Occasional Review

The UK cardiac surgical register, 1977-82

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Abstract

Data for 1977-82 obtained from the Cardiac Surgical Register, established by the Society of Thoracic and Cardiovascular Surgeons of Great Britain and Northern Ireland in 1977, were analysed for trends in incidence and mortality of cardiac surgery and regional workload in the United Kingdom. Operative mortality for most types of cardiac operation showed a general decline. The numbers of operations performed for valvular and congenital heart disease had remained unchanged, but a striking increase had occurred in the number of coronary bypass graft operations: 2297 in 1977 to 6008 in 1982. The figure for 1982, representing an annual rate of 107 operations per million population, was still well below that for other countries such as Australia (410 per million in 1982) and the United States (750 per million in 1981). A wide variation was seen in the regional provision of cardiac surgical services within the United Kingdom. This was particularly appreciable for coronary bypass graft surgery, in which there was a 10-fold difference in numbers of operations performed between the various regions.

The UK Cardiac Surgical Register provides an important source of information on trends within the specialty that could well be followed by other surgical specialties.

Introduction

After a pilot project conducted in 1976[1] the Society of Thoracic and Cardiovascular Surgeons of Great Britain and Ireland agreed to the establishment of an annual register for all cardiac surgery carried out in National Health Service hospitals in the United Kingdom. It was thought that such a register would provide valuable information on the volume, type, and distribution of work performed each year and thereby help to promote the rational use and future planning of cardiac surgical services in this country.[2] It was also thought that the register would have an important role in improving the overall quality of the cardiac surgical services delivered as each year individual surgeons would be presented with information on national mortality for the various categories of operations performed, which would serve as a standard with which they could compare their own performance.

Since 1977 a complete return has been obtained each year from every practising cardiac surgical unit in the United Kingdom, and a considerable amount of data has therefore been accumulated. The present report is based on information from the first six years of the UK Cardiac Surgical Register and is confined to two general analyses: the first relates to changes in the number of and mortality for the three broad categories of cardiac surgery—namely, adult valve surgery, surgery for congenital heart disease, and the surgery of ischaemic heart disease; the second is an analysis of workloads in NHS health regions related to the population of each region and the trends in workload over the last five years of the register.

Methods

At the outset three main problems were recognised with regard to collection of data. These were, firstly, the need to seek enough information on operations performed to be of value and yet retain a form simple enough so that surgeons would not be deterred from filling it in; secondly, the need to preserve confidentiality of material returned from individual cardiac surgical units; and, thirdly, the need to ensure a complete return every year from each practising cardiac surgical unit in the United Kingdom. A practising cardiac surgical unit was defined as any NHS unit in which open heart surgery was being undertaken. Thus the small volume of closed operations performed in those thoracic surgical units without facilities for open heart surgery was excluded.

Initially the form used by the Australian Cardiac Register, which had been established in 1963, was modified slightly and used in a pilot study in 1976.[1] At the time comment was sought from colleagues specifically on the design and deficiencies of the form used for the pilot study, and many of the resulting suggestions were subsequently incorporated into the definitive form used since 1977. Inevitably, further inadequacies have become apparent since then, but we have been reluctant to make major changes in the belief that no single form is ever likely to be perfect and that it would prove irritating to contributing surgeons if the layout of the form was constantly revised. Essentially, the existing form when completed provides information on the type of and mortality for every heart operation, with ("open") or without ("closed") the use of cardiopulmonary bypass, performed in that unit during the calendar year under review. The operations performed by all surgeons working in a particular unit are included in a single return. No distinction is made between elective and urgent or emergency operations, and operative mortality is defined as death at or within 30 days after operation. Information on the cardiac surgical waiting list at the end of each year is also requested but has not always been provided.

Because information on operative mortality was sought, it was thought necessary to devise a system for protecting the confidentiality of material returned. Accordingly, each year completed returns are sent to the secretary of the Society of Thoracic and Cardiovascular Surgeons, who removes the first page from the return identifying the name and surgical staff of that unit and attributes a code number to the now anonymous return. After being checked for any obvious inaccuracies each form is sent to the BUPA Medical Centre, where final analysis of the national data is performed. On completion the annual report is distributed to every member of the Society.

