MEDICAL PRACTICE

Clinical Problems

Diagnosis of Gastric Cancer

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Summary

A prospective comparison was made of the accuracy of different diagnostic methods for gastric cancer. The basis of the study was a consecutive series of 113 patients thought to have gastric pathology; cancer was the final diagnosis in 32. Endoscopy and radiology were the most accurate investigations, whereas biopsy, cytology, and clinical examination gave disappointing results. A wide range of clinical features and laboratory investigations were studied in all patients in an attempt to identify criteria suggestive of malignancy. Multifactorial computer analysis of these investigations failed to improve upon the radiological diagnosis. A systematic approach designed to make optimal use of limited endoscopic and histopathological resources in the diagnosis of gastric lesions is presented.

Introduction

The differentiation between benign and malignant gastric ulcers poses a difficult clinical problem with important prognostic and therapeutic consequences.[1] The advent of endoscopy, with biopsy under direct vision, has been a major advance in the diagnosis of gastric cancer.[2] However, endoscopy facilities are not universally available, and the establishment of such a service is limited by expense and the shortage of trained personnel.[3] This study was conducted: (1) To assess the diagnostic value of endoscopy when compared with that of conventional investigations in a district general hospital and to establish how best to use limited facilities for endoscopy; (2) to study a number of clinical signs and symptoms and laboratory investigations to identify factors differentiating benign from malignant lesions; and (3) to attempt by computer analysis to identify combinations of factors which might predict more accurately the nature of gastric ulcers.

Subjects and Methods

One hundred and thirteen patients (71 males, mean age 62·0 years, and 42 females, mean age 64·2) attending Northwick Park Hospital were studied. In 106 the point of entry to the trial was when a barium meal, ordered as a routine primary investigation, had disclosed a gastric lesion. The remaining seven were admitted to the trial because of a strong clinical suspicion of gastric disease. All 113 patients were then studied prospectively by a series of investigations: endoscopy, biopsy, gastric exfoliative cytology, clinical examination, and a number of laboratory tests.

A final diagnosis in all patients was established at operation, necropsy, or follow-up for at least one year. The relative diagnostic accuracy of each of the special studies was then assessed against this final diagnosis.

Methods

CLINICAL DIAGNOSIS

The clinical diagnosis was that recorded by the clinician after his first examination of the patient.

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CLASSIFICATION OF INVESTIGATIONS

The appropriate specialist classified the results of the barium meal, endoscopy, biopsy, and cytology examination into one of six categories: (1) no gastric lesion, (2) benign gastric lesion, (3) malignant gastric lesion, (4) uncertain if gastric lesion present, (5) uncertain if gastric lesion benign or malignant, (6) technically unsatisfactory. Only the result of the first test in each investigation was used.

CLINICAL FEATURES

All the patients were questioned and examined by A.W.S. before the results of investigations were known. They were asked about abdominal pain (presence or absence, duration in months, and whether aggravated or relieved by food, vomiting, smoking, alkalis, and alcohol), anorexia (severity and duration), vomiting and the severity thereof, haematemesis, melaena, malaise, and abdominal swelling. Changes in the patient's weight were determined by comparing his steady weight, ascertained by direct questioning, with measurements made at the initial presentation of the patient to hospital with the current illness.

The patient was examined for the presence of pyrexia, anaemia, weight loss (and extent thereof), lymphadenopathy, jaundice, abdominal mass, abdominal tenderness, succussion splash, ascites, hepatomegaly, and abnormalities on rectal examination.

ENDOSCOPY

The first 69 patients were examined with a combination of an Olympus oesophagoscope (EF) and an Olympus gastroscope (GFB). The last 44 patients were examined with an Olympus GIF D panendoscope. Standard endoscopic procedures were followed.[4]

BIOPSY

With the Olympus biopsy forceps 5 to 10 specimens were taken from the ulcer rim in each patient.

CYTOLOGY

Gastric washings for cytological examination were obtained before studies of gastric acid began. A naso-gastric tube was passed and the resting juice aspirated (specimen 1). 200 ml of normal saline was then injected into the stomach through the tube, and the tube clamped. The patient was then asked to move about as actively as possible in order to circulate the saline over the gastric mucosa. After five minutes the tube was unclamped and the saline aspirated from the stomach (specimen 2). Both specimens were immediately transported in ice to the laboratory and processed for microscopical examination.[5]

RADIOLOGY

Barium meal examinations were performed as part of the routine diagnostic service by consultant radiologists and by registrars at all stages of training.

