MEDICAL PRACTICE

Occasional Review

Colonoscopy in surgical practice

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British Medical Journal, 1977, **1**, 149-151

Summary

Colonoscopy is a rewarding new technique with a potential for early and more accurate diagnosis. One hundred and seventy colonoscopies carried out over the past three years showed or confirmed colonic cancer in 14 patients, and solitary or multiple colonic polyps were found in 28 cases, of which 18 were excised endoscopically. A large villous adenoma was diagnosed in one patient, and the absence of a suspected sinister lesion was shown by direct examination and biopsy in 110 cases. There were 17 examination failures, including two perforations of the bowel.

Colonoscopy complements rather than supplants barium enema examination and will make diagnostic laparotomy for colonic lesions unnecessary. The use of the diathermy snare allows endoscopic removal of colonic polyps and should greatly reduce the need for formal surgery in these cases. The financial saving to the Health Service will greatly outweigh the expense of the procedure, but it should be undertaken only in well organised centres as a specialist service for selected patients. In skilled hands it is safe, but potential hazards exist for the inexperienced endoscopist.

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Introduction

Colonic cancer accounts for 8000 deaths annually in England and Wales.[1] The five-year survival rates for the condition have not improved for the past 30 years, but earlier diagnosis with consequent treatment of less extensive tumours would probably reduce the mortality figures significantly. The introduction of fibreoptic colonoscopy has made all parts of the colon accessible to direct vision and instrumentation.[2] Mastery of the technique may aid early diagnosis of colonic cancer by permitting thorough investigation of persistent, radiologically negative bleeding or change in bowel habit and by allowing regular examination and biopsy of patients with long-standing (and possibly pre-malignant) ulcerative colitis.

Equivocal lesions shown on barium enema examination can be viewed after bowel washout, so that endoscopic discrimination between polyps and faeces and between benign and malignant strictures can be achieved with a facility often denied the radiologist.[3] Direct examination of a suspicious lesion in the colon and, when appropriate, endoscopic polypectomy with retrieval of the specimen, can spare a patient the pain and morbidity of a laparotomy, and if done on an outpatient or short stay basis may result in a significant saving of Health Service funds by releasing the theatre time and beds, which can be used for other patients.

Several hundred colonoscopes have been purchased in Britain over the past five years, but the effect of their introduction into clinical practice in non-specialised hospitals has not been recorded and has led to speculation that most of the instruments are underused. Our purpose here is to show the value of the technique for diagnosing and treating colonic disease in a large general hospital and to emphasise that a viable and efficient service can be maintained for a relatively small outlay.

In December 1973 an Olympus CFLB2 185-cm colonoscope with a light source and biopsy forceps was bought for use in the Royal Victoria Infirmary, Newcastle upon Tyne. Some months later, the electrocoagulation diathermy equipment necessary for endoscopic polypectomy was bought by the scientific and re-

search committee of the Royal Victoria Infirmary. A diagnostic and therapeutic colonoscopy service was started, and over the past 33 months 170 separate endoscopic examinations of the colon have been undertaken on patients referred from the hospitals in the Newcastle Area Health Authority (Teaching) and from surrounding hospitals in the Northern Region.

Equipment, procedures, and experience

A fibreoptic colonoscope consists of a constantly aligned central bundle of some 30 000 glass fibres of about 12 μm in diameter. Each fibre is coated with a substance of lower refractive index so that all light passing along it is reflected internally. This phenomenon of total internal reflection allows a powerful beam to be transmitted unchanged from a proximal light source with the result that brilliant illumination can be achieved distally without heat transmission to the mucosa. The image formed distally can be transmitted undistorted to the proximal end of the instrument, where a suitable lens system will produce magnification.[4] The flexibility of the fibre-glass bundle allows a relatively safe passage of the most tortuous colon, and distal tip manipulation by four guide wires will permit four-way controlled angling up to 120° in two right-angled planes or poly-directional control up to 200°.[5]

Service and biopsy channels in the instrument allow distal vacuum suction or insufflation of air and water and facilitate a target biopsy technique under direct vision, either with biopsy forceps or with a cytology brush. The biopsy channel may also be used to pass a diathermy snare suitable for polypectomy, and modern instruments with two biopsy channels are available that allow the polyp to be secured with a separate polyp grasper during diathermy amputation.

PREPARATION

The techniques necessary for successfully examining the colon are complex, and failures may occur for various reasons. Stringent preliminary bowel preparation must be undertaken for about 36 hours by limiting intake of high-residue food and by prescribing suitable cathartics and enemas. With experience an empty colon can be produced in most patients, but this may be at a cost of physical discomfort, and care should be taken to ensure that the elderly and infirm are not subjected to unacceptable stress. Endoscopy can be carried out in an environment that is less than ideal provided that solid faeces are not present. The examination may be painful in some people and reactions may be accentuated by a natural apprehension of the unknown. It is kinder to prescribe an intravenous sedative and an intravenous analgesic at the outset in doses related to the individual's age and clinical condition. Inability to tolerate the amount of medication necessary for a successful examination—for example, in patients with chronic bronchitis or severe ischaemic heart disease—may be an absolute contraindication to the procedure.

