

Audit of vascular surgical workload: use of data for service development

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The power of surgical audit lies in the ability to clearly record complications and to compare case mix from year to year and between centres in order to compare results. In addition, accurate data about surgical activity is vital for the development of new services. We have analysed 52 weeks of activity in a developing pure vascular surgical service and compared activity against the recommendations previously published for consultant surgical workload. During the 12-month period the mean number of admissions per week was 25.3 (95% CI, 23.43–27.29). Mean elective surgical activity was 18.2 h/week (95% CI, 16.5–19.9) and mean emergency workload 12.7 h (95% CI, 10.7–15.4). Mean intermediate equivalent value (IEV) operations per week was 37 (95% CI, 33.6–40.8) and of these 26.4 IEV (95% CI, 22.96–29.6) were complex major operations. Finally, the mean bed occupancy of vascular patients on the unit was 23.3 (95% CI, 21.15–24.97).

The recommendations for surgical activity are 3.5 IEV/list. In our unit this would equate to 21 IEV/week compared with 37.2 in our practice. This data forms the basis of a powerful bid for increased consultant manpower and theatre resources.

Surgical audit is time-consuming and should be consultant led, but the benefits are tangible and the data generated can be used to support bids for resource re-allocation.

Medical and surgical audit has a central role in the activity of consultants and trainees. There is little standardisation of data collected and computer programs abound. Despite

the heavy reliance upon technology, several reports confirm that data collection is the fundamental activity and accuracy of data is essential for meaningful audit. A number of authors have recognised that 'ownership' of audit systems by clinicians acts as an incentive for accurate data collection and tangible benefits such as production of discharge summaries within audit activity is desirable.

Collins (1) has reported the 'ideal' workload for a general surgical consultant. The calculations are based on a 44-week working year allowing for holidays and study leave. Standardisation for the type of operation performed is based on intermediate equivalent values (IEV) (2). In brief, this is a scoring system whereby complex major operations, major and minor operations are weighted and compared with intermediate operations. Approximately 620 IEV cases operated on per annum is deemed appropriate. Other authors recognise this requirement for standardisation and point to the discrepancy between caseload (number of cases) and workload (intermediate equivalent values) (3).

We have performed a prospective audit of surgical workload in an evolving dedicated vascular surgery unit over a 1-year period to compare workload with the 'ideal' workload of a general surgeon.

At the commencement of the audit period, one newly appointed pure vascular consultant surgeon joined a firm of two colleagues providing a general surgical service with vascular surgical interest. Two months into the audit two out of the three consultants had a pure vascular surgical commitment exclusively and the third consultant continued to perform some general surgery until the end of the audit year. For the first 2 months, two of the three surgeons took part in the general surgical rota in addition to the vascular rota. After this all three consultants were on call for vascular surgery exclusively. This audit covers

the work of the unit on the St James's site only, where there were 26 beds on a single ward. There were five lists available at an elective surgical site in a separate hospital which are now used predominantly for elective venous surgery. This work was not included in the analysis. The vascular unit provides services for a population of approximately 370 000 in the former Leeds East District and has two higher surgical trainees. One trainee works a 1:5 rota with the general surgical juniors and the other works a 1:3 on call for vascular surgery exclusively.

Methods

All patients admitted to a three-consultant vascular surgery unit were prospectively documented from 1 November 1993 to 31 October 1994. Workload analysis, POSSUM (4) and GORA (5) scores were recorded and workload analysis forms the basis of this paper. Number of admissions, hours of elective and emergency surgery, total intermediate equivalent values of surgery performed and bed occupancy were recorded. Vascular bed occupancy was defined as the number of beds on the vascular ward occupied for a given week and total bed occupancy relates to additional bed days in other wards, including the intensive care unit, occupied by vascular patients.

All operations were graded according to the BUPA scale (Table I). At the weekly audit meeting a list of surgical activity generated by the Theatreman audit system was checked by the clinical team for completeness, accuracy and coding.

Bed occupancy was calculated by assigning each patient a score of 1–7 depending on the number of days each week spent on the ward and dividing the total by 7.

In addition, details of unscheduled readmissions, scheduled and unscheduled return to theatre, scheduled and unscheduled admissions to intensive care and patients cancelled because of the lack of ICU facilities or alternatively operated on in the absence of ICU facilities—deemed preoperatively to be beneficial although not essential—were collected.

Each consultant had two operating lists available each week and there were 26 beds on the vascular ward. Each Monday at 0700, a weekly team audit meeting reviewed the audit data from the previous week. Activity was recorded initially in a diary and later on a Psion series 3 hand-held computer database.

