.4). The answers were a mixture of verifiable local data and generous estimates. There are no readily accessible contemporary data with which to check the figures.

Several interesting facts emerged:

- Some anaesthetists and surgeons either could not or would not answer the questions at all. Some did not return the data (28% of anaesthetists and 33% of surgeons) and others replied in a manner which made analysis impossible e.g. 'many', 'rarely', 'all my cases', 'over 1000' etc.

- Trusts throughout the UK are clearly collecting differing sets of data. Returns included: '<6 months, 6 months-2½ years, 2½-15½ years'; '<3 months, 3 months-4 years, 5-16 years'; '<6 months, 6 months-2 years, 2-18 years'; 'infants (<1 year), pre-school (<5 years), 5-15 years' and '<1 year, 1-5 years, 5-15 years'.

- Anaesthetists and surgeons who said that they did not treat children aged less than six months wrote that they would only do so in an emergency!

The lack of uniformity of data collected within the NHS is shameful. There is a need for a clearly defined data set, which all Trusts could apply. This is vitally important if any form of comparative audit is to take place, as envisaged as part of clinical governance. Secondly, the worst form of practice, i.e. very occasional practice in emergency situations persists within anaesthesia and surgery on children.

Some departments replied jointly. Whilst the data could not be analysed in the main tables, it was felt that this should be tabulated separately (Table 2.1) in view of the diligent way in which the information was returned. In the future clinical governance may require Trusts to identify individual practitioners within aggregated local data.

The figures in Table 2.1 show a considerable variation in exposure to paediatric practice. Gynaecologists see few children and these cases are usually examinations under anaesthesia or termination of pregnancies. What can be the justification for three neurosurgeons sharing an extremely occasional practice?

Table 2.1: Departmental data				
	<6 months	6 months to <2 years	2 to15 years	Total
Paediatric surgery (4 consultants)	Not supplied	Not supplied	Not supplied	1803
Anaesthetic (4 consultants)	0	20	825	845
Gynaecology (4 consultants)	0	0	10	10
Gynaecology (4 consultants)	0	0	8	8
Neurosurgery (3 consultants)	1	1	10	12
Otorhinolaryngology (2 consultants)	6	40	1000	1046
Oral & maxillofacial (4 consultants)	5	100	1600	1705
Orthopaedics (4 consultants)	5	50	800	855
Orthopaedics (5 consultants)	Not supplied	Not supplied	Not supplied	300
Orthopaedics (6 consultants)	11	21	647	679
Orthopaedics (5 consultants)	4	20	311	335
Orthopaedics (4 consultants)	3	31	349	383
Orthopaedics (6 consultants)	1	22	286	309
Trauma service (8 consultants)	0	50	700	750

Who anaesthetises children?

Table 2.2: Consultant anaesthetists by region: "Do you ever anaesthetise children aged 15 or under?"					
	Yes	No	Not returned	Total	Return rate
Anglia & Oxford	229	11	58	298	81%
North Thames	251	24	167	442	62%
North West	258	53	120	431	72%
Northern & Yorkshire	269	22	93	384	76%
South & West	263	9	80	352	77%
South Thames	237	15	107	359	70%
Trent	195	41	74	310	76%
West Midlands	195	16	103	314	67%
Wales	123	6	58	187	69%
Northern Ireland	89	13	33	135	76%
Guernsey	5	0	0	5	100%
Jersey	3	0	2	5	60%
Isle of Man	3	0	1	4	75%
Defence Secondary Care Agency	2	0	3	5	40%
Independent sector	4	3	9	16	44%
Total	2126	213	908	3247	72%

More than a quarter of anaesthetists did not provide answers to these questions. Retirements and other changes in employment are registered slowly and there is inertia in the NCEPOD database. This explanation may partly account for the low figures but some of the return rates are unacceptable (e.g. North Thames).

From this data it appears that 91% of consultant anaesthetists anaesthetise children of 15 years or younger. In the data collected in 1989, 95% of anaesthetists anaesthetised children of ten years or less.

Table 2.3: Number of consultants anaesthetising children in different age groups

Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	1135	434	7
1–9	605	573	154
10–19	162	418	222
20–50	119	463	682
>50	94	222	1020
No figures supplied	11	16	41

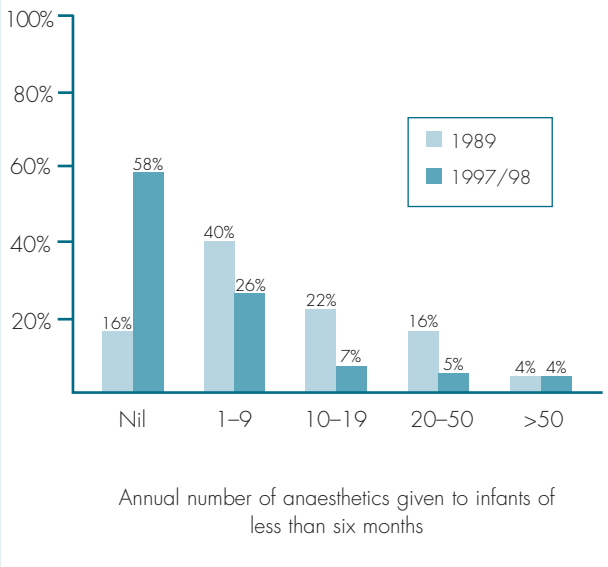
For the youngest age group, infants under six months, direct comparison can be made with similar data collected in 1989. Expressed in terms of percentages, to facilitate comparison, the respective samples are shown in Figure 2.1.

In the 1989 sample the percentage return of those stating that they gave anaesthetics to children of less than six months but giving no figures that could be included in the analysis was 3%; in the current sample it was less than 1%.

During the period between 1989 and the current sample, the proportion of consultants anaesthetising small numbers of infants has fallen. At the same time, the percentage doing none has increased from 16% to well over half of all anaesthetic consultants. This is evidence of the change that has occurred in anaesthesia for children over the past ten years and perhaps an indication of the influence of the earlier report.

In 1997 the House of Commons Health Committee in their Report 'Hospital Services for Children and Young People'[14] stated that it was 'highly undesirable that some surgeons and anaesthetists should be continuing to undertake occasional paediatric practice'. The evidence that they had received on which to base this recommendation was that an anaesthetist engaged in paediatric practice should have a regular annual caseload of 12 infants under six months, 50 infants and children under two years and 300 children under ten. However, of those consultants who do anaesthetise infants aged under six months, 62% (605/980) do fewer than ten cases a year and for children aged between six months and two years, 34% (573/1676) of anaesthetists also do fewer than ten cases a year.

Figure 2.1: Percentage of consultant anaesthetists (based on returned questionnaires) anaesthetising infants of less than six months grouped by number of cases anaesthetised



Who operates on children?

Table 2.4: Consultant surgeons by region: "Do you, or your junior staff, ever operate on children aged 15 or under?"

	Yes	No	Not returned	Total	Return rate
Anglia & Oxford	352	41	165	558	70%
North Thames	444	107	362	913	60%
North West	428	107	329	864	62%
Northern & Yorkshire	463	95	260	818	68%
South & West	428	62	193	683	72%
South Thames	441	74	249	764	67%
Trent	301	124	141	566	75%
West Midlands	354	72	225	651	65%
Wales	204	30	138	372	63%
Northern Ireland	127	35	71	233	70%
Guernsey	6	1	5	12	58%
Jersey	6	0	6	12	50%
Isle of Man	8	1	2	11	82%
Defence Secondary Care Agency	10	6	4	20	80%
Independent sector	8	11	17	36	53%
Total	3580	766	2167	6513	67%

Consultant surgeons by specialty

Accident & Emergency

Question 2.1: A&E consultants (and teams) who operate on children

Yes	26
No	62
Not answered	64
Total	152

Forty-two percent of consultants in this specialty failed to return the questionnaire to NCEPOD. The calculations below are based on the 88 returned questionnaires.

In 1989 the majority of A&E consultants operated on children (110/134, 82%)[10], whereas this figure is now 30% (26/88). Those dealing with babies aged under six months has fallen from 30% (40/134) in 1989 to 10% (9/88). The advent of trauma teams and better provision of paediatric services probably means that A&E consultants and their teams are less likely to treat surgical conditions in children. However, initiating resuscitation in children is appropriate pending the arrival of specialist teams.

Figure 2.2: Percentage of A&E consultants and teams (based on returned questionnaires) operating on infants of less than six months grouped by number of cases treated

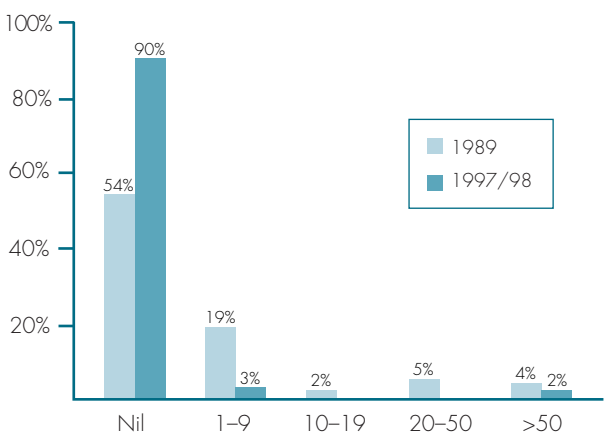


Table 2.5: Number of A&E consultants (and teams) operating on children in different age groups

Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	17	13	0
1–9	3	5	2
10–19	0	1	6
20–50	0	0	6
>50	2	3	7
No figures supplied	4	4	5

Orthopaedic surgery

Question 2.2: Consultant orthopaedic surgeons (and teams) who operate on children

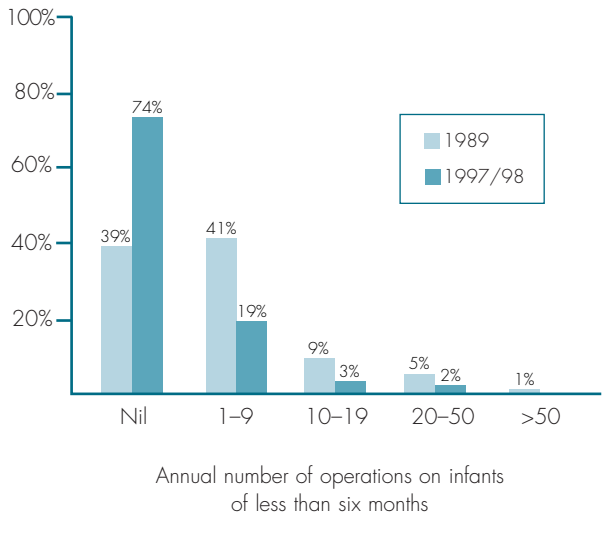
Yes	803
No	108
Not answered	437
Total	1348

Thirty-two percent of consultants in this specialty failed to return the questionnaire to NCEPOD. The calculations below are based on the 911 returned questionnaires.

Table 2.6: Number of consultant orthopaedic surgeons (and teams) operating on children in different age groups

Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	562	245	5
1–9	176	344	82
10–19	23	104	177
20–50	17	68	335
>50	1	12	162
No figures supplied	24	30	42

Figure 2.3: Percentage of consultant orthopaedic surgeons and teams (based on returned questionnaires) operating on infants of less than six months grouped by number of cases treated



One hundred and eight (108/911, 12%) orthopaedic surgeons do not operate on children at all; a total of 670 (670/911, 74%) do not operate on children under six months old. There appears to be further subspecialisation in childhood orthopaedic surgery compared to 1989[10]. Although 176 (19%) surgeons operate on the occasional child under six months old this is a considerable fall from the figure of 41% in 1989. Until there is further expansion and rationalisation in orthopaedic services the need to manage trauma in district general hospitals may make this occasional practice inevitable.

General surgery

Question 2.3: Consultant general surgeons (and teams) who operate on children

Yes	816
No	207
Not answered	498
Total	1521

Thirty-three percent of consultants in this specialty failed to return the questionnaire to NCEPOD. The calculations below are based on the 1023 returned questionnaires.

Table 2.7: Number of consultant general surgeons (and teams) operating on children in different age groups

Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	523	335	0
1–9	220	237	104
10–19	37	127	145
20–50	16	85	369
>50	2	11	157
No figures supplied	18	21	41

Two hundred and seven (207/1023, 20%) general surgeons do not operate on children at all; a total of 730 (730/1023, 71%) do not operate on children aged under six months. This compares with a figure of 32% in 1989[10] and suggests further subspecialisation. However, 220 (220/1023, 22%) general surgeons stated that they do operate on infants less than six months old but undertake fewer than ten operations in this age group per annum. This represents a decrease from the percentage of surgeons who reported occasional practice ten years ago[10]. This suggests that recommendations aimed at reorganising the provision of 'general surgery' services for children have had an overall effect, but occasional practice is still occurring.

Figure 2.4: Percentage of consultant general surgeons and teams (based on returned questionnaires) operating on infants of less than six months grouped by number of cases treated

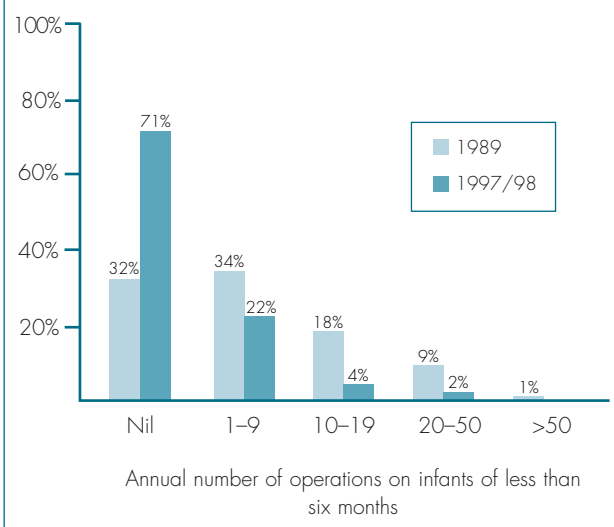
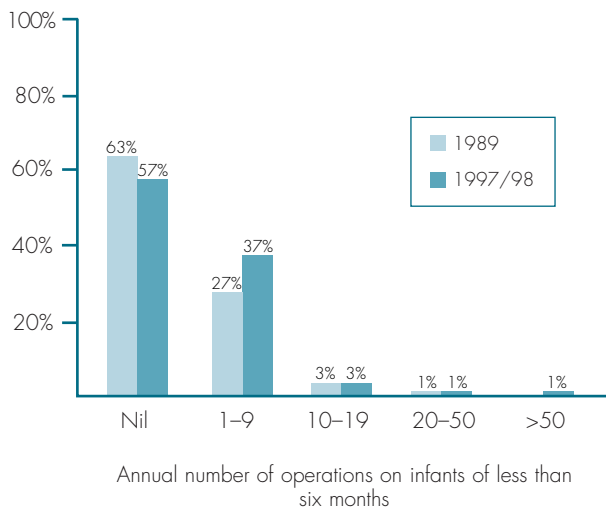


Figure 2.5: Percentage of consultant oral/maxillofacial surgeons and teams (based on returned questionnaires) operating on infants of less than six months grouped by number of cases treated



Oral/Maxillofacial surgery

Question 2.4: Consultant oral/maxillofacial surgeons (and teams) who operate on children

Yes	156
No	5
Not answered	97
Total	258

Thirty-eight percent of consultants in this specialty failed to return the questionnaire to NCEPOD. The calculations below are based on the 161 returned questionnaires.