Each year difficulties have been experienced in obtaining completed returns from a minority of cardiac surgical units, but, with persistence and

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increasing degrees of persuasion by the secretary of the Society, complete returns have been achieved eventually for the years 1977 to 1982. Some years ago the executive of the Society agreed that the final sanction should be the identification in the report of any units not contributing to the annual register, but so far this has never been used. Indeed, as surgeons have become more appreciative of the value of the register the quality and promptness of the returns has steadily improved.

TABLE I—*Number (mortality*) of all cardiac operations 1977-82*

Year	Operations for: Valvular heart disease	Ischaemic heart disease	Congenital valve disease	Adult miscellaneous acquired heart disease	Total
1977	4 832 (8·9)	3 040 (9·3)	3 344 (10·1)	386 (22·8)	11 602 (9·8)
1978	4 873 (9·5)	3 345 (7·5)	3 385 (11·1)	340 (22·1)	11 943 (9·8)
1979	4 791 (9·2)	3 688 (8·4)	3 275 (10·5)	402 (19·2)	12 156 (9·6)
1980	4 814 (7·0)	5 011 (6·1)	3 472 (11·0)	442 (15·4)	13 739 (7·9)
1981	4 762 (6·9)	6 123 (5·8)	3 501 (8·9)	401 (19·7)	14 787 (7·3)
1982	4 652 (6·7)	7 403 (5·2)	3 392 (9·9)	443 (21·7)	15 890 (7·1)
Total	28 724 (8·1)	28 610 (6·6)	20 369 (10·0)	2 414 (19·9)	80 117 (8·5)

*Mortality (%) defined as death at or within 30 days after operation.

TABLE II—*Mortality (%) for open adult valve operations in the United Kingdom, 1977-82*

Year	Type of valve operation: Mitral	Aortic	Double	Triple
1977	7·0	8·6	17·0	16·3
1978	9·6	7·9	16·2	27·6
1979	8·6	7·4	16·0	29·3
1980	7·7	5·0	10·9	18·0
1981	6·6	5·3	11·2	21·2
1982	6·9	4·6	11·3	19·4

TABLE III—*Annual number of open operations for congenital heart disease in patients aged below 1 year and patients older than 1 year together with mortality (%) in parentheses*

Age (years)	1977	1978	1979	1980	1981	1982
<1	1830 (7·9)	1820 (9·3)	1638 (9·2)	1619 (7·7)	1620 (7·0)	1637 (7·3)
≥1	275 (32·4)	333 (38·7)	377 (27·3)	390 (32·3)	426 (24·2)	570 (22·3)
Total	2105 (11·1)	2153 (13·9)	2015 (12·6)	2009 (12·4)	2046 (10·6)	2207 (11·2)

on the cardiac valves. It shows that during the six years little change occurred in the mortality for mitral valve surgery but that mortality for aortic and double valve surgery declined.

Table III shows that the annual number of open operations for congenital heart disease remained constant in the first half of the study but was declining by 1982. There has, however, been a trend towards an increasing number of open operations on infants of less than one year old, and the operative mortality for this technically difficult group of patients also declined.

Table IV shows the number and mortality of operations undertaken for ischaemic heart disease. These operations were subdivided into three groups: the largest comprised those operations in which coronary bypass grafts were performed as the sole procedure; the second consisted of any operations in which one or more coronary bypass grafts formed part of the operation, whether this was for valve replacement, resection of left ventricular aneurysm, closure of an acquired ventricular septal defect, or any combination of such procedures; the third and smallest consisted of operations performed for the complications of myocardial infarction but without concomitant coronary bypass grafting.

