Double contrast enema and colonoscopy in polyp detection

F-T FORK†

From the Department of Diagnostic Radiology, University of Lund, Malmö General Hospital, Malmö, Sweden

SUMMARY The diagnostic accuracy of double contrast enema was assessed by colonoscopy of 250 consecutive patients with polypoid lesions that were observed at double contrast enema. The enema method detected 90% of all existing polypoid lesions, and gave false positive results in less than 3.5%. Colonoscopy revealed 91% of the lesions. Double contrast enema is suitable as a screening procedure and, when used in combination with colonoscopy, only very few polyps will escape detection. The large number of neoplastic polyps detected in this retrospective series emphasises the necessity for a careful radiographic technique combined with colonoscopy to disclose and treat these potentially malignant lesions of the colon.

Since 1954 radiography of the colon according to the double contrast-enema technique, known as the Malmö method,¹⁻³ has been used in our department on almost 100 000 occasions. The value of the method in the detection of polypoid lesions is well documented.⁴⁻¹³

The first flush of enthusiasm for colonoscopy in the examination of patients for polyps¹⁴⁻²¹ now appears to be on the wane,^{6 8 22-24} though colonoscopy is still regarded as indicated first in the investigation of idiopathic symptoms referable to the colon and for the screening of persons at high risk for carcinoma^{6 25 26} or with potentially malignant lesions of the colon. The value of radiographic screening for colonic polyps has been seriously questioned by numerous gastroenterologists.

In an endeavour to assess the relative diagnostic effectiveness of our routine double contrast radiography we compared the results obtained with this method with those obtained at colonoscopy, rectoscopy, and surgery.

Definitions

A polyp or polypoid lesion is to be understood as a mass, smaller than 50 mm, arising from the mucous

membrane and protruding into the lumen of the bowel; a verified polyp is defined as one demonstrated at double contrast enema on two occasions or at colonoscopy, rectoscopy, or surgery. A polyp is not considered to be verified when seen at only one radiological examination, and a single examination with colonoscopy is not considered sufficient to exclude the existence of such a growth. Exclusion of a previously suspected polyp requires the absence of any demonstrable changes at repeat double contrast enema or colonoscopy, focused on the area in question^{5 23} (Fig. 1a and b).

Methods

PATIENTS

The material consisted of the records of 250 consecutive patients who had been examined with complete colonoscopy on 302 occasions and with double contrast radiography on 407. Poor quality of the radiographs in a given case was not regarded as a reason for its exclusion. All the patients had been referred for colonoscopy because of single or multiple polypoid lesions, these being the only changes found at double contrast enema. The patients' ages ranged from 24 to 83 years, mostly from 50 to 79 years. There were 148 men and 102 women. The number of polyps detected at double contrast enema was compared with that at colonoscopy, rectoscopy, and five laparotomies. All the polyps removed were examined microscopically.

*This work was supported by MFR B79-29X-04819-04.

†Address for reprint requests: Dr Frans-Thomas Fork, Department of Diagnostic Radiology, Malmö General Hospital, S-214 01 Malmö, Sweden.

Fig. 1 (a) A pedunculated adenomatous polyp (4 mm) missed by the colonoscopist in 1976. (b) The same polyp two years later, verified by two double contrast enema studies.

Notes were made of the radiologists' reports as well as of the diagnosis made at a retrospective review of the films. At the review the examiner was unaware of the colonoscopic findings. Finally, the colonoscopic findings were compared with those made at repeat radiography, re-colonoscopy, rectoscopy, and surgery.

The sizes of the lesions missed at colonoscopy were measured on the x-ray films and reduced by approximately 15% to compensate for the estimated magnification. All the other polyps were measured after they had been removed.

The histological routine reports of the microscopic findings in biopsy specimens and in snared polyps were recorded and the degree of malignancy was assessed in accordance with Ekelund and Lindström and with Enterline.²⁷⁻²⁹

Results

Within a two and a half year period 410 polyps were verified in the 250 patients. Three hundred and eighty-four polyps were primarily diagnosed by

double contrast enema and 373 by colonoscopy (Table 1). Thirty-nine polyps missed at double contrast enema were detected at colonoscopy, while 37 polyps missed at colonoscopy were detected at double contrast enema. Thirty-five of these were verified at double contrast enema on two or more occasions and two polyps were detected at follow-up colonoscopy. In addition, 13 polyps overlooked at double contrast enema were disclosed at the retrospective review. Thirteen polyps suggested by double contrast enema were not verified.