GASTRIC ACID STUDIES

Basal and peak acid output after pentagastrin stimulation (0·6 μg/kg body weight) were measured in the standard way.[6]

OTHER INVESTIGATIONS

Biochemical measurements and blood grouping were performed by routine methods. Blood counts were performed in the Coulter Counter model S. Serum autoantibodies were measured by Mancini radial immunodiffusion, serum vitamin B_{12} levels by microbiological assay,[7] plasma carcinoembryonic antigen by radioimmunoassay,[8] and α-fetoprotein concentrations by immunoelectrophoresis.[9]

ESTABLISHMENT OF FINAL DIAGNOSIS

A gastric lesion of whatever nature was considered as confirmed for the purpose of this study if observed at operation or necropsy, if clearly visible at endoscopy, or if the same lesion was clearly visible on at least two sequential radiological examinations. This was the case in 113 patients. Malignant lesions were identified in 25 of these patients by histological examinations of operative (21) or necropsy (4) specimens. Seven patients who died did not have either an operation or necropsy but were included in the group with malignant disease because in all cases there was clear clinical, radiological, and endoscopic evidence of a large gastric tumour and because biopsy, and in four cases cytology, gave unequivocal evidence of malignancy. Benign lesions were identified in 15 patients by operation and in 42 patients by follow-up for at least 12 months from the time of the initial diagnosis of the lesion. A gastric lesion was excluded by operation in three patients, by necropsy in two, and by repeated endoscopic and radiological examinations in 17. Two patients lost to follow-up were excluded from the study.

Results

Of the 111 patients 32 were finally diagnosed as having a malignant lesion, 57 as having a benign lesion, and a local lesion was thought to be absent in the remaining 22. The accuracy of clinical, radiological, endoscopic, histological, and cytological diagnosis is shown in tables I, II, III. A malignant gastric lesion was correctly diagnosed by endoscopy in 93·5% of the patients studied, by radiology in 76·7%, and by biopsy in 70·0%. Cytology and clinical examination were much less accurate. A false positive diagnosis of malignancy was made in three patients by radiology and by endoscopy, and in one patient by biopsy.

TABLE II—*Incidence of False Positive Diagnosis of Malignancy*

Diagnostic Procedure	Final Diagnosis	
	Benign Lesion	No Local Lesion
Radiology	2/57 (3·5)	1/21 (4·8)
Endoscopy	2/57 (3·5)	1/22 (4·5)
Biopsy	1/55 (1·8)	0/9
Cytology	0/51	0/19
Clinical	8/51 (15·7)	3/20 (15)

The number of patients misdiagnosed by each procedure is given as a fraction of the total number of patients studied. The percentage this represents is shown in parentheses.

Clinical, haematological, biochemical, and immunological results which did not show statistically significant differences between malignant lesions and the other two groups are shown in table IV, whereas those which were significantly different at the 5% level are shown in table V.

Computerized multifactoral analysis of those factors in which a

TABLE I—*Malignant Gastric Lesions: Diagnostic Accuracy of Various Procedures*

Diagnostic Procedure	Diagnosis by Each Procedure						Number of Patients Studied by Each Procedure
	Malignant Lesion (Correct)	Possible Malignant Lesion	Benign Lesion	Possible Lesion	No Lesion	Unsatisfactory	
Radiology	76·7 (23)	6·7 (2)	6·7 (2)	6·7 (2)	3·3 (1)	0	30
Endoscopy	93·5 (29)	3·2 (1)	3·2 (1)	0	0	0	31
Biopsy	70·0 (21)	3·3 (1)	20·0 (6)	3·3 (1)	3·3 (1)	0	30
Cytology	30·8 (8)	11·5 (3)	3·8 (1)	3·8 (1)	30·8 (8)	19·2 (5)	26
Clinical	43·7 (14)	12·5 (4)	0	25·0 (8)	18·8 (6)	0	32

Results are expressed as percentages, and the number of patients each represents is shown in parentheses.

TABLE III—*Comparison of Accuracy of Various Procedures in the Correct Diagnosis of Malignancy*

			Incorrect			
		Radiology	Endoscopy	Biopsy	Cytology	Clinical
Correct	Radiology		2/29 (6·9)	4/28 (14·3)	13/25 (52·0)	14/30 (46·7)
	Endoscopy	6/29 (20·7)		7/30 (23·3)	15/25 (60·0)	16/31 (51·6)
	Biopsy	2/28 (7·1)	0/30		11/24 (45·8)	13/30 (43·3)
	Cytology	1/25 (4·0)	0/25	1/24 (4·2)		7/26 (26·9)
	Clinical	4/30 (13·3)	0/31	4/30 (13·3)	10/26 (38·5)	

For each pair of procedures the number of patients misdiagnosed by one and correctly diagnosed by the other is given as a fraction of the total number of comparisons. The percentage this represents is shown in parentheses.