HAZARDS AND CAUSES OF FAILURE

Colonoscopy can be unsuccessful because of instrument failure due to excessive torsional stresses produced by a redundant colon or because of the operator's inability to negotiate the tortuous loops encountered in the sigmoid colon and at the hepatic flexure. With practice, failure to carry out an examination owing to the distensibility of the bowel becomes uncommon, as various control manoeuvres allow the excess colon to be "concertina'd" over the instrument, thus restoring momentum to the tip of the endoscope. The force necessary to carry out these control manoeuvres may be considerable, and may result in bowel perforation, especially in the presence of restricting adhesions caused by previous surgery or diverticular disease. Both these factors may be absolute contraindications to colonoscopy. The hazard is reinforced in diverticular disease by the possibility of over-inflation and subsequent perforation of a thin-walled diverticular sac by excessive insufflation of compressed air.[6]

Redundancy of the colon, anatomical inconstancy of the colonic mesentery, and the fact that the organ has very few easily recognised internal features, has meant that radiological screening facilities are essential for comprehensive examination of the large bowel. The facility is needed for only a few seconds during each procedure to allow the anatomical position of the instrument to be confirmed, but the various guiding manoeuvres may be hazardous in the absence of radiological control and no serious colonoscopy can be undertaken without it.

ENDOSCOPIC POLYPECTOMY

Endoscopic polypectomy is associated with several potential hazards. Inconstant contact between the patient and the indifferent electrode during diathermy may lead to skin burns, and intraluminal explosions may result from ignition of any inflammable gas present in the bowel. Snare resection of a polyp may produce bowel perforation or uncontrollable bleeding. If the resected polyp is not retrieved a diagnosis of cancer may be missed, but successful extraction of the polyp does not entirely eliminate this problem, as the line of resection may be too superficial to allow examination of the pedicle for signs of invasion.

In practice most of these hazards can be avoided by scrupulous diathermy technique. Carbon dioxide is now generally insufflated into the bowel before electrosurgery to ensure a suitable inert environment, and most experienced endoscopists feel confident of success in resecting colonic polyps up to 2 cm in diameter. It has become evident over the past few years that colonoscopic polypectomy is a quick and safe alternative to laparotomy and colotomy[7]—a procedure that carries its own morbidity and mortality.[8]

EXPERIENCE

An average of five colonscopies have been carried out each month in Newcastle upon Tyne over the past three years. Two-thirds of the patients were referred by surgeons and one-third by physicians. Ninety-one examinations were carried out to inspect equivocal lesions identified by barium enema examination, and 30 examinations were undertaken to investigate undiagnosed rectal bleeding or persistent change in bowel habit after repeated barium studies had been negative. Thirty-two examinations were to assess the extent and severity of chronic inflammatory disease of the large bowel by multiple target biopsy of the diseased mucosa from caecum to rectum, and 17 examinations were performed to resect colonic polyps previously diagnosed by radiology.

Results

One hundred and fifty-three of the procedures were successful. In 89 the colon was completely examined but in a further 64 a sigmoid lesion was found and accepted as the cause of the symptoms provided that a technically satisfactory barium enema examination was otherwise normal.

Seventeen examinations were unsuccessful. Ten occurred in the first year of operation, five in the second, and two in the third. In two patients bowel perforation occurred as a result of colonic immobility produced by peridiverticular adhesions of the sigmoid loop. Immediate laparotomy was performed in both cases. In one case polypectomy and oversewing of the perforation was undertaken as there was no overt soiling of the peritoneum. In the other a large carcinoma of the descending colon was discovered proximal to the diverticular disease. A Hartmann's procedure with resection of the diseased bowel, oversewing of the rectal stump, and construction of a terminal colostomy was carried out. A third patient developed a large bowel intestinal obstruction some hours after successful colonoscopy. This was caused by partial volvulus of the transverse colon, which was overdistended with air, apparently trapped during colonoscopy by the acute angles of the hepatic and splenic flexures. Laparotomy, decompression of the bowel, and relief of the volvulus produced an uneventful recovery.

The cause of examination failure in the other 15 patients was varied. In four patients passage of the instrument round an easily distensible redundant sigmoid loop was impossible, and in two others the angle of the hepatic flexure was too acute to allow the endoscope tip to enter the ascending colon. In two patients the sigmoid loop was fixed extrinsically—in one case probably by adhesions from previous surgery, and in the other almost certainly by pericolic inflammation from severe Crohn's disease. Endoscope failure occurred on two separate occasions as a result of a guide wire fracture caused by unacceptable torsional stress, and in both of these cases the examination had to be abandoned. In three patients bowel preparation was inadequate, and in two patients the degree of analgesia that could be induced was insufficient to cope with the pain of the procedure.