Table 1 Summary of results obtained with double contrast enema and colonoscopy

	Polypoid lesions (no.)	
	DCE	Colonoscopy
Primarily diagnosed	384	373
Primarily missed	39	37
Seen in retrospect or at re-examination	13	2
Not yet verified	13	
Total		410

The two diagnostic procedures did not differ in number of polyps missed per patient (Table 2). Double contrast enema and colonoscopy missed an isolated polyp in respectively 18 and 20 patients. In six patients two polyps per patient were missed at double contrast enema, in four by colonoscopy, and three polyps per patient in three patients by double contrast enema and in one by colonoscopy. In one patient six polyps in the transverse colon were not reported by the colonoscopist (Fig. 2). All the patients exhibited at least one verified polyp.

Table 3 gives the sites of the polyps missed. In the rectum fewer polyps were missed at double contrast enema than at colonoscopy, whereas in the sigmoid colon it was the other way round. In the transverse colon 12 polyps were missed at colonoscopy and none at double contrast enema. Only few polyps were missed in the other sections of the large bowel.

The sizes of the polypoid lesions missed by one or

the other of the two methods are given in Table 4. Eighty-five per cent (33 out of 39) of the polyps missed at double contrast enema and 90% (33 out of 37) at colonoscopy were only up to 6 mm in diameter. Two polyps missed at double contrast enema and one at colonoscopy were up to 10 mm across, whereas four polyps at double contrast enema and three at colonoscopy were 10 mm or more in diameter.

Table 2 Number of overlooked polyps per patient

No. of polyps	No. of patients	
	DCE	Colonoscopy
1	18	20
2	6	4
3	3	1
>3		1
Total	27	26

Fig. 2 Semi-pedunculated 7 mm in descending colon, extirpated at colonoscopy. Polyps in transverse colon, missed at colonoscopy.

Most of the polyps missed at double contrast enema were adenomas and metaplastic polyps (Table 5). One polyp was an invasive carcinoma (Fig. 3) and one showed histological signs of intramucosal carcinoma. There were also single polypoid lesions made up of normal or non-neoplastic tissue. Most of the 20 polyps missed at colonoscopy and later removed were metaplastic polyps, but one out of

three tubulovillous adenomas (Fig. 4) showed intramucosal carcinoma (for definitions see refs. 27-29). Thirteen of these 20 polyps were removed through the proctoscope, five at colotomy, and two through the colonoscope.

Of the 373 removed polyps, 86% were situated in the left colon, as were all but three of the malignant

Table 3 *Position and number of polyps overlooked by both methods*

Position	No. of polyps overlooked	
	DCE	Colonoscopy
Rectum	6	13
Sigmoid colon	21	6
Descending colon	3	1
Left flexure	2	3
Transverse colon		12
Right flexure	2	
Ascending colon	4	1
Caecum	1	1

Table 4 *Number and size of polyps overlooked by both methods*

Size of polyp (mm)	No. of polyps overlooked	
	DCE	Colonoscopy
2	4	3
3	11	9
4	6	6
5	5	5
6	7	10
-10	2	1
-15	2	
>15	2	3
Total	39	37

Fig. 3 Carcinomatous polyp 10×11 mm in 72 year old man, missed by radiologist.

Fig. 4 Tubulovillous adenoma, 11×15 mm with intramucosal carcinoma, missed at colonoscopy, in a 68 year old man with diverticular disease of the sigmoid colon.

Table 5 *Histological diagnoses of polyps missed; method of removal of lesions overlooked at colonoscopy; polyps overlooked at double contrast enema removed through colonoscope*

	DCE	Colonoscopy
Tubular adenoma	21	5 (colotomy)
Tubulovillous adenoma	6	2 (re-endoscopy, rectoscopy)
Intramucosal or invasive carcinoma	2	1 (re-endoscopy)
Metaplastic polyp	7	12 (rectoscopy)
Miscellaneous polyp	3	

polyps. Thirty-nine per cent of the polypoid lesions removed were at most 5 mm in diameter. Two of these displayed signs of intramucosal carcinoma.

Where the histological diagnoses of these 373 removed polyps were concerned, 292 polyps were neoplastic, including 11 invasive carcinomas and 30 polyps with intramucosal adenocarcinoma. Of the remaining 81 polyps 54 were metaplastic. Five out of these were more than 8 mm across.

