PAPERS AND SHORT REPORTS

Scoring system to improve cost effectiveness of open access endoscopy

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Abstract

The introduction of an open access general practitioner endoscopy service may result in many unnecessary examinations being performed. In an attempt to prevent this, 235 patients attending for endoscopy were interviewed and the results analysed to determine which factors best discriminated between those with major disease (ulcers, cancers, oesophageal strictures; $n=48$) and those without ($n=187$). The six characteristics which best discriminated between the two groups were increasing age, history of vomiting, male sex, smoking, and a past history of peptic ulcer or hiatus hernia. With the use of these six features a scoring system was devised, designed to give an indication of the likelihood of finding such disease in an individual patient. This was assessed prospectively in a further 356 patients.

The results showed that by utilising this scoring system it would be possible to reduce the number of examinations performed by 30% yet still detect 98% of serious disease. If confirmed in further prospective studies, this scoring system (or a modification) could more accurately assess individual priority for endoscopy and enable optimum use to be made of limited resources.

Introduction

With the introduction of fiberoptic endoscopy, large numbers of gastroscopy units have been established throughout Britain.

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In most centres access to this service is limited to hospital practitioners, but in an attempt to reduce the increasing load of outpatient referrals some gastroenterologists have adopted an "open access gastroscopy service," accepting direct referral from the general practitioner.¹⁻³ Although popular with the general practitioners, who appear to have a similar positive yield from their requests as hospital doctors, the introduction of such a system results in a large increase in the number of endoscopies performed.² Furthermore, as numbers increase a greater percentage of patients are found to be normal or to have minor, probably insignificant disease.

The increase in endoscopies which results from an open access service does not appear to result in earlier diagnosis of gastric cancer⁴ or in a reduction in the incidence of the major complication of peptic ulcer disease.⁵ Despite this, however, the introduction of open access endoscopy appears to be a rational development, particularly as general practitioners have for many years been able to order barium studies. It has thus become important to devise methods which would reduce the number of referrals from general practitioners without leading to unnecessary delay in diagnosing patients with serious disease.

We have investigated methods whereby this aim might be achieved. This entailed statistical analysis of the multiple variables obtained from interviewing patients attending for endoscopy. The results suggest that six variables may be used to differentiate patients with serious disease from those without. From these a simple scoring system may be devised which would allow for assessment of the patient's priority for endoscopy, thus allowing a more cost effective use of available resources.

Patients and methods

A total of 235 patients attending for gastroscopy after direct referral from their general practitioner were asked to complete a standard questionnaire of 27 items. The following information was obtained: age, sex, presence of symptoms (abdominal pain, vomiting, loss of weight or appetite, haematemesis, melaena, dysphagia), and present medication; characteristics of abdominal pain if present (for example, duration, relation to food, antacids, and sleep); past history (peptic ulcer, hiatus hernia, or operations); previous investigations; and smoking and alcohol consumption.

On the basis of the subsequent endoscopy result the patients were

divided into two groups depending on whether significant disease was found. For this report significant disease was considered to be carcinoma of any kind, ulcers of any kind, and malignant or benign oesophageal strictures; the remaining patients (classified as non-severe) were those in whom endoscopy either showed nothing abnormal or detected abnormalities considered to be of doubtful clinical relevance.

Analysis—The Statistical Package for the Social Sciences version was used for the stepwise discriminant analysis of the data.⁶ The technique of stepwise discriminant analysis selects those attributes which best

TABLE 1—Incidence of each variable in those with serious disease found at endoscopy and those without (figures are percentages)