Table I. (See Ref. 2)

BUPA grade	IEV value
Minor	0.5
Intermediate	1
Major	1.75
Major plus	2.2
Complex major	4

Results

Data were available for all of the 52 weeks in the audit period.

Number of admissions

The mean number of weekly admissions was 25.3 (95% CI, 23.43–27.29; range 10–48) (Fig. 1). In all, 839 procedures were performed during the 1-year audit period.

Elective surgery (hours)

A mean of 18.2 h (58% of weekly total operating time) was spent operating on elective surgical cases (95% CI, 16.5–19.9; range 5–28.5). For 9 of the 12 months under consideration, 1.5 elective lists were lost each week for cost containment, leaving on average 4.5 lists (15.75 h) per week. In addition, the theatre suite was closed for 1 week during the move to new theatre accommodation (Fig. 2).

Emergency surgery

A mean of 12.7 h (42% of weekly total operating) was spent operating on emergency cases (95% CI, 10.7–15.4; range 0–40) (Fig. 2).

IEV activity

Mean IEV operations per week was 37 (95% CI, 33.6–40.8) and of these 26.4 (95% CI, 22.96–29.6) were complex major operations (Fig. 3). Over the study

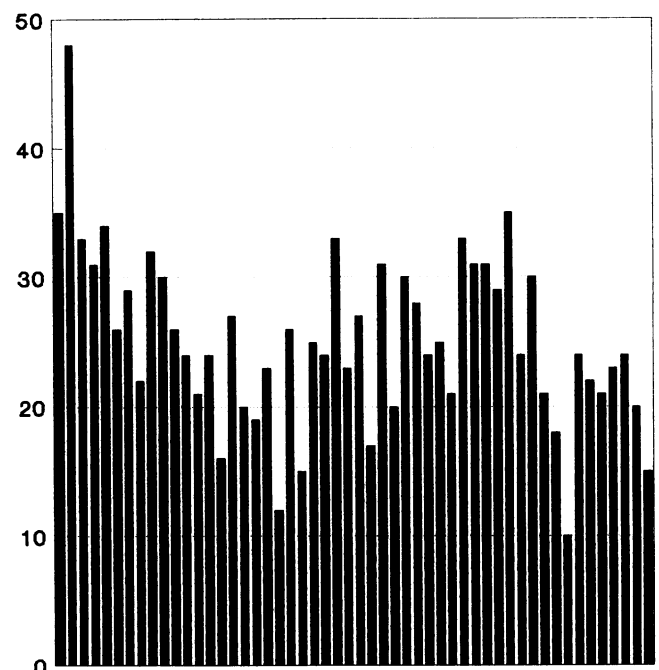


Figure 1. Weekly admissions showed some extreme fluctuations with a mean of 25.4.

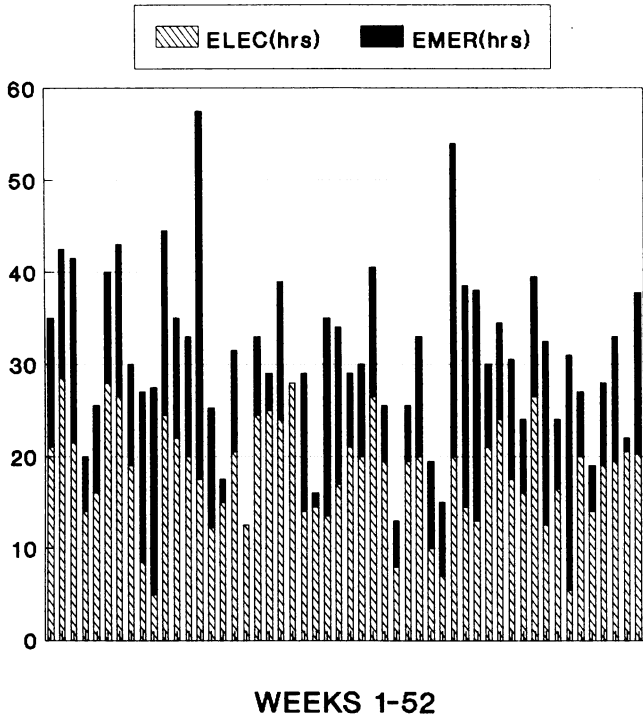


Figure 2. Number of hours operating each week. Elective hours are hatched and emergency hours solid with mean elective surgical activity of 18.2 h/week (95% CI, 16.5–19.9) and mean emergency workload of 12.95 h (95% CI, 10.7–15.4).