Discussion

Several comparisons are available of the value of fibroptic endoscopy of the colon and of conventional radiographic techniques for detecting polypoid lesions of the colon.^{5 8-10 14 15 17 19-24 30-37} Of the radiographic techniques double contrast enema is best.^{8 9 30 33 38 39}

During the last seven years colonoscopy has been carried out at our department by radiologists, fully trained and responsible for gastrointestinal morphological diagnoses. Thus, at the beginning of this series in the summer of 1976, they were equally well versed in both methods.²³ The system has the additional advantage of enhancing diagnostic competition, which is necessary if the large annual number of new carcinomas of the colon is to be reduced.^{9 11 25 37 39 40}

This study was performed in retrospect and, like similar studies, has the disadvantage that the colonoscopist was aware of the radiological findings, whereas the radiologist was never informed in advance.^{8 22-24 30}

During the period of this study the indications for colonoscopy were mainly a presumed inflammatory or neoplastic disease. Patients with the former diagnosis were excluded because of the inconstant occurrence and shape of inflammatory polyps and pseudopolyps. Consequently, it was not possible to collect the true control material necessary for assessing the reliability of double contrast enema. The only methods allowing of such assessment were

repeated radiology of the large bowel, re-colonoscopy, and, to a limited extent, rectoscopy, surgery, and necropsy.²³

It is thus not known how many polyps were missed at double contrast enema in patients examined only once during the time covered by this investigation. However, in an earlier study, colonoscopy revealed only four single polyps in 139 patients with a main radiological diagnosis other than polypoid lesions, a figure suggesting that the under-diagnosis rate of double contrast enema is very low in such patients.⁵ There was no reason to assume that this figure was different during this investigation.

Besides, during the follow-up since the summer of 1976, no additional polyps have been detected in the patients included in this series. On the other hand, 13 polyps diagnosed at double contrast enema were not verified and were therefore considered to be instances of over-diagnosis.

In this series, the number of polyps with intramucosal carcinoma²⁷⁻²⁹ was 8% (30/373 polyps) and with infiltrating carcinoma 3% (11/373 polyps), a figure below that found in other series.^{6 11 21 36 37 41} This difference can be at least partly attributed to the fact that the present material, unlike other reported series, also included polyps less than 5 mm across. Furthermore, these were not benign: 69% were neoplastic and two of them were malignant, which indicates the necessity of adequate methods for their detection and treatment.^{6 11 40}

The distribution of polyps in the colon agreed with that reported by other authors.^{27 35 36} The proportion of adenomas with villous structures—mainly tubulovillous adenoma—was higher, 14%, than that in other studies on record.^{36 37}

In a previous study, it was shown that the number of polyps discovered at double contrast enema but overlooked earlier by the radiologist accounted for 30% of the total number of polyps missed.⁵ This figure (13 out of 39) was the same in the present study.

The number of polyps overlooked by the colonoscopist in this investigation was high (37 out of 410). The same proportion of polyps, 39 out of 410 (9.5%) was missed at double contrast enema.^{24 31} Most of those missed at double contrast enema were situated in the sigmoid colon,^{21 39} whereas the rectum constituted the weak part to the colonoscopist (Table 3). However, in seven patients double contrast enema had not been preceded by rectoscopy, in spite of our policy, which may suggest that the colonoscope had probably been passed too fast through the rectum. All 12 polyps overlooked in the transverse colon were small, less than 5 mm, and situated close to a haustral fold.

The results obtained in this series were comparable

with those reported by Welin.³ How reliable was the diagnosis of a polypoid lesion by double contrast enema and how true was the exclusion of further polyps by this method? Because of the lack of control patients, the diagnostic accuracy of double contrast enema could not be expressed in terms of specificity and sensitivity of the method. Judging from the results of this investigation—the primary radiological reports—double contrast enema will give false positive results in 4.5% (371 verified polyps to 384 double contrast enema suggested lesions) and false negative results in 9.5% (39 overlooked polyps to 410 verified).

The investigation confirmed that the two procedures are truly complementary.^{5 9 10 19 22–24 30 34 39} Double contrast enema is easy to perform and not hazardous, and it is well adapted for screening.^{9 22 23 31 33} Supplementary colonoscopy improves the possibility of a correct diagnosis and facilitates the planning for clinical treatment.^{14 17 18 20 40 42–44} Unfortunately, colonoscopy is attended by certain risks^{16 21 31 43–46} and by technical difficulties,^{10 14 34 39 43} but it is an indispensable complementary examination^{10 33 34 39} and its greatest value is that it facilitates biopsy and removal of mucosal lesions.^{6 15 21 34 35 43 44}

All polypoid lesions suggested at routine double contrast enema are now checked at repeat enema—study focused on the area in question.⁵ In clinical practice this means that the physician who has referred the patient for radiology receives a highly reliable report as to the existence or absence of a polyp. With this routine almost all over-diagnosis by double contrast enema has disappeared.