Table 2.8: Number of consultant oral/maxillofacial surgeons (and teams) operating on children in different age groups

Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	86	22	2
1–9	60	70	2
10–19	5	37	14
20–50	2	20	42
>50	1	4	90
No figures supplied	2	3	6

Dental surgery

Question 2.5: Consultant dental surgeons (and teams) who operate on children

Yes	12
No	3
Not answered	12
Total	27

Forty-four percent of consultants in this specialty failed to return the questionnaire to NCEPOD.

Table 2.9: Number of consultant dental surgeons (and teams) operating on children in different age groups

Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	7	3	0
1–9	5	2	1
10–19	0	4	0
20–50	0	2	0
>50	0	1	10
No figures supplied	0	0	1

Otorhinolaryngology

Question 2.6: Consultant otorhinolaryngologists (and teams) who operate on children

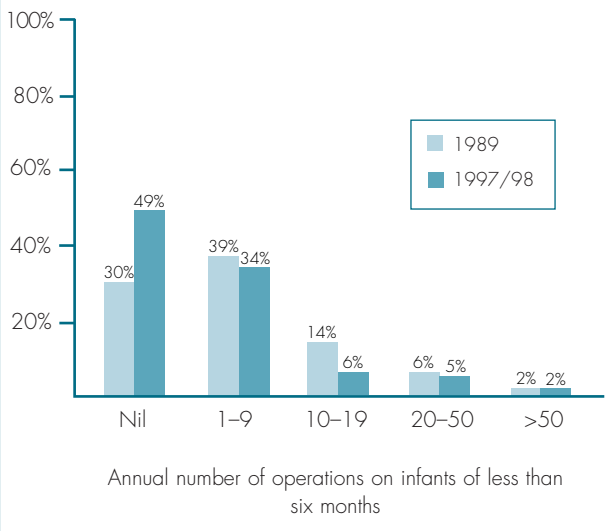
Yes	320
No	4
Not answered	207
Total	531

Thirty-nine percent of consultants in this specialty failed to return the questionnaire to NCEPOD. The calculations below are based on the 324 returned questionnaires.

Table 2.10: Number of consultant otorhinolaryngologists (and teams) operating on children in different age groups

Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	156	25	3
1–9	110	82	1
10–19	19	67	2
20–50	17	99	16
>50	6	32	280
No figures supplied	12	15	18

Figure 2.6: Percentage of consultant otorhinolaryngologists and teams (based on returned questionnaires) operating on infants of less than six months grouped by number of cases treated



Gynaecology

Question 2.7: Consultant gynaecologists (and teams) who operate on children

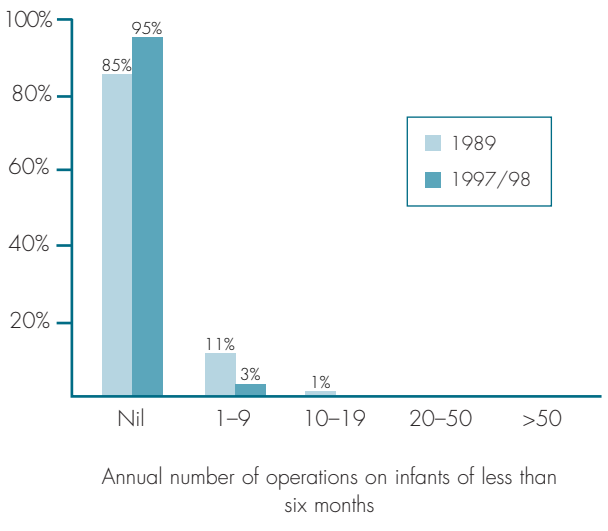
Yes	556
No	215
Not answered	324
Total	1095

Thirty percent of consultants in this specialty failed to return the questionnaire to NCEPOD. The calculations below are based on the 771 returned questionnaires.

Table 2.11: Number of consultant gynaecologists (and teams) operating on children in different age groups

Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	516	429	13
1–9	26	109	444
10–19	0	1	56
20–50	0	0	7
>50	0	0	3
No figures supplied	14	17	33

Figure 2.7: Percentage of consultant gynaecologists and teams (based on returned questionnaires) operating on infants of less than six months grouped by number of cases treated



Most gynaecologists do not operate on small children. The percentage of gynaecologists who occasionally operate on infants aged under six months has dropped from 11% in 1989[10] to 3% in 1997/98. The amount of children's surgery in general is small and often consists of a diagnostic examination under anaesthesia or, in older children, termination of pregnancy.

Neurosurgery

Question 2.8: Consultant neurosurgeons (and teams) who operate on children

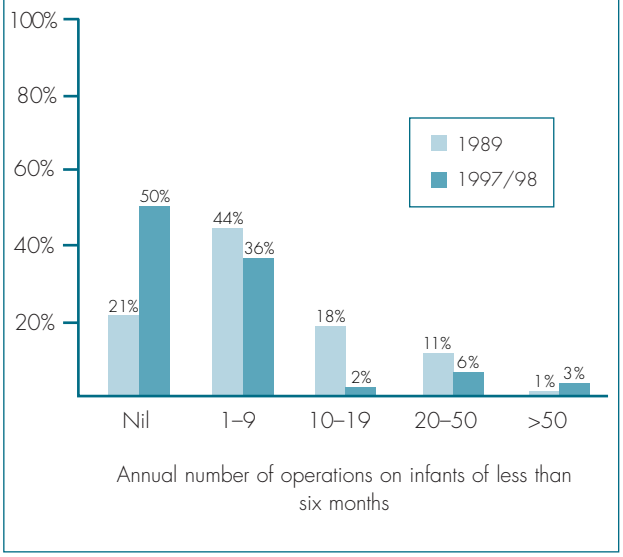
Yes	88
No	27
Not answered	55
Total	170

Thirty-two percent of consultants in this specialty failed to return the questionaire to NCEPOD. The calculations below are based on the 115 returned questionnaires.

Table 2.12: Number of consultant neurosurgeons (and teams) operating on children in different age groups

Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	30	20	0
1–9	41	42	37
10–19	2	9	25
20–50	7	8	13
>50	4	5	9
No figures supplied	4	4	4

Figure 2.8: Percentage of consultant neurosurgeons and teams (based on returned questionnaires) operating on infants of less than six months grouped by number of cases treated



Twenty-three percent of neurosurgeons (27/115) never operate on children and 50% (57/115) do not operate on babies under six months old. This is a change from the data published in 1989[10] when all neurosurgeons reported operating on children. There is still a considerable amount of surgery on children aged under six months which is done by neurosurgeons with an infrequent practice in children of this age.

Ophthalmology

Question 2.9: Consultant ophthalmic surgeons (and teams) who operate on children

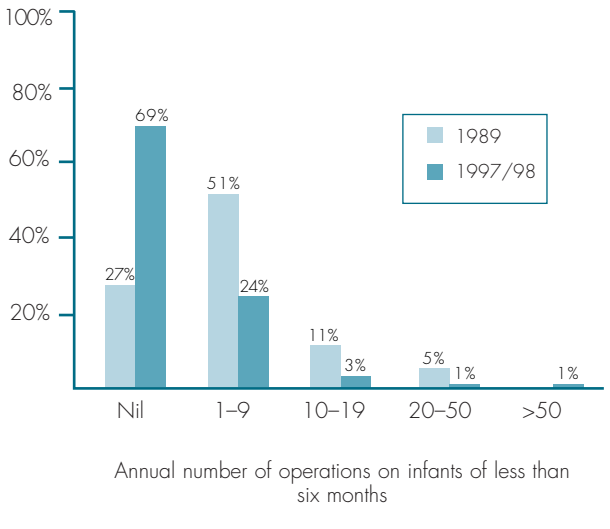
Yes	351
No	26
Not answered	219
Total	596

Thirty-seven percent of consultants in this specialty failed to return the questionnaire to NCEPOD. The calculations below are based on the 377 returned questionnaires.

Table 2.13: Number of consultant ophthalmic surgeons (and teams) operating on children in different age groups

Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	233	45	4
1–9	92	183	88
10–19	13	65	89
20–50	5	44	120
>50	3	8	43
No figures supplied	5	6	7

Figure 2.9: Percentage of consultant ophthalmic surgeons and teams (based on returned questionnaires) operating on infants of less than six months grouped by number of cases treated



Most ophthalmic surgeons operate on children but 259 (259/377, 69%) do not operate on babies under six months old. Occasional practice (less than ten cases per annum) in children aged less than six months has halved in the last ten years, from 51% (210/411) of surgeons in 1989[10] to 24% (92/377).

Paediatric surgery

Question 2.10: Consultant paediatric surgeons (and teams) who operate on children

Yes	54
No	0
Not answered	22
Total	76

Twenty-nine percent (22/76) of consultants in this specialty failed to return the questionnaire to NCEPOD.

Table 2.14: Number of consultant paediatric surgeons (and teams) operating on children in different age groups

Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	0	0	0
1–9	0	0	0
10–19	3	0	0
20–50	5	4	0
>50	38	42	46
No figures supplied	8	8	8

The specialist paediatric surgeons are operating on large numbers of children in all age groups. Those listed as operating on 10-19 and 20-50 cases per annum are probably general surgeons with a specific interest in paediatric surgery.

Urology

Question 2.11: Consultant urologists (and teams) who operate on children

Yes	232
No	76
Not answered	128
Total	436

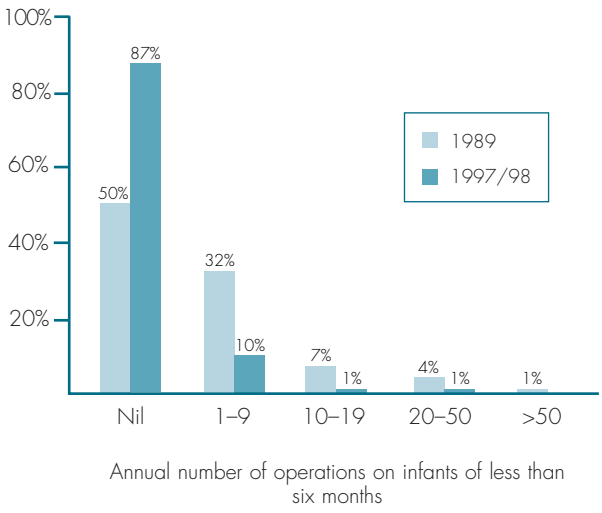
Twenty-nine percent (128/436) of consultants in this specialty failed to return the questionnaire to NCEPOD. The calculations below are based on the 308 returned questionnaires. The practice of a small number of specialised paediatric urologists is included in these figures.

Two hundred and sixty-eight (268/308, 87%) urologists do not operate on children aged under six months (Figure 2.10). This is an increase compared with the situation in 1989[10] (125/251, 50%). The incidence of occasional practice (less than ten cases) in babies aged under six months has fallen from 32% of surgeons in 1989[10] (80/251) to 10% in this report (31/308). This is further evidence of the impact made by guidelines on the provision of surgical services for children[15].

Table 2.15: Number of consultant urologists (and teams) operating on children in different age groups

Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	192	99	0
1–9	31	76	44
10–19	3	32	57
20–50	2	15	89
>50	1	2	29
No figures supplied	3	8	13

Figure 2.10: Percentage of consultant urologists and teams (based on returned questionnaires) operating on infants of less than six months grouped by number of cases treated



Plastic surgery

Question 2.12: Consultant plastic surgeons (and teams) who operate on children

Yes	102
No	1
Not answered	68
Total	171

Forty percent (68/171) of consultants in this specialty failed to return the questionnaire to NCEPOD.

Most plastic surgeons operate on children although for some age groups the practice is infrequent (Table 2.16).

Table 2.16: Number of consultant plastic surgeons (and teams) operating on children in different age groups			
Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	25	5	1
1–9	33	21	1
10–19	13	18	9
20–50	21	34	26
>50	5	19	59
No figures supplied	5	5	6

Thoracic surgery

Question 2.13: Consultant thoracic surgeons (and teams) who operate on children

Yes	22
No	3
Not answered	8
Total	33

Twenty-four percent (8/33) of consultants in this specialty failed to return the questionnaire to NCEPOD.

Table 2.17: Number of consultant thoracic surgeons (and teams) operating on children in different age groups			
Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	16	8	0
1–9	6	11	16
10–19	0	3	5
20–50	0	0	0
>50	0	0	1
No figures supplied	0	0	0

Vascular surgery

Question 2.14: Consultant vascular surgeons (and teams) who operate on children

Yes	26
No	24
Not answered	18
Total	68

Twenty-six percent (18/68) of consultants in this specialty failed to return the questionnaire to NCEPOD.

Table 2.18: Number of consultant vascular surgeons (and teams) operating on children in different age groups			
Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	19	13	0
1–9	7	11	13
10–19	0	2	4
20–50	0	0	8
>50	0	0	1
No figures supplied	0	0	0

Transplant surgery

Question 2.15: Consultant transplant surgeons (and teams) who operate on children

Yes	7
No	3
Not answered	6
Total	16

Thirty-eight percent (6/16) of consultants in this specialty failed to return the questionnaire to NCEPOD.

Table 2.19: Number of consultant transplant surgeons (and teams) operating on children in different age groups			
Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	5	2	0
1–9	1	2	3
10–19	0	2	1
20–50	0	0	2
>50	0	0	0
No figures supplied	1	1	1

Spinal surgery

Question 2.16: Consultant spinal surgeons (and teams) who operate on children

Yes	6
No	2
Not answered	3
Total	11

Twenty-seven percent (3/11) of consultants in this specialty failed to return the questionnaire to NCEPOD.