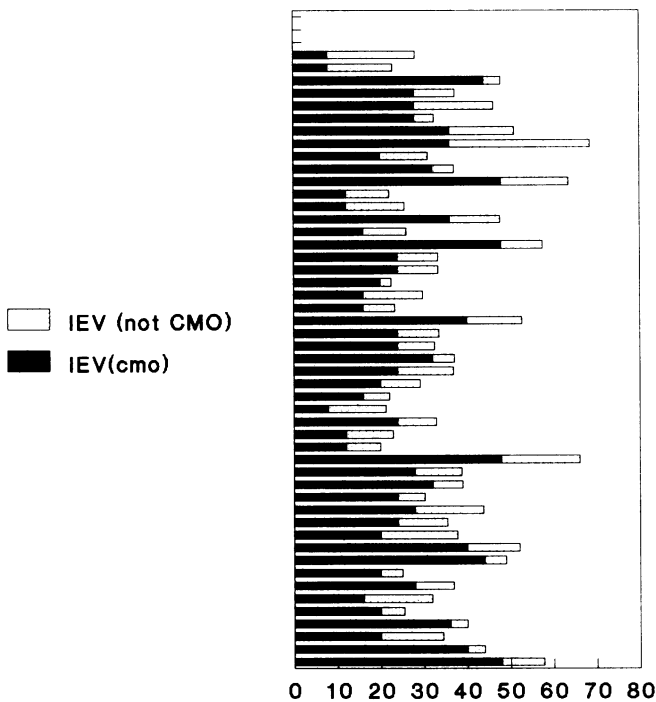


Figure 3. Mean intermediate equivalent value operations per week was 37.2 (95% CI, 33.6–40.8) and of these 26.3 IEV (95% CI, 22.96–29.6) were complex major operations.

period, 211 general surgical procedures accounted for 253 IEV, which represents 13% of the total surgical activity expressed as IEV and 25% of the total operations performed.

General surgical workload

The effect of the increasing specialisation of the unit was evident over the 1-year period. In the first quarter, 39% of all procedures performed were general surgical (83 out of 213), decreasing to 17% in the last quarter (31 out of 180). In addition to the decreased total general surgical workload, the proportion of major, major plus and complex major procedures performed also fell over the year from 49% in the first quarter to 21% in the 2nd, 18% in the 3rd and 39% in the final quarter. The high relative proportion in the final quarter was because of operations performed on patients from the waiting list before the total cessation of general surgical activity (Fig. 4).

Vascular surgical workload

During this 1-year period, 628 vascular surgery procedures were performed, including 66 femoropopliteal grafts, 45 femorotibial grafts, 47 aortic aneurysm repairs and 26 carotid endarterectomies. In addition, there were 29 major amputations, 62 venous operations, 38 femoral embolectomies, 13 chemical sympathectomies, 15 toe amputations, 10 prosthetic graft thrombectomies, and 8 vein graft thrombectomies.

Readmission within 30 days

Over the 1-year period, 36 patients were readmitted within 30 days of discharge (2.8% of total admissions).

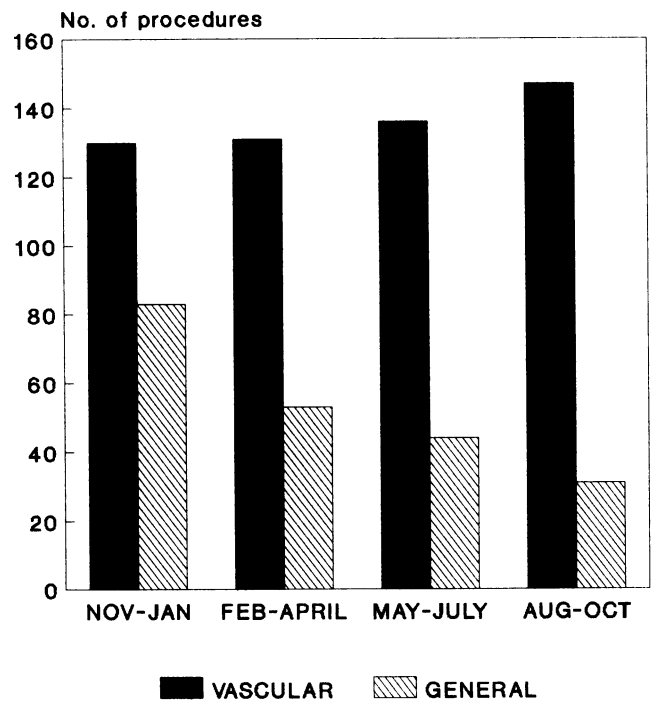


Figure 4. The number of vascular surgery procedures increased each quarter in the audit period while the general surgery workload decreased dramatically.

