Original article

A 25-year study of emergency surgical admissions

WB Campbell¹, EJK Lee¹, K Van de Sijpe¹, J Gooding², MJ Cooper¹

¹Department of Surgery and ²Information Department, Royal Devon and Exeter Hospital, Exeter, UK

Background: Numbers of emergencies are increasing, but no comprehensive data are available for emergency surgical admissions. This study documents the changes over 25 years in a district general hospital.

Methods: Details of all general surgical (including urological) emergency admissions were analysed for every fourth calendar year from 1974 to 1998.

Results: A total of 19,931 patients were admitted during the 7 years studied, rising from 2137 in 1974 to 3578 in 1994 (3377 in 1998). Mean age increased from 47.9 years to 52.6 years while mean length of stay fell from 9.5 days to 5.3 days. Hospital mortality decreased from 6.6% to 3.7%. When calculated per 100,000 population, the increase in admission rate was significant ($P < 0.001$) but bed requirements did not increase despite the increase in workload. Several diagnoses became significantly more frequent (ruptured aortic aneurysm, gallstones, constipation, cutaneous abscess, diverticular disease, gastroenteritis, non-specific abdominal pain, pilonidal sinus and urinary diagnoses). Appendicitis and non-malignant intestinal obstruction became significantly less common.

Conclusions: This study has documented a progressive increase in surgical admissions. Despite increasing age of patients, lengths of stay and hospital mortality have decreased.

Key words: Emergency surgical admissions – Audit – Trends

The overall numbers of emergency admissions to hospital have increased over recent years, placing considerable strain on the ability of many hospitals to undertake elective work. Reports on the increase in emergency admissions^{1–4} have tended to deal with overall admission rates, or with medical admissions, and not with trends in surgical emergencies, which form an important part of the workload of general hospitals. Trends for individual surgical specialties have been published,^{5,6} as has an analysis of all general surgical admissions (emergency and elective) in the Oxford district.⁷ One recent study from a district general hospital has documented a rise in emergency admissions between 1992 and 1999,⁸ but emergency general surgery has not

been the subject of any detailed report, nor has any published work taken a long-term perspective.

The possible reasons for any changes in emergency admission patterns are many and varied.^{3,4,9} A rising age of the population and social deprivation are both associated with increased admission rates,^{10,11} but lower thresholds for referral to hospital, and a greater tendency for patients to present themselves to accident and emergency departments with 'surgical' problems are likely to be significant factors, while increased re-admission rates also play a part.^{3,4} Coding of diagnoses may account for apparent changes, either as a result of new coding systems, inaccurate coding,⁷ or changes in the diagnoses which doctors record (for example in patients

Correspondence to: Prof. Bruce Campbell, Consultant Surgeon, Royal Devon and Exeter Hospital, Exeter EX2 5DW, UK
Tel: +44 1392 402702; Fax: +44 1392 402714; E-mail: brucecampbellxeter@hotmail.com

Table 1 Catchment area population, and details of numbers of emergency surgical admissions, with the mean ages of patients admitted each year. The numbers who died in hospital are also shown. Figures in italics are numbers per 100,000 catchment population for each year, and these have been used to compare the incidences in 1974 with those in 1998 (shown as 95% confidence intervals with a P value in the right hand column). The bottom row shows the total number of discharges and deaths for all specialties in the Exeter hospitals for each year.

	1974	1978	1982	1986	1990	1994	1998	95% CI and P value
Population	281,000	288,285	295,850	306,025	319,651	326,457	335,485	
Admissions	2137	2257	2732	2590	3260	3578	3377	
Admissions per 100,000	761	783	932	846	1020	1096	7008	251 to 419; $P < 0.001$
Mean age (years)	47.9	47.5	50.5	50.0	50.0	51.1	52.6	
Deaths	140	135	135	123	143	136	124	
Deaths as % admission	6.6	6.0	4.9	4.8	4.4	3.9	3.7	
Deaths per 100,000	49.8	46.8	45.6	40.2	44.7	41.7	37	-31.1 to +5.5; NS
Total discharges and deaths from hospital (all specialties)	22,522	25,190	28,844	33,628	37,675	42,874	45,931	

NS, not significant.

Table 2 The mean duration of hospital stay for each year studied, with a calculation of occupied bed days and of the mean daily bed requirement based on these figures.