	Patients with serious disease (n = 48)	Patients without serious disease (n = 187)
Age (years):		
≤ 49	20	50
50–	24	20
60–	28	19
70–	28	10
Sex male	74	48
Previous history:		
Peptic ulcer	26	10
Hiatus hernia	20	10
Barium meal	54	43
Gastroscopy	20	14
Abdominal surgery	19	17
Duration of symptoms:		
0–2 months	33	26
3–6 months	11	10
> 6 months	55	50
Presence of:		
Vomiting	50	26
Anaemia	7	9
Weight loss	50	35
Anorexia	41	30
Haematemesis	7	4
Smokers	50	37
Pain relieved by:		
Milk	35	47
Antacid	63	63
Food	30	31
Opening bowels	50	63
Pain worsened by food	41	30
Pain associated with:		
Constipation	28	20
Diarrhoea	15	15
Wind	28	34
Pain interferes with sleep	48	49
Pain:		
Continuous	11	12
Intermittent	57	64
Localised	63	64
Generalised	20	27
Improved since test requested	31	41
Medication:		
Total taking antacids	52	59
Antacids for six weeks	15	16
Antacids for one year	35	21
Antiemetics	2	6
Antidepressants	7	11
Cimetidine	9	9
"Tonic"	9	15
Analgesics	6	4

distinguish between patients with and those without serious disease. The procedure first selects the single most important variable; then, with this included, it chooses the variable which, when combined with the first, most improves the distinction between the two groups. A third variable is then chosen with the first two being already included in the function. The procedure continues until no extra discrimination is achieved by adding more variables. From the resulting discriminant function a scoring system was devised which took into account the relative importance of each factor.

Results

Of the 235 patients subjected to endoscopy, 96 were found to be normal, 12 to have gastric ulcers (four malignant), 25 to have duodenal ulcers, and 11 to have oesophageal strictures (seven malignant). The remainder had less severe changes such as gastritis, duodenitis, or hiatus hernia. Thus for this study 48 (20.4%) of the patients were considered to have serious disease. Table 1 gives the results of the questionnaire study comparing the incidence of each variable in patients with and patients without serious disease.

The stepwise discriminant analysis was of particular value in determining which features best distinguished between the two groups. In order of importance, these were the age of the patient, a history of vomiting, male sex, a history of smoking, and previous

peptic ulcer disease or hiatus hernia. A scoring system was devised from these six factors which could be simplified for everyday use (table II). The total score for each subject was achieved by adding together the six separate scores (over one for each of the six variables). Thus a man of 70 who smoked and had a history of vomiting would score 695 on the original score (206 + 161 + 141 + 109 + 39 + 39) and 14 on the simplified system.

TABLE II—Scoring systems for detecting patients with serious disease. Total value for each patient achieved by adding together the six individual scores obtained for each heading

	Original calculation	Simplified system
Age (years):		
≤ 49	52	1
50–	103	2
60–	155	3
70–	206	4
Vomiting:		
No	54	1
Don't know	107	2
Yes	161	3
Sex:		
Female	70	1
Male	141	2
Smoking:		
No	36	1
Don't know	73	2
Yes	109	3
Previous ulcer:		
No	39	1
Don't know	78	2
Yes	117	3
Hiatus hernia:		
No	39	1
Don't know	79	2
Yes	118	3
Minimum total score	290	6
Maximum total score	852	18

Tables III and IV show the distribution of patients on the basis of score for the original and simplified scoring systems. With the original scheme 71 (30%) of the patients had a score below 400, and only one of these (1.4%) was found to have serious disease (duodenal ulcer). A total of 141 (60%) had a score below 500, and 10 (7%) of these had serious disease. Similarly, using the simplified scheme 77 (33%) of the patients had a score below 8, and only one of these (1.3%) had serious disease (duodenal ulcer). Thus the score of each patient gave some indication of the likelihood of finding serious disease in that patient.

Table V shows the findings with patients divided into groups on the basis of the presence or absence of one or more of the discriminating factors without using the scoring system. Thus if patients under 55 with no previous history of peptic ulcer disease were not examined 19% of serious disease would be missed. By excluding non-smokers under 55 with no history of vomiting, 44 (19%) fewer endoscopies would have been performed but 98% of serious disease would have been found.

PROSPECTIVE TESTING

We are currently assessing this scoring system in a prospective study of a large number of patients undergoing endoscopy in two hospitals with differing endoscopy practice. At the time of this report 356 patients had been included, of whom 107 (31%) had major disease (cancer 16, ulcers 83, benign oesophageal strictures 8). Interestingly, the incidence of serious disease was 22.9% in the hospital with an open access endoscopy service and 39.2% in that with a restricted hospital service. A total of 116 patients (33%) had an individual score below 400, and only two of these (both young women with duodenal ulcers) scored less than 400 (1.8% of all patients with serious disease). All 16 patients with cancer scored high (mean 625, range 535–703). A further 30 patients with gastric cancer collected retrospectively were also found to have scores above 500.