Table 2.20: Number of consultant spinal surgeons (and teams) operating on children in different age groups			
Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	4	2	0
1–9	2	4	5
10–19	0	0	0
20–50	0	0	1
>50	0	0	0
No figures supplied	0	0	0

Hand surgery

Question 2.17: Consultant hand surgeons (and teams) who operate on children

Yes	3
No	0
Not answered	1
Total	4

Twenty-five percent (1/4) of consultants in this specialty failed to return the questionnaire to NCEPOD.

Table 2.21: Number of consultant hand surgeons (and teams) operating on children in different age groups			
Number of cases per annum	<6 months	6 months to <2 years	2 to 15 years
Nil	1	0	0
1–9	1	0	0
10–19	0	1	0
20–50	1	2	1
>50	0	0	2
No figures supplied	0	0	0

Occasional practice in surgery on children under six months

The figures in Table 2.22 must be seen in the context of the specialty and hospital type. Surgeons may be operating on these small numbers of patients because of local demand and the inability to specialise within the specialty because of a lack of resources. Alternatively the total number of cases may be small and the presenting conditions rare (in which case there should be referral to a centre with adequate experience of these conditions). The precise age which delineates whether a child is treated by a general surgeon with a paediatric interest or a specialist paediatric surgeon has yet to be defined. The important factor is the appropriateness of the procedures done, bearing in mind the expertise and support services available. This is particularly important with regard to anaesthesia. Anaesthetists should not find themselves pressured to maintain a local service, particularly for infants, when there are insufficient cases for them to be able to maintain their expertise. Similar concerns may also be relevant to specialist nursing.

This demand for local provision of healthcare for these young patients may be at variance with the need for rationalisation of specialist services. Recommendations concerning the training of general surgeons were published in 1998[15] but the authors are not aware of much change since then. A review of manpower planning is required to enable surgeons in various specialties to train in the management of small children. This would allow safe local services for those children who do not require major or complex surgery and support the dedicated paediatric surgeons in regional centres.

Table 2.22: Number of surgeons by specialty who operate on small numbers (one to nine) of children per annum aged under six months		
Specialty	Number of surgeons	%
Accident & Emergency	3/88	3%
Orthopaedic surgery	176/911	19%
General surgery	220/1023	22%
Oral/maxillofacial surgery	60/161	37%
Dental surgery	5/15	33%
Otorhinolaryngology	110/324	34%
Gynaecology	26/771	3%
Neurosurgery	41/115	36%
Ophthalmic surgery	92/377	24%
Urology	31/308	10%
Plastic surgery	33/103	32%
Thoracic surgery	6/25	24%
Vascular surgery	7/50	14%
Transplant surgery	1/10	10%
Spinal surgery	2/8	25%
Hand surgery	1/3	33%

Patient profile

Key Points

- *Most deaths were associated with congenital anomalies, necrotising enterocolitis, tumours or trauma.*
- *There were no reported deaths after the common childhood operations of appendicectomy and tonsillectomy.*

Age

Table 2.23: Age of patient at time of final operation

Age	Number
Less than one month	28
One month to less than six months	21
Six months to less than one year	6
One year to less than two years	7
Two years to less than four years	7
Four years to less than 11 years	19
11 years to less than 16 years	24
Total*	112

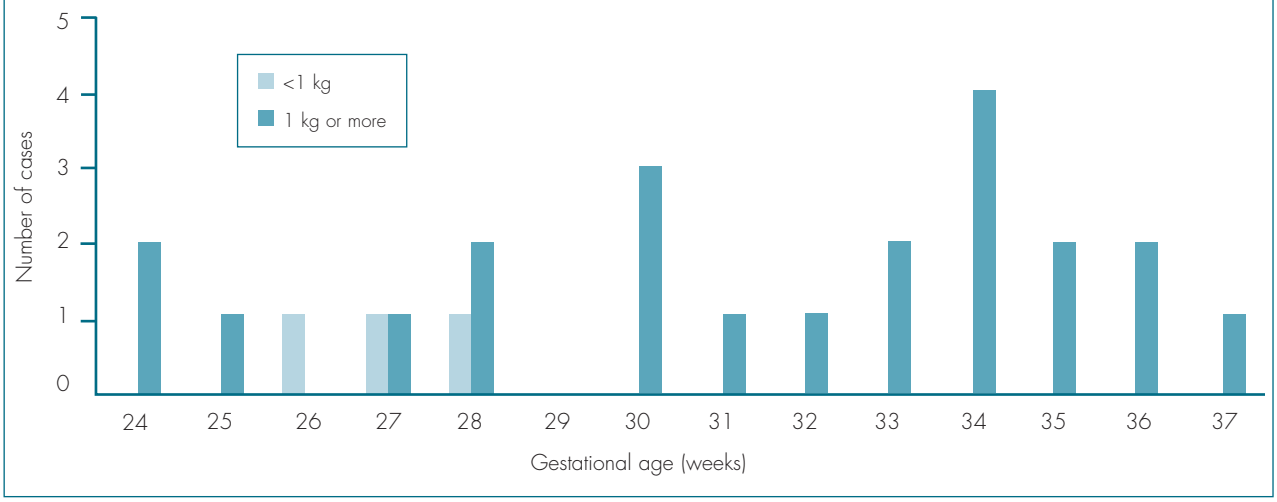
** total number of cases covered by the 93 surgical questionnaires and 85 anaesthetic questionnaires returned to NCEPOD and included in the analysis*

Early deaths were mostly due to congenital anomalies and neonatal problems such as necrotising enterocolitis, and the later deaths mainly resulted from trauma.

Birthweight and perinatal mortality

The survival rate for infants born weighing less than 1500g (very low birthweight, VLBW) is approximately 80% whereas for those born weighing less than 1000g (extremely low birthweight, ELBW) survival is about 63%. A baby who is premature (birth before 37 completed weeks of gestation) and small for gestational age (less than the 10th centile in weight expected for gestation) is in a high-risk group[16]. If the need for surgery arises then the risks of non-survival are increased. In addition, the survivors of combined prematurity and surgery may not have a good quality of life. There is a relatively high incidence of cerebral palsy, impaired vision and hearing, school failure and behaviour problems in these children. Bearing in mind this increased risk, the gestational age and weights of the children who were less than six months old at the time of surgery were analysed.

Figure 2.11: Gestational age at birth (when under six months old at the time of surgery) by weight at operation



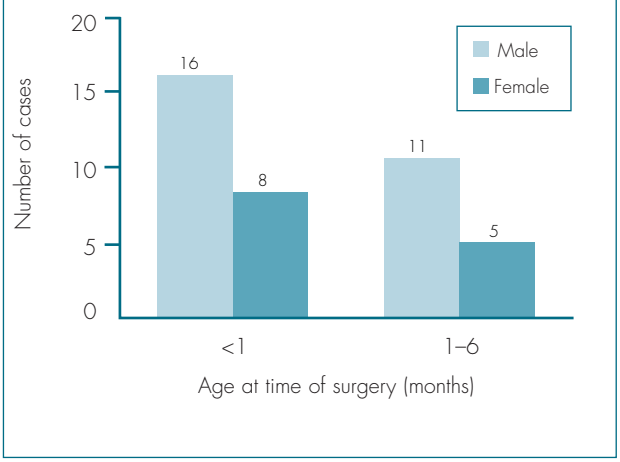
Sex

Question 2.18: Sex of child (SQ5)

Male	53
Female	40
Total	93

Overall there was an equal distribution of the sexes in this sample. However, amongst the children who were less than six months old at the time of surgery there were twice as many boys as girls (Figure 2.12).

Figure 2.12: Age at time of surgery for infants under six months by sex (SQs 1 and 5)



Procedures

Table 2.24 details the procedures done in the 112 cases where the child died. This list is compiled from both anaesthetic and surgical questionnaires. The procedures are grouped by the declared specialty (and subspecialty if known) of the consultant surgeon in charge of the case. There were 58 procedures done by paediatric surgeons, 52% (58/112) of the total. Neurosurgery accounted for 31 procedures, 28% (31/112). Of these neurosurgical operations, 45% (14/31) were done by specialist paediatric neurosurgeons, 26% (8/31) by surgeons with a mixed paediatric and adult practice, 10% (3/31) by neurosurgeons who said they had a mainly adult practice and 19% (6/31) by neurosurgeons who did not specify their type of practice (see page 48 for further discussion on neurosurgery).

In one case (Case 7, page 39) a laparotomy was done under the supervision of a plastic surgeon. This might seem inappropriate but the information returned was incomplete. The patient had undergone reconstructive surgery six days prior to the laparotomy, developed intra-abdominal bleeding and the laparotomy was done by an SpR 4 with a consultant plastic surgeon in theatre. It is not known from which specialty the registrar came. Death from renal failure was unrelated to the surgery.

The management of abdominal trauma in some children was of concern; this is discussed further on page 49.

Table 2.24: Specialty of consultant surgeons and operations performed

Specialty of consultant surgeon	Operation performed
Neurosurgery – Paediatric	Resection of choroid plexus tumour
Neurosurgery – Paediatric	Insertion of intracranial pressure monitor
Neurosurgery – Paediatric	Craniotomy and evacuation of acute subdural haematoma
Neurosurgery – Paediatric	Insertion of intracranial pressure monitor
Neurosurgery – Paediatric	Ventricular drainage and evacuation of cerebellar haematoma
Neurosurgery – Paediatric	Craniotomy and evacuation of haematoma
Neurosurgery – Paediatric	Craniotomy and evacuation of acute extradural haematoma
Neurosurgery – Paediatric	Craniotomy and evacuation of fungal abscess
Neurosurgery – Paediatric	Craniotomy and evacuation of acute subdural haematoma
Neurosurgery – Paediatric	Insertion of intracranial pressure monitor
Neurosurgery – Paediatric	Insertion of ventriculoperitoneal shunt
Neurosurgery – Paediatric	Stereotactic biopsy of brainstem mass
Neurosurgery – Paediatric	Frontoparietal craniotomy (acute subdural empyema). Bilateral antral lavage
Neurosurgery – Paediatric	Cranial expansion surgery
Neurosurgery – Mixed	Posterior fossa craniectomy and debulking of cerebellar tumour (medulloblastoma)
Neurosurgery – Mixed	Craniotomy, evacuation of subdural haematoma, and insertion of intracranial pressure monitor
Neurosurgery – Mixed	Craniotomy and evacuation of acute subdural haematoma

Specialty of consultant surgeon	Operation performed
Neurosurgery – Mixed	Insertion of external ventricular drain and revision of ventriculoperitoneal shunt
Neurosurgery – Mixed	Insertion of intracranial pressure monitor
Neurosurgery – Mixed	Revision of ventriculoperitoneal shunt
Neurosurgery – Mixed	Posterior fossa craniectomy and debulking of cerebellum
Neurosurgery – Mixed	Occipitocervical fixation using lateral mass plates and removal of posterior arch C1
Neurosurgery – Adult	Posterior fossa decompression and C1 - C2 laminectomy
Neurosurgery – Adult	Craniotomy and insertion of external ventricular drain
Neurosurgery – Adult	Evacuation of acute subdural haematoma
Neurosurgery	Craniotomy and evacuation of acute subdural haematoma
Neurosurgery	Insertion of intracranial pressure monitor
Neurosurgery	Endoscopic ventriculoscopy
Neurosurgery	Craniotomy for tumour
Neurosurgery	Craniotomy, evacuation of haematoma and temporal lobectomy
Neurosurgery	Ventriculoperitoneal shunt
Paediatric	Upper GI endoscopy and sclerotherapy to bleeding ulcer in oesophagus. Insertion of Sengstaken tube
Paediatric	Exploration of abdomen and external biliary drain
Paediatric	Exteriorisation of PD catheter cuff site and excision of granulation tissue. Insertion of femoral arterial and venous lines (open technique)
Paediatric	Thoracotomy and repair of aortic fistula
Paediatric	Second look laparotomy (in moribund patient to clarify appropriateness or not of continued active care on PICU)
Paediatric	Laparotomy
Paediatric	Oesophagoscopy
Paediatric	Attempted PEG, converted to open Stamm gastrostomy
Paediatric	Repair tracheo-oesophageal fistula and oesophageal atresia
Paediatric	Left mini-thoracotomy; aspiration of fluid. Bilateral chest drain insertion. Open drainage hip joint
Paediatric	Laparotomy, splenectomy and packing of liver laceration
Paediatric	Laparotomy
Paediatric	Silastic silo construction for gastroschisis
Paediatric	Laparotomy, ileal resection, ileoanal anastomosis and jejunostomy
Paediatric	Muscle and skin biopsy
Paediatric	Right hemicolectomy and insertion of Broviac catheter
Paediatric	Insertion of Hickman catheter
Paediatric	Rectal biopsy and insertion of Hickman catheter
Paediatric	Open muscle biopsy
Paediatric	Repair of intestinal perforations and ileostomy
Paediatric	Laparotomy, small bowel resection and primary anastomosis
Paediatric	Laparotomy, resection of ileum and split ileostomy
Paediatric	Second look laparotomy, ligation of bleeding vessels from liver surface and retroperitoneum, packing of abdominal cavity
Paediatric	Laparotomy, excision and closure of perforated gastric ulcer, peritoneal lavage
Paediatric	Laparotomy
Paediatric	Laparotomy, peritoneal lavage and closure of small bowel perforation
Paediatric	Laparotomy extended to thoracotomy and exposure of thoracoabdominal aorta
Paediatric	Laparotomy and ileostomy
Paediatric	Insertion of peritoneal drain under local anaesthetic
Paediatric	Abdominal drain insertion
Paediatric	Trucut biopsy and central venous catheter insertion
Paediatric	Laparotomy
Paediatric	Laparotomy, Ladd's procedure, ileostomy and insertion of central venous catheter
Paediatric	Second look laparotomy, loop jejunostomy and insertion of Hickman catheter
Paediatric	Laparotomy, division of adhesions, small bowel resection and primary anastomosis, revision of stoma
Paediatric	Anal cut back