Conclusions

Properly performed double contrast enema can detect most polypoid lesions. It is the method of choice for screening for these lesions. In combination with colonoscopy practically all polyps are disclosed. Even those less than 5 mm in diameter should be possible to detect and treat.

References

- Fischer AW. Über die Röntgenuntersuchung des Dickdarmes mit Hilfe einer Kombination von Lufteinblasung und Kontrasteinlauf. *Arch klin Chir* 1925; **134**: 209–69.
- Welin S. Über die röntgenologische Untersuchung des Dickdarmes mit der Doppelkontrast-Methode. *Radiologie* 1962; **2**: 87–100.
- Welin S. Results of the Malmö technique of colon examination. *JAMA* 1967; **199**: 369–71.
- Andrén L, Frieberg S, Welin S. Roentgendagnosis of small polyps in the colon and rectum. *Acta Radiol (Diagn) (Stockh)* 1955; **43**: 201–8.
- Fork F-Th. Resultatvergleich zwischen der Doppelkontrastuntersuchung des Dickdarmes und der Koloskopie mit Biopsie. In: Welin S, Welin G, eds. *Die Doppelkontrastuntersuchung des Dickdarms. Erfahrungen mit der Welin-Modifikation*. Stuttgart: Thieme, 1980.
- Gabrielsson N, Granqvist S, Ohlsén H *et al.* Malignancy of colonic polyps. Diagnosis and management. *Acta Radiol (Diagn) (Stockh)* 1978; **19**: 479–95.
- Gershon-Cohen J, Shay H. The colon as studied by the double contrast enema. *AJR* 1932; **27**: 838–46.
- Laufer I. The double-contrast enema: myths and misconceptions. *Gastrointest Radiol* 1976; **1**: 19–31.
- Miller RE. Die vollständige Colonuntersuchung. *Radiologe* 1975; **15**: 410–20.
- Miller ER, Lehman G. Polypoid colonic lesions undetected by endoscopy. *Radiology* 1978; **125**: 295–7.
- Ott DJ, Gelfand DW. Colorectal tumors: pathology and detection. *AJR* 1978; **131**: 691–5.
- Young AC. Recent advances in the investigation of large bowel diseases. The Malmö enema at St Mark's hospital: a preliminary report. *Proc R Soc Med* 1964; **57**: 257–278.
- Young AC. Radiology of the colon and rectum. In: Irvine WJ, ed. *Modern trends in surgery*. London: Butterworths, 1966: 32–53.
- Christie JP. Fiberoptic colonoscopy: diagnostic value in 250 consecutive patients. *South Med J* 1976; **69**: 540–544, 549.
- Christie JP, Shinya H. Indications for fiberoptic colonoscopy. *South Med J* 1975; **68**: 881–6.
- Overholt BF. Colonoscopy. A review. *Gastroenterology* 1975; **68**: 1308–1320.
- Shinya H, Wolff W, De Beer R, *et al.* Radiographic and colonoscopic diagnosis of colon and rectal pathology—an adjunctive and comparative analysis of five-hundred cases. Abstract. *Gastroenterology* 1974; **66**: 825.
- Waye DJ. Colonoscopy *Surg Clin North Am* 1972; **52**: 1013–1024.
- Winawer SJ, Melamed M, Sherlock P. Potential of endoscopy, biopsy and cytology in the diagnosis and management of patients with cancer. *Clin Gastroenterol* 1976; **5**: 575–95.
- Wolff WI, Shinya H. Colonofiberoscopy. *JAMA* 1971; **217**: 1509–1512.
- Wolff WI, Shinya H. Colonofiberoscopic management of colonic polyps. *Dis Colon Rectum* 1973; **16**: 87–93.
- Laufer I, Smith NCW, Mullens JE. The radiological demonstration of colorectal polyps undetected by endoscopy. *Gastroenterology* 1976; **70**: 167–170.
- Leinicke JL, Dodds WJ, Hogan WJ, *et al.* A comparison of colonoscopy and roentgenography for detecting polypoid lesions of the colon. *Gastrointest Radiol* 1977; **2**: 125–128.
- Thoeni RF, Menuck L. Comparison of barium enema and colonoscopy in the detection of small colonic polyps. *Radiology* 1977; **124**: 631–635.
- Gilbertsen VA. Proctosigmoidoscopy and poly-