TABLE IV—*Clinical Features and Laboratory Investigations the Results of which were not Significantly Different in Patients with Malignant Gastric Lesions*

Clinical Examination		Laboratory Investigation		
Symptoms	*Signs*	*Haematological*	*Biochemical*	*Immunological*
Abdominal pain	Abdominal tenderness	Erythrocyte sedimentation	Serum albumin	Carcinoembryonic
presence	Anaemia	rate	Alkaline phosphatase	antigen
effect of food,	Ascites	Haemoglobin	Bicarbonate	α-fetoprotein
vomiting, smoking	Hepatomegaly	White blood cell count	Bilirubin	Tissue autoantibodies
Abdominal swelling	Jaundice	Red blood cell count	Chloride	
Anorexia	Lymphadenopathy	Packed cell volume	Globulin	
Haematemesis	Pyrexia	Blood group	Iron binding capacity	
Melaena	Rectal examination		Potassium	
Previous perforation	Succussion splash		Sodium	
Vomiting	Weight loss		Urea	
Others				
Sex				

TABLE V—*Investigations in which the Results were Significantly Different at the 5% Level in Patients with Malignant Lesions*

Investigation		Final Diagnosis			
	Units	No Lesion	Benign	Malignant	S.D.
Clinical Features					
Abdominal pain					
Exacerbated by alcohol	%	18·2 (22)	18·5 (54)	0 (32)	
Improved by alkalis		45·5 (22)	55·4 (56)	28·1 (32)	
Duration (6 months or less)		57·1 (14)	56·4 (39)	83·3 (27)	
Anorexia (duration of 3 months or less)		27·3 (22)	26·3 (57)	40·6 (32)	
Malaise		33·3 (21)	47·3 (55)	68·7 (32)	
Abdominal mass (present)		19·0 (21)	9·3 (54)	40·6 (32)	
Investigations					
Age	Years	60·0 (22)	61·4 (57)	68·0 (32)	11·65
Weight loss	kg	4·5 (22)	3·3 (54)	6·8 (30)	5·42
Serum cholesterol	mmol/l	5·8 (19)	5·9 (54)	4·9 (28)	1·32
Serum iron	μmol/l	14·7 (22)	12·7 (56)	7·4 (31)	8·36
Serum vitamin B_{12}	ng/l	544 (21)	450 (55)	374 (25)	20·55
Peak acid output	mmol/kg/h	0·32 (18)	0·31 (47)	0·08 (22)	0·23

Results of clinical features are expressed as the percentage of patients in whom the symptom or sign is present. Results of investigations are expressed as the mean absolute value, and the overall standard deviation is shown. The number of patients on whom these measurements were made is shown in parentheses.

significant difference between benign and malignant lesions was observed (table V) did little to identify the lesion in an individual patient. The computer analysis suggested that none of the factors considered, alone or in combination, were particularly successful when the radiological conclusions were in doubt. We have not considered numerically the effect of simply repeating unsatisfactory radiological examination.

Discussion

The results of this study emphasize the great difficulty in distinguishing between benign and malignant gastric ulcers.

The first part of the study was aimed at determining the relative accuracy in a district general hospital of various procedures that might be used in the diagnosis of gastric lesions. As expected, clinical evaluation had poor discriminatory powers. Radiology, which was the basis for selection of the majority of patients for the trial, gave the correct diagnosis in 77% of the malignant lesions. The endoscopic appearance of the ulcer was the most accurate diagnostic criterion, malignant ulcers being diagnosed correctly in 94% and suspected in a further 3%. Malignant lesions were falsely diagnosed in three patients by both radiology and endoscopy. Under the conditions of this study endoscopy was found to have greater diagnostic accuracy than radiology, but the results are not truly comparable because radiology was

used primarily as a screening investigation whereas in the majority of cases endoscopy was performed as a definitive diagnostic procedure after the presence of a gastric lesion had been suspected on radiology. It is possible that the diagnostic accuracy of the procedures would have been reversed by reversing the order in which they were performed.

Cytological examination of gastric washings gave disappointing results. It was hoped that gastric washings taken immediately before gastric acid studies might be a simple and useful addition to the standard procedure. In some special centres gastric cytology has been useful in the diagnosis of gastric cancer,[10] but the methods we used often provided unsatisfactory material for examination in addition to the high yield of false negative results.