Specialty of consultant surgeon	Operation performed
Paediatric	Division of adhesions, ileostomy and mucous fistula
Paediatric	Repair of recurrent inguinal hernia
Paediatric	Laparotomy, small bowel resection and ileostomy
Paediatric	Laparotomy, small bowel resection and jejunostomy
Paediatric	Laparotomy and ileostomy
Paediatric	Laparotomy, splenectomy and packing of abdominal wound
Paediatric	Proposed closure of gastroschisis; baby died at induction
Paediatric	Laparotomy, open and close
Paediatric	Laparotomy, suture of mesenteric vessel and irrigation
Paediatric	Resection small bowel and ileostomy
Paediatric	Laparotomy
Paediatric	Laparotomy
Paediatric	Laparotomy and colectomy
Paediatric	Incision and drainage of perianal abscess
Paediatric	Laparoscopy, laparotomy, division of adhesions and repair of right ureter
Paediatric	Duhamel pull through
Paediatric	Open liver biopsy
Paediatric	Inguinal herniotomy
Paediatric	Laparotomy, biopsy of retroperitoneal mass and gastrojejunostomy
Paediatric	Laparotomy and ileostomy
Paediatric	Insertion of Broviac catheter
Paediatric	Laparotomy and ileostomy
Transplantation	Liver transplantation
Transplantation	Liver transplantation
Vascular	Insertion of Hickman line
Plastic	Fascial excision of full thickness burns to upper trunk and excision of necrotic muscles in both upper limbs
Plastic	Escharotomy
Plastic	Laparotomy
Plastic	Bilateral cleft lip repair
Plastic	Tracheostomy and right upper limb escharotomy
Otorhinolaryngology	Unilateral choanal atresia correction
Otorhinolaryngology	Removal of tracheal stent, reintubation and packing of trachea with adrenaline soaked swabs
Otorhinolaryngology	Microlaryngobronchoscopy and tracheostomy
Otorhinolaryngology	Tracheostomy
Otorhinolaryngology	Repair choanal atresia. Insertion of nasal stent
Otorhinolaryngology	Microlaryngobronchoscopy
Otorhinolaryngology	Bronchoscopy and laser to granulations
Otorhinolaryngology	Tracheostomy and bronchoscopy
Otorhinolaryngology	Drainage of periorbital abscess and insertion of intracranial pressure monitor
Thoracic/Cardiothoracic (Paediatric)	Open lung biopsy
Thoracic	Open lung biopsy
Thoracic	Resection of recurrent sarcoma neck and mediastinum. Repair subclavian and innominate veins
Orthopaedic	Through hip amputation
General + Paediatric	Needle biopsy of mediastinal tumour (closed)
General + Paediatric	Laparotomy; packing to prevent haemorrhage from liver

Preoperative status

Key Points

- *The great majority of children in this sample were very severely ill with associated respiratory and cardiovascular disease in addition to their primary surgical diagnosis.*
- *If surgical outcomes are to be objectively assessed, appropriate weighting of comorbidities is essential. The American Society of Anesthesiologists' (ASA) grading system is widely used by anaesthetists but, as a comparatively simple system, it does have limitations.*

Table 2.25: Coexisting medical disorders (AQ13)
(85 cases; answers may be multiple)

Coexisting medical disorder	Number
None	6
Not answered	2
Respiratory	50
Cardiac	31
Neurological	26
Endocrine	5
Alimentary	27
Renal	25
Hepatic	18
Musculoskeletal	8
Vascular	4
Haematological	24
Genetic abnormality/recognised syndrome	19
Obesity	1
Sepsis	25

Question 2.19: Were any respiratory therapies in use before the operation? (AQ19)

Yes	60
No	24
Not answered	1
Total	85

If yes, please indicate which:
(*60 cases; answers may be multiple*)

Oxygen therapy	33
Artificial airway	25
Ventilatory support (including CPAP, IMV, IPPV etc.)	50

Question 2.20: Were other intensive treatments in progress? (AQ20)

Yes	25
No	54
Not answered	6
Total	85

If yes, please indicate which:
(*25 cases; answers may be multiple*)

Inotropic support	21
Renal support	7

Question 2.21: Was it necessary to delay the anaesthetic to improve the child's state before the operation? (AQ23)

Yes	13
No	69
Not answered	3
Total	85

If yes, please indicate which system(s) needed attention:
(*13 cases; answers may be multiple*)

Cardiac	6
Respiratory	4
Metabolic	3
Not answered	2

The responses to the questions set out above relating to the child's preoperative condition show the extreme problems posed for their anaesthetic management. Fifty-eight percent were on ventilatory support and 25% were receiving inotropic support.

ASA grade

Key Point

- *Surgeons, particularly neurosurgeons, need to understand and adhere to the ASA system or define an acceptable alternative.*

Table 2.26: ASA status prior to the final operation (AQ14 and SQ37)

	Anaesthetic questionnaire		Surgical questionnaire	
ASA 1	3	4%	14	15%
ASA 2	3	4%	6	6%
ASA 3	17	20%	8	9%
ASA 4	35	41%	46	49%
ASA 5	27	32%	18	19%
Not answered	0	-	1	1%
Total	**85**		**93**	

Agreement between the disciplines is not good.

In the anaesthetic questionnaires returned, three cases were graded ASA 1, in two of which death occurred at home and was sudden.

CASE 1 • *A male infant was diagnosed in the antenatal period as having a bilateral cleft lip and palate. At birth following a full term delivery he weighed 2.8 kg and was transferred to a specialist centre where he was operated on two days later and all went well. Three days following the operation he was discharged from hospital and died 11 days later at home. Following a postmortem the cause of death was given as sudden infant death syndrome.*

CASE 2 • *Thirty-eight days after delivery at 39 weeks gestation, a 4 kg male child developed a perianal abscess. This was incised and drained by the registrar in paediatric surgery. The child was discharged home. Seven days later he died suddenly and the cause of death given following a postmortem was unexpected death in infancy.*

These deaths are disquieting. There may be no association with their hospital admission and surgery but the occurrence of two such deaths in otherwise fit children must require explanation. The local reporting system to NCEPOD has been developed to identify those deaths following surgery that occur in hospital. The reporting of these deaths that occurred out of hospital is therefore fortuitous. Conceivably there could be others. It is also of note that in the previous examination of paediatric deaths published by NCEPOD in 1990[10] there were two such 'cot deaths' that occurred at home. One followed 18 days after an uneventful Ramstedt's operation in a mature six-week-old who weighed 4 kg and the other was a four-month-old infant born at 30 weeks gestation who had had a bilateral herniotomy.

The Confidential Enquiry into Stillbirths and Deaths in Infancy (CESDI) in its 3rd Report drew attention to the association between previous hospital admission and sudden infant death[17]. Cot deaths occur in approximately 1:700 babies and they are more common in babies who have been born prematurely or have had illnesses requiring hospital treatment. There is, however, no evidence of any causal relationship between either hospital admission or surgery and cot death. Only an effective national scheme, perhaps based on death certification, could identify all such deaths that occurred following surgery and anaesthesia.

The third case, graded ASA 1, was a neurosurgical procedure.

CASE 3 • *A two-year-old child weighing 14 kg had a frontal craniotomy for a tumour. The blood loss of 4.5 litres occurred in 50 minutes and there was some difficulty in obtaining blood products in this single specialty hospital. The anaesthetist stated that the surgeons were unable to control the haemorrhage and surgery was abandoned. No surgical questionnaire was returned on this case.*

The anaesthetist is to be congratulated for keeping up with such a catastrophic blood loss, which amounted to a four-fold exchange transfusion in 50 minutes. The presence of a brain tumour was potentially life threatening and an ASA grade of 3 would therefore seem to have been more appropriate.

Of the 14 patients graded ASA 1 by surgeons, two were also graded ASA 1 by the anaesthetists and are described above. For six others no anaesthetic questionnaire was returned and for the final six the anaesthetist gave a much higher grade. Brief details are given in Tables 2.27 and 2.28.

It would appear that, particularly amongst neurosurgeons, the concept of grading the fitness of patients according to their state of health at the time they undergo surgery and anaesthesia is not properly understood. Surgeons, being less familiar with ASA grading than anaesthetists, are grading on

Table 2.27: Patients graded ASA 1 by surgeons and where no anaesthetic questionnaire was returned		
	Age at death	Details
Case 4	9 days	Jejunal atresia, laparotomy, partial jejunectomy, end to end jejuno-jejunal anastomosis. Complicated by meconium peritonitis due to perforated gangrenous jejunal segment and cardiac tamponade with extravasation of TPN fluid, probably due to myocardial necrosis at the site of cardiac perforation.
Case 5	7 days	Intracranial haemorrhage resulting from haemophilia and minor trauma. Craniotomy and evacuation of acute subdural haematoma.
Case 6	14 years	Head injury with brain oedema. Intracranial pressure monitoring.
Case 7	13 years	Crush injury to abdomen, pelvis and legs. Laparotomy for intra-abdominal bleeding (see also page 39).
Case 8	14 years	Hydrocephalus, blocked ventriculoperitoneal shunt.
Case 9	12 years	Head injury. Evacuation of acute subdural haematoma. Uncontrollable raised intracranial pressure (see also page 39).

Table 2.28: Patients graded ASA 1 by surgeons and where an anaesthetic questionnaire was returned			
	Anaesthetic ASA	Age at death	Details
Case 10	4	10 years	Major head injury, ICP bolt.
Case 11	5	7 years	Massive haemorrhage, ruptured aorta and common iliac artery (see also page 49).
Case 12	3	18 months	Hydrocephalus secondary to cerebellar primitive neuroectodermal tumour, insertion of shunt.
Case 13	4	11 years	Severe head injury, craniotomy and evacuation of acute subdural haematoma.
Case 14	5	14 years	Multiple injuries including head injury, laparotomy.
Case 15	5	13 years	Severe head injury, craniotomy and evacuation of acute subdural haematoma.

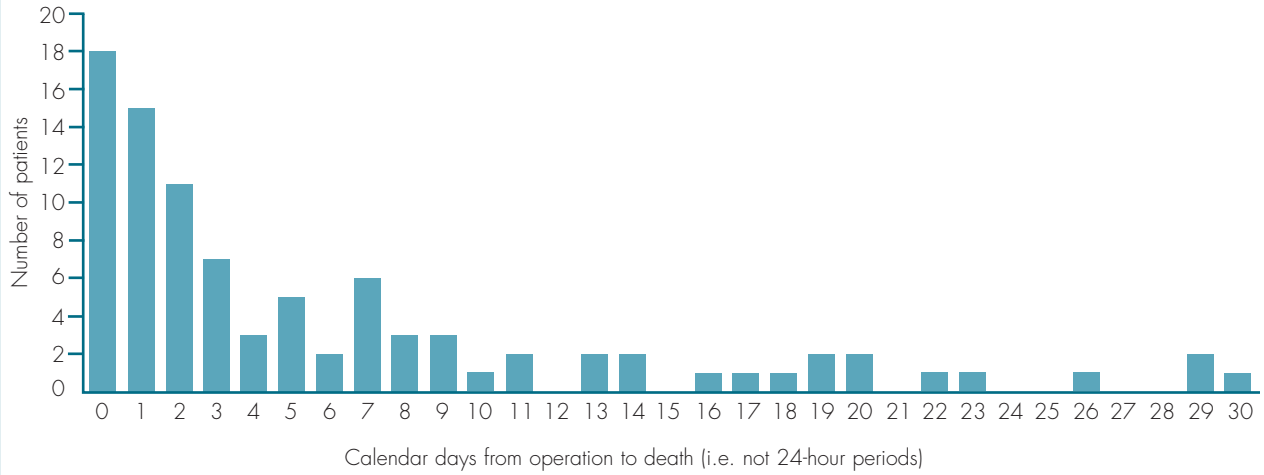
Table 2.29: Classification of final operation by ASA status (AQs14 and 27)								
	Emergency		Urgent		Scheduled		Elective		Total
ASA 1	0	-	1	2%	2	12%	0	-	3
ASA 2	0	-	1	2%	2	12%	0	-	3
ASA 3	1	4%	11	25%	5	29%	0	-	17
ASA 4	7	29%	20	46%	8	47%	0	-	35
ASA 5	16	67%	11	25%	0	-	0	-	27
Total	24		44		17		0		85

the child's premorbid state rather than the child's condition at the time of surgery. Any method for comparison of surgical outcomes that is to be of value will require a much more coherent use of such grading systems.

Time of death

The pattern of time from operation to death is almost identical to that seen in any age group and sample and has been demonstrated in previous NCEPOD reports[5, 9]. Most deaths occur within three days of surgery; a small number of deaths then occur for many days after surgery and presumably continue to occur beyond the chosen, and purely arbitrary, cut-off period of 30 days.

Figure 2.13: Calendar days from operation to death



Hospitals, facilities and staffing

Key Points

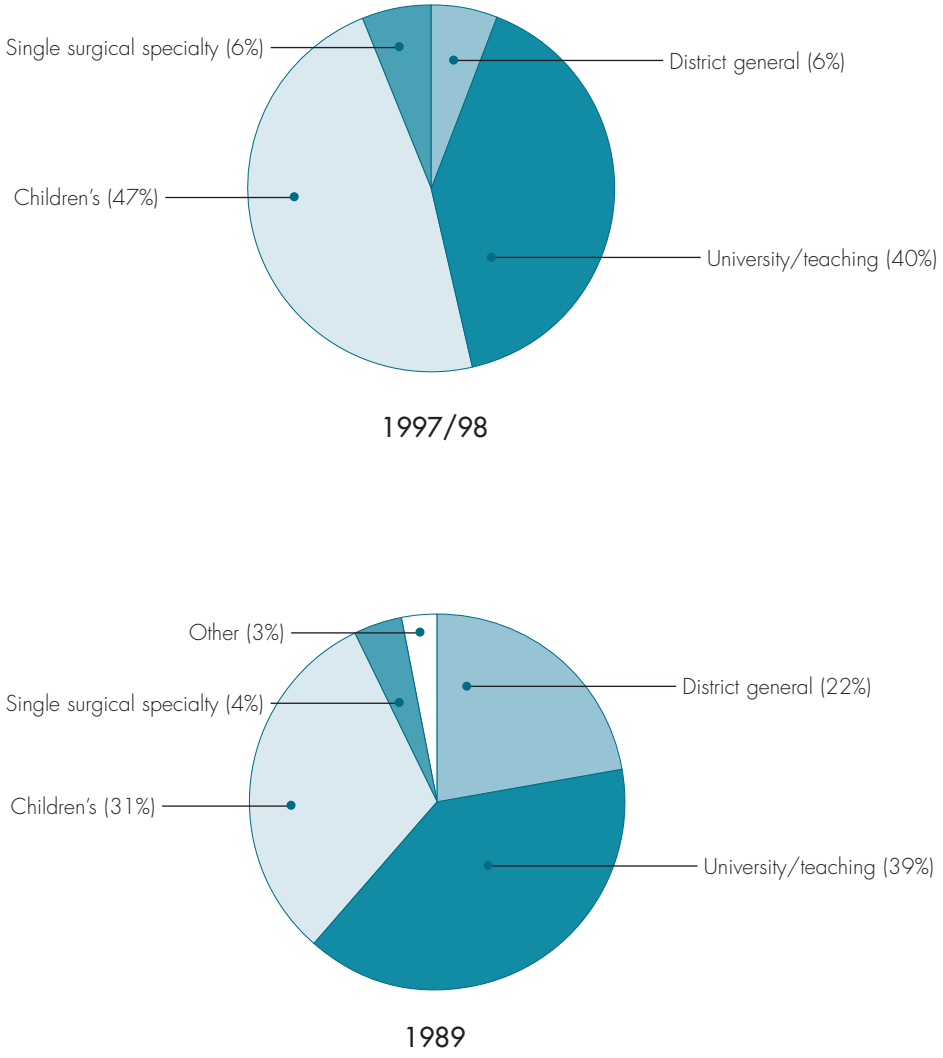
- *Specialist paediatric surgeons carried out 91% of children's surgery.*
- *Consultants anaesthetised 84% of patients. Senior trainees anaesthetised a further 14%.*
- *The recommendations as to the seniority and experience of anaesthetists taking responsibility for particular patients as set out by the Royal College of Anaesthetists[21], and NCEPOD[6, 7] in previous reports, are being complied with in the management of these patients.*
- *Suitably experienced assistance was available to anaesthetists for these cases.*