Detection of colonic polyps

- pectomy in reducing the incidence of rectal cancer. *Cancer* 1974; **34**: 936-9.
- ²⁶Kirsner JB, Rider AJ, Moeller HC *et al.* Polyps of the colon and rectum: statistical analysis of a long-term follow-up study. *Gastroenterology* 1960; **39**: 178-182.
- ²⁷Ekelund G, Lindström C. Histopathological analysis of benign polyps in patients with carcinoma of the colon and rectum. *Gut* 1974; **15**: 654-63.
- ²⁸Enterline HT. Polyps and cancer of the large bowel. Pathology of the gastrointestinal tract. *Curr Top Pathol* 1976; **63**: 95-141.
- ²⁹Ekelund G. Cancer risk with single and multiple adenomas: synchronous and metachronous tumors. In: Winawer S, Schottenfeld D, Sherlock P, eds. *Colorectal cancer: prevention, epidemiology and screening*. New York: Raven Press, 1980: 151-5.
- ³⁰De Beer RA, Geffin A, Shinya H *et al.* Comparison of colonoscopy and contrast x-ray study in diagnosis of 500 cases of colorectal disease. *JAOA* 1976; **75**: 569-74.
- ³¹Fuchs HF, Stadler U, Reichert J. Der Stellenwert der Röntgendiagnostik bei der Frühdiagnose des Colonicarcinoms in Vergleich zur Koloskopie. *Radiologe* 1979; **19**: 21-4.
- ³²von Goumoens E, Müesch HJ, Kobler E *et al.* Wie sicher ist die Radiologie in der Kolonkarzinomdiagnostik? *Schweiz Med Wochenschr* 1977; **107**: 533-4.
- ³³Polyps, enemas and colonoscopes. Editorial. *Lancet* 1974; **1**: 1265-6.
- ³⁴Waye JD. Colitis, cancer and colonoscopy. *Med Clin North Am* 1978; **62**: 211-24.
- ³⁵Williams CB, Hunt RH, Loose H *et al.* Colonoscopy in the management of colon polyps. *Br J Surg* 1974; **61**: 637-82.
- ³⁶Wolff WI, Shinya H. A new approach to colonic polyps. *Ann Surg* 1973: 367-76.
- ³⁷Wolff WI, Shinya H, Geffen A, *et al.* Comparison of colonoscopy and the contrast enema in five hundred patients with colorectal disease. *Ann J Surg* 1975; **129**: 181-6.
- ³⁸Granqvist S, Gabrielsson N, Sundelin P. Diminutive polyps—clinical significance and management. *Endoscopy* 1979; **1**: 36-42.
- ³⁹Ott DJ, Gelfand DW, Ramquist NA. Causes of error in gastro-intestinal radiology. *Gastrointest Radiol* 1980; **5**: 99-105.
- ⁴⁰Ottenjann R. Colonic polyps and colonoscopic polypectomy. *Endoscopy* 1972; **4**: 212-6.
- ⁴¹Osnes M, Serck-Hansen A, Myren J. Malignancy in polyps removed by endoscopic snare resection. Paper XIII *Scand Congr Gastro-enterology and V Scand Meeting on Gastrointestinal Endoscopy*. Helsinki 1979.
- ⁴²Dehyle P, Seuberth K, Jenny S, *et al.* Endoscopic polypectomy in the proximal colon. *Endoscopy* 1971; **2**: 103-5.
- ⁴³Frühmorgen P, Demling L. Complications of diagnostic and therapeutic colonoscopy in the Federal Republic of Germany. Results of an inquiry. *Endoscopy* 1979; **11**: 146-50.
- ⁴⁴Frühmorgen P, Zeus J, Demling L. New aspects of therapeutic colonoscopy. *Endoscopy* 1975: 59-63.
- ⁴⁵Gathright JB. Evaluation of the colonoscopic examination: complications. *Dis Colon Rectum* 1975; **18**: 374-5.
- ⁴⁶Geenen JE, Schmitt MG, Hogan WJ. Complications of colonoscopy (Abstract). *Gastroenterology* 1974; **66**: 812.