Discussion

We have identified the six characteristics which could be used to predict which patients attending an open access gastroscopy clinic would be expected to have serious disease. In

order of importance, these characteristics were age over 55, history of vomiting, male sex, history of smoking, and previous peptic ulcer or hiatus hernia. These results are largely compatible with those from studies assessing the outcome of barium meal investigations,^{7,8} although unlike these we found that the nature of the pain was less discriminatory. It is perhaps surprising that symptoms such as anorexia and weight loss are not good discriminative factors, as they occur more frequently in patients with serious disease. Patients who lost weight, however, were generally older and thus had already been selected out on the basis of this.

Arguably our criteria for judging serious disease may be an oversimplification. In our opinion, however, these are conditions which if detected would be most likely to alter treatment. The relevance of gastritis, duodenitis, or hiatus hernia—which are all commonly encountered—is unclear, and their treatment is

mainly directed at symptomatic relief and unlikely to be greatly altered by accurate diagnosis. Nevertheless, if other workers thought that these were important it would be possible to change the scoring system to take other conditions into account.

There have been several reports of computer diagnosis of patients with dyspepsia, and it is possible quite accurately to predict the final diagnosis.⁹⁻¹² This, however, requires a time consuming interview and the use of a microcomputer, neither of which at present is practicable for a busy general practitioner or gastroenterologist. A system such as ours based on six simple questions therefore appears to have many advantages.

These results have special relevance in the assessment of patients referred for endoscopy by their general practitioner. A form which demands information regarding the six factors shown to be discriminatory could easily be devised, enabling a score to be calculated. Although the original system would

TABLE III—Breakdown of disease into groups divided by score using original system

	Score					
	<400	400-449	450-459	500-549	550-599	≥600
No of patients	71	39	31	42	26	26
Normal	41	13	14	15	8	5
Gastritis	5	3	2	1	3	
Duodenitis	3	4	2	5		1
Oesophagitis	5		4	2	2	2
Hiatus hernia	9	4	3	2	2	1
Hiatus hernia with oesophagitis	7	8	4	3	2	1
Duodenal ulcer	1	3	1	7	4	9
Gastric ulcer:						
Benign		2	1	1	2	2
Malignant		1		1	1	1
Oesophageal stricture:						
Benign		1		1		2
Malignant				3	2	2
Total serious disease in group	1 (1.4%)	7 (18.0%)	2 (6.5%)	13 (31.0%)	9 (34.6%)	16 (61.5%)
% Reduction in examinations if patients with this score or less not examined	30	47	60	78	69	100
% Serious disease missed if patients with this score or less not examined	2	17	21	48	67	100

TABLE IV—Breakdown of disease into groups divided by score using simplified system

	Score					
	≤8	9	10	11	12	≥13
No of patients	77	45	34	31	25	23
Normal	44	16	15	8	9	4
Gastritis	6	3	2	1	4	
Duodenitis	5	3	3	4		1
Oesophagitis	5	1	3	3	1	2
Hiatus hernia	9	4	3	2	2	1
Hiatus hernia with oesophagitis	7	10	3	3	5	1
Duodenal ulcer	1	4	3	4	5	8
Gastric ulcer:						
Benign		2	1	1	1	3
Malignant		1		1	1	1
Oesophageal stricture:						
Benign		1		1	2	
Malignant			2	2	1	2
Total serious disease in group	1 (1.3%)	8 (17.8%)	6 (17.6%)	9 (29.0%)	10 (40.0%)	14 (60.9%)
% Reduction in examinations if patients with this score or less not examined	33	52	65	78	98	100
% Serious disease missed if patients with this score or less not examined	2	19	32	41	62	100

TABLE V—Breakdown of findings in patients divided into groups depending on presence or absence of one or more variable