Coronary bypass graft surgery accounted for the biggest increase in workload, which more than doubled over the six years (2297 to 6008 per annum). A steady increase also occurred in the number of other procedures accompanied by coronary bypass grafting (584 to 1224). During this period the mortality for coronary bypass graft operations, most of which included three or four separate grafts at each operation, was reduced by half from 6·4% to 3·2%. The mortality, however, for operations for the complications of myocardial infarction remained high, whether these were accompanied by coronary bypass grafting or not. This simply reflects that the degree of ventricular damage preoperatively is an important determinant of operative mortality.

CARDIAC SURGICAL WORKLOAD BY HEALTH REGION

Below are summarised the differences between and changes in the cardiac surgical workload for each of the various health regions in the United Kingdom during the period 1977-82.

Mean workloads

England has 14 health regions with populations varying from 1·9 million (East Anglia) to 5·2 million (West Midlands) (table V). Wales and Northern Ireland, which are each served by a single cardiac surgical unit, and Scotland, which has three cardiac surgical units, were regarded for the purpose of this analysis as three other health regions within the United Kingdom. In addition, the Department of Health and Social Security recognises a Special Health Authority comprised of the three large national heart and chest hospitals—namely, the Brompton, National Heart, and London Chest hospitals—and a national referral centre for paediatric cardiac surgery at the Hospital for Sick Children, Great Ormond Street.

TABLE IV—*Number of operations for ischaemic heart disease with mortalities (%) in parentheses*

	1977	1978	1979	1980	1981	1982
Coronary artery bypass grafts	2297 (6·4)	2653 (5·1)	2918 (6·1)	4057 (3·7)	5130 (3·7)	6008 (3·2)
Coronary artery bypass grafts and other procedures*	584 (16·8)	537 (16·8)	620 (16·0)	802 (15·1)	839 (14·5)	1224 (12·4)
Procedures without graft†	159 (23·9)	155 (16·8)	150 (21·3)	152 (20·4)	154 (24·7)	171 (22·8)
Total	3040 (9·3)	3345 (7·5)	3688 (8·4)	5011 (6·1)	6123 (5·8)	7403 (5·2)

*Includes all valve operations accompanied by coronary bypass grafts as well as operations for complications of myocardial infarction.
†Includes operations for complications of myocardial infarction such as resection of ventricular aneurysm or closure of acquired ventricular septal defect.

Results

CHANGES IN THE NUMBER AND MORTALITY OF CARDIAC OPERATIONS

Tables I-IV show the numbers and respective mortalities of the various categories of cardiac surgical operations. Table I, which includes all cardiac operations both with (open) and without (closed) the use of cardiopulmonary bypass, shows that, during the six years reviewed, the volume of valve surgery and surgery for congenital heart disease remained about constant and that the increase in total operations from 11 602 in 1977 to 15 890 in 1982 was due to an appreciable increase in surgery for ischaemic heart disease, which more than doubled during that period.

Table II shows the operative mortality for open valve surgery. This includes both operations for valve replacements and reparative procedures

For each health region the mean number of operations per million population for the three main categories of cardiac surgery was calculated for the six years 1977-82. For England and Wales the population for each region was the mean of the figures published by the Office of Population Censuses and Surveys for 1978 and 1981. For Scotland and Northern Ireland figures were supplied by the DHSS. Cardiac operations performed by the three London hospitals comprising the Special Health Authority were attributed to the four Thames regions, from which most of the patients are admitted, on the basis of a recent analysis of origin of inpatient referral of cardiothoracic surgical patients. The residual 23% of patients operated on from other health regions and the 9% of patients from outside the United Kingdom were excluded from analysis, as were the patients (roughly 400 per annum) treated at the Hospital for Sick Children, which serves as a national referral centre.

Table V shows the cardiac surgical workload achieved by each health region during 1977-82. The small number of operations for miscellaneous acquired cardiac abnormalities has been included in the total number of operations but has not been listed separately. All numbers given include both open and closed cardiac operations for each particular category. All operations for ischaemic heart disease were performed using cardiopulmonary bypass, and were therefore defined as open, whereas a small proportion of adult valve surgery and roughly one third of all operations for congenital heart disease were performed without the use of the heart-lung machine.