Return to theatre

Over the audit period, 20 patients had a scheduled reoperation and 87 an unscheduled reoperation (12.8% of 839 operations performed).

ICU utilisation

There were 53 patients admitted to ICU electively after surgery and a further 52 patients were admitted after emergency surgery or because of complications during surgery. Two operations were cancelled owing to the lack of ICU beds. A further 23 patients had surgery performed in the absence of an available ICU bed where this had been identified preoperatively as optimal.

Discussion

The debate continues about centralisation of vascular surgery into large units, avoiding the single-handed vascular surgeon. With up to 30% of vascular surgery derived from emergency admissions (6), there are advantages to both surgeons and patients if a number of consultants provide a specialist vascular service and on-call rota.

Consultant expansion is required to achieve the aims of the *New Deal, Achieving a Balance* and to implement the recommendations of the Calman report. The common aims of these initiatives is to promote training, shift the burden of clinical care provision to consultant level and hence improve patient care. Appointment of new consultants is not expected to increase workload but rather to redistribute the existing workload. Planning new services should be based on activity analysis and assessments of the current work pattern. Accurate records of activity are important and audit can provide this function in addition to its central purpose of assessing the quality of health care provision.

Standardisation of the complexity of surgical procedures is difficult. Application of the BUPA scale is invaluable as a weighting tool and conversion of operative complexity into Intermediate Equivalent Values (IEV) further aids comparison of activity between cases, operating lists, surgeons and specialties (4). In this study, 30% of the operations were general surgical but accounted for only 16% of the IEV total. In contrast, the majority of vascular surgical procedures are more complex and time-consuming in nature and this is reflected in the high proportion of IEV accounted for each week in complex major operations.

These data confirm that activity in a teaching hospital vascular surgical service is considerably greater than the 'ideal' workload proposed by The Royal College of Surgeons of England. With 3.5 IEV/list (21 IEV/week) as the recommended activity; the mean activity in our unit was 77% higher and exceeded the guideline of 21 IEV on 90% of the weeks reviewed. At first sight the available elective operating time is also 21 h/week. However, Monday lists were lost for all Bank Holidays (6/year)

and only five lists were available each week for 9 of the 12 months studied because of rotational closure of theatre sessions to contain costs. The mean of 18.2 elective hours of surgery each week represents full utilisation of the available elective lists. On the other hand, 12.7 h/week were spent on emergency surgery outside normal operating time. Some of these cases were performed out-of-hours because of the limited elective time available.

Unscheduled returns to theatre are a useful indicator in vascular surgery and several authors report reoperation rates of 9–11% (7,8). In this study, unscheduled reoperation within 30 days occurred in 10.3% of all cases. These cases have been reviewed locally and serve to close the audit loop.

These data are also of value as an indication of the requirements for ICU facilities for a vascular surgery unit of this size. The mean requirement for ICU beds was one bed for scheduled and one bed for unscheduled patients each week. Of some concern was the relatively high number of patients for whom optimal care would include ICU admission postoperatively, but for whom no ICU bed was available. Two ICU beds may be required on an on-going basis to support our vascular surgery unit.

Use of readmission rates and reoperation rates within audit as a measure of outcome other than lengths of stay or mortality is controversial. Clarke (9) argues that readmission may be avoidable in less than half of cases and therefore is a poor indicator of the adequacy of care. There is little data on what an acceptable rate of readmission may be for a dedicated vascular surgery unit. Chambers and Clarke (10) report a 4% readmission rate for general surgery patients, higher than the 2.8% in this study. While imperfect, these data may prove useful in the future when comparing consecutive audit periods.

On the basis of these data a new pattern of work in the vascular unit has been devised and a successful application for a fourth consultant vascular surgeon has been made to the Yorkshire Regional Task Force. The job plan has been designed specifically to allow one consultant to be free of elective commitments each week to perform the majority of emergency surgery during daylight hours in a dedicated emergency theatre. In addition, this consultant will supervise the day-to-day ward management on the vascular unit. Perhaps the most important change in working pattern is the conversion of four half-day vascular and two general surgery operating sessions into three all-day vascular theatre lists, which has increased the efficiency of theatre utilisation (data unpublished).

Ellis *et al.* (11) have previously reported the value of accurate audit data in resource planning. These data are a powerful tool in reorganising surgical services, in resource allocation and in applications for funding of new consultant posts. This application of vascular surgical audit data is a further reason why on-going prospective data collection in surgical practice should be actively encouraged.

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