Ten of the examination failures occurred in patients being investigated for equivocal lesions identified by barium studies (table I). Colonic cancer was diagnosed in nine of the other 81 patients and four patients were found to have colonic polyps. In the other 68 patients the presence of a sinister lesion was excluded by inspection and, when appropriate, biopsy.

TABLE I—*Results of colonoscopy*

	Reason for examination			
	Equivocal enema	Undiagnosed rectal bleeding	Assessment of inflammatory disease	Radiological evidence of polyps
No examined ..	91	30	32	17
No of technical failures ..	10	5	1	1
Lesion found ..	13	14	0 (ie, no malignancy on histology)	16
Lesion excluded	68	11	31	0

Five examination failures occurred in patients under investigation for undiagnosed but persistent change in bowel habit or rectal bleeding. In the other 25 patients in this group causative lesions were found in 14. Colonic cancer was diagnosed in five, solitary or multiple colonic polyps in seven, and a large villous adenoma in one. One patient had mild inflammatory bowel disease, which may have been responsible for the symptoms.

One examination failure occurred in the 32 patients under investigation for assessment of the extent and severity of long-standing colonic inflammatory disease. Considerable foreshortening of the colon was a feature of many of these patients, and probably explained why colonoscopy was effortless in most of them.

One examination failure occurred in the group of 17 patients who were known to have colonic polyps before endoscopy was carried out, but in four other cases in this group subsequent surgery was also necessary, as some of the polyps encountered were too large to be accommodated in the available polypectomy snares and thus could not be dealt with at the same time as the smaller lesions (table II).

TABLE II—*Results of polypectomy*

Initial diagnosis		Endoscopic polypectomy successful	Surgical polypectomy necessary
By radiology	17	12	5
By colonoscopy	11	6	5
Total	28	18	10

In 153 successful examinations colonic cancer was either confirmed or newly diagnosed in 14 patients. In 28 patients solitary or multiple polyps were found, which were totally excised endoscopically from 18 patients. A large villous adenoma was diagnosed in one patient, and the absence of any sinister lesion was shown by direct examination and biopsy in 110 cases.

Discussion

In a well-prepared bowel colonoscopy allows detailed examination of almost every part of the colon. Lesions may be missed around flexures, behind haustral folds, and as a result of the rapid movement of deliberately shortened loops of redundant bowel released from the tip of the instrument during withdrawal. Experience and careful re-examination of the equivocal area can minimise the number of false-negative examinations, but it is unlikely that the procedure will ever replace barium enema examination as the primary method of colonic screening, because it is too time-consuming and potentially more dangerous and painful. No colonoscopy should ever be undertaken without prior examination of a technically satisfactory barium enema film to identify obvious hazards and difficulties, and the two procedures should be regarded as complementary. Repeat barium studies preceded by stringent bowel preparation may be as rewarding as colonoscopy in many cases, and endoscopy should be necessary only in patients requiring polypectomy or in a few cases in which diagnosis is difficult.

The procedure should probably be confined to the larger centres, where financial, technical, and manpower facilities are available to maintain a comprehensive service. The instruments are fragile; the torsional stresses of the redundant colon are considerable; and, in the most experienced hands, a repair bill of about a third of the initial cost of each endoscope may be expected during a working life of some 200 examinations.[3] Provision must be made for nursing help, and time set aside for training one or two enthusiastic assistants, not only in the examination manoeuvres but also in maintaining instruments, in correctly orientating and fixing biopsy specimens using a dissecting microscope, and in the potential hazards of intravenous analgesia and sedation.

Capital expenditure on equipment, major maintenance bills, and a commitment of at least one or two sessions a week have to be balanced against the advantages of earlier diagnosis of equivocal cases of colonic cancer, in which cure may still be possible. Endoscopic polypectomy can also eliminate the need for formal surgery in many cases and thus minimise the cost of inpatient investigations, theatre time, convalescent facilities, and absence from work.

In a large general hospital colonoscopy soon justifies the initial financial outlay by speeding up the diagnosis and treatment of patients with colonic disease, and it should be regarded as an important adjuvant to surgical practice. In future the technique will probably be the key to the natural history of colonic cancer. Studies are under way in Newcastle upon Tyne into the cell kinetics, biochemistry, and histology of malignant, premalignant, and apparently normal mucosa taken from all parts of the previously inaccessible large bowel. These studies may identify factors that will allow earlier diagnosis of colonic cancer and thus facilitate future treatment of the condition.

We thank Dr C K Warrick for providing radiological screening facilities in the Department of Diagnostic Radiology, Royal Victoria Infirmary.

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(*Accepted 20 October 1976*)

What is the most suitable type of underwear for a cold climate?

One basic need in cold weather underwear is to be thick without being heavy, since the insulation depends on the thickness of the air trapped in the clothing rather than the insulating properties of the material itself. Another important point is that it should cover the limbs as far as possible, since otherwise vasoconstriction and countercurrent heat exchange throughout the limb may cause the hands and feet to become excessively cold. Commercially available cold weather underwear often meets these points fairly well, except that protection is seldom provided over the arms.