Type of hospital

Table 2.30: Type of hospital in which the final operation took place (AQ2 and SQ9)

Type of hospital	1997/98		1989	
District general (or equivalent)	7	6%	20	22%
University/teaching	45	40%	35	39%
Children's	53	47%	28	31%
Single surgical specialty	7	6%	4	4%
Other	0	-	3	3%
Total	112		90	

Figure 2.14: Comparison of the type of hospitals in which surgery took place in 1997/98 and 1989 (percentage of final operations)



The shift in paediatric practice over the past ten years, such that operations on sick children increasingly take place in specialist paediatric hospitals, is shown in Table 2.30 and Figure 2.14. These compare information collected from anaesthetic questionnaires on deaths in children under ten years in 1989 and the current data taken from both anaesthetic and surgical returns.

Facilities

Table 2.31 shows the provision of special care areas and the out-of-hours availability of CT, MRI and angiography in the 30 hospitals represented. In 66 of the 112 cases both anaesthetic and surgical questionnaires were available, for 19 only the anaesthetic questionnaire had been returned and for 27 only the surgical questionnaire was received.

There were occasionally significant discrepancies in answers given by different clinicians in the same hospital. For this reason, in all cases where there was a conflict between answers or where data was missing altogether, a member of NCEPOD administrative staff contacted the hospital by telephone to ascertain the availability of facilities.

Table 2.31: Availability of special care areas and out-of-hours imaging facilities (AQ3 and SQ40)

Hospital type	Number of cases	SCBU/ NICU	HDU (C)	HDU (C&A)	ICU (C)	ICU (C&A)	Ward (C)	CT	MRI	Angio
C	7	✓	✓		✓		✓	✓	✓	✓
C	8	✓			✓		✓	✓	✓	✓
C	23	✓	✓		✓		✓	✓	✓	✓
C	2	✓	✓		✓		✓			
C	2	✓	✓		✓		✓	✓	✓	✓
C	7		✓		✓		✓	✓	✓	✓
C	4	✓	✓		✓		✓	✓		
DGH	1	✓	✓			✓	✓	✓	✓	✓
DGH	1	✓		✓		✓	✓	✓		✓
DGH	1	✓	✓	✓	✓		✓	✓	✓	✓
DGH	1			✓		✓	✓	✓	✓	✓
DGH	2	✓		✓		✓	✓	✓		✓
DGH	1	✓				✓	✓	✓	✓	✓
SSS	6					✓	✓	✓	✓	✓
SSS	1	✓	✓		✓		✓			
U/T	5	✓	✓			✓	✓	✓	✓	✓
U/T	2	✓	✓		✓	✓	✓	✓	✓	✓
U/T	3	✓	✓		✓		✓	✓	✓	✓
U/T	1	✓	✓		✓		✓	✓	✓	✓
U/T	2	✓	✓		✓		✓	✓	✓	✓
U/T	2		✓			✓	✓	✓	✓	✓
U/T	2	✓	✓			✓	✓	✓	✓	
U/T	9	✓			✓		✓	✓	✓	✓
U/T	1		✓				✓	✓	✓	✓
U/T	1			✓		✓	✓	✓		✓
U/T	5	✓	✓		✓		✓	✓	✓	✓
U/T	6	✓		✓	✓		✓	✓	✓	✓
U/T	2	✓	✓		✓		✓	✓	✓	✓
U/T	2	✓		✓		✓	✓	✓	✓	✓
U/T	2	✓	✓		✓		✓	✓	✓	✓

Total hospitals = 30 Total cases = 112. This table is based on answers given on questionnaires, supplemented by information provided by telephone to NCEPOD staff.

Key	
Angio	Angiography facility
C	Children's
CT	CT scanner
DGH	District general hospital
HDU (C)	Children's high dependency unit
HDU (C&A)	Combined adult and children's high dependency unit
ICU (C)	Children's intensive care unit
ICU (C&A)	Combined adult and children's intensive care unit
MRI	MRI scanner
SCBU/NICU	Special care baby unit and/or neonatal intensive care unit
SSS	Single surgical specialty
U/T	Undergraduate/teaching hospital
Ward (C)	Children's ward

Question 2.22: Does the hospital have a specific separate consultant anaesthetic paediatric on-call rota? (AQ6)

Yes	64
No	13
Not answered	8
Total	85

Two of the six anaesthetic questionnaires returned from district general hospitals and 23 of the 29 returned from university hospitals indicated that there was a specific separate consultant anaesthetic on-call rota for paediatric surgery. In 1989 the respective figures were two of 20 questionnaires for district general hospitals and 18 of 35 for university hospitals.

Question 2.23: Where is this paediatric surgical service provided? (SQ9a)

A stand-alone unit	30
Situated within a larger hospital with paediatric medicine on-site	63
Total	93

One third of the paediatric deaths occurred in centres that might appear to be isolated, with less than ideal arrangements for dealing with sick children. However, a specific question was asked about paediatric medical cover in the ward at the hospital where the final operation took place (SQ23) and, for 91% (85/93) of the cases, this appeared satisfactory.

Staffing

Question 2.24: Was experienced medical paediatric cover available for this ward/area? (i.e. a resident on-call team of paediatricians, one of whom has more than 12 months experience in acute paediatrics, including neonatal care) (SQ23)

Yes	85
No	6
Not answered	2
Total	93

In six instances children were treated in surgical units without experienced medical paediatric support. These were one case of severe burns and five neurosurgical patients.

Improvement is needed in units where it is necessary to provide specialist services, e.g. neurosurgery, for children and where there is currently no medical paediatric cover and no paediatric critical care service. Managers and specialists should work together and make local arrangements which will provide, at a minimum, high dependency care (level 1) facilities for postoperative care, and respiratory support, if necessary, in the context of a level 2 paediatric intensive care unit[18].

Seven children died after surgery or procedures in a district general hospital. These procedures were:

CASE 16 INSERTION OF HICKMAN LINE • *A 15-year-old with acute lymphoblastic leukaemia (ASA 3). Treatment was being given on a medical paediatric ward in a district general hospital with no paediatric oncology provision. An experienced vascular surgeon, with no regular paediatric commitment, inserted a Hickman line. The anaesthetist was a first year SHO. There was a pneumothorax postoperatively and the patient was admitted to the ICU. Death occurred 20 days later due to complications of the underlying disease.*

Should this 15-year-old with acute lymphoblastic leukaemia have been in a paediatric oncology unit?

CASE 17 ESCHAROTOMY • *A one-year-old in a burns unit situated within a district general hospital. The child was graded ASA 5. There was no on-site paediatric cover. Death occurred one day after surgery due to the severity of the burns.*

This child was treated in the correct hospital for the management of the burns but it was an unsuitable unit for a child.

CASE 18 CRANIOTOMY AND EVACUATION OF ACUTE SUBDURAL HAEMATOMA • *A four-year-old with a head injury was treated in a neurosurgical unit (with paediatric facilities) within a district general hospital. Intubated, CT scanned and operated on by a neurosurgeon with paediatric experience. A craniotomy and evacuation of an acute subdural haematoma was undertaken. Massive brain damage was confirmed at postmortem examination.*

There was expert assessment and management in a properly equipped hospital.

CASE 19 BOWEL RESECTION • *A very premature baby with severe necrotising enterocolitis (NEC) and septicaemia (see also page 50).*

CASE 20 LAPAROTOMY • *A premature child with NEC. The findings at laparotomy were incompatible with life and support was withdrawn.*

CASE 21 POSTERIOR FOSSA DECOMPRESSION AND C1 – C2 LAMINECTOMY • *A fifteen-year-old had high-risk neurosurgery in a unit with very little paediatric expertise on hand.*

It appears that the team failed to appreciate the risks (see page 39 for more details on this case).

CASE 22 LAPAROTOMY – PACKING TO PREVENT BLEEDING FROM LIVER • *A 14-year-old with multiple trauma. There was a severe head injury and intra-abdominal bleeding. The patient died the same day, after the laparotomy.*

This was appropriate emergency surgery in a moribund child.

There is little disagreement with the policy of providing surgical treatment for neonates in specialist neonatal surgical centres. Most such centres are based in larger specialist regional centres supported by specialist anaesthetists, critical care services, specialist nurses, physiotherapists, oncologists, radiologists, dieticians etc. Anaesthetists and general surgeons at a local level in district general hospitals satisfactorily undertake most elective general paediatric surgery. This type of anaesthesia and surgery tends to be low risk, high volume work and does not require on-site specialist paediatric services. These anaesthetists and surgeons, who wish to treat children, are required to maintain an appropriate level of practice in line with current guidelines[15, 19]. Paediatric anaesthesia and surgery can, however, be associated with considerable morbidity or mortality if things go wrong. Correct decision-making and the ability to identify the severity of disease are vital. In the acute situation, if appropriate expertise is not available when urgent, but not necessarily immediate, surgical treatment is required in a district general hospital, then the child should be transferred to a specialist centre (see page 43).

Shared care

Question 2.25: Was the care of the child undertaken on a formal shared basis with paediatric physicians? (SQ25)

Yes	69
No	23
Not answered	1
Total	93

There was no formal shared care in a quarter of the cases (23/93, 25%). This is an improvement when compared with the 1989 NCEPOD report[10], which showed that 44% of the children who died after non-cardiac surgery were not managed in a collaborative manner. Input from specialists in paediatric medicine is not necessary in all cases but is strongly advised for preterm neonates, oncology patients and others in critical situations. Teamwork is the ideal but in some instances, particularly if an emergency occurs quickly, there may not be time for formal consultation. Paediatric surgeons who are familiar with drugs (and their dosages) and intravenous fluid requirements in childhood, do not always share care with paediatricians in an emergency situation. Systems should be put in place to assist this situation and ensure paediatric medical input into perioperative management. If this does not happen then children in some units, especially those with incomplete paediatric medical cover, are likely be treated by doctors who are unfamiliar with the intravenous regimens and drug dosages appropriate for children (see Questions 2.23 and 2.24 on page 37).

The surgeon

Table 2.32: Specialty of consultant surgeon in charge at the time of the final operation (SQ27)

Specialty	Number
Paediatric	48
General with a subspecialty interest in paediatric surgery	2
Neurosurgery – paediatric	14
Neurosurgery – adult	3
Neurosurgery – mixed	8
Orthopaedic	1
Otorhinolaryngology	8
Plastic	5
Thoracic/cardiothoracic – paediatric	1
Transplantation	2
Vascular	1
Total	93

The answers given in Questions 2.26 to 2.30 below all refer to the consultant surgeon in charge at the time of the final operation.

Question 2.26: What type of surgery does this consultant provide for children? (SQ28)

General (or non-specialist) paediatric surgery *(i.e. relatively common disorders which do not usually require a major or complex operation or perioperative care)*	7
Specialist or tertiary paediatric surgery	85
Other	1
Total	93

The figures above are very encouraging. In 91% (85/93) of cases, the care was delivered by surgeons with a specialist practice in paediatric surgery.

Question 2.27: Does this consultant manage neonates (i.e. children under one month old)? (SQ29)

Yes	89
No	3
Not answered	1
Total	93

This subspecialisation confirms that the surgeons were appropriately specialised to deal with the children who were aged less than one month.

Question 2.28: Has this consultant had specialist training in surgery on children? (SQ30)

Yes	87
No	6
Total	93

The answers to this question do not marry with the previous answers. Where the answer was negative, the surgeons' specialties were given as neurosurgery (in four cases), plastic surgery and

otorhinolaryngology (in one case each). Neurosurgeons who are essentially familiar with adult practice are required to operate on children. Some teenage children might be considered adults by clinicians. Details of the clinical situations where the consultant had no specialist training in children's surgery are given below. One neurosurgical procedure (Case 21) was elective. Why was the patient not transferred to a unit with paediatric expertise (see also page 43)?