Biopsy of gastric ulcers under direct endoscopic vision was surprisingly inaccurate. In only 70% of neoplastic lesions did biopsy show histological evidence of malignancy. Similar results have been previously reported[4] and reflect the morphology of gastric cancers rather than poor technique, as it has been shown that biopsy of gastric cancer in operative specimens under direct vision has a similar failure rate.[11]

In the second part of the study a large number of clinical, biochemical, haematological, and immunological findings were studied in an attempt to identify factors indicative of malignancy. Only a few had any discriminatory value (table V). Though none

of them was diagnostic of malignancy, the patients with a loss in weight of greater than 7 kg, a palpable abdominal mass, a serum iron of less than 7 μmol/l, a peak acid output of less than 8 mmol/h in the first hour, a serum B_{12} level of less than 400 ng/l, or a serum cholesterol of less than 5 mmol/l, were more likely than not to have neoplastic lesions. Though of little value in isolation, these criteria may be useful in raising or increasing the suspicion of malignancy in lesions that otherwise appear benign or doubtful. It is of interest that the erythrocyte sedimentation rate, commonly thought of as an indicator of serious disease, was not significantly different in patients with benign and malignant gastric ulcers.

The final component of this study involved a computerized multi-factoral analysis of the investigations described above to differentiate benign from malignant lesions. The computer analysis weights the different factors to allow for their discriminative power. The analysis was done without including endoscopy. Radiology was picked out as by far the most discriminatory test, and in no case was the evidence from other factors sufficient to alter the radioscopic diagnosis when the latter was a firm one. When the radiological conclusions were uncertain (in 27 cases, or 24% of the total), the analysis suggested the presence of an abdominal mass as the most discriminating factor. When this was used alone, correct diagnoses were made in 18 out of 20 non-malignant cases but only 4 out of 7 malignant cases (endoscopic diagnosis was wrong in 1 and doubtful in 2 of the benign cases, and wrong in 1 of the malignant cases, for which the computer diagnosis was also incorrect).

What guides are these observations to the management of patients in whom gastric pathology is suspected or shown to be present? Firstly, gastric radiology, which has stood the test of time, appears to be reasonably accurate and is likely to remain as the preliminary examination. The definite radiological diagnosis of gastric cancer is rarely incorrect and should be taken as an indication for operation without recourse to endoscopy.

Endoscopy should be reserved for barium-negative dyspepsia and for the definitive diagnosis of any gastric lesion not diagnosed as malignant by radiology. The endoscopic diagnosis of malignancy by an experienced observer is much more accurate than

gastric biopsy (93 and 70% respectively). Thus gastric ulcers which appear malignant should be treated as such and biopsy reserved for equivocal or benign lesions. Endoscopy and biopsy can only confirm and never refute the presence of gastric cancer and thus should be repeated on ulcers in which serious doubt remains. Negative biopsies, which we found in 30% of malignant lesions, should never be taken to indicate the benign nature of a lesion—only that no evidence of malignancy was seen.

Loss of weight greater than 7 kg, short duration of pain, the presence of an abdominal mass, serum iron concentrations of less than 7 μmol/l, cholesterol of less than 5 mmol/l, a serum vitamin B_{12} level less than 400 ng/l, and a peak acid output of less than 8 mmol/h in patients with gastric lesions should alert the clinician to the possibility of malignancy.

It is hoped that the proposed approach to the diagnosis of gastric ulcers, which is in accord with the views of others,[4] will serve as a guide to the optimal use of limited endoscopic and histological resources.

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Pulled Elbow: A Study of 100 Patients

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Summary

Pulled elbow is a common condition but may not be recognized by practitioners unaware of its existence. Most of a series of 100 children with this condition were aged 1 or 2 years, and none were over 6 years. An important precipitating factor was the normal recalcitrance of the 1-3 age group. The three children who were over 5 years had all had earlier episodes which may have stretched the annular ligament. The wrist was the most common site of pain after the elbow. A single manipulation was successful in 96 cases but multiple manipulations may be needed.

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Introduction

A pulled elbow occurs in young children when the head of the radius is pulled partially through the annular ligament.[1-3] This may occur because the radial head may be small in relation to the annular ligament or because in certain positions of the arm —especially when the forearm is pronated—the shape of the head may make it liable to be pulled out of place. The fibres of the annular ligament may actually tear in some children.

Though pulled elbow is common and well recognized by orthopaedic surgeons[1-5] and has been well known for many years[6-8] it is often unrecognized by general practitioners, even those dealing with many children. Green and Gay[9] stated that cases of pulled elbow were often thought to be due to brachial plexus injury by doctors who did not know the condition.

The condition predominantly affects young children; there is an acute onset of considerable pain and parents are alarmed because the child suddenly loses the use of an arm. Thus, 100