	Under 55	Under 55 no previous peptic ulcer	Under 55, no vomiting	Under 55, non-smoker	Under 55, female	Under 55 no vomiting, non-smoker	Under 55 female, no vomiting	Under 55 female, non-smoker
Total No	126	105	84	68	62	44	43	32
Normal	62	54	43	36	34	25	25	16
Gastric ulcer:								
Benign	3	3	2		2			
Malignant								
Duodenal ulcer	11	6	4	4	1	1	1	1
Oesophageal stricture:								
Benign								
Malignant								
% Reduction in examinations if group not investigated	54	45	36	29	26	19	18	14
% Serious disease missed if group not investigated	36	19	13	8	6	2	2	2

probably be more accurate, the simpler system appears to be more practical for everyday use. From the individual score the likelihood of finding serious disease could be assessed. Depending on resources and the number of investigations that the department is prepared to perform a cut off score could then be introduced. Patients referred by their general practitioner who fall below this level would be deferred, with the doctor retaining the option of seeking a consultant opinion.

An alternative way of restricting the numbers of investigations would be to exclude certain groups of patients in whom there is less likelihood of finding serious disease. This method—although more easily applicable—is not as effective as the scoring system. Whichever system is used, however, there will always be occasional patients with serious disease who do not meet the criteria for investigation. Fortunately, our results suggest that these are likely to be patients with peptic ulcer disease, as patients with malignant disease generally scored higher. Finally, if either system is introduced it must be appreciated that it is merely a guide to the likelihood of finding serious disease in an individual patient and as such may not be appropriate for some patients with obvious indications for endoscopy.

In conclusion we suggest that, subject to confirmation in further prospective studies, the introduction of a simple scoring system could greatly increase the cost effectiveness of endoscopy. It has greatest potential in assessing individual priority and for allowing optimum use to be made of limited resources. Although the system is particularly applicable to open access endoscopy, when it can be used to restrict the number of

examinations performed, we are currently assessing its relevance for hospital based endoscopy.

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Effect of terbutaline sulphate in chronic "allergic" cough

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Abstract

The effects of terbutaline sulphate were studied in 30 patients who presented with chronic cough at an allergy clinic. After a three week baseline period terbutaline and its placebo were given for two periods of three weeks each in a randomised, double blind, crossover manner. Patients kept a daily record of day and night cough scores and peak expiratory flow readings. Twenty one patients responded to terbutaline; placebo produced no significant effect. Both day and night cough scores ($p < 0.001$) and peak expiratory flow rates were significantly improved ($p < 0.05$) by the end of the first week of treatment with terbutaline. This improvement was achieved with only a fairly small change in airway calibre.

Introduction

Cough may be caused by a wide variety of conditions affecting different anatomical sites.¹⁻³ Definitive treatment depends on

establishing the underlying cause. Although cough, dyspnoea, and wheezing constitute the triad of classical symptoms of asthma, cough may precede the other symptoms or indeed be the sole manifestation of an allergic state, and this is often overlooked. In Kuwait chronic intractable cough, frequently non-productive, is common, particularly during the spring and summer.⁴ In the present study I assessed the effects of terbutaline sulphate in 30 patients who presented at an allergy outpatient clinic with chronic cough in the absence of dyspnoea.

Patients and methods

I studied 30 patients attending the allergy outpatient clinic over three years. They were prospectively selected if they presented with a chronic cough of at least three months' duration that was unaccompanied by dyspnoea or wheezing. None of the patients smoked or had any evidence of lung disease. The table shows clinical and physiological data on the patients studied. After a careful physical examination all patients underwent radiography of the chest and sinuses and electrocardiography. Bacteriological examination of the sputum was carried out whenever the cough was productive. In addition, blood specimens were examined for eosinophils, and prick skin tests with a wide variety of allergens were performed. No patient had been receiving antiasthma treatment before referral to the clinic. Most had previously received multiple courses of different antibiotics, antitussives, decongestants, and antihistaminics with no effect.

Before admission to the study reversibility of any airflow obstruction present was tested for with a dry wedge spirometer (Vitalograph), the forced expiratory volume in one second being measured before

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