CASE 7 • *A 13-year-old had a laparotomy done by an experienced registrar (with CCST). The indication was intra-abdominal bleeding a week after reconstructive surgery following an RTA and major injuries, including a crush injury to the abdomen, pelvis and legs. A consultant plastic surgeon, with no specific paediatric training, supervised.*

CASE 9 • *A neurosurgical registrar (SpR 4) operated on a 12-year-old patient following a head injury and raised intracranial pressure. The assistant was a consultant neurosurgeon (with an adult practice). An acute subdural haematoma was evacuated and considerable cerebral contusion noted. The raised intracranial pressure was uncontrollable.*

CASE 21 • *A fifteen-year-old had high-risk neurosurgery (an elective posterior fossa decompression and C1 – C2 laminectomy) in a unit with very little paediatric expertise on hand. Surgery was by a registrar (SpR 4) supervised by a consultant neurosurgeon with an adult practice. The anaesthetist was a trainee. Death occurred eight days after surgery due to respiratory complications.*

CASE 23 • *A four-year-old child with a closed head injury. A registrar (SpR 4) inserted an intracranial pressure monitor under the direct supervision of a consultant neurosurgeon with no formal training in paediatrics but a declared special interest in paediatric neurosurgery.*

CASE 24 • *A seven-year-old child, with known cardiac anomalies, suffered a cervical cord injury. A consultant gave the anaesthetic. A consultant neurosurgeon (with a mixed practice) did an urgent occipitocervical fixation using lateral mass plates, together with the removal of the posterior arch of the first cervical vertebra.*

CASE 25 • *A one-year-old child required revision of a tracheostomy and bronchoscopy because of bleeding from the tracheostomy stoma. A consultant anaesthetist gave the anaesthetic. There were multiple cardiac and tracheo-oesophageal congenital anomalies. Neither the registrar who operated nor the supervising consultant (otorhinolaryngology) had any formal paediatric training.*

Question 2.29: What is this consultant's regular sessional commitment for surgery in children (i.e. operating sessions)? (SQ31)

No regular sessional commitment	10
More than one per week	75
Weekly	7
Not answered	1
Total	93

Question 2.30: What is the surgical specialty of consultants with no regular sessional commitment? (SQs 27 and 31)

Neurosurgery – mixed	5
Neurosurgery – adult	3
Transplantation	1
Vascular	1
Total	10

Question 2.31: In the hospital in which the final surgery took place, is there an identified consultant surgeon who leads the provision of surgical services for children? (SQ32)

Yes	62
No	22
Not answered	9
Total	93

If yes, was this the consultant in charge of this case?

Yes	33
No	26
Not answered	3
Total	62

It is recommended that a hospital providing general paediatric surgical services should ensure that at least one surgeon is responsible for these services (a lead clinician, if not a clinical director)[15]. This may not be happening in all centres.

Surgical consultant involvement

Table 2.33: Overall surgical consultant involvement (SQs 44, 53, 54 and 63)

Consultant involvement	Number
Operating	62
Assisting	2
Present in operating room	9
Present in operating suite	3
Elsewhere in hospital	2
Consulted before operation	14
No involvement detailed*	1
Total	93

**SpR 2 was most senior involved.*

In all but one case (1%, 1/93) consultant surgeons were aware and involved in the care of these children. This is a commendable performance and an improvement on the situation NCEPOD identified in 1989[10] when there was no consultant involvement in 4% (4/98) of the cases where children died. Also, in 1989, 14% of non-cardiac index operations (those not associated with death) were undertaken without the knowledge of a consultant. Whenever a child is about to undergo

a surgical procedure in theatre, the relevant consultant must be informed.

Table 2.34: Grade of the surgeon who signed the consent form (SQ45)

Grade of surgeon	Number
Consultant	28
Locum appointment – service (consultant)	1
Locum appointment – training (grade not specified)	1
Specialist registrar	35
Senior house officer	13
House officer	1
Other	10
Not answered	3
Not known	1
Total	**93**

Consultants were usually the most senior operating surgeons (67%, 62/93) but at the time of this survey (1997/98) consultants took the consent in 31% (29/93) of cases. It is generally recommended that the operating surgeon should deal with the process of obtaining consent[20]. The surgeon and members of the surgical team should give an honest, realistic and sensitive account of the options for treatment. For children, this will usually be followed by obtaining explicit consent from the person with parental responsibility for the child[20]. Children under 16 may be competent to consent to treatment[20]. They should be involved in decisions about their surgical treatment. Realistically it will be the consultant who has the knowledge and experience to lead this process. Obtaining consent should not be delegated to trainees unless there has been a thorough, documented discussion on a prior occasion.

The anaesthetist

Table 2.35: Grade of most senior anaesthetist present at the start of the anaesthetic (AQ32)

Grade of anaesthetist	Number
Consultant	71
SpR – Accredited/CCST	3
SpR 4	7
SpR 3	2
SHO 1	1
Not answered	1
Total	**85**

Table 2.36: Grade of most senior anaesthetist present at the start of the anaesthetic, by classification of operation (AQs 32 and 27)

	Emergency	Urgent	Scheduled	Elective	Total
Consultant	19	37	15	0	71
SpR – Accredited/CCST	3	0	0	0	3
SpR 4	1	6	0	0	7
SpR 3	0	1	1	0	2
SHO 1	0	0	1	0	1
Not answered	1	0	0	0	1
Total	**24**	**44**	**17**	**0**	**85**

Table 2.37: Grade of most senior anaesthetist present at the start of the anaesthetic, by ASA status (AQs 32 and 14)

	ASA 1	ASA 2	ASA 3	ASA 4	ASA 5	Total
Consultant	2	2	12	32	23	71
SpR – Accredited/CCST	0	0	0	1	2	3
SpR 4	1	0	3	2	1	7
SpR 3	0	1	1	0	0	2
SHO 1	0	0	1	0	0	1
Not answered	0	0	0	0	1	1
Total	**3**	**3**	**17**	**35**	**27**	**85**

Question 2.32: If the most senior anaesthetist present at the start of the anaesthetic was not a consultant, when was a consultant anaesthetist informed about this case? (AQ36)

Before the anaesthetic	8
After the anaesthetic	2
Consultant not informed	3
Not answered	1
Total	14

Two of the three cases where the anaesthetic consultant was not informed were neurosurgical cases in older children and the anaesthetist was a trainee in their final year. The third case was 15 years old but ASA 3 and was anaesthetised by a first year SHO. Further details are given in Case 16 on page 37.

Question 2.33: If the most senior anaesthetist at the start of the anaesthetic was not a consultant, where was consultant help available? (AQ37)

A consultant came to the theatre before the end of the anaesthetic	1
A consultant was available in the operating suite but not directly involved	1
A consultant was available in the hospital but was not present in the operating suite	2
A consultant was available by telephone	9
Not answered	1
Total	14

The information set out in the preceding tables indicates clearly the very high level of direct involvement that consultant anaesthetists had with the management of these very sick children. Paediatric anaesthesia is a consultant-run specialty. Involvement of trainees was appropriate in almost all cases and it may be noteworthy that consultants and trainees were exclusively involved with these anaesthetics.

Both the Royal College of Anaesthetists[21], and NCEPOD[6, 7] in previous reports, have made specific recommendations as to the seniority and experience of anaesthetists taking responsibility for particular patients. These recommendations can be set out against the paediatric patients in this sample to test compliance.

ROYAL COLLEGE OF ANAESTHETISTS' RECOMMENDATIONS

"A consultant should always accompany SHO1 grades who are anaesthetising children under the age of ten."[21]
No SHO 1 was required, accompanied or otherwise, to anaesthetise a child under the age of ten.

"SHOs and SpR 1 grades should always be supervised at neurosurgery and cardiothoracic operations."[21]
Five SHOs or SpR 1s were present at such operations. All were accompanying more senior anaesthetists.

NCEPOD RECOMMENDATIONS

"Very sick patients should be anaesthetised in the knowledge and (or) presence of senior registrar (SpR 3 or 4) or consultant."[7]
In 61/62 children of ASA grade 4 or 5 the anaesthetic was given by a consultant or senior specialist registrar. In one case the question was unanswered (see Table 2.37).

"Many operations, particularly those of long duration, will require two anaesthetists at least for part of the time."[6]
Seventeen anaesthetics took three hours or longer. There were two anaesthetists present in sixteen.

"Anaesthesia for emergency or life-saving operations should ideally be managed by a team of anaesthetists."[6]
The NCEPOD classification was stated as 'Emergency' (immediate life-saving operation) for 24 children. There were at least two anaesthetists present in 23. In one report the question asking whether there was more than one anaesthetist present was not answered.

This analysis shows that paediatric anaesthetic practice conforms very closely indeed to the recommendations from both the Royal College of Anaesthetists and from NCEPOD.

Question 2.34: Was advice sought, at any time, from another anaesthetist who was not present during the anaesthetic? (AQ38)

Yes	12
No	61
Not answered	12
Total	85

If yes, from what grade of anaesthetist was advice sought?

Consultant	10
Not answered	2
Total	12

In eight of the ten cases where advice was sought from a consultant, another consultant sought the advice. Given the nature and complexity of procedures such as posterior cervico-occipital fixation and craniotomy for resection of large choroid plexus tumour with raised ICP, this is a very positive comment on consultant anaesthetic practice.

Assistance for the anaesthetist

Question 2.35: Was there a trained anaesthetist's assistant (i.e. ODP, anaesthetic nurse) present for this case? (AQ44)

Yes	81
No	1
Not answered	3
Total	85

If yes, does the assistant work regularly with children?

Yes	77
No	1
Not answered	3
Total	81

The single case where it is recorded that the anaesthetist had no trained assistant is almost certainly an error as in the subsequent question it is noted that the assistant works regularly with children. Similarly, the single case where it is recorded that the assistant does not work regularly with children may be incorrect. The patient was a premature baby with NEC and the operation took place in a single specialty hospital.

It seems therefore that trained assistance was available to the anaesthetist for all these cases and that assistants worked regularly with children. In 1989 a single case was recorded amongst the 89 non-cardiac deaths in which non-medical help was not available.

Anaesthetic monitoring

Question 2.36: Were monitoring devices used during the management of this anaesthetic? (AQ50)

Yes	84
Not answered	1
Total	85

If yes, were monitoring instruments already attached to the patient (i.e. from ICU or A&E)?

Yes	58
No	25
Not answered	1
Total	84

Table 2.38: Monitoring devices used during the operation (AQ50) (*84 cases; answers may be multiple*)

Monitoring device	Number of cases
ECG	84
Pulse oximeter	84
Indirect BP	61
Oesophageal or precordial stethoscope	23
O_2 analyser	78
Inspired anaesthetic vapour analyser	64
Expired CO_2 analyser	80
Airway pressure gauge	73
Ventilation volume	40
Ventilation disconnect device	68
Peripheral nerve stimulator	14
Temperature	54
Urine output	31
CVP	25
Direct arterial BP (invasive)	39
Intracranial pressure	6

ECG and pulse oximetry were used in all cases. In 1989, 80% of patients were monitored with an ECG and 77% with oximetry.

Six patients did not have their blood pressure monitored by either an indirect or direct method. In three cases, all premature babies with NEC, access for direct measurement could not be achieved and indirect measurement was not used. Two were short anaesthetics for anal surgery and the final case was for bronchoscopy and laser treatment in an infant of one month.

Question 2.37: Did anything hinder full monitoring? (AQ51)

Yes	15
No	67
Not answered	3
Total	85

Problems with either obtaining or maintaining arterial access were noted in six cases and in two others there were difficulties with central venous access. Other difficulties which were noted with monitoring included the lack of a suitable temperature probe, the lack of a capnograph in the anaesthetic room, problems related to maintaining satisfactory monitoring during the transfer to various sites in the hospital and obtaining access in a patient with extensive burns.

Admission and transfer

Key Points

- *There should be increased provision for retrieval teams from the specialist hospital with the appropriate paediatric skills and experience.*
- *Whenever possible acute paediatric surgical admissions should go directly to specialist paediatric beds.*
- *Every opportunity should be taken for the transfer before birth of those identified as having potential problems that may require postnatal surgical intervention.*

Admission category and pathway

Information on the admission category and pathway was available for the 93 cases for which surgical questionnaires were returned. In particular, information about an acute transfer was available for 58 of these patients. In addition, information about transfer was available from the anaesthetic questionnaires on 53 of 85 children.

Table 2.39: Admission category (SQ10) (NCEPOD definitions)

Admission category	Number
Elective	10
Urgent	11
Emergency	69
Born in the hospital in which the final operation took place	2
Not known	1
Total	93

Table 2.40: Pathway for admission (SQ11)

Admission pathway	Number
Transfer as an inpatient from another acute surgical hospital	58
Transfer from another non-acute hospital	6
Referral from a general medical or general dental practitioner	4
Admission following a previous outpatient consultation	2
Admission via A&E department	14
Other	9
Total	93

The majority of children who died after anaesthesia and surgery were critically ill, requiring urgent or emergency admission (86%, 80/93); many were transferred from another acute hospital.

Transfer

Questions relating to the transfer of patients were asked in both the anaesthetic and surgical questionnaires. In addition, both the anaesthetic and surgical advisors were asked when they examined the questionnaires and associated information to indicate if, on the information available to them, transfer was performed satisfactorily.

Question 2.38: Was the child transferred as an inpatient from another hospital? (AQ11)

Yes	53
No	31
Not answered	1
Total	85

If yes, had the child's condition apparently deteriorated during transfer?

Yes	2
No	47
Not answered	3
Not known	1
Total	53

From the responses to this question in the anaesthetic questionnaire it can be seen that 62% of these patients were transferred as inpatients.

A similar question was asked in the surgical questionnaire.

Question 2.39: Did the child's condition deteriorate during transfer? (SQ19)

Yes	4
No	49
Not answered	3
Not known	2
Total	58

Of those that deteriorated, only one patient appeared in both anaesthetic and surgical responses. The anaesthetic and surgical advisors

also considered this transfer to have been unsatisfactory.

CASE 11 • *A seven-year-old boy was admitted to a DGH following a crush injury to the lower abdomen. A period of one-and-a-half to two hours elapsed during which an abdominal CT scan was performed before transfer to a specialist paediatric unit was commenced. Massive haemorrhage, ruptured aorta and common iliac artery (see also page 49).*

The other transfer identified in an anaesthetic questionnaire in which deterioration occurred was also regarded by advisors as unsatisfactory.

CASE 26 • *An infant was born prematurely at 33 weeks weighing 1.92 kg. He had a severe gastroschisis which the paediatric surgeon who operated described as the "worst gut seen in more than 30 cases". Following a transfer of about 12 miles undertaken by staff from the referring hospital, the consultant anaesthetist at the receiving hospital noted "infant reported to be stable and in good condition on leaving referring unit. Infant acidotic, cardiovascularly unstable and in respiratory difficulty on arrival". It was also noted that the gastroschisis had been diagnosed antenatally at 22 weeks.*

Should the baby have been delivered in a unit with on-site, or at least readily accessible, paediatric surgical facilities? Given the severity of this particular case the outcome was almost certainly inevitable but consideration of better transfer options, including a retrieval team, could be beneficial in the future.

This issue of antenatal diagnosis has been studied in considerable detail. The most important factor is good neonatal care when the baby is born to ensure that it is stabilised and in optimum condition before transfer to a surgical unit.

The other cases stated in a surgical questionnaire to have deteriorated are listed below:

- *Age 7 years. Cerebellar haematoma.*
  Continued deterioration, transfer satisfactory.
- *Age 14 years. Posterior fossa haematoma.*
  Continued deterioration, transfer satisfactory.
- *Age 4 months; weight 5.35 kg. Tracheal stenosis.*
  Difficult transfer but no evidence of deterioration.