	1974	1978	1982	1986	1990	1994	1998	% change (1998 versus 1974)
Total	2137	2257	2732	2590	3260	3578	3377	153
Length of stay (days)	9.5	8.3	7.4	7.0	6.2	5.4	5.3	55.8
Occupied bed days	20,302	18,733	20,217	18,130	20,212	19,321	17,898	88.2
Average daily beds required	55.6	51.3	55.4	49.7	55.4	52.9	49.0	88.1

with abdominal pain). With increasing specialisation, the distribution of certain types of emergency admissions between different departments may have changed, especially in some large referral centres; and internal transfers of patients between specialties may account for an apparent rise in admissions.⁹

The Royal Devon and Exeter Hospital cares for a district population within a catchment area which has changed little in the last three decades. Emergency general surgical and urological admissions have been admitted to the same department throughout that time, with no major shifts of referrals to other specialists. In addition, the coding practice of the hospital has attracted relatively high scores for its accuracy from the regional quality control programme. These considerations suggested that a study of our emergency surgical admissions over 25 years would provide a reasonable reflection of changes in emergency surgical practice during the latter part of the 20th century.

Patients and Methods

The Royal Devon and Exeter Hospital is a district general hospital serving a population which increased from 281,000 in 1974 to 335,485 in 1998 – an increase of 19% (Table 1). The number of people over the age of 70 years increased from 38,000 to 51,361 (35% increase) during that time; and the number over 80 years of age increased from 9500 to 19,688 (107% increase).

Emergency general surgery was admitted under the care of four consultants in 1974, who dealt with all elective and emergency general surgery and urology. By 1998, this number had doubled to six general surgeons and two urologists, but all emergencies continued to be admitted under the general surgeons (being transferred to the urologists as appropriate the following day).

Details of all emergency admissions under the care of the general surgeons were retrieved from the Patient Administration System (PAS) computer system for every fourth year during a 25 year interval (1974, 1978, 1982, 1986, 1990, 1994, and 1998) including age, primary diagnosis, duration of hospital stay, and hospital mortality.

The commonest primary diagnoses were analysed for their incidence per 100,000 catchment area population in each of the years studied. These diagnoses were chosen by studying all the diagnostic codes recorded, and combining some to provide clinically relevant categories (for example all diagnostic codes relating to gallstones and biliary disease; and miscellaneous urological diagnoses). Significant changes in incidence were sought by analysing the differences in two independent proportions between 1974 and 1998 for each diagnosis (comparing numbers of admissions per 100,000 catchment population for each year).¹² This method was also used to compare the incidence of hospital deaths in 1974 and 1998. The results are presented with 95% confidence intervals (CI), and with a P value for those which showed a significant

Table 3 Numbers of specified primary diagnoses among the emergency admissions for each year, with the incidence per 100,000 population shown in *italics*. The right hand column shows 95% confidence intervals (CI) and a P value for analysis of the incidence per 100,000 population in 1974 compared with that in 1998.

(a) Conditions which increased significantly in incidence from 1974 to 1998

	1974	1978	1982	1984	1990	1994	1998	1998 versus 1974 95% CI and P value
Aortic aneurysm – ruptured	1 <i>0.4</i>	7 <i>2.4</i>	6 <i>2.0</i>	7 <i>2.3</i>	12 <i>3.8</i>	14 <i>4.3</i>	22 <i>6.6</i>	1.0 to 11.4 <i>P</i> < 0.05
Biliary /gallstones	70 <i>24.9</i>	107 <i>37.1</i>	124 <i>41.9</i>	100 <i>32.7</i>	128 <i>40.0</i>	173 <i>53.0</i>	158 <i>47.1</i>	5.6 to 38.9 <i>P</i> < 0.01
Constipation	16 <i>5.7</i>	21 <i>7.3</i>	27 <i>9.1</i>	34 <i>11.1</i>	92 <i>28.8</i>	113 <i>34.6</i>	136 <i>40.5</i>	21.4 to 48.2 <i>P</i> < 0.001
Cutaneous abscess	18 <i>6.4</i>	28 <i>9.7</i>	31 <i>10.5</i>	28 <i>9.2</i>	41 <i>12.8</i>	63 <i>19.3</i>	61 <i>18.2</i>	2.1 to 21.5 <i>P</i> < 0.05
Diverticular disease	30 <i>10.7</i>	31 <i>10.8</i>	92 <i>31.1</i>	60 <i>19.6</i>	80 <i>25.0</i>	90 <i>27.6</i>	88 <i>26.2</i>	3.6 to 27.4 <i>P</i> < 0.05
Gastroenteritis	13 <i>4.6</i>	33 <i>11.5</i>	29 <i>9.8</i>	20 <i>6.5</i>	6 <i>1.9</i>	8 <i>2.5</i>	82 <i>24.4</i>	9.3 to 30.4 <i>P</i> < 0.001
Non-specific abdominal pain	189 <i>67.3</i>	330 <i>114.5</i>	411 <i>138.9</i>	523 <i>170.1</i>	583 <i>182.4</i>	682 <i>20.9</i>	555 <i>165.4</i>	68.2 to 128.0 <i>P</i> < 0.001
Pilonidal sinus	7 <i>2.5</i>	10 <i>3.5</i>	14 <i>4.7</i>	28 <i>9.2</i>	27 <i>8.5</i>	28 <i>8.6</i>	32 <i>9.5</i>	0.21 to 13.8 <i>P</i> < 0.05
Urinary retention	16 <i>5.7</i>	23 <i>8.0</i>	61 <i>20.6</i>	78 <i>25.5</i>	108 <i>33.8</i>	118 <i>36.1</i>	108 <i>32.2</i>	14.6 to 38.6 <i>P</i> < 0.001
Ureteric calculus	20 <i>7.1</i>	29 <i>10.1</i>	31 <i>10.5</i>	33 <i>10.8</i>	38 <i>11.9</i>	44 <i>13.5</i>	115 <i>34.3</i>	14.6 to 39.8 <i>P</i> < 0.001
Urinary problems	46 <i>16.4</i>	76 <i>26.4</i>	109 <i>36.9</i>	109 <i>35.6</i>	153 <i>47.9</i>	220 <i>67.4</i>	121 <i>36.1</i>	5.5 to 33.9 <i>P</i> < 0.01