The number of cardiac operations carried out in the various regions varied greatly. For example, the South Western Region, Oxford, and Wales had all done less than one third of the total cardiac operations per million population performed by three of the four Thames regions. This wide variation was particularly apparent for coronary artery surgery (fig 1). There was roughly a 10-fold difference in the number of operations performed for ischaemic heart disease between the South Western and Oxford regions (14 and 22 operations per million population) and the North Western and South Eastern Thames regions (195 and 212 operations per million population). Figures 2 and 3 provide similar information for valve and congenital surgery respectively, although in both these categories the regional differences were less striking than for coronary artery surgery.

TABLE V—*Number of cardiac operations per million population per annum*, 1977-82*

UK health regions				No of operations for:		
No	Name	Population (million)	Total No	Ischaemic heart disease	Valvular heart disease	Congenital heart disease
1	Northern	3·1	191	57	75	55
2	Yorkshire	3·6	203	64	75	58
3	Trent	4·6	164	43	76	38
4	East Anglia	1·9	177	72	74	20
5	NW Thames	3·4	429	195	110	108
6	NE Thames	3·7	364	169	129	55
7	SE Thames	3·6	413	212	125	60
8	SW Thames	2·9	206	111	61	29
9	Wessex	2·7	175	63	59	46
10	Oxford	2·3	84	22	37	22
11	S Western	3·2	83	14	31	35
12	W Midlands	5·2	169	38	77	49
13	Mersey	2·5	217	34	70	110
14	N Western	4·0	191	61	99	26
	Wales	2·8	107	26	59	20
	N Ireland	1·5	235	63	91	75
	Scotland	5·2	248	88	101	56

*All figures given are a mean of the number of operations performed for each category during 1977-82.

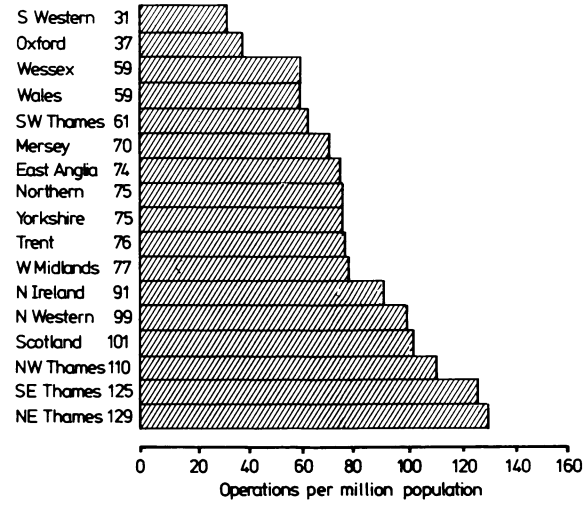

FIG 2—Histogram showing average annual number of valve operations per million population for each health region during 1977-82.

TABLE VI—*Percentage change in workload of health regions, 1978-82*

All cardiac operations		Operations for ischaemic heart disease		Valve surgery (adults)		Congenital surgery	
Region	Change (%)	Region	Change (%)	Region	Change (%)	Region	Change (%)
W Midlands	8	Mersey	44	N Western	−23	NE Thames	−37
Trent	19	W Midlands	51	Wessex	−21	Trent	−35
Wessex	19	Wessex	91	SE Thames	−19	Oxford	−28
Mersey	20	NW Thames	98	Oxford	−16	NW Thames	−17
Oxford	23	Yorkshire	99	NE Thames	−15	Wales	−14
Yorkshire	23	SE Thames	107	W Midlands	−10	Scotland	−11
N Western	31	Scotland	110	NW Thames	−7	N Western	−10
NW Thames	32	Wales	159	N Ireland	−5	Yorkshire	−7
Wales	33	NE Thames	171	Mersey	0	N Ireland	1
Scotland	33	Northern	175	East Anglia	2	Wessex	8
N Ireland	43	Trent	183	SW Thames	2	Northern	10
SE Thames	44	East Anglia	183	Yorkshire	2	W Midlands	16
NE Thames	46	N Western	191	Scotland	4	East Anglia	18
S Western	46	S Western	195	Trent	5	S Western	20
Northern	57	SW Thames	195	Wales	17	Mersey	24
East Anglia	78	Oxford	214	S Western	25	SE Thames	34
SW Thames	118	N Ireland	349	Northern	26	SW Thames	50