Question 2.40: Was the child accompanied by a medical/nursing team during transfer? (SQ18)

Yes	50
No	2
Not answered	5
Not known	1
Total	58

If yes, where did the team come from?

Transferring hospital	33
Receiving hospital	14
Not answered	2
Not known	1
Total	50

Two patients were identified as being unaccompanied during transfer. One was a 15-year-old referred to a neurosurgical specialist centre for decompression of a Chiari malformation; this patient is described in more detail elsewhere (Case 21, page 39). The other was referred to a specialist children's unit aged five months with respiratory symptoms including apnoeic attacks having had multiple problems since her birth at 24 weeks.

Figure 2.15 shows whether the team came from the transferring or receiving hospital broken down into three age groups.

For those aged under six months it can be seen that 12 were retrieved by the receiving hospital but 16 were transferred by medical staff from the hospital in which the infant was already a patient. By contrast for the older children, many of whom were neurosurgical cases, the transferring hospital was nearly always responsible.

Question 2.41: What was the condition of the child on admission to the receiving hospital? (SQ20)

Satisfactory	37
Unsatisfactory	19
Not answered	2
Total	58

Figure 2.15: Accompanying team for interhospital transfer

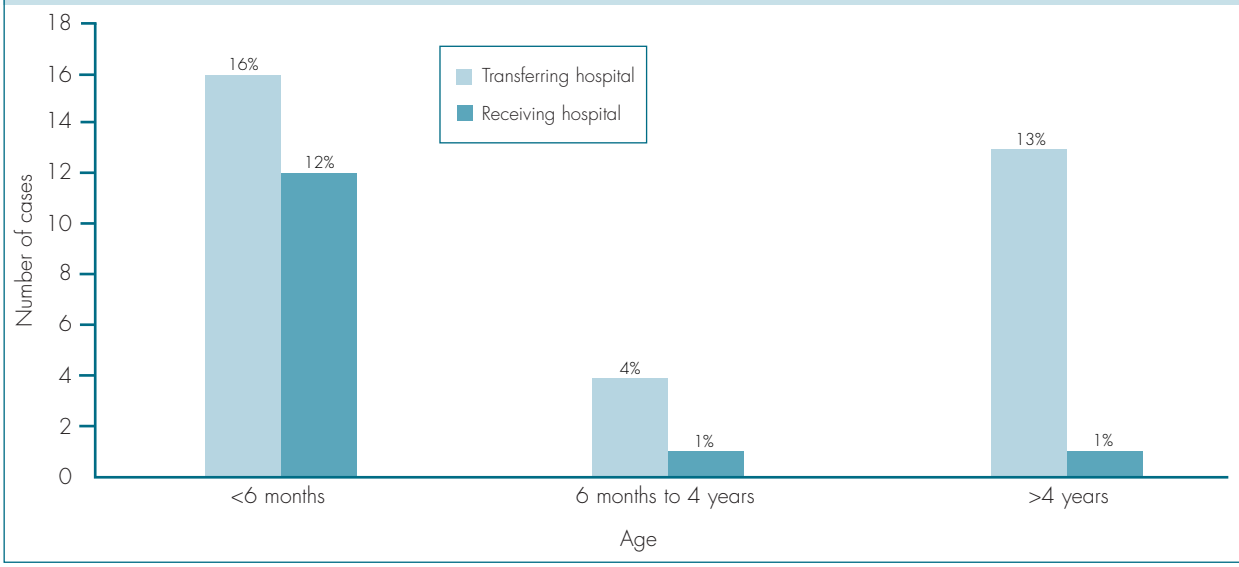


Table 2.41 gives details of the age, weight, gestational age and diagnosis for the 19 children whose condition was unsatisfactory on admission to the receiving hospital. It also gives the reason stated by the surgeon completing the questionnaire as to why the condition of the child was deemed to be unsatisfactory.

Table 2.41: Cases where condition was deemed unsatisfactory on arrival at receiving hospital (SQ20)

Age	Weight	Gestational age	Diagnosis	Reason given as to why unsatisfactory
1 month	0.8 kg	28 weeks	NEC	Metabolic acidosis, coagulation disorder, DIC
25 days	1 kg	27 weeks	NEC	On ventilator, tender distended abdomen with X-ray evidence of perforation, thrombocytopaenia, tachycardia etc.
9 days	1.3 kg	30 weeks	NEC	Very sick because of underlying disease
14 days	1.6 kg	30 weeks	NEC	Poorly perfused, acidotic, clotting derangement but function of disease probably rather than care.
1 month	1.86 kg	28 weeks	NEC	Requiring inotrope support and high ventilatory pressures
24 days	0.91 kg	26 weeks	Bowel perforation	–
7 days	0.62 kg	24 weeks	Bowel perforation	Moribund
1 month	1.47 kg	28 weeks	Bowel perforation	Very sick
2 days	1.48 kg	34 weeks	Bowel perforation	Severely acidotic
6 months	5 kg	–	GI bleeding post cardiac surgery	Critically ill infant brought by retrieval team from receiving hospital
0 days	1.9 kg	33 weeks	Gastroschisis	Poor state of bowel, hypovolaemia, acidotic
14 years	–	–	Posterior fossa haematoma	Despite all attempts at resuscitation
7 years	–	–	Pontine tumour	O_2 because of bradycardia and agitation (for transfer)
4 days	2.72 kg	40 weeks	Intracranial haemorrhage	Unconscious, floppy, poor respiratory effort, signs of intracranial hypertension
7 years	–	–	Head injury	Low blood pressure
9 years	30 kg	–	Head injury	Patient in poor neurological state, GCS 6
7 years	22 kg	–	Intra-abdominal arterial rupture	Continuing haemorrhage
4 months	5.35 kg	39 weeks	Tracheal stenosis	Critical airway narrowing
5 months	4.4 kg	40 weeks	Mitochondrial myopathy	Very poorly

From Table 2.41 it can be seen that the reason for the unsatisfactory condition of these children on admission to the receiving hospital was related to the severity of the underlying disease and their continuing deterioration.

The organisation of paediatric care into specialist centres has the consequence that transfer of sick children is more frequent. The result of this concentration of paediatric practice, although beneficial for overall patient care, is that the skills and experience for paediatric care, particularly of neonates, becomes increasingly limited in many of the hospitals which first admit them. The ability of the staff in these hospitals to handle transfers therefore diminishes.

In this sample of paediatric deaths, transfers that were unsatisfactory were limited to isolated examples. However, the number of patients being transferred as a proportion of the whole group was high. The rigorous auditing of paediatric transfers must be maintained and the responsibility for this, particularly for those of less than six months of age, lies with regional paediatric specialist units.

Site and appropriateness of admission

Table 2.42: Type of area to which the child was first admitted in the hospital in which the final operation took place (SQ22)

Area	Number
Paediatric surgical ward	11
Specialist surgical ward	4
Paediatric medical ward	13
A&E holding area (or other emergency admission ward)	3
Paediatric ICU/HDU	23
Neonatal ICU/SCBU	27
Adult ICU/HDU	3
Direct to theatre	8
Other	1
Total	93

Cases that went into A&E holding area

CASE 6 • *Head injury with brain oedema. Intracranial pressure monitoring. (University/teaching hospital).*

CASE 18 • *Head injury. Craniotomy and evacuation of acute subdural haematoma. (District general hospital). (See also page 37).*

CASE 27 • *Trucut biopsy. Central venous line insertion. (Children's hospital).*

These children may have been admitted to an A&E holding area as a necessity pending the identification of an appropriate bed. The situation does not seem ideal but no further details are available.

Cases that went into adult ICU

CASE 23 • *Insertion of ICP monitor following closed head injury in a four-year-old. (Surgical specialty: neurosurgery) (See also page 39).*

CASE 28 • *Revision of ventriculoperitoneal shunt. (Surgical specialty: neurosurgery).*

CASE 29 • *Posterior fossa craniectomy and debulking of cerebellar tumour. (Surgical specialty: neurosurgery).*

Immediate access to paediatric intensive care beds is crucial; the provision of very high intensity care is known to be beneficial to these critically ill children[22]. An adult ICU can no longer be considered as a satisfactory location in which to manage children and, as a minimum, there should be dedicated paediatric beds available linked with appropriate staffing.

It appears from this sample that, in 1997/98, the standards of the framework document on the provision of paediatric intensive care were not being met[22]. This document was published in 1997; partial compliance was required by July 1998 and full compliance by the year 2000.

Delay in referral or admission

Questions were asked about delays.

Question 2.42: Was there any delay in either the referral or the admission of this child? (SQ26)

Yes	8
No	83
Not answered	1
Not known	1
Total	93

There were eight cases where the surgeon replied that there had been a delay. The reasons for the perceived delay were not always clear from the returned questionnaires. The cases are as follows:

CASE 5 • *Intracranial haemorrhage resulting from haemophilia and minor trauma. Craniotomy and evacuation of acute subdural haematoma. (University/teaching hospital).*

CASE 26 • *Severe gastroschisis. Silo construction following transfer to children's hospital. (See also page 44).*

CASE 30 • *Head injury. Craniotomy and evacuation of haematoma after transfer to children's hospital.*

CASE 31 • *Laparotomy, jejunostomy and ileal resection with ileo-ileal anastomosis. (Children's hospital).*

CASE 32 • *Through-hip amputation. (Children's hospital).*

CASE 33 • *Occipital burrhole and insertion of external ventricular drain. (University/teaching hospital).*

CASE 34 • *Laparotomy, suture of mesenteric vessel and irrigation. (Children's hospital).*

CASE 35 • *Laparoscopy, laparotomy, freeing of adhesions and anastomosis right ureter. (Children's hospital).*

Audit

Key Point

- *Audit of deaths in children was not universal practice.*

There were questions concerning audit in both anaesthetic and surgical questionnaires. In order to maintain a good standard of professional practice when treating children (although the same is true for any age group) anaesthetists and surgeons must participate in both internal and external medical and clinical audit[23] and be prepared, as individuals, to undergo regular review of their practice. In particular, any general surgeon who wishes to provide general paediatric surgery in a district general hospital is advised to fulfil a series of criteria including participation in audit and the maintenance of continuing education in paediatric surgery[15]. Similar criteria are laid down by the Royal College of Anaesthetists[24].

Anaesthetic responses

Question 2.43: Do you have morbidity/mortality review meetings in your anaesthetic department? (AQ86)

Yes	78
No	7
Total	85

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

Yes	26
No	51
Not known	1
Total	78

Thus seven deaths took place following anaesthesia by an anaesthetist working in a department that does not hold morbidity/mortality review meetings. A total of 65% (51/78) of cases where children died were not discussed in a review/audit meeting by anaesthetists. It is possible that these deaths were not perceived as occurring as a direct result of anaesthesia but, given that the care of children involves teamwork, it is surprising that there was not more involvement in audit by anaesthetists.

Surgical responses

Question 2.44: Has this death been considered, or will it be considered, at a local surgical audit/quality control meeting? (SQ92)

Yes	71
No	19
Not answered	3
Total	93

In surgery, 20% (19/93) of deaths were not discussed at an audit meeting. In which specialties did these deaths occur?

Table 2.43: Specialty of surgeon where cases not considered at a local audit/quality control meeting

Specialty	Number
Neurosurgery – paediatric	6
Neurosurgery – adult	1
Neurosurgery – mixed	5
Paediatric	3
Plastic	3
Otorhinolaryngology	1
Total	19

The majority of deaths where there was no audit took place in neurosurgical units (63%, 12/19). Neurosurgeons will argue that there is little to be gained from repeated audit of common conditions such as extradural and subdural haematomas.

Whatever the special pleading of individual specialties, it is not unreasonable to consider each case and review the events surrounding the death of a child. This should be done in the context of multidisciplinary clinical audit. At present, this process is not universal.

Specific Issues

Neurosurgery

Key Point

- *The organisation of paediatric neurosurgery is complex. There is, however, scope for more shared care.*

The issues around neurosurgery are difficult in that it is a surgical specialty where complex procedures for rare conditions are done on small numbers of children and yet, at the same time, a comprehensive emergency service has to be provided for equally small numbers.

There were 31 deaths in this survey which occurred in neurosurgical patients; this was 28% of the total. There were six cases where no surgical questionnaire was returned and the information available is limited to that in the anaesthetic questionnaire. The neurosurgical procedures are listed in Table 2.24 on page 28. They can be divided into three groups: trauma, shunt surgery and other generally more major operations. The seniority of the surgeon within these groups is shown in Table 2.44.

The document 'Safe Paediatric Neurosurgery'[25], prepared by the Society of British Neurological Surgeons, recognises that some children suffering from these conditions, where travel or transfer to a unit with a paediatric neurosurgical team would be deemed dangerous, will be treated in units without a major paediatric commitment. This happened on four occasions in this sample (4/31, 13%). At present there are neurosurgery units with a paediatric interest but with no resident medical paediatric support and no PICU. There is guidance about the minimum services required for the care of children[22]. If difficulties arise with emergencies then local arrangements with neighbouring paediatric units are needed.

Particular problems are created for anaesthesia as there are few consultants with requisite skills in both neuro and paediatric anaesthesia and those that do have the appropriate training often have great difficulty in maintaining their paediatric skills based on a limited practice. When problems arise, skilled support may not be immediately at hand. Postoperative intensive care and ventilatory support for children (if required) can create considerable problems in isolated units.

Although problems were seen, and some are described in the case studies in this report, it is not justifiable to make broad recommendations on the basis of a few individual cases. However, those responsible for paediatric neurosurgical services will need to consider carefully arrangements for future provision, since amongst these deaths are indications that all is currently not satisfactory.

Table 2.44: Seniority of surgeon in neurosurgical operations

Condition	Consultant	Trainee	Total
Trauma	2	14	16
Shunt surgery	0	4	4
Other operations	9	1	10
Total	11	19	30

Abdominal trauma

Key Points

- *Medical staff treating trauma in children should be familiar with the Advanced Paediatric Life Support (APLS) guidelines.*
- *Contrast-enhanced CT scanning is the radiological investigation of choice for major blunt abdominal trauma in children. Surgeons who manage such cases must have access to this investigation.*

Staff working in centres that receive children with trauma should be familiar with the Advanced Paediatric Life Support (APLS) guidelines[26]. Courses offering tuition on paediatric life support are widely available and the Advanced Trauma Life Support (ATLS) course also contains guidance on paediatric trauma. Centres receiving children with trauma also require an adequate provision of paediatric intensive care beds.