(b) Conditions which decreased significantly in incidence from 1974 to 1998

	1974	1978	1982	1984	1990	1994	1998	1998 versus 1974 95% CI and P value
Appendicitis	321 <i>114.2</i>	310 <i>107.5</i>	274 <i>92.6</i>	270 <i>88.2</i>	253 <i>79.1</i>	249 <i>76.3</i>	227 <i>67.7</i>	–20.0 to –72.9 <i>P</i> < 0.001
Intestinal obstruction (non-malignant)	75 <i>26.7</i>	61 <i>21.2</i>	74 <i>25.0</i>	60 <i>19.6</i>	104 <i>32.5</i>	162 <i>49.5</i>	92 <i>5.4</i>	–10.2 to –32.4 <i>P</i> < 0.001

(c) Conditions which did not change significantly in incidence between 1974 and 1998. This table includes conditions which showed a peak in incidence during the mid part of the study interval, rather than a gradual trend

	1974	1978	1982	1984	1990	1994	1998	1998 versus 1974 95% CI*
Ano/rectal abscess	22 <i>7.8</i>	26 <i>9.0</i>	40 <i>13.5</i>	41 <i>13.4</i>	56 <i>17.5</i>	57 <i>17.4</i>	50 <i>14.9</i>	–2.2 to +16.4
Aortic aneurysm – non-ruptured	3 <i>1.1</i>	6 <i>2.1</i>	2 <i>0.7</i>	6 <i>2.0</i>	12 <i>3.8</i>	10 <i>3.1</i>	16 <i>4.8</i>	–1.1 to +8.5
Carcinoma of colon/rectum	68 <i>24.2</i>	66 <i>22.9</i>	57 <i>18.3</i>	57 <i>18.6</i>	75 <i>23.5</i>	65 <i>19.9</i>	63 <i>18.8</i>	–18.3 to +7.5
Femoral hernia	27 <i>9.6</i>	–	25 <i>8.5</i>	36 <i>11.8</i>	21 <i>6.6</i>	18 <i>5.5</i>	22 <i>6.6</i>	–10.9 to +4.9
Inguinal hernia	59 <i>20.3</i>	44 <i>15.3</i>	74 <i>25.0</i>	60 <i>19.6</i>	61 <i>19.1</i>	53 <i>16.2</i>	54 <i>16.1</i>	–16.0 to +7.6
Peripheral arterial disease	36 <i>12.8</i>	43 <i>14.9</i>	52 <i>17.6</i>	53 <i>17.3</i>	72 <i>22.5</i>	111 <i>33.9</i>	66 <i>19.7</i>	–4.3 to +18.7
Rectal bleeding	–	–	14 <i>4.7</i>	10 <i>3.3</i>	30 <i>9.4</i>	39 <i>11.9</i>	37 <i>11.0</i>	–1.46 to +14.1

*Values were statistically not significant.

change. All analyses were done according to the number of admission episodes.

The use of the PAS system as a basis for our data deserves comment for three reasons. First, because of past criticisms about its potential for inaccuracy – this is the system which provides Hospital Activity Analysis (HAA) data.¹³ Our hospital has had a record of favourable external coding assessments over many years (recent coding of primary diagnoses across all specialities was at least 89% accurate). Second, it should be noted that there was a change in coding from International Classification of Diseases version 8 (ICD 8) to ICD 9 in 1979, and to ICD 10 for 1998. Two specific problems with ICD 8 were a lack of certain codes (for example intestinal ischaemia), and an incapacity to differentiate between the presentations of peptic ulcer (perforation, bleeding, neither) – this is why all diagnoses involving peptic ulcer were grouped together. Third, small numbers of some diagnoses in the 1970s in this study raised suspicion of incomplete recording (for example only 16 cases of urinary retention in 1974 and 23 in 1978), but we could not identify other codes under which cases might reasonably have been 'hidden'. Checking the total numbers of emergency admissions for each individual year from 1974 to 1984 showed a steady and credible rise, suggesting that most cases had been captured and coded.