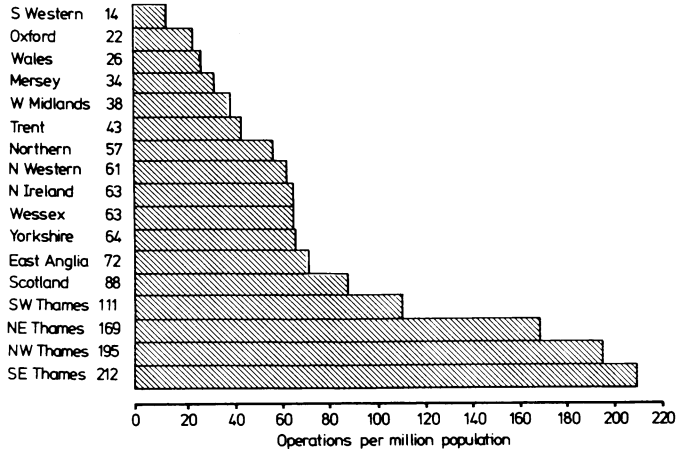

FIG 1—Histogram showing average annual number of operations for ischaemic heart disease per million population for each health region during 1977-82.

Change in workload

Because all data on regional operations provided thus far reflect the average workload over a six year period and because it is known that there has been a substantial national increase in coronary bypass graft surgery during this period the change in workload in each region was analysed, comparing 1978 with 1982, for each of the categories of cardiac operations. Table VI shows the results, which confirm that the increase in total cardiac surgical workload has been due predominantly to the demands of coronary artery surgery and that during the five years every health region increased its throughput of operations for ischaemic heart disease from a minimum of 44% (Mersey) to a maximum of 349% (Northern Ireland). Table VI also shows the varying responses made by different health regions to meet these demands. Caution should, however, be exercised in drawing conclusions from figures relating to changes in workload in a particular region over five years in isolation and without reference to the absolute number of operations performed during a similar period, as given in table V.

Discussion

All the information presented in this paper was derived from data collected by the annual UK Cardiac Surgical Register from the year of its inception in 1977. Each year, despite difficulties, complete data have eventually been obtained from every NHS cardiac surgical unit in the United Kingdom. Without the cooperation of every consultant practising within these surgical centres this would not have been possible. The register was initiated by the Society of Thoracic and Cardiovascular Surgeons of Great Britain and Ireland at a time when it was sensed that increasing demands were likely to be made on the specialty and that regular and accurate information on how much cardiac surgery was being done nationally and what the regional distribution was would help with planning future provisions required by the specialty to meet these demands.

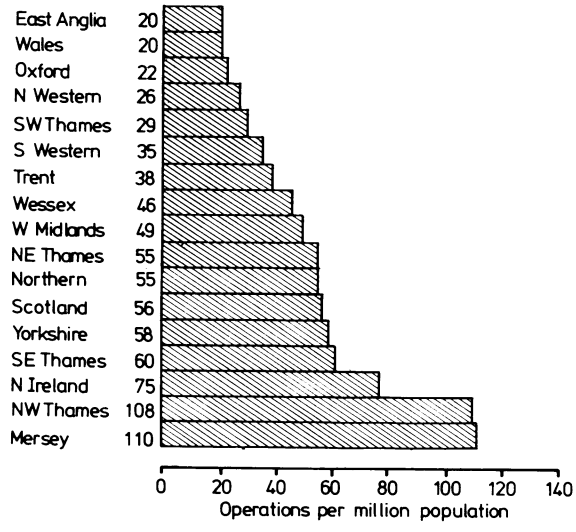

FIG 3—Histogram showing average annual number of operations for congenital cardiac abnormalities per million population for each health region during 1977-82.