Inappropriate laparotomies were done on children following abdominal trauma. Undue reliance was placed on diagnostic peritoneal lavage. The problem with diagnostic peritoneal lavage, in a haemodynamically stable child, is that the presence of blood does not dictate the need for a laparotomy. A double contrast CT scan of the abdomen (with intravenous and intragastric contrast) is the radiological investigation of choice for major blunt abdominal trauma in children[26]. Such an investigation must be immediately available in centres receiving such cases, should be performed early and must not delay further treatment.

Case 11 • *A seven-year-old boy was admitted to a DGH following a crush injury to the lower abdomen. He was fully conscious but had abdominal bruising and impaired circulation in one leg. A period of one-and-a-half to two hours elapsed during which an abdominal CT scan was performed before transfer to a specialist paediatric unit was commenced. A surgical senior registrar and anaesthetic registrar accompanied the child on the journey of more than 20 miles (the receiving hospital did not have a retrieval team). Massive transfusion was required during this transfer. On arrival he was found to be poorly perfused with no peripheral pulses present. Consultants in paediatric vascular surgery, paediatric surgery and anaesthesia were present to lead the resuscitation but efforts to cannulate a vessel for arterial monitoring and CVP measurement were unsuccessful due to the complete circulatory shutdown. It was decided to proceed to theatre and cross clamp the aorta via a thoracoabdominal incision. There was a complex tear in the lower aorta and common iliac artery. Bleeding and deterioration continued and resuscitation was abandoned when cardiac arrest occurred two hours after arrival at the receiving hospital. A postmortem examination confirmed the surgical findings.*

This was probably not a case for transfer in the first place. The request for sophisticated scanning delayed surgical intervention. Blood loss continued during transfer; an earlier laparotomy might have enabled control of haemorrhage and stabilisation whilst advice and help were sought. There was also questionable senior involvement at the time of transfer.

Necrotising enterocolitis

Key Point

- *The management of this condition requires close teamwork by experienced clinicians and discussion with the infant's parents.*

This condition is associated with prematurity and has a multifactorial causation. Necrotising enterocolitis (NEC) may improve with expert medical care. In general, 30-40% of babies with NEC require a laparotomy (for the repair of a perforation or resection of necrotic bowel), of whom 70% survive. Ninety percent of the babies with this condition are premature and 50% of the survivors of surgery are left with a handicap related either to prematurity or intestinal function. There is a paucity of denominator data concerning surgery for this condition in the UK; the authors are aware of only one study in recent years[27].

The management of this condition requires close teamwork, an appreciation of the risks and wide discussion about care, including the wishes of the parents. Decisions about these sick children need to be made at consultant level. If a child's condition fails to improve with conservative measures then it is usually right to proceed to laparotomy. This surgery should be done by an experienced paediatric anaesthetist and surgeon in a centre with adequate NICU services. Relative contraindications to surgery include extreme prematurity or additional major conditions associated with a predictable severe handicap. Decisions not to operate raise difficult ethical issues. Such decisions need to be discussed and agreed between professional staff (both medical and nursing) as well as the parents. There may be a need to discontinue supportive care if there is total gut necrosis at laparotomy and again parental acceptance is vital.

Case 19 • *A very premature 600 g baby developed severe necrotising enterocolitis and septicaemia. It was unlikely that the parents would have another child because of their medical problems. The medical staff advised against surgery and suggested withdrawal of treatment but the nursing staff insisted that surgery was the only appropriate option. The parents were warned of the likely poor outcome but pressed for surgery. A small bowel resection was done and the child died 13 days later. No postmortem examination was done.*

This case raises very difficult issues. At this gestation and weight, overall survival is less than 50% and, had the baby survived, the risk of major neurological handicap would have been greater than 25%. An additional issue here is the need for an identified team leader. This could either be someone in an overall position of authority or someone identified case by case. In this case, the anaesthetic and surgical staff felt under pressure from the nurses, team management broke down and conflict occurred.

Postoperative pain relief

Key Point

- *The importance of effective postoperative pain relief in children would appear to be widely recognised.*

Question 2.45: Is there an acute pain team available for children? (AQ78)

Yes	63
No	21
Not answered	1
Total	85

Question 2.46: Do nursing staff receive training in acute pain techniques? (AQ79)

Yes	80
No	4
Not answered	1
Total	85

The importance of the effective management of postoperative pain in children has been a recent concern[28]. No questions relating to this aspect of patient care were asked in 1989, but it would appear that the problem is being addressed.

The four cases where nursing staff were recorded as not receiving training in acute pain techniques came from university hospitals; two were neurosurgical patients.

Question 2.47: Were drugs given in the first 48 hours after operation for pain? (AQ80)

Yes	70
No	9
Not answered	6
Total	85

If yes, which drug type *(answers may be multiple)*

Opiate/opioid	61
Local analgesic	3
Non-steroidal analgesic	4
Paracetamol	15

Method/route *(answers may be multiple)*

Intramuscular injection	3
Oral	12
Rectal	4
Continuous IV/SC infusion	48
PCA	3
Continuous epidural	1
IV bolus *(including nurse controlled analgesia)*	9

The infrequent use of intramuscular injection was commented on very favourably by the anaesthetic advisors.

Question 2.48: Did complications occur as a result of these analgesic methods? (AQ80c)

Yes	1
No	68
Not answered	1
Total	70

The child noted to have complications was delivered at 27 weeks and had NEC. At three months of age the baby had a further laparotomy. Postoperatively the child experienced hypotension related to the use of local anaesthesia and continuous IV/SC infusion for pain relief.

Good handling of deaths

Key Point

- *The death of a child has an impact on clinical staff as well as on the family and close friends. The emotional consequences for clinical staff may not be acknowledged; help and support should be provided if requested.*

The death of a child is a profoundly disturbing situation for all concerned. On occasions treatment is withheld or withdrawn. Amongst the deaths reported to the Enquiry there were examples of children with brainstem death (mainly following head injuries) and children in the 'no chance' or 'no purpose' situation. These deaths were all handled well, sympathetically and according to the framework for practice published in 1997[29].

Most staff are trained in the support of bereaved parents and the questionnaires returned to NCEPOD contained some excellent examples of support and follow-up for parents and siblings. The emotional impact on the healthcare team can often be overlooked in these situations, leading to a sense of failure, guilt and a quest for understanding of the course of events. When time permits, the creation of an ethical forum may provide an opportunity for all those involved with a severely ill child to talk about their concerns, receive advice and ensure understanding of the issues.

In the case studies given below we highlight good practice. An example of the uncertainty which can occur (Case 19) is discussed on page 50.

Case 36 • *A two-day-old full-term infant was referred for assessment of an oesophageal atresia with a tracheo-oesophageal fistula. Initial oesophagoscopy revealed a very atypical anatomy and the planned repair was not feasible. Discussion took place between paediatric ENT surgeons and the paediatric general surgeon. The result of these discussions was that there was a predicted mortality of over 90% for corrective surgery. These facts were presented to the parents who then declined surgical treatment for their child. The child remained on ventilatory support throughout the day whilst the parents continued to think about the options. However, by the following day the parents had not changed their minds and, following a full discussion with them, it was decided to withdraw support. The child died peacefully that day.*

Case 37 • *A premature newborn baby (32 weeks gestational age at birth) developed a fulminant acute abdomen. A laparotomy was done after appropriate resuscitation. This revealed complete infarction of both small and large bowel. A discussion was held with the parents and treatment was then withdrawn. The baby died in the parents' arms.*

Case 38 • *A premature baby (24 weeks gestational age at birth) was transferred to a regional paediatric surgical unit with a clinical diagnosis of necrotising enterocolitis. A laparotomy showed a hopeless situation and this prognosis was discussed with the parents. The child was then extubated in his mother's arms and died peacefully.*

It is perhaps important to remember that the emotional scars inflicted by the death of a child are not limited to family and friends.

Case 39 • *An experienced paediatric anaesthetist reported the case of a death in the anaesthetic room. A neonate with gastroschisis had a cardiovascular collapse on induction and intubation. Resuscitation was unsuccessful. A very thoughtful and thorough investigation and postmortem examination followed but the postmortem was essentially negative.*

It was apparent from the comments in the anaesthetic questionnaire that the death had a profound psychological effect on the anaesthetist concerned. The psychological impact of deaths in children on clinical staff may not be acknowledged and the need for counselling and support of health professionals is too often disregarded. Help and support should be provided if requested.

PATHOLOGY

Key Points

- *There is a need for pathologists to improve the dissemination of information gained at a postmortem examination.*
- *Postmortem examination rates for children have fallen; this is a national trend. A limited or directed postmortem examination, or possibly a magnetic resonance necropsy, may be the way to improve this situation.*

GENERAL

Postmortem examinations were performed in 41 cases (41/93, 44%), of which 30 were at the request of Her Majesty's Coroner and 11 with consent from the next of kin. This is a considerable decline from the situation reported in 1989[10] when the postmortem rate was 72%. Of the 41 postmortem examinations, less than half (19) were performed by a paediatric pathologist, nine by a neuropathologist, four by a Home Office pathologist and five by a general histopathologist (in four cases the status of the pathologist is unknown).

Postmortem reports were available for only 22 cases (13 Coroner's and nine hospital). In some cases at least this was because of refusal of the Coroner involved to release the report to the Enquiry under Rule 57 of the Coroner's Rules 1984. This goes against a recommendation of The Allitt Inquiry[30] which states *"We recommend that in every case Coroners should send copies of postmortem reports to any consultant who has been involved in the patient's care prior to death whether or not demanded under Rule 57 of the Coroner's Rules 1984 (Para 4.2.9)"*. This statement emphasises the importance of obtaining the results of a Coroner's postmortem examination in paediatric medical practice but could reasonably also be applied to surgical practice. It should be noted, however, that this is only a recommendation and there is no obligation for the Coroner to follow it.

The comments that follow are based on the small sample of 22 postmortem examination reports and so no general conclusions about the overall service can be made but some observations still hold.

THE POSTMORTEM EXAMINATION REPORT

Of the reports received the standard was generally good but there were some lamentable exceptions. All postmortem reports were typewritten but not all conformed to the minimum standards laid down by the Royal College of Pathologists[31]. A history was included in 86% (19/22) of cases. The cases without written histories were performed for Coroners, suggesting that in some areas the Coroner does not permit clinical information to be included in the pathological report. There may be good reasons for this practice as any inaccuracy in the history may cause distress to relatives and general confusion. In two of the cases the amount of information supplied was so brief as to be of no help in reviewing the case. On a more positive note, the advisors were particularly struck by the impressive quality of the neuropathology examinations.

The macroscopic description was, in the main, detailed and appropriate to the case but in four cases no description of the surgical operation site was included. In one case the description of the internal organs was telegraphically brief and not a single organ was weighed, or at least their weight was not recorded in the report.

Samples for histology were not taken in every case. In three Coroner's cases histology was not taken. While this may be explicable, if not excusable, it is more difficult to accept that in two hospital examinations no histology was undertaken. When histology was taken it was not always adequate for the case, such as in a child with myeloproliferative disorder when the bone marrow was not examined.

No postmortem examination report was deemed unacceptably bad but three reports were judged to be poor. These included the above case with myeloproliferative disorder and the case of a child with severe burns in whom the description of the burns and internal organs was perfunctory and no histology or microbiology was taken. Assessing the significance of the reports, no report was found in which there was a discrepancy that would have led to a change of treatment or prognosis but there is no room for complacency.

Communication of the postmortem result to the surgical team

This is a continuing theme and is also commented on in the section on pathology in the elderly (see page 98). Twenty-nine percent of surgeons did not receive a copy of the postmortem findings and of those who did less than half did so within 30 days of the examination. This is clearly unacceptable and all pathologists are urged to improve the dissemination of information gained at postmortem examinations. There may be difficulties here with regard to the report of a Coroner's postmortem examination. Such a report is confidential to the Coroner. Whether or not information from it is disseminated to clinicians is entirely a matter for the Coroner to decide. It would be a breach of trust for a pathologist to pass a report (even informally) to a clinician without the Coroner's consent.

Comment

The postmortem rate for children is still low, even in this group of highly selected cases. Paediatric postmortem rates are traditionally higher than in adults. The figures described above are comparable to those collected by the Confidential Enquiry into Stillbirths and Deaths in Infancy (CESDI)[32].

Postmortem examination is an important part of the medical management of a child and an important part of the audit of that process. A postmortem examination on his or her child is the right of every parent.

Case 40 • *A premature baby died two days after a laparotomy for peritonitis and small bowel obstruction secondary to a milk curd obstruction. A patent ductus arteriosus was also present. There was no postmortem examination. This should have been done to confirm the diagnosis, as there was a possibility of cystic fibrosis, which would have implications for the parents and future offspring.*

Where, for whatever reason, the parents are reluctant to agree to full postmortem examination they may consent to a more targeted examination, for example of a single organ system or body cavity. There were no cases in this group in which a report of a limited postmortem was submitted. However, one surgeon did describe the use of a limited postmortem examination.

Case 26 • *A premature baby had a silo constructed for gastroschisis. The child was very sick and died of multiorgan failure within 24 hours. The surgeon expressed an interest in the state of the bowel, and a limited postmortem examination was undertaken in order to obtain the necessary information (see also page 44).*

A limited or directed postmortem examination may yet prove to be the way to improve the postmortem rate. Magnetic resonance necropsy might offer an alternative in infants who die in the perinatal period, which is the most prognostically important age group for necropsy[33, 34]. Whilst some pathologists may still consider MRI to be supplementary to necropsy, it is becoming increasingly widespread.

Hospital pathologists need to include a clinical history in their reports, they need to take more histology and they need to describe the operation site. It is important that postmortem examinations on children be carried out by pathologists with training and experience in carrying out autopsies on children, as recommended by The Allitt Inquiry[30] and the Royal College of Pathologists[31]. Those responsible for paediatric services should ensure that specialist staffing in paediatric pathology is adequate, and that sufficient numbers of pathologists are trained in these skills, to ensure that there is the minimum of delay in obtaining relevant clinical information and releasing the body to the parents.

No examination, however well performed, will achieve its maximum impact if the results are not communicated to the clinicians in charge of the care of the child and pathologists are strongly urged to improve their systems in this regard. This issue was specifically addressed by the Royal College of Pathologists in 1993 in their guidance on postmortem examinations[31], where they particularly suggested that an audit should be undertaken of the time taken for reports to be issued and delivered. We should perhaps reapply ourselves to that exhortation.