Results

There was a total of 19,931 admissions in the 7 years studied, with increases in the numbers of admissions and in the mean age of patients (Table 1). As shown in Table 1, the duration of hospital stay and the hospital mortality rate both decreased.

Table 2 shows calculations of the numbers of occupied bed days, and the average numbers of beds required each day for emergencies in each year of the study. The mean length of stay almost halved during the 25-year study interval, and the calculated numbers of occupied bed days (and the daily bed requirements) decreased slightly.

Table 3 presents the frequencies of individual conditions year by year, showing both the absolute numbers of patients with each diagnosis, and also the incidence of each condition per 100,000 catchment population per annum.

Discussion

The progressive increase in the numbers of emergency surgical admissions and decreasing length of hospital stay shown in this study accord with other reports on the overall trends of emergency work over recent years. These observations invite a number of interpretations.

The rise in admission numbers must be due, in part, to the increasing population, but also in part to the disproportionate increase in the numbers of elderly people. However, these

factors cannot account for the whole increase, and referral patterns almost certainly contribute. Enhanced expectations of patients, the fears of doctors about medicolegal action, and greater use of 'on-call' services by general practitioners during the period of this study may have all lowered the threshold for referral to hospital from primary care. In addition, self-referral to the accident and emergency department seems to have become more frequent. These influences might have accounted for the large increase in frequency of non-specific abdominal pain and constipation as causes of emergency admission. There is evidence that a proportion of the increase in emergency admissions is due to re-admission (perhaps as a result of earlier discharge from hospital),³⁴ but this aspect was not addressed by the present study.

The rising numbers of emergency admissions have been accommodated without an apparent need for any great increase in numbers of surgical beds, and this contrasts with the observations of Chezian and colleagues.⁸ Nevertheless, the more rapid turnover of emergencies places considerable demands on nursing, medical, and ancillary staff in terms of their intensity of work and their morale. Bagust *et al.*¹⁴ have described the need for spare bed capacity in the effective management of emergency admissions. These are important considerations in the currently perceived crisis within the National Health Service.

The changes in numbers of primary diagnoses almost certainly reflect real changes in the incidence of some conditions over the years. The most noticeable decrease was in the incidence of acute appendicitis – a change also observed in other studies.^{15,16} Conditions which have been documented as increasing in frequency in recent years include aortic aneurysm (both ruptured and non-ruptured):^{17,18} we observed a significant increase only in ruptured cases, although there was a steady (non significant) increase in the numbers of non-ruptured cases presenting as emergencies. Increases in the emergency presentation of biliary disease¹⁹ and in emergency operations for diverticular disease have also been observed in other studies.²⁰ There is a widespread belief that complications of peptic ulcer have become less common since the introduction of more effective medical therapies in the late 1970s, but we saw no continuous or significant trend during the 25 years of this study.

A few diagnoses became surprisingly more frequent during the 25 years of the study, such as cutaneous abscesses and cellulitis, and pilonidal sinus. Perhaps some of these used to be dealt with in the past by general practitioners in community hospitals (with which our district has always been well endowed). The huge increase in all kinds of urological problems also exceeded our expectations: some of this increase may be explained by increasing age of the population, and some by a lower threshold for emergency referral from primary care, but these two factors are unlikely to explain such a large increase.

The fact that all analyses were done for numbers of admission episodes meant that patients with multiple admissions in any year were counted more than once. However, any inaccuracies introduced by multiple admissions on the calculated incidence of specific conditions was likely to be minor – both in the context of the total number of admission episodes, and because multiple admissions were likely to have occurred similarly in each of the years studied.

Conclusions

This study confirms that emergency general surgical admissions have contributed to the rise in emergency work which is often attributed simply to medical patients, and which is hampering the ability of many hospitals to deal with elective cases. Surgeons and managers need to consider ways of addressing the problem, which may well include greater involvement of consultants in assessing patients, with cancellation of their elective commitments when on call for emergencies. This in turn would have implications for arranging cover when on leave, and for the experience and training of junior staff. Surgical assessment or emergency admission units are possible adjuncts, while the ready availability of emergency operating theatres is still an unsolved problem in many hospitals. These are just some of the many possibilities which should be debated, in an attempt to deal efficiently with the problem of increasing emergency admissions.

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