The question of whether to seek information on operative mortality was a difficult one. The decision to do so has, we believe, been vindicated. A system for preserving confidentiality of results from individual units has been devised, and each year surgeons can compare the performance of their own centre with figures on the national mortality for the various types of operations. The UK Cardiac Surgical Register was based in part on the Australian Cardiac Surgical Register, which has been the responsibility of the Australian National Heart Foundation,[3] and we are indebted to its first director, Dr Ralph Reader, for helpful advice at the beginning of our project. West Germany has had a similar register since 1978,[4] but we are not aware of any other published national registers.

This analysis of our data summarises some of the more interesting trends in cardiac surgery that have occurred within the United Kingdom during the past few years. The two most important perhaps are the decline in mortality for most categories of cardiac operations and the striking increase in operations performed for the consequences of ischaemic heart disease, most of which are coronary bypass graft operations. The total of 6008 for 1982, representing roughly 107 operations per million population, is, however, still considerably less than the 300 coronary bypass graft operations per million per annum that the DHSS has indicated might be taken into account by service planners when considering future patterns of provision in the United Kingdom. It also compares unfavourably with Australia (6244 in 1982, equivalent to roughly 410 per million population)[5] and the United States (159 000 in 1981, equivalent to roughly 750 per million population).[6]

Interesting information is also provided on regional workload, with respect both to absolute numbers of operations per million population within each region and to the change in workload within health regions during the past five years. The second was considered to be important as a reflection of how each region was responding to the change in national trends, particularly the ever increasing demand for coronary bypass graft surgery. It is evident from table V that there is a wide variation in the provision of cardiac surgical services within the United Kingdom. The same has been shown to be true of cardiological staffing and facilities.[7] The reason for this is partly historical in that, when the technology for open heart surgery became available in the late 1950s and early 1960s, most medical schools sought to establish cardiac surgical units, often for purposes of prestige, with the result that no fewer than 16 of the present 42 cardiac surgical units in the United Kingdom are centred in or around London. Evidently, some of these hospitals still provide cardiac surgery for substantial numbers of patients from health regions that are less well provided for.

We believe that the Society of Thoracic and Cardiovascular Surgeons has fulfilled an important function in collecting and making this information available and that this method of surgical audit is an example that other surgical specialties might follow. Furthermore, we believe that it remains the responsibility of the DHSS, in conjunction with individual health regions, to provide a more equal service for patients in those parts of the country where cardiac surgical services are deficient.

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Can any of the techniques, surgical or otherwise, recommended in the lay press for treating male pattern baldness be safely advocated as effective?

The simple answer is No. There is no evidence that any of the non-surgical treatments offered in the lay press have any objective beneficial effect whatsoever on male pattern baldness. This includes all the embrocations, whether hormonal, irritant, vitamins, or "nutritional," and the electrical and massage treatments. Any benefit claimed by the therapists or by the bald is likely to be subjective. The latest topical remedy enjoying the doubtful accolade of double blind trials is minoxidil. There is some evidence that this drug can convert some hair follicles from producing fine short lanugo hair to long thick terminal hair, but no report has been published showing full restoration to a normal hair pattern from obvious male pattern baldness.

On the other hand, transplantation of scalp hair bearing skin to bald areas is a well established and accepted technique for producing terminal hair growth in areas affected by male pattern alopecia. Scalp reduction—that is, excision of bald areas—will also reduce the bald area in advanced male baldness. To ensure viability transplants are usually only 4 mm in diameter so that the number of transplants can be considerable depending on the area needing treatment. The likely complications of this therapy are considerable and include sepsis, irregular or total failure of the grafts to take or produce terminal hair, hair growing in the wrong direction, and even keloid formation at donor and recipient sites. The donor sites inevitably remain as bald discs, and since these are usually at the back of the scalp they may become apparent later in life when this area becomes thinned. When this technique is successful then the result is certainly "effective." Because a successful result cannot be guaranteed by even the most reputable of hair transplant surgeons, as a procedure it cannot be "safely advocated."—A B SHRANK, consultant dermatologist, Shrewsbury.